To: Clark, Ray[Clark.Ray@epa.gov]
From: DeCair, Sara
Sent: Thur 11/14/2013 9:10:45 PM
Subject: slides on PAGs
PAGs Webinar 6-19-2013.ppt

Sara D. DeCair

http://www.epa.gov/radiation/rert/pags.html

202-343-9108

2013 PAG Manual Revision

Overview with Questions & Answers

Sara DeCair and Kathryn Snead, US EPA

ED_001057_00013566

Webinar etiquette

- Please put your phone on mute *6
- Presentation for 20 minutes, followed by questions

Questions:

- Please type your questions in the chat box as we present
- We'll answer chat box questions after the presentation
- Comments must be submitted to the docket

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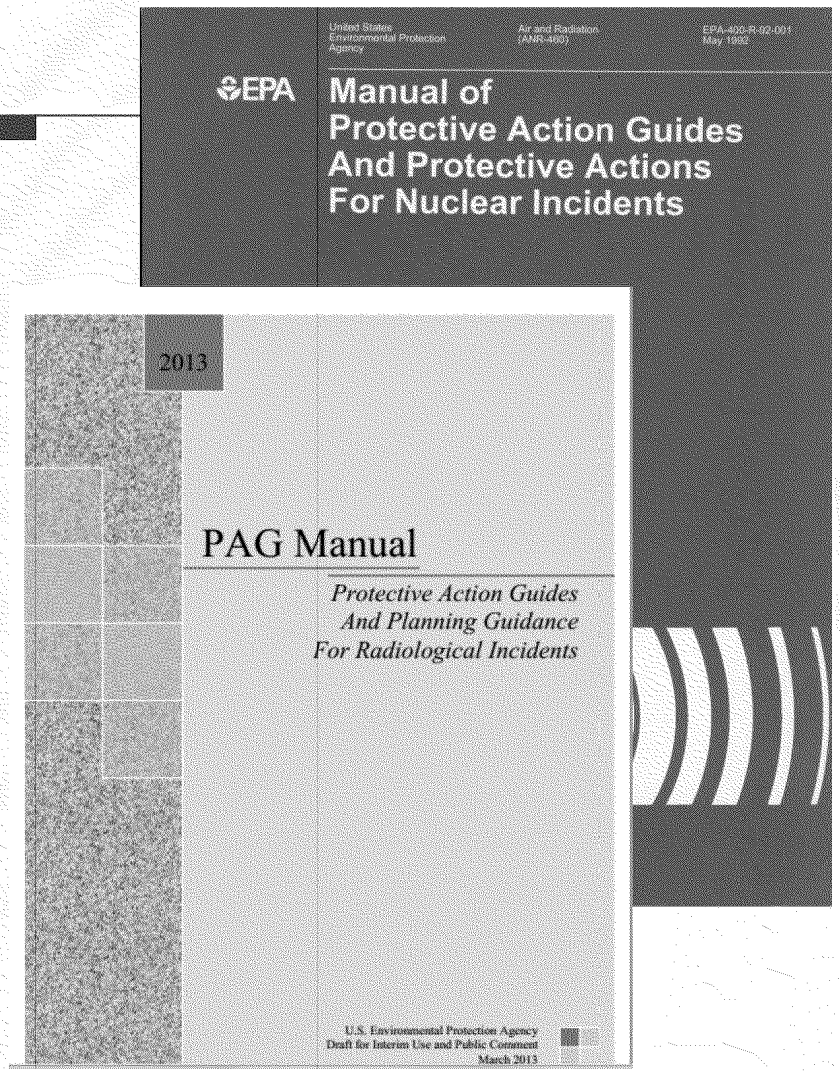
PAGs Manual

- Protective Action Guides (PAGs) Manual (1992)
- Early, Intermediate Phases only
- Promised Water and Late Phase (Recovery) PAGs



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2013 Draft PAG Manual

- Clarifies the use of PAGs for all radiological incidents, including terrorism
- Lowers projected thyroid dose for KI, via FDA
- Requests input on drinking water guidance
- Refers to 1998 FDA food guidance
- Includes guidance for long-term site restoration
- Updates dosimetry from ICRP 26 to ICRP 60, by referring to FRMAC methods

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When Do PAGs Apply?

- Not for radioactively contaminated sites
- Releases, incidents, or accidents
- Public protection is the focus
- Guidance, not regulatory
- This is not CERCLA or Superfund
- Avoided dose ≠ safe limit to allow

EPA

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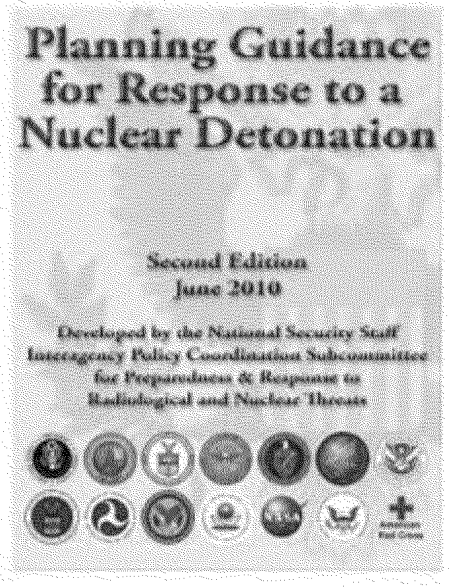
Relationship of EPA and DHS PAGs

- DHS vetted the Early and Intermediate PAGs for RDDs or INDs and provided needed guidance for Late Phase (recovery) guidance in 2008
  - ✓ EPA PAG Manual incorporates this late phase guidance
  - ✓ DHS document will 'sunset' when PAG Manual is finalized
- Planning Guidance for IND (2010)
  - ✓ PAGs don't apply well after an IND
  - ✓ Scope and scale
  - ✓ Priority on lifesaving and avoiding acute effects
  - ✓ Short response timeframe
  - ✓ Unique fallout decay curve
  - ✓ Referenced in PAG Manual



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Federal Register Questions

- Regarding the entire Manual:
  - ✓ Readers are referred to FRMAC Assessment Manuals for calculations using up-to-date dosimetry. Please comment on the usefulness of this approach and how to facilitate implementation of these methods.

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Early Phase

1992	2013
➢ Evacuation/Shelter 1-5 rem (10-50 mSv) ✓ thyroid/skin 5, 50 x higher	➢ Evacuation/Shelter 1-5 rem (10-50 mSv) ✓ (no organ dose specified)
➢ KI 25 rem (250 mSv) thyroid dose (adult)	➢ KI threshold 5 rem (50 mSv) thyroid dose (child)
➢ Worker 5, 10, 25+ rem (50, 100, 250+ mSv)	➢ Worker 5, 10, 25+ rem (50, 100, 250+ mSv)

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Potassium Iodide (KI) Actions

- FDA recommends a multi-pronged approach:

Threshold Thyroid Radioactive Exposures and Recommended Doses of KI for Different Risk Groups				
	Predicted Thyroid exposure(cGy)	KI dose (mg)	# of 130 mg tablets	# of 65 mg tablets
Adults over 40 yrs	≥500	130	1	2
Adults over 18 through 40 yrs	≥10			
Pregnant or lactating women	≥ 5			
Adoles. over 12 through 18 yrs*				
Children over 3 through 12 yrs		65	1/2	1
Over 1 month through 3 years		32	1/4	1/2
Birth through 1 month		16	1/8	1/4

- A simplified approach:
  - ✓ Provide KI to public if 5 rem (50 mSv) child thyroid dose projected
  - ✓ This is a supplemental action where evacuation is the primary protection

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Guidance for Emergency Workers

Dose (rem)	Activity	Condition
5	All	None
10	Protecting valuable property	Lower dose not practicable
25*	Lifesaving or protection of large populations	Lower dose not practicable

* Greater than 25 rem for lifesaving only to volunteers aware of the risks

EPA

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Federal Register Questions

Regarding the Early Phase:

- Please comment on the usefulness of the simplified KI implementation guidance
- Please comment specifically on the appropriateness of not retaining the skin and thyroid evacuation thresholds

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Intermediate Phase

1992	2013
➢ Relocate population ✓ ≥ 2 rem (20 mSv) first year (projected dose) ✓ 0.5 rem (5 mSv) any subsequent year ✓ 5 rem (50 mSv) over 50 yrs ➢ Apply dose reduction techniques ✓ < 2 rem (20 mSv)	➢ Relocate population ✓ ≥ 2 rem (20 mSv) first year (projected dose) ✓ 0.5 rem (5 mSv) any subsequent year ✓ (removed 50-year Relocation PAG) ➢ Apply dose reduction techniques ✓ < 2 rem (20 mSv)

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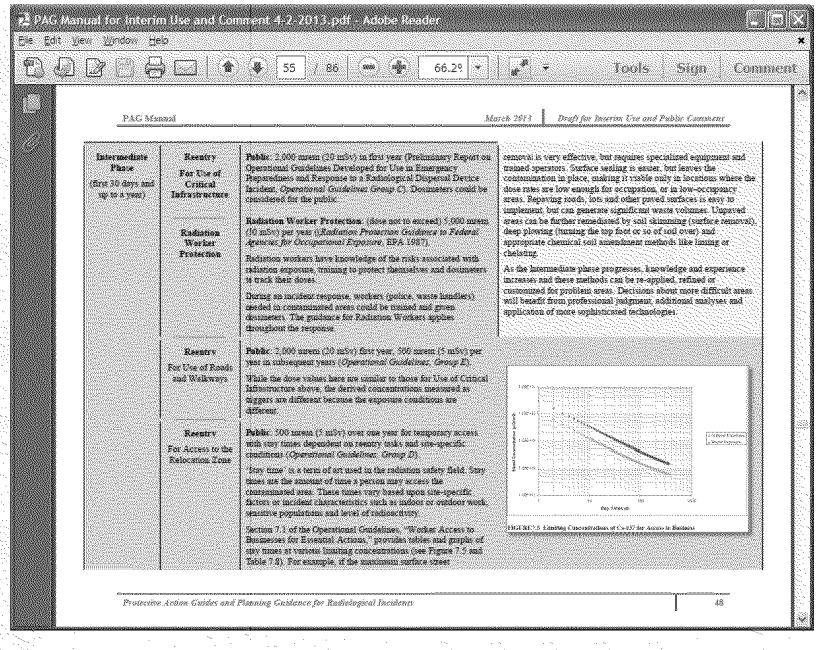
Re-entry Matrix

- New quick reference matrix
- Public, workers re-entering Relocation area to work during cleanup
- Basis: Relocation PAGs
- Assumptions: Detailed exposure scenarios in Operational Guidelines
- Do it yourself: RESRAD-RDD software


PAG Manual for Interim Use and Comment 4-2-2013.pdf - Adobe Reader

PAG Manual | March 2013 | Draft for Interim Use and Public Comment

Intermediate Phase (first 30 days and up to a year)	Reentry For Use of Critical Infrastructure	**Public**: 2,000 mrem (20 mSv) in first year (Preliminary Report on Operational Guidelines Developed for Use in Emergency Preparedness and Response to a Radiological Dispersal Device Incident, *Operational Guidelines, Group C*). Dosimeters could be considered for the public.	removal is very effective, but requires specialized equipment and trained operators. Surface sealing is easier, but leaves the contamination in place, making it viable only in locations where the dose rates are low enough for occupation, or in low-occupancy areas. Repaving roads, lots and other paved surfaces is easy to implement, but can generate significant waste volumes. Unpaved areas can be further remediated by soil skimming (surface removal), deep plowing (turning the top foot or so of soil over) and appropriate chemical soil amendment methods like liming or chelating.
	Radiation Worker Protection	**Radiation Worker Protection**: (dose not to exceed) 5,000 mrem (50 mSv) per year (*Radiation Protection Guidance to Federal Agencies for Occupational Exposure*, EPA 1987). Radiation workers have knowledge of the risks associated with radiation exposure, training to protect themselves and dosimeters to track their dose. During an incident response, workers (police, waste handlers) needed in contaminated areas could be trained and given dosimeters. The guidance for Radiation Workers applies throughout the response.	As the Intermediate phase progresses, knowledge and experience increases and these methods can be re-applied, refined or customized for problem areas. Decisions about more difficult areas will benefit from professional judgment, additional analyses and application of more sophisticated technologies.
	Reentry For Use of Roads and Walkways	**Public**: 2,000 mrem (20 mSv) first year, 500 mrem (5 mSv) per year in subsequent years (*Operational Guidelines, Group E*). While the dose values here are similar to those for Use of Critical Infrastructure above, the derived concentrations measured as triggers are different because the exposure conditions are different.	
	Reentry For Access to the Relocation Zone	**Public**: 500 mrem (5 mSv) over one year for temporary access with stay times dependent on reentry tasks and site-specific conditions (*Operational Guidelines, Group D*). 'Stay time' is a term of art used in the radiation safety field. Stay times are the amount of time a person may access the contaminated area. These times vary based upon site-specific factors or incident characteristics such as indoor or outdoor work, sensitive populations and level of radioactivity. Section 7.1 of the Operational Guidelines, "Worker Access to Businesses for Essential Actions," provides tables and graphs of stay times at various limiting concentrations (see Figure 7.5 and Table 7.6). For example, if the maximum surface street	

FIGURE 7.5 Limiting Concentrations of Cs-137 for Access to Business

Protective Action Guides and Planning Guidance for Radiological Incidents | 48

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Federal Register Questions

Regarding the Intermediate Phase:

- Please comment on the appropriateness of removing the 5 rem over 50 years Relocation PAG
- Please comment on the format and utility of new Re-entry guidance
- Comment on whether it would be useful to develop a combined, all-pathways Intermediate Phase PAG

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Drinking Water PAG

1992	2013
➢ Promised	➢ National Primary Drinking Water Regulations provide emergency actions ✓ Increased monitoring ✓ Notifications ➢ Comments sought on whether, and what value, an emergency PAG for water should be considered

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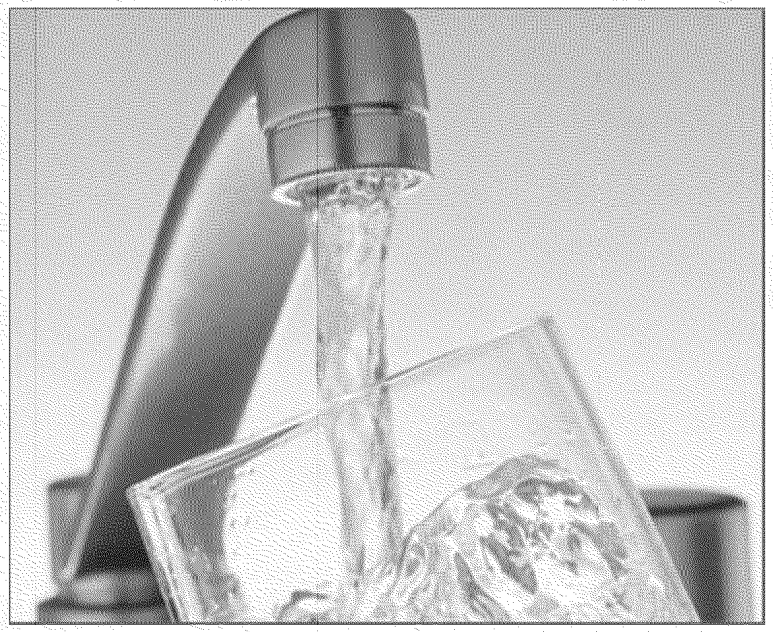
Drinking Water PAG

- Comments sought on whether, and what value, an emergency PAG for water should be considered
- Other related guides from WHO, IAEA, DHS, FDA may inform your input



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FDA Food PAGs

1992	2013
➢ 1982 FDA guidance ➢ NCRP 39 methodology ➢ Preventive PAG 0.5 rem (5 mSv) whole body and 1.5 rem (15 mSv) thyroid ➢ Emergency PAG 10 times higher, depends on impact ➢ Dose only, no activity levels provided	➢ 1998 FDA guide, by reference ➢ ICRP 56 & NRPB methods ➢ One set of PAGs ✓ 0.5 rem (5 mSv) whole body dose or ✓ 5 rem (50 mSv) to most exposed organ or tissue ➢ Dose and derived intervention levels (DILs) provided

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Federal Register Questions

Regarding Food and Water:

- Input on the appropriateness of, and possible values for, a drinking water PAG is being sought
- Since FDA's 1998 Food guidance is already final and published, comments are not requested on it

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Late Phase: Cleanup Goal

- Customer expectation of cleanup goal = background?
- Prescriptive or flexible
- Time, costs, risks, benefits
- What about your personal items?

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Step-wise Process

- Characterization and stabilization
- Establish cleanup goals based on options analysis
- Implementation and reoccupancy

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Decision-Making Organizations

- Focus on process for reaching consensus:
  - ✓ Decision Team – might be requesting funding
    - Senior local, state and federal officials
  - ✓ Recovery Management Team
    - Senior leadership in the field recovery effort
  - ✓ Stakeholder Working Group
    - Community leaders, local businesses, nongovernmental representatives, members of the public
  - ✓ Technical Working Group
    - Select subject matter experts, communicators

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Late Phase: Waste Management

- Document focuses on options for disposal
  - ✓ Licensed LLRW disposal facilities
  - ✓ RCRA solid and hazardous waste landfills
  - ✓ Federal facilities/sites
  - ✓ Newly developed disposal capacity
  - ✓ Appropriate for level of hazard
- States bear primary responsibility
  - ✓ Waste volumes will drive decision-making
    - Could overwhelm existing disposal capacity (see Japan)
    - Need to be considered in early planning

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EPA Waste Management Resources

- Waste Estimation Support Tool (WEST)
  - ✓ First-order estimates of waste types and volumes
  - ✓ Based on analysis of plume maps
- CBR Disposal Technology Workshop report
  - ✓ Technical issues in developing new capacity
  - ✓ http://www.epa.gov/nhsrc/pubs.html
- Minimization/Segregation Technology Guideline
  - ✓ Developed through the WARRP effort (available soon)
- Interactive, web-based waste management planning tool for incidents (early concept)

EPA

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Federal Register Questions

Regarding Late Phase:

- Please comment on the usefulness of the brief cleanup planning guidance, and how it might be implemented in state, tribal and local plans
- Please comment on the merging of the 2008 DHS RDD/IND cleanup guide with this Manual
- Please comment on the basic waste disposal planning guidance and how it should be implemented in plans at all levels of government

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Time for Questions & Answers

If you haven't already, please type your question in the webinar chat.

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The End

Thank you for your attention!

Enjoy the rest of the day!

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To: siddhanti@endyna.com[siddhanti@endyna.com]
From: DeCair, Sara
Sent: Tue 9/24/2013 4:27:44 PM
Subject: Good example of Comment Spreadsheet
PAGs Comment Sheet with Responses 5-10-2011.xlsx

Thank you!!

Sara D. DeCair

http://www.epa.gov/radiation/rert/pags.html

202-343-9108

To: Milligan, Patricia[Patricia.Milligan@nrc.gov]; Boyd, Mike[Boyd.Mike@epa.gov]; ann.heinrich@nnsa.doe.gov[ann.heinrich@nnsa.doe.gov]
From: DeCair, Sara
Sent: Tue 7/30/2013 5:43:43 PM
Subject: Short Term Countermeasures report
WPNEM_International Countermeasures Survey 2012_March 2013_FINAL.docx
NEA short-term-countermeasures 2003.pdf
US-Intl Compilation 5-25-2012.docx

Mike, Trish, Ann;

I reviewed the final but not yet published Short Term Countermeasures report that the WPNEM put together. Sadly, we missed the opportunity to provide US input on it, and I'm not sure how that got past us, but I will say that this version is not really as useful, in my opinion, as the 2003 report. I've attached both versions here, and I recommend that you hang on to the 2003 one for when it is not on NEA's web site anymore.

The new report has more graphics with categorized responses, but does not summarize the numeric values as handily as the 2003 report (see Tables 5, 7 and 9 for example). As you might guess, my interest is in seeing how consistent PAGs are with the rest of the world, and to see how these things are evolving over time.

Another related item is the attached Comparison table that I crafted along with interagency partners in response to a White House Fukushima Lessons tasking. It is intended to help us message about differences in the world's PAG levels the next time there is a radiological incident outside the US. I'm not sure where it will wind up being published, or in what format, but for now I am just hanging on to it.

Thanks!

Sara

Sara D. DeCair, Health Physicist

EPA's Center for Radiological Emergency Management

202-343-9108

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Short-term Countermeasures in Case of a Nuclear or Radiological Emergency

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NUCLEAR ENERGY AGENCY
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

ED_001057_00013724

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original Member countries of the OECD are Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became Members subsequently through accession at the dates indicated hereafter: Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22nd November 1996), Korea (12th December 1996) and the Slovak Republic (14 December 2000). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

NUCLEAR ENERGY AGENCY

The OECD Nuclear Energy Agency (NEA) was established on 1st February 1958 under the name of the OEEC European Nuclear Energy Agency. It received its present designation on 20th April 1972, when Japan became its first non-European full Member. NEA membership today consists of 28 OECD Member countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, Norway, Portugal, Republic of Korea, Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The Commission of the European Communities also takes part in the work of the Agency.

The mission of the NEA is:

- to assist its Member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes, as well as
- to provide authoritative assessments and to forge common understandings on key issues, as input to government decisions on nuclear energy policy and to broader OECD policy analyses in areas such as energy and sustainable development.

Specific areas of competence of the NEA include safety and regulation of nuclear activities, radioactive waste management, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information. The NEA Data Bank provides nuclear data and computer program services for participating countries.

In these and related tasks, the NEA works in close collaboration with the International Atomic Energy Agency in Vienna, with which it has a Co-operation Agreement, as well as with other international organisations in the nuclear field.

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FOREWORD

Following the Chernobyl accident, the Nuclear Energy Agency substantially increased its activities to assist in the improvement of nuclear emergency and post-emergency preparedness and management, both nationally and internationally.

With the first international nuclear emergency exercise (INEX 1) in 1993, participating countries were able, for the first time, to test approaches and policies for managing the international and transboundary aspects of a nuclear or radiological emergency. The lessons learnt during INEX 1 led to an improvement in nuclear emergency management.

In order to follow up on the issues identified during INEX 1, the NEA organised three workshops covering the following topics: short-term countermeasures; agricultural aspects of nuclear and/or radiological emergency situations; and nuclear emergency data management.

In preparation for the first of these workshops, the NEA distributed a questionnaire to its member countries in order to establish an overview of currently used short-term countermeasures. The answers received were analysed and discussed during the workshop on "The Implementation of Short-term Countermeasures" held in Stockholm in June 1994.

National practices regarding short-term countermeasures subsequently evolved, thus inciting the NEA Working Party on Nuclear Emergency Matters to modify the questionnaire and to redistribute it in spring 2001 with the aim of preparing an updated overview of these practices. The NEA received 15 completed questionnaires from 14 countries: Australia, Canada, the Czech Republic, Finland, Germany, Hungary, Ireland, Japan, Luxembourg, Norway, Sweden, Switzerland, the United Kingdom and the United States.

Sabine Bittner evaluated the completed questionnaires and prepared a draft report. Her report was further elaborated and finalised by the NEA Working Party on Nuclear Emergency Matters, the results of which are reproduced herein.

ED_001057_00013724

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1. INTRODUCTION

Nuclear emergency planning, preparedness and management are essential elements of any country's nuclear power programme. Part of nuclear emergency planning and preparedness is the implementation of national emergency plans, including detailed procedures for the implementation of short-term countermeasures, before during and after the release of radioactive substances.

The timely and appropriate implementation of short-term countermeasures, such as sheltering, evacuation and iodine prophylaxis, can, in case of a nuclear emergency with a release of radioactive material, considerably reduce the doses to the public in the vicinity of the nuclear installation.

Although international guidelines exist, national procedures and practices may differ due to different national habits, cultural specificity and societal needs. Different national procedures and practices, however, may, in the case of a radioactive release affecting two neighbouring countries, lead to different decisions in the implementation of countermeasures.

In order to better understand existing approaches and to facilitate the comparison of national practices, the NEA decided to launch a questionnaire on current practices regarding short-term countermeasures, updating a similar survey performed in 1994, as countries' practices have since evolved and been modified.

The information collected may be used to understand the basis for decisions in various countries, and, if deemed necessary, as a basis for international harmonisation. This may also assist member countries to explain to the public affected by an emergency why the decisions in neighbouring countries may vary.

This report summarises the information given by member countries, following, in general, the structure of the questionnaire. The overview includes information on the relevant national and regional organisations responsible for developing the legal framework, who recommends and those who decide upon the implementation of a short-term countermeasure. General objectives for implementing short-term countermeasures are given followed by descriptions of emergency plans. More specific information, including intervention criteria, will be found regarding the countermeasures ***evacuation***, ***sheltering*** and ***iodine prophylaxis***. Finally, informing the public, countermeasures for special groups, international harmonisation and economic consequences of countermeasures are discussed.

The NEA questionnaire, as it was distributed to the member countries, is given in Annex 1.

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2. GENERAL OBJECTIVES OF IMPLEMENTING SHORT-TERM COUNTERMEASURES

This chapter will summarise the objectives of implementing short-term countermeasures in case of a nuclear emergency. It will give an overview on the urgent countermeasures for the general public employed in NEA member countries, and describe the basis for setting intervention levels for the different short-term countermeasures.

Aim

The general objective of implementing short-term countermeasures is to reduce health consequences; in particular to avoid deterministic effects and to keep stochastic effects as low as possible.

The measures implemented should aim at a minimisation of the contamination of the environment in general and the food chain in particular. Special attention should be given to a reduction and minimisation of psychosocial impacts.

Australia mentions, as general objective, the removal of the source – in the case of a nuclear-powered warship.

Table 2 gives an overview of the urgent countermeasures, which are planned by the different countries. For the countries with nuclear power plants or nuclear installations, evacuation, sheltering and stable iodine are the preferred short-term countermeasures in the near field. In addition, there are other countermeasures such as access control, and a variety of precautionary agricultural countermeasures. In case of a far field accident, evacuation plays a minor role. Sheltering and stable iodine would be implemented, depending on the distance to the accident place.

Some countries had difficulties with the wording “far field” accident. A definition of what is meant by “far field”, in terms of distance, would have been helpful.

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Planned urgent countermeasures for the general public

Table 2. Urgent countermeasures for the general public

	Near field accident					Far field accident			
Countries	**Evacuation**	**Sheltering**	**Stable Iodine**	**Others**		**Evacuation**	**Sheltering**	**Stable Iodine**	**Others**
Australia	X	X	X	X[a]					
Canada	X	X	X	X[#]					X[#]
Czech Republic	X	X	X				X	X	
Finland	X	X	X	X[b,c,#]					X[e]
Germany	X	X	X	X[d]					
Hungary	X	X	X				X		
Ireland							X	X	X[c]
Japan	X	X	X	X[b]					
Luxembourg						X	X	X	X[b,#]
Netherlands	X	X	X	X[b,f]			X	X	X[b,f]
Norway	X		X				X[o]	X	
Sweden	X	X	X	X[b,c,e,*,#]					
Switzerland	X	X	X	X*		–	–	–	X
United Kingdom	X	X	X	X[#]		–	X[~]	X[~]	X[#]
United States	X	X	X	X[b,c,d,*,#]		X	X	X	X[b,c,d,*,#]

a. (Re) move the ship.

b. Access control.

c. Shelter dairies cows, and where possible protect feedstuffs stored outside, crops, etc.

d. Warning of the consumption of fresh harvested foodstuff.

e. *Advice for Finnish (the following is also applicable in Sweden) citizens in an affected country:* such as to follow advice from authorities in affected country, iodine prophylaxis, sheltering.

Advice for Finnish Embassy in an affected country: such as recommendations to Embassy personal as for private Finnish citizens, organise measures for Finnish citizens.

Advice for Finnish travellers to an affected country: such as cancelling travelling to affected country or parts of it, iodine prophylaxis.

Advice for travellers from affected country: such as counselling travellers, monitoring travellers, decontamination of travellers.

Advice concerning transport and trade with affected country: such as ban on food from affected country, recommending restrictions on trade with affected country, monitoring goods, foodstuffs and feeding stuffs from affected country, decontamination of goods.

f. Food and feeding stuffs control and eventually restrictions; and if relevant: skin decontamination; decontamination of goods, including cars; closing water intakes to drinking water reservoirs; closing green houses; forbidding irrigation; advice not to drink rainwater.

* Traffic control.

\# Food and feedstuff restrictions.

~ Only for Beyond Design Accidents (BDA).

o Sheltering in private homes.

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Planning basis

For **Australia, Canada, Czech Republic, Finland, Germany, Hungary, Ireland, Japan** and **Norway**, the International Basic Safety Standard for protection against ionising radiation and for the safety of radiation sources (IAEA Safety Series No. 115) is the basis for the development of intervention levels for urgent countermeasures.

Australia also uses NHMRC Radiation Health Series No. 32.

In **Norway**, the Basic Safety Standard is part of the planning basis. In addition, the Nordic co-operation and harmonisation effort is important (e.g. "Nordic Intervention Criteria for Nuclear or Radiological Emergencies – Recommendations")

The intervention level for iodine prophylaxis in **Finland** is based on WHO 1999 guidelines for Prophylaxis following Nuclear Accident. Information regarding intervention levels for other countermeasures were not mentioned.

Several sources of input form the planning basis in **Sweden**. The Nordic harmonisation efforts are of great importance, e.g. "Nordic Intervention Criteria for Nuclear or Radiological Emergencies – Recommendations." Intervention levels for iodine prophylaxis are based on WHO 1999 guidelines.

In the **United Kingdom**, NRPB has a statutory duty to recommend intervention levels. However, in developing its advice, NRPB takes account of international guidance. **Luxembourg,** too, uses the philosophy of the NRPB documents, Volume 8 No. 1, 1997, Application of emergency reference level of dose in emergency planning and response, for the development of their intervention levels.

Switzerland and **Germany** use ICRP publication 63 as planning basis. As a member of the European Union **Germany** and **The Netherlands**, like other EU Member Countries, adopted the maximum levels for contamination of foods and animal feeds laid down by the EU.

The Netherlands had as a planning basis several international standards and recommendations, but divers somewhat from those.

The **United States** bases its intervention levels on a variety of different sources of information and recommendations. These include reports from the National Council on Radiation Protection and Measurements, the International Commission on Radiological Protection, the International Atomic Energy Agency and the World Health Organization. In addition, there are numerous Federal reports and studies that provide a substantial basis for the United States' intervention levels.

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3. IMPLEMENTATION OF SHORT-TERM COUNTERMEASURES: EMERGENCY PLAN

In connection with the emergency plan, member states were asked to give information on:

- national organisations involved in the development of general guidelines for the implementation of the emergency plan and the development of procedures for the implementation of short-term countermeasures;
- factors considered in developing emergency plan guidelines (general rules);
- public consultations before establishing countermeasure guidelines, if any;
- what is considered necessary and sufficient to justify the implementation of short-term countermeasures;
- physical zones that are pre-established for the purpose of countermeasure implementation and the reasons for the sizes of these zones; and
- whether phased implementation of countermeasures is considered in emergency plans.

National organisations involved in the development of general guidelines and the development of procedures for the implementation of short-term countermeasures

Australia

Emergency Management Australia and ARPANSA provide guidance. State emergency services develop plans for nuclear powered warship visits. ANSTO develops plans for emergencies at the research reactor site.

Canada

The provincial emergency measures organisations and, at the federal level, Health Canada develop the general guidelines for the implementation of emergency plans. The provincial emergency measures organisations also develop procedures for implementation. There are no procedures for sheltering, evacuation and stable iodine at the federal level. Concerning food restrictions, procedures are developed by Health Canada and the Canadian Food Inspection Agency.

Czech Republic

General guidelines for an on-site plan were developed by SUJB through its regulation Nos. 184/1997 Coll. and 219/1997 Coll. The Ministry of Interior developed general guidelines through its regulation No. 25/2000 Coll. for an off-site plan.

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The nuclear power plant and Regional (District) Offices developed procedures for implementing sheltering and stable iodine. Regional (District) Offices developed procedures for evacuation and other short-term countermeasures.

Finland

The Act on Emergency Preparedness (1991), Act on Rescue Services (1999) and Decree on Rescue Services (1999) defines the basic obligation of Finnish authorities to plan for emergencies. The basic planning obligation for NPPs is also included in the Nuclear Energy Act and Decree (1988) and in the Council of State Decision General regulations for Emergency Response Arrangements at Nuclear power Plants (397/1991).

The guidance needed for application of the legislation is developed by the Ministry of the Interior in co-operation with STUK and other relevant counterparts for governmental, provincial and local authorities and by STUK for NPPs.

All authorities in Finland have a responsibility to develop procedures for their own administrative sector.

Germany

The general guidelines are laid out in the "Basic Recommendations for Disaster Response in Areas Surrounding Nuclear Facilities" which were endorsed by the Radiological Protection Commission (federal level) and approved by the Conference of Ministers of the Interior (Länder level) as well as the Länder Committee for Nuclear Energy – Executive Committee. The responsible organisations of the Länder, e.g. the county district magistrates or the district authorities, developed procedures for the implementation of short-term countermeasures.

Hungary

The general guidelines for the existing emergency plan were developed by the Ministry of Interior, Civil Protection, in collaboration with other ministries and national organisations. The emergency plan is currently under revision. Guidelines for the revision have been elaborated by the Hungarian Atomic Energy Authority, in co-operation with the newly-formed Directorate General for National Emergency Management (which belongs to the Ministry of Interior) – based on the IAEA guidelines. The Ministry for Interior, the Directorate General for National Emergency Management, the Ministry for Public Health and the Hungarian Atomic Energy Authority developed procedures for the implementation of countermeasures, in co-operation with other sectoral organisations, which play a role in emergency preparedness.

Ireland

The National Competent Authority (RPII) developed the general guidelines in consultation with the Department of Public Enterprise, the government department responsible for the Emergency Plan. The views of other Government departments and national agencies were sought and incorporated into the final document.

Each organisation with responsibilities under the National Emergency Plan for Nuclear Accidents is required to have written procedures for carrying out its responsibilities under the Plan.

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Japan

General guidelines entitled "Nuclear Disaster Prevention Guidelines" were developed by the Nuclear Safety Commission. Procedures for the implementation of short-term countermeasures are provided in the Law for Nuclear Emergency Preparedness and the Basic Plan for Emergency Preparedness, which is developed by the Central Emergency Preparedness Council headed by the Prime Minister.

Luxembourg

The Radiation Protection Department (Ministry of Health) and the Civil Defence Organisation (Ministry of Interior) developed general guidelines for the implementation of the emergency plan as well as procedures for the implementation of short-term countermeasures

The Netherlands

The Ministry of the Environment in consultation with all other relevant Ministries developed the general guidelines for the emergency plans. Procedures for the implementation of short-term countermeasures are provided in the Nuclear Energy Law and in the Plan for Emergency Preparedness (NPK). These were developed by the same organisations.

Norway

The Norwegian Radiation Protection Agency (NRPA) developed, on behalf of the Crisis Committee, the general guidelines for the emergency plans. The members of the Crisis Committee (NRPA, Police, Civil Defence, Health Authorities, Food Control Authorities, and Defence) provide procedures for the implementation of short-term countermeasures.

Sweden

The Rescue Services Act, the Decree on Rescue Services and the Decree with instruction for the Swedish Radiation Protection Authority defines the basic obligations of Swedish authorities on local, regional and central level to plan for emergencies. Central authorities develop guidelines and provide regional and local authorities with expert advice, based on the actual – or expected – radiological situation. The implementation of short-term countermeasures is mainly performed by regional authorities.

Switzerland

The Federal Commission on NRBC protection developed the general guidelines for the implementation of the emergency plan in close collaboration with NEOC, HSK and federal agencies responsible for emergencies at federal and local level. This Commission, with its working groups, develops procedures for the implementation of short-term countermeasures. Local authorities are supported by HSK.

United Kingdom

In the United Kingdom, the HM Nuclear Installations Inspectorate and the Home Office (Government Department) developed general guidelines for the implementation of the emergency plan. Procedures for the implementation of short-term countermeasures are developed by the independent government advisor, the National Radiological Protection Board (NRPB).

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United States

In the United States, the development of intervention measures is generally accomplished through the Federal Radiological Preparedness Co-ordinating Committee (FRPCC). The FRPCC is comprised of 17 Federal departments and agencies with responsibilities for preparing and responding to nuclear or radiological emergencies. The primary agencies involved in developing intervention measures include the Environmental Protection Agency, the Department of Agriculture, the Food and Drug Administration (Department of Health and Human Services), the Nuclear Regulatory Commission, the Department of Energy and the Department of Defense.

Factors considered in developing emergency plan guidelines

In developing emergency plan guidelines and procedures, the responsible organisations consider a variety of factors. Table 3 summarises the factors considered by the countries. The most important factor for all countries seems to be the time necessary to implement countermeasures, followed by public health risk, the shielding qualities of average houses and public trauma.

Table 3. Considerations for emergency plan guidelines

	Countries														
Factors	Australia	Canada	Czech Republic	Finland	Germany	Hungary	Ireland	Japan	Luxembourg	Netherlands	Norway	Sweden	Switzerland	United Kingdom	United States
Public health risk	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Time necessary for the implementation	X	X	X	X[b]	X	X	X	X	X	X	X	X	X	X	X
Shielding qualities of average house	X	X	X		X	X		X	X	X	X	X	X	X	X
Availability of basement and shelters			X		X			X	X	X	X		X		
Transportation availability			X		X			X	X	X	X	X	X	X	
Public trauma		X	X			X	X	X	X	X	X	X	X	X	X
Night or day			X		X			X	X	X	X		X		
Nuclear power plant near a border			X		X	X			X		X	X	X		
Costs		X	X			X		X	X		X	X	–	X	X
Counter-measure applied to entire population		X	X		X	X	X	X	X	X[c]	X		X		
Other					X[a]					X[d]		X[a]	–		

a. Weather conditions.

b. Only for evacuation.

c. Stable Iodine and Sheltering could be only for children. In the case of Evacuation, if there is not enough time and/or transport facilities pregnant women and children first.

d. Weather conditions and Number of people involved.

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In general, there is no public consultation before establishing countermeasure guidelines, except in the **Czech Republic**, **Japan** and the **United Kingdom**. In **Switzerland** local authorities are consulted before implementing the guidelines.

In **Australia**, revised recommendations on intervention will undergo a period of public consultation. Some state plans are publicly available. In **Finland**, according to the Act on Rescue Services, the public has to be informed about plans and given an opportunity to comment.

In **Canada** studies on how the population accept risks are taken into account at local level when establishing countermeasure guidelines.

In **the Netherlands** the Parliament was consulted for the Plan for Emergency Preparedness and for the Law all official steps to adopt a Law are taken including the pre-publication of the Law and the possibility for the population to make comments and complaints.

Information or criteria to justify the implementation of short-term countermeasures

The implementation of the countermeasure stable iodine is in **Australia** based on the measured concentration of the radionuclide Iodine-131 in the atmosphere.

In **Canada**, the implementation of a countermeasure will be justified with an estimated averted dose greater than the intervention level, the time of release, and the ability of a safe implementation of the countermeasure. This includes, e.g. weather conditions and availability of transportation, but does not take into account the costs to implement the measure.

In the **Czech Republic**, the safety status of and the radiation situation in the nuclear power plant together with radiation monitoring results on site and in the vicinity, are considered necessary and sufficient to justify the implementation of short-term countermeasures.

In **Finland** and also in **Sweden**, the implementation of an evacuation of the inner part of the emergency planning zone (0-5 km) (0-15 km for Sweden) will be based on the plant situation and the risk of release. Other countermeasures (sheltering indoors, iodine prophylaxis, access control etc) in other parts of the emergency planning zone (5-20 km) (15-50 km in Sweden) or outside these zones will be decided according to the projected or actual radiation situation.

For **Germany,** the following information is required to justify the implementation of short-term countermeasures:

- current plant status and prediction of its development;
- dose (based on predictions and, to the extent possible, on measurements);
- release and environmental situation and
- meteorological situation.

In **Hungary** the decision on the implementation is based on the following information:

- evaluation of on-line data from the Hungarian nuclear power plant (in case of an accident therein);
- meteorological data;
- plume dispersion calculations;
- dose projections with recommended countermeasures;
- measured radiological data from the monitoring network.

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In **Ireland,** an official notification of a potential/actual radioactive release to the environment, which could have radiological impact on the country, justifies the implementation of short-term countermeasures.

In **Japan**, the projected dose, the averted dose by protective measures, the timing of the release of radioactive materials or radiation to the environment, the economic costs accompanying the protective measures, the social disruption due the protective measures and the individual anxiety and disruption caused by the protective measures are considered while justifying the implementation of short-term countermeasures.

For **Luxembourg** the prognostics and diagnostics concerning the accident scenario (e.g. loss of safety barriers), the predicted source term, environmental measurements and advice of neighbouring states are elements for justifying the implementation of short-term countermeasures.

In **the Netherlands** the implementation of a countermeasure will be justified with a calculated projected dose greater than the intervention level, taking into account the estimated averted dose. Moreover, the abnormal or potentially abnormal plant condition and the time before release, and the ability of a safe implementation of the countermeasure are off importance. This includes, e.g. weather conditions and availability of transportation, but does not take into account the costs to implement the measure. Furthermore, psychological criteria may be considered in the decision process and political pressure could play a part.

As a basis the projected dose in stead of the averted dose is used because the estimation of the averted is full of wild guesses. However, the guessed averted dose is taking into account and should not be too low.

In **Norway**, prognoses and assessments of the avertable dose are considered necessary and sufficient to justify the implementation of short-term countermeasures.

In **Switzerland,** the potential threat caused by the emergency at the facility justifies the implementation of short-term countermeasures. Furthermore, psychological criteria may be considered in the decision process.

In the **United Kingdom,** abnormal or potentially abnormal plant/process conditions are sufficient criteria for the activation of the countermeasure plan. Real or potential changes in on-site and environmental conditions are also considered. Plant prognosis, weather conditions and radiological field measurements are sufficient information to justify the implementation of short-term countermeasures.

In the **United States**, abnormal or potentially abnormal plant conditions are sufficient criteria for the implementation of emergency response plans. Real or potential changes in on-site and off-site environmental conditions are also factored into the decision-making process. Degrading plant conditions, deteriorating weather and radiological field measurements are also sufficient to justify the implementation of short-term countermeasures.

Pre-established physical zones for the purpose of countermeasure implementation

Around nuclear installations, planning zones for the implementation of countermeasures are pre-established.

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The planning zone for evacuation is, in general, in the order of 10 km around the nuclear installation, whereas in **Hungary** evacuation is considered up to 31 km around the nuclear power plant (see Table 4). The planning zones for sheltering and stable iodine are generally of the same size, and range from 10-20 km, larger than the evacuation zones. Choosing identical planning zones, indicates that sheltering and stable iodine are often implemented together. In **Hungary** the planning zone for sheltering may be extended up to 71 km.

In all cases, zone sizes are based on detailed analyses of possible accidents, their severity and consequences.

Table 4. Pre-established emergency planning zones

Country	Zones	Reasons for the sizes
Australia	*Zone 1:* 500 m pre-planned evacuation zone *Zone 2:* 2.2 km (dependant upon conditions) ANSTO exclusion zone – 1.6 km	Based on reference accident model used to assess the suitability of Australian ports for visits by nuclear powered warships
Canada	*Evacuation zone:* 7 km[1] *Sheltering zone:* 10 km *Iodine zone:* 10 km	Specific analysis made at the nuclear power plant Gentilly 2, to avoid deterministic effects for severe accidents and to reduce stochastic effects for design basis accidents
Czech Republic	*NPP Dukovany:* 10 km evacuation zone 20 km sheltering and stable iodine zone *NPP Temelin:* 5 km evacuation zone 13 km sheltering and stable iodine zone	Detailed analyses of possible sequences of severe accidents submitted by NPP
Finland	*Protective zone:* 5 km distance from the facility *Emergency planning zone:* Extending to about 20 km from the facility	Detailed analyses of consequences of severe accidents. The size of areas may differ in actual emergency situation due to, e.g. weather conditions
Germany	*Central Zone:* Surrounds the nuclear facility in a 2 km radius. *Intermediate Zone:* A circle with a radius of up to about 10 km around the NPP *Outer Zone:* A circle with a radius of up to about 25 km around the NPP	The size of the zones were chosen in the early years of commercial use of nuclear energy and later backed up by the German Risk Study Phase A.
Hungary	31 km sheltering zone where evacuation can be considered, 71 km where sheltering can be considered (for NPP)[2]	International practice and recommendations as well as practical considerations (ALARA principle, actual density of population)
Ireland		
Japan	8-10 km sheltering zone including evacuation zone (for nuclear power plants)	Potential release of radioactive material for an hypothetical accident postulated in nuclear safety review Furthermore past accidents (Tokaimura, TMI) were studied

1. Under revision. New proposal: 8 km for all three zones.
2. Currently under revision. In the revision the zones are proposed in conformity with the IAEA recommendations: PAZ (Precautionary action zone): 3 km; UPZ (Urgent protective action planning zone): 24 km; LPZ (Long-term protective action planning zone): 80 km.

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<table>
<tr><td>Luxembourg</td><td colspan="3">Up to 25 km zone for iodine prophylaxis; for evacuation and sheltering case by case decision</td><td>Potential thyroid doses to infants and children</td></tr>
<tr><td rowspan="9">Netherlands</td><td colspan="3">Radius Implementation zone around the NPP:</td><td rowspan="9">Implementation zone: Zone asking for pre-established co-operation between local authorities in the area. Emergency preparedness in detail in these zones
Countermeasure zone: Based on the km where the countermeasure should be applied taking into account a PWR5 accident and the highest intervention levels</td></tr>
<tr><td><100 MWe: 5 km</td><td>100-500 MWe: 10 km</td><td>>500 MWe: 15 km</td></tr>
<tr><td colspan="3">Radius Countermeasure zones for the respective MWe, distance from the NPP:</td></tr>
<tr><td colspan="3">Evacuation</td></tr>
<tr><td>0</td><td>5</td><td>5</td></tr>
<tr><td colspan="3">Iodine prophylaxis</td></tr>
<tr><td>4</td><td>10</td><td>15</td></tr>
<tr><td colspan="3">Sheltering</td></tr>
<tr><td>7</td><td>20</td><td>30</td></tr>
<tr><td colspan="3">In a segment depending on the wind direction. For evacuation >100 MWe always also in a circle with 2 km radius</td></tr>
<tr><td>Norway</td><td colspan="3">For two research reactors, zones are being established according to the draft IAEA Safety Series on emergency planning and response</td><td>Local adjustments will be made, both geographical and related to the foreseen accident scenarios at the two reactors (depending on design)</td></tr>
<tr><td>Sweden</td><td colspan="3">Inner emergency zone: Up to 12-15 km in radius around the NPP
Indication zone: Up to approximately 50 km in radius around the NPP</td><td>Analyses of consequences of severe accidents. The size and the shape of the areas in which protective actions will be taken may differ in an actual emergency situation due to, e.g. weather conditions. The zones may also be divided into sectors</td></tr>
<tr><td>Switzerland</td><td colspan="3">Zone 1: Approximately 4 km in radius around the NPP (= sheltering zone)
Zone 2: Approximately 20 km in radius (= sheltering zone)</td><td>Zone 1: Possibility of deterministic effects for unprotected people.
Zone 2: Possibility of high doses, but below deterministic effects for unprotected people</td></tr>
<tr><td>United Kingdom</td><td colspan="3">1-3 km</td><td>Plant safety case and fault analyses</td></tr>
<tr><td>United States</td><td colspan="3">Inhalation Pathway Zone – 16 km
Ingestion Pathway Zone – 80 km</td><td>Potential for release of radioactive material for a hypothetical accident postulated in nuclear safety review</td></tr>
</table>

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Phased implementation of countermeasures

Phased implementation of countermeasures is not foreseen in the emergency plan of **Canada** and **Norway**.

In **Australia,** and **Luxembourg** countermeasures are first implemented in the area close to the emergency followed by areas farther away.

In **Germany** and **Finland**, a phased implementation of countermeasures is foreseen, viz., close area followed by further expansion of the restricted area, specific population followed by general population and children in schools followed by general population.

In **Japan**, the specific population will be followed by general population.

In **the Netherlands** for evacuation phased implementation is based on projected doses (so normally firstly in the area close to the emergency). For other countermeasures the same as for the UK, but if possible besides schools also pregnant women (and their children). The **Swiss** emergency plan foresees a time-scaled phased implementation of countermeasures, prioritising schools, factories, etc followed by the general population.

In **Sweden**, phased implementation is not laid out in detail in the emergency plans, but different time frames for different countermeasures are important and self-evident, both for practical and protective reasons. In the inner emergency zone (up to approximately 15 km), early actions will be initiated depending on the actual situation in the NPP – based on pre-made analyses of the possible impact on the general public. Such countermeasures could be e.g. evacuation, information about iodine prophylaxis and sheltering of dairy animals. Countermeasures farther away from the NPP could possibly await some analyses and prognoses. It is also of great importance to synchronise the efforts in order not to expose the public to danger by doing things in the "wrong order".

In the **United Kingdom**, criteria such as close areas followed by farther areas and schools followed by general population are considered in the actual decision, but are not laid down in the emergency plan.

In the **United States**, countermeasures are first implemented in the area close to the site of the emergency followed by areas further away. For example, in response to an emergency at a nuclear power plant the countermeasures are implemented in a 360 degree circle around the plant site out to a distance of 3.2 km and then in the downwind direction out to 8 or 16 km. The resulting area resembles a keyhole.

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4. EVACUATION

The term evacuation characterises rapid clearance of an area, organised or at least assisted by emergency personnel. In general, the duration of an evacuation does not exceed a time span of two weeks. Depending on the contamination of the residential area, it might be necessary to further extend evacuation, which is called temporary relocation or resettlement.

Evacuation reaches the highest protection against external and internal exposure, if undertaken and fully implemented in the pre-release phase. In case, the full implementation of an evacuation could reach the release phase, the decision for implementing evacuation or sheltering will be based on the dose averted.

Compared to other countermeasures such as iodine prophylaxis and sheltering, evacuation will certainly have the highest psychological, social and economic impact, and the decision process for its implementation should adequately take these factors into account.

The BSS mentions a generic optimised intervention level for temporary evacuation of 50 mSv of avertable dose in a period of no more than 1 week.

Intervention level, dose, integration time, operational intervention criteria

An overview on various intervention levels, doses, integration time and operational intervention criteria used to initiate evacuation is given in Table 5.

Most countries use an estimated or anticipated effective dose of 30 to 500 mSv as intervention level for the implementation of an evacuation. The integration time is normally one week, with the exception of **Switzerland**, where the integration period is the first year following the accident.

Canada, **Hungary, Ireland, Norway** and **Sweden**[1] use an intervention level of 50 mSv averted dose integrated over one week. **Australia** uses the same intervention level but gives no integration time. The **Czech Republic** uses an averted dose of 100 mSv as intervention level. **United Kingdom** uses an intervention level range of 30-300 Sv doses averted by the countermeasure.

The **Netherlands** uses several intervention levels based on the time of release and also levels to avoid deterministic effects. Normally evacuation will take place after cloud passage or before the release if there is enough time to finish the evacuation before the cloud passage. When very high doses could be expected the evacuation will be implemented during the cloud passage (direct evacuation).

1. Swedish intervention levels are generic, i.e. they are used in the planning process – not for decision making in the acute situation.

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Table 5. Summary of evacuation criteria

Country	Intervention level [mSv]	Dose	Integration time	Operational intervention level
Australia	50	Averted dose		
Canada	50	Averted dose	7 days	To be developed.
Czech Republic	50-500 100	Effective dose Averted dose	7 days	1 mSv/h ambient dose rate in plume and from deposition
Finland	50	Averted dose	7 days	1000 microSv/h*
Germany	100	Effective dose	External exposure in 7 days and effective dose commitment due to radionuclides inhaled during this period	Given for the inventory released, the time-integrated air concentration, soil contamination, time-dependent ambient dose rate (see annex 4)
Hungary	50	Effective averted dose	7 days	1 mSv/h, 4 h plume transition
Ireland	50	Averted effective dose	7 days or less	
Japan	50 500	Estimated effective dose Estimated equivalent dose		
Luxembourg	30-300	Anticipated effective dose	7 days	
Netherlands	4 000 1 000 5 000 3 000 1 000	Lung dose RBM dose Thyroid dose Skin dose Effective dose	Estimated for the first day (ext. and internal doses without foodstuffs)	Evacuation under all circumstances, i.e. also during the cloud ("direct evacuation")
	50-500 1 500 2 000	Effective dose Thyroid dose Lung dose	Estimated for the 1rst day (ext. and int. doses, without foodstuffs)	Before or after cloud passage, NOT during ("first day evacuation")
	50-250	Effective dose	Estimated for the first year (ext. and int. doses)	Evacuation within 14 days ("late evacuation")
Norway	50	Averted dose	7 days	
Sweden	50	Averted dose	7 days	To be investigated.
Switzerland **	100-500	Effective dose	The first year following the accident	Dose-rate >500 mikroSv/h after 24 h
United Kingdom	30-300	Sum of committed effective dose and external whole body dose, averted by c/m		Varies with site/operator
United States	10-50	Projected TEDE***	4 days	

* Caused by the contamination after passage of the plume.

** Evacuation is in Switzerland not a short-term countermeasure (for the plume phase) but only considered in the later phase.

*** TEDE denotes total effective dose equivalent, the sum of external dose equivalent and committed effective dose equivalent.

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Operational intervention levels (OILs) are mentioned by six countries. Four of them give explicit values. An operational intervention level of 1 mSv/h is used by the **Czech Republic**, **Finland** and **Hungary**, whereas **Germany** uses different operational intervention levels for different starting-points. A list is given in Annex 2. **Canada** is going to develop operational intervention criteria for evacuation. In **Australia** and **Sweden**, the OILs are currently under review.

Criteria for ending the countermeasure

Criteria for ending an evacuation are in **Finland** the radiation situation, the movement of the radioactive cloud, the averted doses, operational intervention criteria and the contamination. In **Hungary**, a dose of 10 mSv in a month would be the ending criteria for evacuation**.** Almost the same is valid for **Canada.** Here, if the dose averted is less than 10 mSv in a month, an evacuation will be ended.

In **the Netherlands**, the evacuation ends either when the treat for a release is gone or the release was much smaller than could be expected. The return can take place when de effective dose in the first 50 year after the return will be between 50-250 mSv, depending on social, psychological and economical factors.

Switzerland's criteria for ending the countermeasure is the dose rate. A dose-rate <5 mikroSv/h means no further restrictions. A dose-rate <500 mikroSv/h means no evacuation but living in the area with restrictions.

In **Sweden**, detailed mapping of the contamination, and if needed, also decontamination have to be performed prior to any decision about returning to evacuated areas. If the evacuation was initiated by a threat of release in the near future, the countermeasure can be ended as soon as the threat is no longer present.

In the **United Kingdom**, a countermeasure comes to an end when there is no further threat of release and when there is adequate monitoring in the countermeasure area.

In the **United States**, a countermeasure is usually terminated when the threat to public no longer exceeds the appropriate protective action guide. However, other factors, such as plant and weather conditions, may be taken into consideration when making the decision to terminate the countermeasure.

Factors taken into account at the time of a nuclear accident when deciding an evacuation

Main factors considered when deciding an evacuation are, as summarised in Table 6, the release in progress, the averted dose, time delay for the countermeasure and weather conditions, as well as the expected dose without protection and the psychological impact on the public.

The answers given are in agreement with those given in Table 3, Chapter 4.2. It is, however, surprising that, in Table 3, only two countries mention the importance of weather conditions, whereas here, where the weather conditions are a part of the factors mentioned, nearly all find them very important.

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Table 6. Considerations for recommending evacuation

Factors	Countries														
	Australia	Canada	Czech Republic	Finland	Germany	Hungary	Ireland	Japan	Luxembourg	Netherlands	Norway	Sweden	Switzerland	United Kingdom	United States
Averted dose	X	X	X	X		X	X	X	X	(X)	X	X	(X)	X	X
Expected dose without protection	X	X	X	X	X		X	X	X	X		X	X		X
Operational intervention criteria			X	X	X	X	X		X	X			X		
Weather conditions	X	X	X	X	X	X		X	X	X		X	X	X	X
Time of day	X	(X)	X		X			X	X	X		X	X		X
Release in progress	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Time delay for the counter-measure		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Level of preparedness of the population	X		X			X							X	X	
Media impact	X		X												
Psychological impact on the public	X	(X)	X		X		X	X	X	X	X	X	X		
Phased implementation or targeted populations			X	X				X	X	X	X	X			X
Other		X[a]								X[b]	X[c]				

a. Ability to safely implement the countermeasure (federal level), residual dose (provincial level).

b. Number of people involved.

c. Economic impact, number of people involved.

The most important factors for **Australia** are the averted dose and the expected dose without protection. For **Ireland**, the averted dose is the only important factor. For **Hungary,** the averted dose indicated by the operational intervention level would be the most important factor. For the **Czech Republic,** the averted dose and the release in progress are the most important ones. For Norway, the averted dose and the number of people affected are the most important factors when deciding whether or not to implement evacuation.

In **the Netherlands** the projected dose in stead of the averted dose is the most important because the estimation of the averted is full of wild guesses. However, the estimated averted dose is taken into account and should not be too low.

When deciding whether or not to implement evacuation, the public health risk is the most important factor in **Finland** and in **Sweden** while for **Canada, Germany** and **Luxembourg**, expected dose is the most important one. Another important factor for **Canada** is the ability to safely implement the countermeasure.

In the **United Kingdom**, an alignment of the factors mentioned above with the predetermined intervention options is important when deciding whether or not to implement a countermeasure.

From the factors considered above, the operational intervention criteria is most important in **Switzerland** when deciding on whether to implement an evacuation.

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Experience with evacuation

For an actual or potential radiological emergency

Japan experienced an evacuation during a radiological emergency. The size of the evacuated population was about 150, and the affected area was within 350 m radius of the plant.

As a result of a non-radiological emergency

Australia experienced evacuation during Cyclone Tracy in 1974. About 40 000 persons evacuated from Darwin Flood. Bush fires require evacuation of local or regional areas on occasion. As a result of these, Emergency Management Australia was formed.

In **Canada,** the largest evacuation was of the City of Mississauga, Ontario (1979), due to a serious train derailment and threat of chlorine release. A multi-stage evacuation occurred as the order spread to an increasingly large area. The size of the evacuated population ultimately reached about 250 000. Other, smaller, evacuations for floods, forest fires and tornadoes.

The evacuation zone is normally restricted and the number of evacuees generally smaller than 1 000. In the Saguenay flood of 1996, 16 000 persons were evacuated from different zones. When there was black ice, in 1998, no evacuation was necessary, but 17 800 people went to emergency service stations.

In 1997, floods affected nearly a third of the area of the **Czech Republic**. At that time, all villages, some parts of towns, facilities, hospitals, schools and offices amounting to some ten thousand people were evacuated. An evacuation was also carried out when there was a threat of an oil-well explosion.

These experiences were used for the preparation of the EPZ external emergency plan of the NPP Temelin, and are currently used during the revision of the EPZ external emergency plan of the NPP Dukovany. They are also used for the development of external district emergency plans and plans for chemical facilities, for which serious accidents cannot be excluded.

On 5 November 1994, in Ludwigshafen **(Germany)**, an evacuation was necessary during the de-activation of two bombs from the second world war. For the first bomb 10 000 inhabitants and for the second bomb 15 000 inhabitants were evacuated, both within a radius of 1.8 km.

In **Hungary**, some 10 000 people in an area of 100 km^2 were evacuated. This experience was applied to the nuclear emergency planning and preparations.

In **Ireland**, a small population was evacuated due to local floods.

In **Japan**, volcanic eruption forced temporary evacuation of the whole population of the island of Izuoshima, Tokyo Prefecture, which amounts to about 9 500.

In 1995, the threat of floods from the so-called large rivers caused the evacuation of 210 000 people and about 50 000 animals (mostly cows and pigs) in an area of ca. 1 000 km2 in the centre of **the Netherlands**. This evacuation was performed very smoothly and only a few people refused to go. This mostly due to the great help of the media, who informed the public as good as

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possible without exaggeration or trivialising the situation, but showing on television and in the journals the situation (the high water threatening the dykes) from moment to moment. In the end, most dykes didn't break, but some did or were broken on purpose to relieve the other dykes.

During a fire at the Lillestrøm railway station, the centre of Lillestrøm (**Norway**) was evacuated (i.e. small society, order of magnitude: 1 000 persons). Evacuation has been implemented also in connection with avalanches (small number of people affected).

In 1991, a railway accident occurred in Säckingen (**Switzerland**), where several wagons loaded with fuel caught fire. About 200 people around the accident site had to be evacuated. In 1994, another railway accident during transportation of fuel occurred in Affoltern, near Zürich. In this case 120 persons had to be evacuated. After an accident involving hazardous chemicals in the main railway station area in Lausanne in 1994, an evacuation was ordered for the area around the accident site. About 1 000 people were affected. However, this evacuation took place after the accident, as a precautionary measure, during the removal of the damaged wagons and the recovering of the hazardous material. The time for evacuation was not critical and the evacuation was performed without any problems. Parts of this non-nuclear experience, especially in the field of communication, was applied to the Swiss nuclear emergency planning.

A bomb incident at Aintree Racecourse, in the **United Kingdom**, led to the evacuation of 80 000 people from an area of 1.1 km^2. The autumn 2 000 floods caused the evacuation of 11 000 people from numerous locations throughout England and Wales. A major gas leak occurred in the Tower Hamlets, London. Approximately 200 people were evacuated from residential tower block and an Evacuee/Rest Centre was opened; but only 30 evacuees were received as the majority chose to stay with family or friends during the emergency. Lessons learned from these events: the information was used to improve local emergency plans and to assist with the preparation of a guidance document on mass evacuation. The experiences were not applied to the nuclear emergency planning and preparations.

The **United States** has experienced numerous evacuations in response to hurricanes, floods, and accidents involving the release or potential release of hazardous materials. The number of people evacuated range from a few dozen to tens of thousands depending on the size of the hurricane, the amount of flooding expected, or the quantity and type of hazardous material involved in the accident.

Real evacuation as part of an exercise

The port area in Queensland (**Australia**) was evacuated during an exercise. Problems with communications and responsibilities were identified.

Federal organisations in **Canada** suggested the implementation of a real evacuation as part of provincial exercises, but the provincial organisations in Québec rejected the idea.

In the **Czech Republic**, evacuation was exercised in practice during the verification of the emergency plans in areas potentially or actually affected by radiological, chemical or natural emergencies and accidents. Knowledge and experience from these exercises were used to improve the activities of decision makers and exercise participants.

Japan carried out evacuation exercises. People living within a few kilometres radius around a nuclear power plant moved to a gathering spot, from where they were transported by public buses

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provided by the local government to a safe area. The evacuation was successfully conducted according to the exercise scenario.

Sweden has carried out evacuations during nuclear emergency exercises at several occasions. The lessons learned have been implemented into current emergency plans.

The **United Kingdom** carried out a real evacuation during an exercise. No details are given in the questionnaire.

Practical aspects

In **Australia**, an evacuation will be implemented, as a planned operation, only after nuclear release and contamination, based on measured level of release. Response specifies individual cars with police/state emergency service assistance to others. For children and nursing homes there will be special considerations.

In **Finland**, precautionary evacuation would be carried out only in the vicinities of domestic NPPs. The decision is based on plant conditions and the time available for the evacuation. People living in the protective zone, extending to a five kilometres distance from the facility, are planned to be evacuated before a release. In the case where release starts very rapidly, inhabitants would shelter indoors until the release ends. Outside the protective zone, evacuation will be based on the actual contamination level and only implemented after nuclear release and contamination. Evacuation is executed as a planned operation by organised transport and by individual cars. In the Archipelago, the evacuation is executed by organised transport (coast guard) or by individual boats in a protective zone of 5 km distance from the NPP.

As no nuclear power plant exists in **Ireland**, and the nearest one is 100 km across the Irish Sea, it is not envisaged that a situation requiring evacuation would result from an accident at a nuclear power plant. A situation could arise where small-scale, temporary, evacuation may be required due to a radiological accident other than a nuclear power plant abroad.

In **Canada,** the **Czech Republic**, **Germany**, **Hungary**, **Luxembourg**, **Japan, the Netherlands** and the **United Kingdom,** an evacuation will be done as a planned operation before or after a release. Evacuation will be carried out as a planned operation by organised transport or by individual cars. However, it is also seen as a spontaneous reaction of the population in some countries; for example **Hungary, the Netherlands** or **Switzerland**. In **The Netherlands** and the **United Kingdom**, field measurements are used to select between an evacuation and sheltering. No differences are made for different groups within the population, except in **Finland**, where this may be necessary after the passage of a radioactive plume when decontamination and other recovery operations are underway.

Evacuation in **the Netherlands** is foreseen either before or after release and contamination. During the plume phase, evacuation is only foreseen if deterministic effects could occur.

In **Norway**, evacuation is an initial countermeasure foreseen either before or after release or contamination. Evacuation will be implemented as a planned operation using organised transport and individual cars. Special considerations in the implementation of the countermeasure will be given to certain groups within the population, e.g. children in kindergartens close to the research reactors.

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In **Sweden**, people living in the inner emergency zone may be evacuated as a preventive action in case of a threat of release. The decision must be based on plant conditions and the time available for the evacuation. It is not obvious that people in the direct vicinity – up to a few kilometres – of a NPP should be advised to shelter even if there is an ongoing release. A rapid evacuation by e.g. private cars could be advantageous even if the decontamination problem has to be taken into account. Outside the inner zone, evacuation will be based on predictions of the contamination, taking e.g. weather conditions into account, or the actual contamination level. The authorities will focus their efforts on actively helping people who are unable to leave the area by themselves, and on supporting activities that helps the rest of the public to evacuate by e.g. private cars. In this context, correct and timely informing the public is of vital importance.

Evacuation in **Switzerland** is only foreseen after release, as in **Switzerland**, enough shelters are available to protect every citizen, at least in the area around the nuclear power plants. The duration of an evacuation can be several weeks to three months.

In the **United Kingdom**, it is considered not practicable to alert a particular population group without alerting the others. It is wise to include all members of a community in emergency plans, accepting that the implementation of a countermeasure may not be optimum for some members, rather than deliberately excluding some members because of their location or age. However, where certain population groups which are likely to be more at risk can be readily contacted (e.g. schools), priority can be given to informing such groups about the implementation of a countermeasure.

In the **United States**, evacuation is a planned countermeasure for protection of the public in the vicinity of most, if not all, nuclear facilities. Evacuation is also considered for emergencies involving other radioactive sources, depending on the projected dose to a member of the general public and other emergency conditions. In the case of nuclear facilities, the decision to evacuate is normally based on whether or not plant conditions are stable or deteriorating, the number of engineered safety features that are still functioning, the time available for evacuation and other factors that may have an impact on the effectiveness of the evacuation as a countermeasure. In the event the release starts very rapidly, inhabitants may be directed to shelter indoors until directed to evacuate. Although state and local officials have developed evacuation plans for the populations surrounding nuclear facilities, there is concern that the public will react to the emergency by spontaneously evacuating the area using their own vehicles. Depending on the magnitude of such an evacuation, this could result in increased traffic congestion and reduce the effectiveness of the evacuation in reducing individual exposures.

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5. SHELTERING

A simple protective measure for mitigating the impact of a passing radioactive cloud is to advise people to stay indoors, preferably in cellars and closed rooms. In order to be informed about the development of the situation, people are asked to listen to the radio or other media. This counter-measure may be combined with the intake of iodine tablets.

Staying indoors will reduce the whole-body dose due to external gamma radiation. A substantial reduction of the inhalation dose can be achieved by closing windows, outer doors, and ventilation systems. The shielding from external radiation depends strongly on the type of building, the building material and the surrounding buildings.

Long-term sheltering, however, may cause social, medical and hygiene problems, except in specially designed facilities. For a sheltering period of 24 hours or longer, food and medical care for shelter occupants has to be considered.

According to the BSS, the generic optimised intervention level for sheltering is 10 mSv of avertable dose in a period of no more than 2 days.

Intervention level, dose, integration time, operational intervention criteria

Variation in intervention levels used for sheltering is smaller than for other countermeasures (see Table 7).

Australia, the **Czech Republic**, **Hungary, Ireland**, **Norway** and **Sweden** use an intervention level of 10 mSv averted dose with an integration time of one or two days. **Australia** gives no integration time. **Canada** uses 5 mSv averted dose in 1 day. In the United Kingdom, the intervention is based on a range of 3-30 mSv of committed effective dose and external whole body dose averted by the countermeasure.

Intervention levels based on effective dose range from 3-50 mSv, using integration times from 2 days to one week.

As an exemption, **Switzerland** differentiates between staying indoors based on an intervention level of 1-10 mSv effective dose in the plume phase and staying in cellars based on an intervention level of 10-100 mSv effective dose. The reason is that nearly every house in Switzerland is equipped with a shelter.

Another exemption is the **Netherlands**: sheltering means staying indoors, doors and windows closed. An integration time of only 6 hours is taken, because after that time the concentration indoors will be higher than outdoors. The level is between 5 and 50 mSv effective dose. It is foreseen that, if relevant, it will be announced that the sheltering is only necessary for children.

Operational intervention levels were introduced in six countries. The **Czech Republic**, **Finland** and **Hungary** use an ambient dose rate varying from 0.1 mSv/h to 1 mSv/h. A list of varying operational intervention levels exist in **Germany** (see Annex 3).

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Canada developed operational intervention criteria for sheltering, in **Australia** these criteria are currently under review.

Table 7. Summary of sheltering criteria

Country	Intervention level [mSv]	Dose	Integration time	Operational intervention level
Australia	10	Averted dose		
Canada	5	Averted dose	1 day	To be developed
Czech Republic	5-50 10	Effective dose Averted dose	2 days	1 mSv/h ambient dose rate in plume and ambient dose rate from deposition
Finland	10	Averted dose	2 days	100 microSv/h
Germany	10	Effective dose	External exposure in 7 days and effective dose commitment due to radionuclides inhaled during this period	They exist for the released activity in the surrounding area, the released activity in the remote area, the time-integrated air concentration, and soil contamination (see Annex 5)
Hungary	10	Effective averted dose	In 2 days	0.2 mSv/h, 4 h plume transition
Ireland	10	Averted effective dose	In 2 days or less	
Japan	10-50 100-500	Estimated effective dose Estimated equivalent dose		
Luxembourg	3-25	Anticipated effective dose	7 days	
Netherlands	5-50	Estimated effective. dose	6 hours	Probably, the level of action will always be around the 5 mSv
Norway	10	Averted dose	2 days	
Sweden	10	Averted dose	2 days	
Switzerland	1-10 (staying indoors) 10-100 (staying in cellars)	Effective dose	Dose from the plume	Source term estimation from dose-rate inside the containment
United Kingdom	3-30	Sum of committed effective dose & external whole body dose, averted by c/m		Varies with site/operator
United States	10-50 (100 for special groups)	Projected TEDE*	4 days	

* TEDE denotes total effective dose equivalent, the sum of external dose equivalent and committed effective dose equivalent.

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Criteria for ending the countermeasure

In **Canada,** sheltering ends when the dose is less than 5 mSv in one day. Sheltering of up to 1-2 days would be the maximum. In **Switzerland,** the decision to end sheltering is based on the dose rate, however no explicit value is given. In **Hungary** and **Sweden**, time is a criterion for ending sheltering, ending latest after two days. In **Finland,** the radiation situation, movement of the radioactive cloud, averted doses, operational intervention criteria and contamination, are criteria for ending sheltering. In the **Netherlands**, it will be advised to open doors and windows after about 6 hours if not the cloud is still passing and the concentration outdoors is higher than indoors.

Factors taken into account at the time of a nuclear accident when deciding sheltering

The main factors taken into account (see Table 8) are the same as for evacuation: release in progress, the averted dose, the expected dose without protection, weather conditions and the time delay for the countermeasure. Contrary to evacuation, the level of preparedness of the population plays a minor role in the case of sheltering.

Table 8. Considerations for recommending sheltering

Factors	Countries														
	Australia	Canada	Czech Republic	Finland	Germany	Hungary	Ireland	Japan	Luxembourg	Netherlands	Norway	Sweden	Switzerland	United Kingdom	United States
Averted dose	X	X	X	X		X	X	X	X	(X)	X	X	(X)	X	X
Expected dose without protection	X	X	X	X	X		X	X	X	X		X	X		X
Operational intervention criteria			X	X	X	X	X		X				X		
Weather conditions	X	X		X	X			X	X	X	X		X	X	X
Time of day		(X)			X		X	X	X	X	X				X
Release in progress	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Time delay for the counter-measure	X	X	X	X		X		X	X	X	X	X		X	X
Level of preparedness of the population			X												
Media impact	X		X												
Psychological impact on the public	X	(X)	X				X	X	X	X	X		X		
Phased implementation or targeted populations			X	X	X			X	X	X	X		–		X
Other		X[a]									X[b]		–		

a. Ability to safely implement the countermeasure (federal level), residual dose (provincial level).

b. Economic impact, number of people, time of year.

For **Switzerland,** the operational intervention criteria are the most important factors when deciding whether or not to implement sheltering. For **Hungary**, the averted dose (indicated by the operational intervention level when measured) is the most important criteria for the implementation of sheltering. For **Canada, the Netherlands** and **Germany,** the expected dose without protection is most important. For **Canada,** the ability to safely implement the countermeasure is also an important criterion. In **the Netherlands**, sheltering for children and adults is advised at different dose levels to allow adults to go outdoors for work and for food supply. Public health risk is considered most

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important for **Finland**. For the **Czech Republic**, the expected dose in EPZ and the averted dose are the important criteria. For **Norway**, the averted dose together with the time of the day and the year are the most important factors. In **Sweden**, the public health risk is the most important factor, and consequently the averted dose together with the expected dose without protection is most important.

Experience with sheltering

For an actual or potential radiological emergency

Japan sheltered about 310 000 people within 10 km radius of the plant during a radiological emergency.

The **United Kingdom** experienced sheltering for an actual or potential radiological emergency. No detailed information was given in the questionnaire.

Sheltering, in the **United States** is the usual advice in the event of a chemical spill or threat. Sheltering usually requires that people stay indoors, close windows and doors, stay tuned to the radio or television for further instructions, etc.

As a result of a non-radiological emergency

Several thousands, affected by a petrochemical release, were sheltered in Melbourne City, **Australia**. As a result of this, EMA (Emergency Management Australia) was built.

A sheltering order was given in Laval, Quebec, **Canada** in response to a fire at a paint manufacturer's in which paint drums exploded and paint particles were dispersed **to the environment**. "Stay-in" advice (a form of sheltering) has been given for asthmatics and elderly people in some cities during periods with high pollution.

Some small chemical accidents occurred in the **Czech Republic**. The population of the affected area, of ten to hundred meters, was warned in time and sheltered. This experience was applied namely for warning systems and notifying the public.

In **Finland**, only very limited areas have been sheltered. In **Germany**, only local areas around chemical installations experienced sheltering. In **Ireland**, a small population near the accident site was sheltered.

In **the Netherlands**, there is many experience on a limited scale: e.g. some streets or one quarter of a city, in cases that toxic materials are released due to fire or otherwise. During the passage of the plume a dose reduction of 3 and after the plume (with doors and windows open) a reduction of 90% is assumed.

Norway has sheltering experiences in connection with storms and risk of avalanches in the northwestern part of Norway.

In the areas around the chemical industry in **Switzerland** the alarm signal is occasionally sounded. This means that the population has to stay indoors and listen to the radio. Normally only a

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couple of blocks around the concerned facility are affected, i.e. several hundred to a couple of thousand people. But this experience was not applied to the nuclear emergency planning.

Sheltering, in the **United Kingdom** is the usual advice in the event of a chemical spill or threat; this requires that the people stay indoors and close windows and doors, etc.

In **Sweden**, limited areas have been sheltered in the event of big fires, accidents at chemical plants or other chemical spill outs.

Real sheltering as part of an exercise

In the **Czech Republic,** sheltering is exercised to verify the emergency plans both internal and external). Experiences are used to improve the activities of decision makers and exercise participants.

Real sheltering was tested in **Finland** during two exercises, where people stayed in civil defence shelters for 3 days.

In **Japan** sheltering was implemented within several kilometres of the outer area of an evacuation zone for the people around a nuclear power plant. It was conducted successfully according to the exercise scenario.

Sheltering as an initial countermeasure

For almost all countries, sheltering is implemented as the initial countermeasure, as it is easy communicate and to implement. During sheltering, population can easily be located in case of the additional implementation of iodine prophylaxis.

In Arpansa and Tasmania, **Australia**, sheltering is used as an initial countermeasure, but in Queensland and Northern Territory this is not possible as housing is not suitable for providing adequate radiological shelters.

In **Ireland**, due to the distance from the nearest nuclear power plant, sheltering would be the most likely countermeasure to be implemented in the event of an atmospheric release.

In **Luxembourg**, as a non-nuclear country, evacuation of the population is considered rather improbable. For this reason, sheltering and the distribution of KI tablets are seen as the more likely option.

In **the Netherlands**, sheltering will be the countermeasure **of first choice**, unless the doses justify evacuation. Even so, for iodine prophlaxis, the doses are calculated assuming sheltering, **so** three times lower doses during the sheltering time.

As **Norway** has no nuclear power reactors, sheltering will be the initial countermeasure in case of a far-field accident.

In **Switzerland**, almost all houses have shelters with a high shielding factor. Sheltering is, in general, combined with KI administration as initial countermeasure.

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Countermeasures accompanying or following sheltering

In most cases, sheltering is combined with the donation of stable iodine tablets.

In **Finland**, sheltering is combined with intake of stable iodine, access control and protection of livestock production. If the radiological situation would require sheltering for more than one or two days, people will be evacuated.

Application for different groups within the population

Sheltering is always applicable for the entire population living in the affected area.

In **Finland**, there is a recommendation, especially for children, to avoid going outdoors as a "lighter" countermeasure.

Criteria used when selecting between sheltering and evacuation

The averted dose, projected dose, and ability to carry out the countermeasure safely (taking into consideration weather, release time, etc) are the criteria when deciding between sheltering and evacuation in **Canada**. Sheltering will be the preferred option as long as it is uncertain whether intervention levels as given in the "Plan des mesures d'urgence nucléaire externe à la centrale nucléaire Gentilly 2" will be reached, if there is not sufficient time to evacuate all potentially affected people, or if weather conditions are atrocious (snow storm, black ice, etc) making evacuation dangerous.

In the **Czech Republic**, the actual safety status of the NPP, actual meteorological conditions, time and the dose in case of venting are criteria for the deciding between sheltering and evacuation.

In **Finland**, criteria are based on the threat analysis made by STUK. Sheltering is an appropriate measure outside the planning zone; evacuation will be carried out in the area five-kilometres around the facility. Apart from the situation on-site, the decisions will be based on weather conditions and the time of release.

The decision between sheltering and evacuation will, in **Germany**, be based on the projected dose if no countermeasure is implemented and the time necessary to implement the countermeasure.

In **Hungary**, the decision between sheltering and evacuation is in theory based on the averted dose, but will in practice be taken on the basis of operational intervention levels, e.g. measured dose rates.

The averted dose, feasibility and hardship imposed are criteria used in **Ireland** when selecting between the two countermeasures.

In **Japan**, the decision between sheltering and evacuation depends on intervention levels only.

In **Luxembourg**, the predicted dose, weather conditions, time of day, as well as the release in progress, are criteria when selecting between sheltering and evacuation.

In **the Netherlands**, the choice is made mainly on predicted projected doses, but also on assumed averted and residual doses.

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In **Norway**, the decision between the implementation of sheltering or evacuation will be based on the averted dose and the number of people involved.

As there are enough shelters in **Switzerland** for every citizen, at least in the area around their nuclear power plants, the countermeasure "staying in shelters" is the initial preventive countermeasure.

In **Sweden**, the decision is based on several factors, e.g. weather conditions, averted and predicted dose, time of release (if not already on-going) and distance to the affected NPP.

In **United Kingdom**, field measurements are used for deciding between sheltering and evacuation.

In the **United States**, the decision between sheltering and evacuation is based on the projected dose, weather conditions, presence of competing disasters, local physical factors that may impede evacuation, and mobility of special population groups.

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6. USE OF STABLE IODINE

The intake of specific stable iodine compounds, for example potassium iodine or potassium iodine, is effective in reducing the uptake of radioactive ^{131}I and other radioiodines in the thyroid gland (iodine prophylaxis).

According to the WHO Guidelines for Iodine Prophylaxis Following Nuclear Accidents from 1989, the uptake of radioiodine by the thyroid is effectively blocked by a recommended administration of 100 mg stable iodine, corresponding to 130 mg potassium iodide or 170 mg potassium iodide. For pregnant women and children aged 3-12, the dose should be reduced to 50 mg stable iodine, for children younger than 3 years to 25 mg. Neonates are particularly sensitive to the effects of iodine excess, especially in iodine deficiency areas. Therefore, the administered amount for neonates should preferably not exceed 12.5 mg.

The maximum benefit from stable iodine is clearly obtained by taking tablets before exposure to radioiodine, or as soon as possible afterwards. Administration a few hours after exposure from to radioiodine can reduce the thyroid activity by a factor of up to 2. Little reduction in thyroid radiation dose would be achieved if administration of stable iodine is delayed beyond 6 hours and the protective action is of no value 12 hours after radioiodine exposure.

Although its effectiveness decreases with time, a single administration of stable iodine is effective for up to a few days, but this varies depending upon the natural dietary intake. If exposure to radioiodine continues beyond 2 days, further administration of stable iodine may be required.

Administration of stable iodine will rarely be used as a stand-alone protective action. It will normally be recommended in conjunction with sheltering or evacuation. Administration of stable iodine should be considered when inhalation of radioiodine is a major exposure pathway. In situations where uncontaminated food supplies are readily available, it is more appropriate to reduce doses from ingestion radioiodine by imposing restrictions on the production and consumption of foodstuffs.

According to the BSS, the generic optimised intervention value for iodine prophylaxis is 100 mGy of avertable committed absorbed dose to the thyroid due to radioiodine.

Intervention level, dose, integration time, operational intervention criteria

Intervention levels, type of dose, integration time and the operational intervention criteria used to initiate the countermeasure “use of stable iodine” are summarised in Table 9.

Australia, Canada, Hungary, **Ireland** and **Norway** use 100 mGy or rather mSv averted thyroid dose as an intervention level for this countermeasure (see Table 9). This value is comparable to the value of 100 mGy of avertable committed absorbed dose to the thyroid due to radioiodine laid down in the International Basic Safety Standards.

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Four countries **(Czech Republic, Luxembourg, United Kingdom**, and **Switzerland)** use an intervention level range, based on the two-tier concept. **United Kingdom** and **Switzerland** use the same values for their intervention level range (30-300 mSv), but the values belong to different doses. Whereas **Switzerland** uses the anticipated thyroid dose, **United Kingdom** uses the committed thyroid dose averted by the countermeasure. Furthermore, the intervention level range from **Switzerland** is combined with an integration time of the first year following an accident.

Luxembourg uses an intervention level range from 30-250 mSv only for children.

The Netherlands uses an intervention level of 500 mSv thyroid dose for children and 1 000 mSv for adults. These levels are relatively high following the advice of endocrinologists – well-known thyroid experts – who claim that the intake of stable iodine is not without risks as thyroiditis could follow. Moreover, it is still not known whether or not people will become sensitive to iodine, getting allergic reactions the next time they are exposed to iodine (e.g. in medicine). The Polish experience does not solve that problem (yet). The intervention levels are nevertheless currently under discussion, because of the decrease in the intervention levels abroad.

The **Czech Republic** gives two different intervention level ranges: one for the effective dose (5-50 mSv) and one for the averted thyroid dose (50-500 mSv).

The intervention levels used by **Germany** for this countermeasure are originally based on 1989 WHO Guidelines for Iodine Prophylaxis following Nuclear Accidents. As Germany is an iodine deficient area, the recommended WHO values were adopted to these conditions. In addition, the experience of Chernobyl, especially with regard to childhood thyroid cancer, was taken into consideration when developing intervention levels. The result is that Germany has two different intervention levels: the lower intervention level (50 mSv) applies to children up to 12 and pregnant women, and the higher intervention level (250 mSv) applies to adults up to the age of 45. As an appropriate integration time for the calculation of the anticipated thyroid organ dose through radioactive radioiodine inhaled, 7 days were selected, including dose equivalent commitment. If, in case of long-lasting releases, the passage of the radioactive cloud takes longer than 7 days, the integration time is prolonged accordingly.

Finland has already adopted new intervention levels for iodine prophylaxis based on a WHO publication from 1999. Intake of iodine tablets is recommended for children under 18, if the averted dose to the thyroid is 10 mGy. For adults, the intervention level is 100 mGy.

Sweden has adopted the 1999 WHO recommendations on dosage. For people older than 40 years the use of iodine prophylaxis is not recommended due to the limited risk of developing thyroid cancer. The generic intervention level is 100 mGy to the thyroid gland (children), but recommendations will follow when the predicted averted dose may exceed 10 mGy.

Japan has no predetermined intervention level for the use of iodine tablets. For Japanese experts, it depends on the amount of radioactive iodine and the anticipated dose to the thyroid. The complex procedure of determining the intervention level is postponed to the case of an event and done by the judgement of experts. In case the event requires immediate action, there is no preliminary intervention level at hand.

Four countries have operational intervention criteria for the use of stable iodine. The **Czech Republic** already uses, and **Hungar**y will probably introduce a default criteria of 0.1 mSv/h ambient dose rate in the plume, as recommended by the IAEA in TECDOC-955.

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Table 9. Summary of stable iodine criteria

Country	Intervention level	Dose	Integration time	Operational intervention criteria
Australia	100 mGy	Averted dose		[1]
Canada	100 mSv[2]	Thyroid organ dose (averted dose)		[3]
Czech Republic	5-50 mSv 50-500 mSv	Effective dose Organ dose (averted)		0.1 mSv/h[4]
Finland	10 mGy (for children under 18) 100 mGy (for adults)	Averted dose to the thyroid		10 µSv/h (for children under 18) 100µSv/h (for adults)
Germany	50 mSv (for children up to 12 and pregnant women) 250 mSv (for adults up to age of 45)	Thyroid organ dose (anticipated)	Radioactive iodine inhaled over a period of 7 days including dose equivalent commitment	Criteria are given for: • released activity of iodine at the source and • time integrated air concentration (see Annex 6)
Hungary	100 mGy	Thyroid organ dose (averted)		0.1 mSv/h; 4 h plume transition[5]
Ireland	100 mSv	Anticipated averted thyroid dose		Thyroid dose from radioiodines
Japan	Where a large amount of radioactive iodine is released and a high thyroid dose is anticipated, stable iodine prophylaxis could be taken according to the judgement of experts			
Luxembourg	30-250 mSv	Anticipated organ dose, children		
Netherlands	250 mSv children (<17) and pregnant women 1000 mSv adults	Projected Thyroid dose	1 day	
Norway	100 mGy	Averted dose		
Sweden	10-100 mGy for children	Averted dose to the thyroid		
Switzerland	30-300 mSv	Organ dose (anticipated dose)	Inhalation dose integrated over time of plume passage	Source term estimation
United Kingdom	30-300 mSv	Committed thyroid dose, averted by countermeasure		Varies with site/operator
United States	≥5 Gy (for adults over 40 yrs) ≥100 mGy (Adults 18-40 yrs) ≥50 mGy (for pregnant/lactating women) Adults 12-18 yrs Children 3-12 yrs Children 1 month-3 yrs Birth through 1 month	Committed dose equivalent to thyroid		

1. Under review at present.
2. Health Canada's Federal Recommendation. The province of Quebec has other intervention levels: ffffiffl mSv (0-20 years), ff fflffl mSv (20-40 years).
3. To be developed.
4. The default value of several ten mSv/h will be used, depending on real course and conditions of radio-nuclides release; for calculation the averted dose of 100 mSv from inhalation was used as basis assumption, and various accident sequences for WWER-213 reactor were calculated to assess the possible consequences for country specific conditions.
5. To be included into the National Nuclear Emergency Plan being revised, not yet accepted.

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Finland uses also 0.1 mSv/h ambient dose rate in the plume to initiate the intake of tablets for adults. For the protection of children, a dose rate of 10 μSv/h will initiate the countermeasure.

Germany uses as operational intervention criteria for the decision on the intake of iodine tablets the released activity of iodine at the source and the time integrated air concentration, calculated for different times after shut-down of the reactor and for different distances from the source. Detailed values are given in Annex 4.

In the **United Kingdom,** the operational intervention criteria vary with the site and the operator. Therefore no examples are given.

Canada will be developing operational intervention criteria for this countermeasure. In **Australia,** these criteria are currently under review.

The decision to end the countermeasure is in all countries based on whether potential and real radiation exposures had fallen sufficiently, estimated for example via the activity in the air, the movement of the radioactive cloud, etc. Explicit criteria such as an operational intervention criteria were not mentioned.

Form of stable iodine used, iodine dosage, ingestion frequency, duration

In nearly all countries stable iodine is give in form of KI tablets (see Table 10). The KI content of a tablet varies from 65 mg KI to 100 mg KI and even 130 mg KI. In the ***United Kingdom***, potassium iodate (KIO_3) tablets are used, containing 50 mg equivalent mass of stable iodine.

Australia, **Finland**, **Germany**, **Ireland, Norway,** the **United Kingdom** and **Switzerland** adopted the WHO recommendations regarding the single iodine dosage according to the different age groups of the population. Whereas:

- **Canada** adopted the dosage for the different age groups, but not every province adopted the single administration.
- **Sweden** may recommend an additional KI dose within 48 hrs if the release is still on-going.
- The **Czech Republic** recommends the same dosage for the different age groups, but over a time period of 48 hours.
- **Hungary** makes no distinction between the age groups and recommends a twice-daily dosage of 65 mg mass of KI for each person for a duration of 10 days.
- **Japan** uses a dosage of 50 mg mass of KI for children and infants. The dosage would be given for a maximum period of ten days, with less than 1 g KI in total.
- **Luxembourg** adopted WHO's envisaged dosage, with a single dose for neonates and pregnant women. Infants, children and adults would get the recommended dosage twice within two days.

For territories with low dietary iodine levels, there are no differences in terms of dose, duration or frequency.

United Kingdom prefers a single administration of stable iodine tablets. Instead of ordering a second administration, an evacuation would be the preferred action.

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Table 10. Dosage criteria for stable iodine

Country	Population[1]	Dosage (mg)		Frequency	Duration
		Mass of KI	Mass of iodine		
Australia	Infants		25-50	Single dose	
	Children		50	Single dose	
	Adults		100	Single dose	
	Pregnant women		100	Single dose	
	Emergency Workers		100	1 per day	10 days
Canada	Neonates		12.5[2]	[3]	[3]
	Infants		25[2]		
	Children		50[2]		
	Adults		100[2]		
Czech Republic	Infants	32		24 h 16 mg	48 h
	Children	65		24 h 32.5 mg	48 h
	Adults	130		24 h 65 mg	48 h
	Pregnant women	130		24 h	max. 2x
	Others	130			
Finland	Neonates	16		[4]	24 h
	Infants	32.5			
	Children	65			
	Adults	130			
	Pregnant women	130			
Germany	Neonates	12.5		Normally single dose. In exceptional cases taking an additional tablet may be recommended	The intake for neonates should be confined to one day
	Infants	25			
	Children	50			
	Adults	100			
	Pregnant women	50			
Hungary	Infants[5]	65		Twice daily	10 days
	Children[5]				
	Adults[6]				
	Pregnant women[5]				

1. Neonates: birth-1 month.
   Infants: 1 month-3 years.
   Children: 3-12 years.
   Adults: include adolescents aged 13-16 years.
2. Federal recommendation follows the 1989 WHO Guidelines. Varies by province.
3. Varies by province. In New Brunswick, the frequency is 1 dose per 24 hr (except for newborns, where a single dose is advised), until instructed to stop. At the federal level, a protracted dose is generally not advised.
4. If needed, authorities give an order for another dosage after 24 h.
5. ½ or ¼ may be administered depending on age or in case of iodine sensitivity.
6. Adults below 40 years.

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Ireland	Neonates Infants Children Adults Pregnant women		12.5 (1/4 tablet) 25 (1/2 tablet) 50 (1 tablet) 100 (2 tablets) 100 (2 tablets)		One day
Japan	Infants Children Adults Pregnant women	50 100 100 100		50 mg/day 100 mg/day 100 mg/day 100 mg/day	Max. 10 days; Less than 1 g (total)
Luxembourg	Neonates Infants Children Adults Pregnant women		12.5 25 50 100 100	1	Only 1 dose 2 days 2 days 2 days Only 1 dose
Netherlands	0-4 year 5-16 year >16 year Pregnant women	KIO_3	25 50 100 100	Normally single dose. In exceptional cases taking an additional tablet may be recommended	Only during the passage of the plume. Normally, "clean" food can be supplied
Norway	Neonates Infants Children Adults Pregnant women	16 32.5 65 130 130		[4]	24 h
Sweden	0-1 month Infants <3 yrs Children <12 yrs Adults <40 yrs Pregnant women	16 32.5 65 130 130		Normally single dose. In the case of a prolonged release, an additional dose may be recommended	
Switzerland	Neonates Infants Children Adults Pregnant women	16.2 32.5 65 130 130		Single dose Single dose Per day Per day Per day	Only one time Only one time [7] [1] Max. 2 days
United Kingdom	Neonates Infants Children Adults (including pregnant and lactating women)		12.5 25 50 100	Single administration only, preferred	Single administration provides protection for 24 hours
United States	Birth through 1 month 1 month through 3 yrs Children 3-12 yrs Adults 12-18 yrs Adults over 18 yrs Pregnant/lactating women	16 32 65 130			Until risk of significant exposure to radio-iodine by either inhalation or ingestion no longer exists

7. The duration depends on the actual situation.

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Assumed shelf life of stable iodine tablets

A summary of the assumed shelf life for pre-distributed tablets (KI) is given in Table 11.

In **Switzerland,** the assumed shelf life for pre-distributed tablets (KI) is eight years. Stockpiled tablets are periodically controlled after these eight years. In **Luxembourg,** the producer of the stable iodine tablets (KI) guarantees a shelf life of ten years. In **Australia,** tablets are controlled after five years and, depending on the result, the shelf life might be extended. In **Ireland,** the manufacturer gives an expiry date of five years, whereas tests indicate that the expiry date could be extended to 10-15 years as long as tablets are stored correctly. **Hungary**, the **Czech Republic**, **Canada** and **Finland** also have an expiry date of five years for the tablets. **Germany** has an expiry date of 10-15 years under favourable storage conditions (cool and dry) for stable iodine tablets.

In the **United Kingdom** the assumed shelf life of the tablets (KIO_3) is three years, in **the Netherlands** it is 5 years.

In **Sweden**, iodine tablets are pre-distributed to the households within the inner emergency zone (up to about 15 km from the NPP). Every 5 years new tablets are distributed. The expiry date could be extended up to 10 years or longer, depending on storage, but the 5 year cycle was chosen in order to ensure the availability by compensating for possible loss or misplacing of tablets by the public.

In the **United States**, the Federal policy on the use of KI for protection of the general public from radioiodine has been recently revised. As such, there is not much experience with the long-term storage of KI. The current assumed shelf life for KI tablets is 5-7 years. As experience with long-term storage is gained, the expiration date could be extended.

Table 11. Stable iodine tablets shelf life

Country	Assumed shelf life for stable iodine tablets [years]	
	KI	KIO_3
Australia	5[8]	
Canada	5	
Czech Republic	5	
Finland	5	
Germany	10-15	
Hungary	5	
Ireland		5
Japan		
Luxembourg	10	
Netherlands		Check every 5 years
Norway	5	
Sweden	5	
Switzerland	8	
United Kingdom		3

8. After five years the tablets are controlled and depending on the result, the shelf life might be extended.

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Precautions with regard to side effects caused from a high dose of stable iodine

Information about possible side effects are given in special leaflets (**Sweden, Switzerland, Germany, United Kingdom, Ireland, Finland,** the **Czech Republic**) or calendars which are distributed to all families within the emergency planning zone before an emergency.

In **Germany**, people aged over 45 are recommended not to take iodine tablets as, owing to the general iodine deficiency in Germany, early forms of thyroid over-activity (so-called functional autonomy or "hot nodules") are common in people aged over 45. The risk of taking iodine tablets (deterioration in the metabolic situation) outweighs the radiation risk due to radioactive iodine, which is very low in this age group.

In **Luxembourg**, individuals who may suffer severe side effects from a high dose of stable iodine, or known to have thyroid disease, are invited to consult their doctors in advance. Furthermore, information on risks and side effects is also given during emergency situations.

In the **United States**, the mechanism for providing information about the possible side effects from taking stable iodine has not yet been developed. The use of special leaflets, calendars, or other forms of instruction may be used by those states that decide to stockpile KI for the protection of the general public around nuclear power plants.

Distribution logistics and availability

With the exception of the **Austria, Canada,** and **United Kingdom**, stable iodine tablets are commercially available at pharmacies. In **Luxembourg**, tablets are only available for children not older than four years.

In **Australia**, the tablets will be distributed in an emergency situation only. The tablets are not commercially available, e.g. at pharmacies, but are stockpiled by the police and local and national authorities. In case of an emergency, they will be distributed to the residences of the population and to pre-designated locations.

In **Canada**, the provinces are responsible for the decision to distribute stable iodine. There are various policies, some provinces decided to pre-distribute the iodine tablets to residences, other provinces make them available at pre-designated locations. Within a radius of about 8 km around Gentilly 2 nuclear power plant, for example, iodine tablets will be pre-distributed to some 12 500 persons (inhabitants and workers). In New Brunswick, 3 500 people living within 20 km radius around Pt. Lepreau NPP received stable iodine tablets. Pills are also provided in quantity to police departments, public health offices, schools and local facilities. Additional supplies are stockpiled at the generating station and at the off-site emergency centre in Lepreau, New Brunswick. In Canada, iodine tablets are not commercially available at pharmacies.

The **Czech Republic** has the most widespread pre-distribution of stable iodine tablets to residences, businesses, pharmacies, schools and other locations. Around the nuclear power plant Dukovany, about 110 000 people living in the emergency planning zone have already received the tablets. Around the Temelin nuclear power plant, about 40 000 people living in the emergency planning zone received the tablets. People may also buy stable iodine tablets in designated pharmacies.

In **Finland**, tablets are pre-distributed to residences surrounding (5 km) nuclear power plants. The tablets are also pre-distributed to companies near the nuclear power plant. Stable iodine

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tablets are pre-distributed to about 1 150 people living around Loviisa NPP (50 permanent inhabitants and about 400 holiday homes with a maximum of 1 100 inhabitants) and 1 370 people surrounding Olkiluoto NPP (70 permanent inhabitants and about 450 holiday homes with a maximum of 1 300 inhabitants). In case of an emergency, tablets will also be distributed by emergency services at pre-designated locations and at public shelters.

In others parts of **Finland**, iodine tablets are also made widely available, e.g. in schools and nurseries. In addition, tablets are commercially available at pharmacies.

In **Germany**, stable iodine tablets are currently stockpiled in schools, public shelters, pharmacies and at local authorities. In case of an emergency they will be distributed at pre-designated locations or, with the help of emergency services, directly to the residences of the population.

The **German** Radiological Protection Commission (SSK) recommended a pre-distribution of tablets to households within a radius of up to 5 km around a nuclear power plant; this will be carried out as soon as iodine tablets containing 130 mg KI are commercially available in Germany. In addition there will be three national stockpiles storing stable iodine tablets for children up to 12 and for pregnant women, in case of an emergency outside a radius of 25 km around the nuclear power plants. Tablets are also commercially available at pharmacies.

In **Hungary**, tablets are stored at pharmacies and will be distributed at pre-designated locations during an emergency. Tablets will be distributed to every household in **Ireland**. In **Japan**, the tablets are stockpiled by local authorities and distributed at public shelters during an emergency.

In **Luxembourg**, stable iodine tablets will be commercially available in pharmacies for children of up to five years only. For other population groups, the tablets are stockpiled at schools and other pre-designated locations (e.g. local and national authorities).

In **the Netherlands**, stable iodine tablets are stockpiled in a central depository. They are also available around Borssele in Health Service Centres.

In **Norway**, stable iodine will distributed by the emergency services at designated locations. The distribution system is being revised. In Northern Norway, tablets will be available for all relevant groups and distributed through local authorities (from schools, hospitals etc). For the rest of the country, national authorities keep a central storage (few tablets). Around the research reactors, the operator has supplied some tablets (stored at the plant and by the police). This system for distribution might be changed.

In **Sweden**, iodine tablets are pre-distributed to all households within the inner emergency zone around the four NPP. This procedure is repeated every 5 years. There is also central storage of tablets for additional distribution. Larger workplaces, schools and hospitals have also received tablets.

In **Switzerland**, iodine tablets are pre-distributed about 4 km (zone 1) around the nuclear power plants. Depending on the location of the NPP, between 3 000 and 30 000 tablets are pre-distributed to residences of the population, to places of business, local authorities and pharmacies. Up to a distance of 20 km (zone 2) around nuclear power plants, tablets need not be distributed if the population can get them within the first two hours of an emergency. In this case, the public in general must go and fetch their tablets at specially designated locations. The solution chosen depends on the decision taken by the local authority. Currently, discussions are underway to change the legal basis to allow for a pre-distribution in zone 2 as well. In addition, a national central stockpile is available from

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where tablets can quickly be transported by helicopters to any location in Switzerland. Stable iodine tablets are also available commercially from pharmacies.

In general, there is no pre-distribution of potassium **iodate** tablets in the **United Kingdom**. However, the local health authority together with the operator, the police and the local government takes the decision for a pre-distribution in certain areas. Around Sellafield and Hinkley Point, the population density is low and residences are widespread around the sites. The local authorities therefore decided to pre-distribute tablets in an area of 1-3 km around the sites. Apart from that, tablets are stockpiled in schools, places of business, public shelter, and local authorities. Potassium **iodate** tablets are not accessible by the general public, e.g. cannot be purchased at pharmacies. They will only be distributed as part of the agreed emergency response arrangements after decision of the relevant Directors of Public Health.

In the **United States**, the distribution of KI for the general public is the responsibility of State and local officials. Because the Federal policy addressing the use of KI by the general public was only recently changed, there is not much experience with the logistics associated with the distribution and storage of KI on a large scale. However, each State that desires to stockpile KI for the population living in the vicinity of a nuclear power plant will have to develop a distribution plan that will be reviewed by the Federal government. In the United States, KI is available over the counter. But, most pharmacies do not keep it in stock and thus it is not readily available to the general public in large quantities.

Costs

The cost for the tablets in **Australia** is split between the local and the national authority, whereas in **Japan,** only the local authority pays for them. In **Ireland** and **Hungary,** the national authority pays for the tablets. In the **United Kingdom**, **Luxembourg**, **Germany**, **Canada** and the **Czech Republic,** the nuclear power plant operator pays for the tablets.

In **Finland,** the national and the local authority, as well as companies pay for the stable iodine tablets. Iodine tablets for residences in protective zones (0-5 km) around nuclear power plants are paid by the nuclear power companies.

In **the Netherlands**, the Ministry of Health pays for the tablets.

In **Norway**, the operator and the national authority pay for the stable iodine tablets, but this might be changed in future. Individual members of the public can purchase iodine tablets, if they wish.

In **Switzerland** the operator pays for the costs of the iodine tablets needed for zone 1 (4-5 km around nuclear power plants) and zone 2 (4-20 km around nuclear power plants), as well as for half of the tablets needed for the rest of the national territory. The rest is covered by the national authority.

In **Sweden**, the operators of nuclear power plants pay emergency fees to the state, and this money is used by the national authorities to pay for the tablets and the distribution.

In the **United States**, the Nuclear Regulatory Commission has agreed to pay for the initial supply of KI for each State that desires to stockpile KI for the general public living in the vicinity of a nuclear power plant. However, it has not committed to paying for additional KI as it reaches the end of its shelf life.

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Combination of the countermeasure "use of stable iodine" with other countermeasures

The distribution and use of stable iodine tablets is, generally, not seen as an isolated countermeasure. Most countries consider the administration of stable iodine in combination with sheltering or evacuation to be the most effective countermeasure strategy. **Hungary** would also use the distribution of stable iodine as a stand-alone countermeasure. **Finland** would use the distribution of stable iodine tablets as an isolated countermeasure for infants and children under 18 years.

Experiences with the distribution of stable iodine tablets

During an emergency in the **United Kingdom,** stable iodine tablets have been distributed to site staff only. No significant effects from the countermeasure were observed. During an exercise, "simulated" stable iodine tablets were distributed to site staff only.

Australia, has distributed "simulated" stable iodine tablets during an exercise. It was observed that, for legal reasons, the police was reluctant to issue medication.

In **Hungary,** also, "simulated" stable iodine tablets have been distributed during an exercise. The main results were that:

- more education and information was needed;
- non-residents did not understand the reason for the distribution; and
- storage places should be nearer to the villages involved.

In **the Netherlands** some years ago the population around the NPP Borssele got house-to-house mailing that they could get stable iodine tablet at certain points in their villages to store these in their homes as pre-distribution. The interest was almost zero.

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7. INFORMATION OF THE POPULATION AROUND A NUCLEAR POWER PLANT

Educational programmes on nuclear energy and its associated risks

Australia has an educational programme via local liaison committees, pamphlets and shop fronts, which includes visits to research reactors and nuclear-powered warships. The Commonwealth government, the state and ANSTO are responsible for these programmes.

In **Canada**, there are fact-sheets, instructional videos, public information centres and tours to the nuclear facilities. The nuclear utilities, provincial emergency measures organisations and the Federal Regulator are responsible for these educational programmes.

The **Czech Republic** has prepared an educational programme at two levels: For elementary schools, as part of the science education, and for state administration specialists, as part of the Civil Protection education programme. The Ministry of Schools, Youth and Sports and the Ministry of [illegible]

Finland's educational programme includes:

- description and effects of nuclear and radiological accidents (at nuclear power plants, nuclear powered ships and satellites, transportation of nuclear material, nuclear waste or radioactive material, etc);
- health effects;
- emergency preparedness of authorities for these accidents; and
- tasks of authorities in nuclear or radiological emergencies and accidents.

These educational programmes are developed by the rescues authorities and STUK.

Japan's high school curricula contain nuclear energy and nuclear power generating studies. More than ten universities have nuclear engineering faculties.

The issue of educating and informing the public about radiation – its risks and benefits – is one of the most important tasks for the **Swedish** Radiation Protection Authority (SSI). Information can be found on public web sites, in leaflets and brochures. The national authorities also take part in information campaigns in the society. Educational material on radiation and radiation protection in general may be downloaded from the Internet to be used in public schools on all levels from the age of 6, up to 19 years.

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Specific information issued to populations around nuclear power plants

Information prior to an emergency

In general, information prior to an emergency is delivered to the population via brochures, leaflets and in some cases calendars. Although, net based information might gain increased importance, it was mentioned only by two countries.

Australia delivers a pamphlet. Additional information is available at libraries. The Internet is used increasingly to supplement information. Specific presentations or courses, paid by the government, are available for emergency workers. The decision to give the courses is taken locally or nationally.

In the **Czech Republic**, the whole population and each family in the emergency planning zone receive information leaflets, and calendars containing basic information on how to behave in case of a radiological emergency.

In **Canada**, brochures are distributed to the population within a radius of 16 km around the nuclear power plant Gentilly 2. In addition, specific courses are organised by district councils in co-operation with the utility. While the district councils pay for the courses, the utility pays the experts. The decision to give these courses is laid down in the governmental order No. 11/1999 Coll.

In **Finland**, the licensee (NPP), in co-operation with the local rescue authorities, is responsible for providing information in advance. The information is distributed to the public in the emergency planning zone and includes basic information about radioactivity, examples of various hazard situations and their effects on the population and the environment, planned measures to alert, protect and help the population, instruction for action and so on. The information material is regularly updated. There are also courses given by the local authorities, civil organisations and the power plant operators. The decision to perform courses is taken on a local level.

In **Germany**, leaflets are distributed to the population surrounding the nuclear power plant up to a distance of 10 km. These brochures comprise information about radioactivity (basic concept: e.g. Bq, Sv, acticity, comparison of natural and artificial radioactivity), effects of radiation on man and on the environment etc.

In **Hungary**, every inhabitant in the 30 km region around the power plant receives useful information on siren alert signals and suggested action for various emergency situations. Besides this, the information is printed on calendars and distributed. Occasionally, there are specific presentations or courses, for which the Paks nuclear power plant pays. The decision for these courses is taken at a local level.

In **Japan**, information on specific features of nuclear emergency short-term counter-measures, involving local residents and others, is delivered via brochures to neighbouring residents.

Luxembourg uses an information leaflet, which is distributed to all households. The brochure and a short description of the emergency plan are also available on the Internet.

In **the Netherlands**, the whole Dutch population got house-to-house leaflets to inform them how to act in the case of chemical, nuclear or other accidents. A number was given were to ask for more specific information e.g. about nuclear accidents and iodine prophylaxis.

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Leaflets about nuclear accidents and iodine prophylaxis were actively spread under the population around nuclear power plants up to about 20 km distance.

Regarding potential nuclear emergencies and planned responses, **Switzerland** issued specific information to the population around nuclear power plants. In a brochure about radioactivity, a special chapter deals with nuclear emergencies, describing briefly and understandable the potential threat of operating a nuclear power plant, emergency preparedness, planned countermeasures and what people are expected to do in an emergency situation. This brochure is distributed to households in Zone 1 (4 km radius) and to communities in zone 2 (20 km radius). People in zone 2 may receive a brochure on request. Some cantons have prepared documents and leaflets containing more detailed site-specific information for the local population around the nuclear power plants.

In **Sweden**, information is distributed to the public in the inner emergency zone, in connection to the distribution of iodine tablets. It includes basic information about radioactivity, examples of various hazard situations and their effects on the population and the environment. It also includes information on planned measures to alert, protect and help the population together with instructions on how to act in the case of an alarm. The information material is regularly updated.

In the **United Kingdom**, calendars are distributed to the local residence and itinerant workers.

In the **United States**, the licensee, in co-operation with local officials, usually provides information about the nuclear power plant in advance. The information is distributed to the public in the 16 km emergency planning zone (inhalation pathway zone) and includes basic information about the plant, the effect of the plant on the environment and the population, and measures to alert and protect the public in the event of an emergency. The information is updated regularly.

Information in case of an accident

In case of an accident, the potentially affected population will be alarmed and informed by sirens, vehicles with loud speakers, radio and television, and only in one country by going from door to door.

Australia

The population will be informed via radio and TV. Targeted telephone areas are under development.

Canada

Local media and local authorities, such as the fire brigade, will inform the population by going from door-to-door.

The legal basis for it is laid down in article 373 of the “Loi sur les services de santé et les services sociaux” of the Ministry of Health.

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Czech Republic

Warning will be done by electronic sirens, information will be given through emergency broadcasting, radio and TV. The legal basis for public information is laid out in Acts No 18/1997 Coll. (Atomic Act), No. 239/2000 Coll. (on Integrated Rescue System), No. 240/2000 Coll. (Crisis Act) and the Governmental Order No. 11/1999 Coll.

Finland

Sirens and vehicles with loud speakers alert the population around a nuclear power plant. They are kept informed by radio and television.

The legal basis for this information comprises the protective measures in a radiation situation and information to the Public (Order of the Ministry of the Interior 1/97), the Council of the State Decision 397/1991 concerning the NPP and the Decree of Radiation and Nuclear Authority (STUK) 1515/1991 concerning STUK.

Germany

The potentially affected population will be warned by siren signals (one-minute wailing sound, meaning "turn on radios and listen to the announcements") or other suitable means (e.g. public address announcements), followed by co-ordinated media information. Media information will be rapidly and repeatedly given as official announcements on radio, television or videotext.

Civil defence sirens have generally been removed by federal order. In some Länder, however, the sirens were retained and modernised for use in the area of the intermediate zone around nuclear installations, or in the vicinity of installations with high danger potential.

The legal basis is given in Section 51 para. 2 of the Radiological Protection Ordinance in accordance with the requirements of EU directive 89/618/EURATOM.

Hungary

The population is alerted via sirens, which gives the signal to listen to national radio or TV broadcasts. The legal basis is stipulated in Act LXXIV, 1999 on the management of catastrophes and in the related Governmental Decrees governing the execution of the Act.

Japan

The public will be informed by local radio, public information cars and mass media, based on the Law for Nuclear Emergency Preparedness, and the Basic Plan for Emergency Preparedness.

Luxembourg

For information in case of an accident, sirens, radio and television messages, and mobile loud speakers for individuals who cannot be reached by sirens, are used. The Council Directive of 27 November 1989, on informing the general public about health protection measures to be applied and steps to be taken in the event of a radiological emergency, is the legal basis, as well as the "Règlement grand-ducal du 11 août 1996 concernant l'information de la population sur les measures de protection sanitaires applicables et sur le comportement à adopter en cas d'urgence radiologique".

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The Netherlands

The population is alerted via sirens and in some areas with mobile loud speakers for individuals who cannot be reached by sirens, which gives the signal to listen to national radio or TV broadcasts.

Norway

The Crisis Committee has a responsibility to submit information to the public in an emergency situation.

Switzerland

Sirens followed by instructions and information on the radio alert the population.

The radio stations are obliged to broadcast information on behalf of the authorities. An amendment of the law is underway to take into account the recent development in the field of privatisation and an open market.

Sweden

Outdoor sirens and RDS (Radio Data System) receivers for in-door warning in all homes within the inner zone. The public is also informed on public and commercial radio "Urgent Message to the Public". Public websites on the local, regional and central levels will be used during an accident. This way of informing the public is very important and effective. Concern has to be taken to co-ordinate all information on all levels in the society.

United Kingdom

The population is informed via the media and through emergency services. The legal basis is stipulated in the Public Information for Radiation Emergencies Regulations (PIRER).

United States

The population around the nuclear power plant is alerted by a series of sirens. When the sirens are sounded, the public is to turn to their radios and televisions and listen for instructions from the Emergency Alert System.

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8. COUNTERMEASURES FOR SPECIAL GROUPS

Emergency workers

Australia

The dose limit for occupational exposure of police, fire service and defence services is 20 mSv effective dose. For rescue operations, the dose limit is 500 mSv (value currently under revision). As additional countermeasures for emergency workers, stable iodine tablets, personal dosimetry, protective clothing and breathing apparatus are planned.

The State Emergency Service, hospitals, and the bureau of meteorology are other special groups where specific short-term countermeasures would be implemented. Hospitals are prepared for emergencies.

Canada

Criteria and countermeasures for emergency workers are currently under development. They will be in line with internationally agreed criteria.

Czech Republic

The criteria for emergency workers are laid down in Regulation of SUJB No. 184/1997 Coll. Details are not given in the completed questionnaire.

Finland

Dose limits are given in the radiation decree. These limits are valid unless there is a serious reason to deviate. The emergency workers are divided into three groups:

Type of countermeasures to be implemented by emergency workers	Dose limits
Immediate measures in accident situations (measures needed to restrict the radiation hazard and bring the radiation source under control in an accident situation).	It is possible to exceed the normal criteria for radiation workers (50 mSv/year). Still the measures shall be taken in such a way that the radiation exposure due to the situation is kept as low as possible. Workers and volunteers shall be appropriately trained and aware of the potential health risks of radiation exposure. Monitoring of exposure and medical surveillance shall be organised. The effective dose shall not exceed 0.5 Sv or the skin dose 5 Sv if the measure is not a life saving operation.
Mitigation of consequences (warning people about the dangers, measures connected with access controls, etc).	Dose limits of radiation workers are followed.
Other measures.	Emergency workers are regarded equal to members of the general public. If the dose is higher than that of the public, additional advice will be given to reduce exposure.

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Germany

According to a recommendation of the German Radiation Protection Commission, a dose of 250 mSv may only be exceeded in exceptional cases, such as to rescue persons or to prevent a serious increase of damage, given that a radiation protection expert has assessed this exposure as being necessary and justified. The dose of 1 Sv, however, must never be exceeded. While taking early action to protect the population, the whole body doses of emergency workers should by all means be kept below 100 mSv. In connection with cordoning off measures, a level of 5 mSv is valid and, for the protection of material assets, a dose level of 15 mSv.

For members of the public, fire brigades, police, and medical rescue services breathing equipment, contamination protection and iodine tablets are foreseen as countermeasures. The radiation exposure must be monitored and recorded. The personnel has to be informed about expected exposure and potential health consequences.

Hungary

The limits for occupational exposed personal, set by a ministerial decree, are:

- 100 mSv effective dose in 5 years, 50 mSv in one year;
- 150 mSv for the eye;
- 500 mSv/cm^2/y for the skin; and
- 500 mSv/y for the limbs.

Recommendations for emergency workers are not yet approved. Following the IAEA recommendation, they will be set at:

- 250 mSv for life saving or core damage prevention;
- 50 mSv for preventing serious injury, high collective dose, catastrophe; and
- 25 mSv for short-term recovery, urgent protective actions, sampling, etc.

In all cases, the implementation of thyroid blocking is assumed. If this is not the case, the above-mentioned values shall be divided by 5.

Ireland

There are no countermeasures for special groups.

Japan

The effective dose limit for emergency workers is 50 mSv in general, and 100 mSv for life saving.

Luxembourg

There is a reference level of 50 mSv effective dose for general intervention and 250 mSv effective dose for life-saving actions.

For civil defence, police and fire brigades, respiratory protection, protective clothing and dose meters are foreseen as countermeasures.

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The Netherlands

For all emergency work (in general).	50 mSv[a]
Protecting goods, support and/or performing about measurements, evacuation, iodine-prophylaxe and secure public etc.	100 mSv[a]
Saving big economical interests, however voluntarily and after being informed about the risks.	250 mSv[a]
Saving lives or avoiding high risks for populations and individuals, however on a voluntarily basis and being informed about the risks.	750 mSv[a, b]

a. These levels are effective doses and meant for non-pregnant workers, during the first 24 hours after an emergency.
b. This value is only meant as a guidance level, in special situations it can be exceeded.

Norway

Dosimetric criteria for special groups can be found in the "Nordic Intervention Criteria for Nuclear or Radiological Emergencies – Recommendations".

Switzerland

Generally, the dose limit for emergency workers is set to 50 mSv effective dose for the first year after the accident. For life saving actions, the dose limit is 250 mSv effective dose for a time period of one year after the accident.

Sweden

Generally, the dose limit for radiation workers is 50 mSv/year or 100 mSv accumulated over 5 consecutive years. These limits may be exceeded in the case of an emergency. A "guide-line" dose limit is 100 mSv, and this should be exceeded only by volunteers in life-saving efforts. Still, measures shall be taken so that the radiation exposure is kept as low as possible. Workers and volunteers shall be appropriately trained and aware of the potential health risks of radiation exposure. Monitoring of exposure and medical surveillance shall be organised.

United Kingdom

Three categories of workers are known:

- those involved in urgent actions at the scene of a serious accident – avoid exposures that would result in serious deterministic injuries;
- those implementing emergency countermeasures – generally keep below one-off exposure to worker annual dose limit;
- those involved in recovery operations – full ICRP system of dose limitation.

United States

The dose limit for occupational exposure of emergency workers is 50 mSv. However, this limit can be exceeded for workers performing the following emergency services. The following Table provides the recommended dose limits for various emergency actions and the conditions which apply.

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Dose Limit TEDE (Sv)	Activity	Condition
0.10	Protecting valuable property	Lower dose not practicable
0.25	Life saving or protection of large populations	Lower dose not practicable
>0.25	Life saving or protection of large populations	Only on a voluntary basis to person fully aware of the risks involved

Workers performing services during emergencies should limit dose to the lens of the eye to three times the listed value and doses to any other organ (including skin and body extremities) to ten times the listed value. These limits apply to all doses from an incident, except those received in unrestricted areas as members of the public during the intermediate phase of the incident.

Table 12. Dose limits for emergency workers

Country	Emergency workers/Effective dose [mSv]	
	General limit	Limit for life saving actions
Australia	20	500*
Canada		
Czech Republic		
Finland	50/year	500
Germany	100[a, b]	250
Hungary		250***
Ireland		
Japan	50	100
Luxembourg	50	250
Netherlands	50, 100 or 250[c]	750 or higher
Sweden	50/year or 100/5 years	100[d]
Switzerland	50**	250**
United Kingdom		

* Under review.
** Time period of one year after the accident.
*** Not yet approved.
a. For the fire brigade 100 mSv per assignment.
b. For the police 100 mSv per year.
c. See text.
d. This limit may be exceeded by volunteers if they are well informed about the radiation risk (see text above).

As general countermeasures for emergency workers, dosimetric measurements to allow effective control of the exposure, iodine prophylaxis and protective clothing, and in the Netherlands respiratory protection for special actions are foreseen.

Other special groups identified for the implementation of short-term countermeasures are police, civil defence, drivers of public transportation, coastguards, military and others.

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Warning of farmers, hospitals or others

Czech Republic

For notification and warning of inhabitants and facilities in the EPZ, emergency plans foresee the use of the Integrated Rescue System.

Finland

There are special plans for early warning of farmers, hospitals or others needing extra-time to prepare for evacuation and sheltering. Protective clothing and iodine tablets are foreseen for farmers, social workers (home-aid for old people), workers at waterworks and electricity workers etc.

Switzerland

Hospitals, schools, public institutions and large enterprises are informed at an early stage in order to be prepared for the implementation of sheltering when the order is given by national authorities.

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9. HARMONISATION OF THE COUNTERMEASURES

Australia

Due to the fact that emergencies at visiting nuclear powered warships are assumed to be restricted to one state, there is no harmonisation with other states or countries. Reference is made to ARPANSA's "Reference Accident" for assessment of suitability of ports visited. Emergency Management Australia is responsible for maintaining cross-border co-operation and co-ordination.

Furthermore, some states have systems to register and monitor people who will be affected by countermeasures for the purpose of determining costs, but not for appropriate compensation. Plans are exercised every two years.

Canada

Federal recommendations for countermeasures/intervention levels must be harmonised with the Provinces. The federal emergency management and information exchange arrangements are harmonised with the United States.

The Province Québec has harmonised agreements regarding the transmission of an alarm with Ontario and New Brunswick. There will also be an exchange of liaison personnel.

In case of an emergency at a nuclear power plant near the border, there will be co-operation between Canada and the United States at a federal level, as well as between the respective Canadian Province and US State.

At the federal level, co-ordination and co-operation are carried out in accordance with the Canada-United States Joint Radiological Emergency Response Plan, maintained by the Office for Critical Infrastructure Protection and Emergency Preparedness for Canada, the Federal Emergency Management Agency, and the Department of Health and Human Services for the US.

Czech Republic

In case of an emergency at the nuclear power plant Dukovany, there is a co-operation with the provincial warning central of **Lower Austria**. The Regional Office in Brno and the Czech Government are responsible for maintaining this co-operation.

Finland

There was co-operation between rescue authorities when the emergency plans of the emergency planning zone Loviisa and Rauma area were revised.

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Furthermore the Nordic countries (**Sweden, Norway, Denmark, Iceland** and **Finland**) have long co-operated in the field of harmonisation, and joint policy papers have been issued on e.g. concentration of radionuclides in foodstuffs. A document on joint Nordic intervention criteria for nuclear or radiological emergencies was issued in 2001.

In case of an accident near the border, information from the accident country would be sufficient for the implementation of harmonised countermeasures.

Germany

Alert measures, means of communication, information of the public and the implementation of countermeasures, especially the use of iodine tablets because of different dosages used across borders, was harmonised between neighbouring Länder and with France, Switzerland and the Netherlands. Further attempts are underway to harmonise the intervention levels for countermeasures, as well as starting points for the implementation of the countermeasures.

The authorities responsible for maintaining this cross-border co-operation and co-ordination are the local and regional competent Länder authorities, such as the chief administrative office of the district Waldshut, the Regierungspräsidium Freiburg and the Ministry of Environment and Traffic of Baden-Württemberg. At a federal level, they are the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety.

Hungary

In the framework of the IAEA RER/9/050 Harmonisation project, an attempt has been made to harmonise basic rules with neighbouring countries. For nuclear power plants near the border there is co-operation/co-ordination between emergency management in the emergency planning zones of the different countries. It is not regulated which organisations are responsible for maintaining co-operation and co-ordination across the borders. In practice, the power plants and Regulatory Bodies keep working relationships. Bilateral agreements on early exchange of information with the neighbouring countries are a good basis for this item.

Ireland and Japan

Because of geographical distance to neighbouring countries, harmonisation of countermeasures was not undertaken.

Luxembourg

There is close collaboration between the Radiation Protection department (Ministry of Health), the Civil Defence Organisation (Ministry of Interior) and local authorities of the German Länder (federal states) and French Départements.

The Netherlands

Harmonisation with other European countries and especially with the neighbour countries are not yet achieved, but is a major point of concern.

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Norway

The Nordic countries (**Sweden, Norway, Denmark, Iceland** and **Finland**) have long co-operated in the field of harmonisation, and joint policy papers have been issued on e.g. concentration of radionuclides in foodstuffs. A document on joint "Nordic Intervention Criteria for Nuclear or Radiological Emergencies – Recommendations" was issued in 2001.

Switzerland

There is a close collaboration between Switzerland and Germany due to the fact that the Swiss nuclear power plant Leibstadt is located directly at the border to Germany. A second power plant is located about 8 km from the German border. Regarding the implementation of urgent countermeasures, both countries co-ordinated their emergency preparedness to the extent possible. In the past few years the long-term countermeasures have received more and more attention. Collaboration in these fields has therefore been intensified. In addition, Switzerland started collaborating with France.

A joint Swiss German commission is responsible for maintaining co-operation and co-ordination at federal and at local level.

In case of an accident occurring in a neighbouring country (region) near the border, information from the accident country is sufficient for the implementation of harmonised countermeasures. However, improvements to this information exchange is an ongoing task.

Sweden

The Nordic countries (**Sweden, Norway, Denmark, Iceland** and **Finland**) have long co-operated in the field of harmonisation, and joint policy papers have been issued on e.g. concentration of radionuclides in foodstuffs. A document on joint "Nordic Intervention Criteria for Nuclear or Radiological Emergencies – Recommendations" was issued in 2001.

In the **United Kingdom**, an attempt has been made to harmonise basic rules or specific emergency plans with neighbouring countries. Due to differences in regulations and other boundary conditions, real harmonisation on both sides of a national border may not be possible. But each side should know the concepts of the other and the reason for existing differences, and must be able to inform the public about this if different actions have to be implemented.

Within the **United States**, all Federal, State and local officials utilise the protective action guides (countermeasures) published by the Environmental Protection Agency. These guides are developed in co-operation with other Federal departments and agencies and endorsed by the Federal Radiological Preparedness Co-ordinating Committee. In the event of an emergency in either **Canada** or the **United States** that has a transboundary impact, there will be co-operation between **Canada** and the **United States** at the Federal level.

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10. ECONOMIC CONSEQUENCES OF COUNTERMEASURES

Canada

Costs were not considered while developing the emergency plan and they do not have any influence on the decision to implement a countermeasure.

At the federal level, there is no mechanism for identifying all people in an affected area, although those using the Evacuation Reception Centres in the event of an evacuation order will be registered upon arrival. At the federal level, Canada's third-party nuclear liability legislation, the Nuclear Liability Act (NLA) does contain provisions for establishing dose registry and claim registration mechanisms under Part II of the Act. Part II is proclaimed when the Governor in Council deems that the operator's liability could exceed USD 75 million, or, as a result of extensive damages or injury, it is in the public interest to provide special measures for compensation. Under Part II, a Nuclear Damage Claims Commission would be established by the Governor in Council as a tribunal to hear and determine claims.

Under the present Act, the provisions and regulations for establishing dose registry and claim registration mechanisms under Part II would be developed following the occurrence of a nuclear incident. Proposed revisions to the NLA will take into consideration that both the rules and regulations governing the activities of the Nuclear Damage Claims Commission be established in draft form in advance of a nuclear incident.

Czech Republic

The costs for on-site countermeasures were considered when the internal emergency plan was developed. When developing the external emergency plan, costs had not been considered. Within the emergency planning zone, costs do have an influence on the decision to implement a countermeasure, but these attitudes are not yet fully processed. A system exists to register people who will be affected by countermeasures.

Finland

Costs of implementing various countermeasures are not considered in developing the emergency plan. The do not have any influence on the decision to implement a countermeasure. A system to register and monitor people who will be affected by countermeasures for the purpose of determining costs and appropriate compensation is in place.

Germany

Only the costs for KI tablets are considered in developing the emergency plan. In Germany people in emergency centres are monitored and registered, however not for the purpose of determining costs and appropriate compensation.

Hungary

Costs are only implicitly considered in developing the emergency plan.

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Ireland

The decision to implement a countermeasure rests with a committee of government ministers. While costs would be considered, public health would be the major concern.

Japan

National and local governments bear the costs for implementing various countermeasures. Costs do not have any influence on the decision to implement countermeasures.

Luxembourg

Cost estimates may have an influence on the decision to implement a countermeasure. This depends on the countermeasure.

Norway

Costs of implementing various short-term countermeasures were considered while developing the emergency plan. Cost estimates do have an influence on the decision to implement a countermeasure. There is no national system to register and monitor people who will be affected by countermeasures for the purpose of determining costs and appropriate compensation.

United Kingdom

In developing its advice on intervention levels, NRPB took account of a wide range of consequences expected as a result of implementing each countermeasure, specifically the health risks and benefits, the monetary costs and the social consequences (such as reassurance, anxiety, disruption).

United Kingdom has a system to register and monitor people who will be affected by countermeasures.

Switzerland

Costs of implementing various short-term countermeasures are not considered while developing the emergency plan. Cost estimates do not have an influence on the decision to implement a short-term countermeasure. A system to register and monitor people who will be affected by countermeasures for the purpose of determining costs and appropriate compensation does not yet exist.

Sweden

A wide range of factors have been considered when developing the emergency plans, and cost for various short-term countermeasures is one of them. But, cost has no direct influence on the decision to implement a countermeasure. There is currently no national system to register and monitor people who will be affected by countermeasures for the purpose of determining costs and appropriate compensation.

United States

The economic consequences of some countermeasures were considered in the development of the associated action levels. For example, the cost of housing, lost wages, transportation and food were considered in the development of the action level for evacuation of the general public.

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11. CONCLUSIONS AND PERSPECTIVES

Fourteen NEA member countries completed the questionnaire on short-term countermeasures, providing an updated overview of current practices and regulations regarding short-term countermeasures, as well as some insights into short-term countermeasure planning and implementation.

The information given in this report allows NEA member countries to compare national practices with other countries, and identify areas for further review and co-ordination. The information may also be used to understand the basis for decisions in various countries, and, if deemed necessary, as a basis for international harmonisation. This may help to explain to the public affected by an emergency why the decisions in neighbouring countries may vary.

Although regional and national differences can be observed, the regulations regarding the implementation of short-term countermeasures are, in general, in line with the IAEA recommendations.

In some countries, competencies and duties in connection with short-term countermeasures are shared between different levels, e.g. federal and regional levels such as Länder or Provinces.

Since the NEA Workshop, which was held in Stockholm, Sweden, in 1994, many countries have consolidated their implementation of short-term countermeasures. Objectives of countermeasures, dose limits for emergency workers, factors considered in developing emergency plans and the way of informing the general public remained in general unchanged. Regarding the iodine prophylaxis, many countries rely now on a pre-distribution of the tablets, whereas in 1994 central storage was still the preferred option. Regarding intervention levels, the majority of countries use now a single value abandoning the concept of a range. Operational intervention levels were introduced in a few countries, some of which participated in the IAEA programme on Regional Harmonisation on Emergency Preparedness.

Intervention levels for the decision on the implementation of sheltering are very similar in the countries regarded, whereas corresponding levels for evacuation and iodine prophylaxis show stronger variations. Some harmonisation may be desirable with a view to the public perception of the implementation of a countermeasure in neighbouring countries.

Regarding the criteria for ending a countermeasure, only a few countries have given fixed dose level below which the countermeasure would be ended. Canada, for example, has stipulated that in case of sheltering, the countermeasure would be ended when the dose be less than 5 mSv in one day. Other countries give more general criteria such as the radiation situation, movement of the cloud, contamination situation, end of the release, etc. This issue might be further discussed.

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Two countries mentioned the importance of protecting livestock production as early phase countermeasure, i.e. sheltering cattle, protection of their drinking water and feeding stuffs, in order to prevent exposure in the later phase of an accident caused by ingestion of contaminated food. Future investigations should therefore include the implementation of agricultural short-term countermeasures, which were not yet covered in the questionnaire, e.g. shelter dairy cows, protect feedstuff stored outside, warning of the consumption of fresh harvested foodstuff.

This survey of national policies regarding short-term countermeasures should be regularly updated, e.g. every five years.

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ABBREVIATIONS

ALARA	As low as reasonably achievable.
ANSTO	Australian Nuclear Science and Technology Organisation.
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency.
CEZ	Czech Power Company.
EMA	Emergency Management Australia.
EPC	Emergency planning zone.
GCC	Governmental Co-ordination Commission.
GRHZS	Ministry of Interior of the Czech Republic – General Directorate of Fire Rescue Service.
HAEA	Hungarian Atomic Energy Authority.
HSE	Health & Safety Executive.
HSK	Hauptabteilung für die Sicherheit der Kernanlagen (Swiss Federal Nuclear Safety Inspectorate).
LAR	Leitender Ausschuss Radioaktivität.
NEOC	Nuclear Emergency Operation Centre (= Nationale Alarmzentrale, NAZ).
NHMRC	National Health and Medical Research Council (Australia).
NII	Nuclear Installations Inspectorate.
NPP	Nuclear power plant.
NRBC-Protection	Eidgenössische Kommission für AC-Schutz, KOMAC.
NRPA	Norwegian Radiation Protection Authority.
NRPB	National Radiological Protection Board.
OIL	Operational Intervention Level.
RPII	Radiological Protection Institute of Ireland.
RRSSS	Régie régionale de la santé et des services sociaux.
SSI	Swedish Radiation Protection Authority.
STUK	Radiation and Nuclear Safety Authority (Finland).
SUJB	State Office for Nuclear Safety.
WHO	World Health Organisation.

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Annex 1

THE ORIGINAL QUESTIONNAIRE OF NEA

Background

In 1994, the NEA launched a questionnaire on short-time countermeasures distributed to the NEA member countries to establish an overview, at that time, on the current practices regarding short-term countermeasures. The answers received were analysed by Rosemary Hogan of the US NRC and discussed during the Workshop on "The Implementation of Short-term Countermeasures" held in Stockholm in June 1994.

Countries' practices regarding short-term countermeasures have since evolved and been modified. The Working Party therefore decided to modify the questionnaire and proposed its distribution with the aim of preparing an up-to-date overview on these practices.

At its 59th meeting, 5-7 March 2001, the NEA Committee on Radiation Protection and Public Health (CRPPH) approved the questionnaire and agreed to distribute it to the CRPPH members. The CRPPH members agreed to act as national co-ordinators to distribute the questions within their country, and to collect the answers to be sent back to the NEA secretariat.

The answers will be subsequently discussed by the Working Party on Nuclear Emergency Matters and will be published as an NEA report.

Action

Each CRPPH member is asked to

- **Distribute** the questionnaire to the relevant organisations in their country;
- **Collect** and **co-ordinate** the answers; and
- **Send** the completed questionnaire to the NEA secretariat not later than **1 June 2001**.

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QUESTIONNAIRE ON SHORT TERM COUNTERMEASURES

0. Organisation

What organisations (type and jurisdictional level) were involved in completing this questionnaire?

1. General objectives and criteria for short-term countermeasures

1.1 What are the objectives of implementing short-term countermeasures in the case of a nuclear emergency?

1.2 Which urgent countermeasures for the general public are employed in your country?

	Near field accident	**Far field accident**
Evacuation		
Sheltering		
Stable iodine		
Other (specify)		

1.3 What intervention levels[1] and operational intervention criteria are used to initiate countermeasures?

	Intervention levels in mSv[1]	**Operational intervention criteria**
Evacuation		
Sheltering		
Stable iodine		
Other (specify)		

1.4 What criteria are used for ending countermeasures?

	Criteria for ending a countermeasure
Evacuation	
Sheltering	
Stable iodine	
Other(specify)	

1. Specify which dose is used: averted dose, anticipated dose, effective dose, organ dose, and give integration period (one day, one week?)

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1.5 Is the International Basic Safety Standard for protection against ionising radiation and for the safety of radiation sources (IAEA safety series N° 115) a basis for the development of your intervention levels?

Yes ff No ff

If not, on which bases did you develop your intervention levels?

2. National Organisation for Nuclear Accidents

2.1 What organisation(s)[2] developed the legal framework for these intervention levels?

2.2 What organisation(s)[1] makes recommendation concerning the implementation of countermeasures in case of a nuclear emergency?

2.3 What organisation(s)[1] has the authority to make the decision whether or not to implement countermeasures in case of a nuclear emergency?

3. Implementation of short-term countermeasures

3.1 Emergency plan

3.1.1 What organisation(s)[3] developed the general guidelines for the implementation of the emergency plan?

3.1.2 What organisation(s)[2] developed the procedures for the implementation of short-term countermeasures?

3.1.3 Which factors were considered in developing emergency plan guidelines (general rules)?

Public health risk	Yes ff	No ff
Time necessary for the implementation	Yes ff	No ff
Shielding qualities of average house	Yes ff	No ff
Availability of basement and shelters	Yes ff	No ff
Transportation availability	Yes ff	No ff
Public trauma	Yes ff	No ff
Night or day	Yes ff	No ff
Nuclear power plant near a border	Yes ff	No ff
Costs	Yes ff	No ff
Countermeasure applied to entire population	Yes ff	No ff
Other	Yes ff	No ff

2. Specify both the type of organisation and its jurisdictional level within the country, i.e. federal, state, etc.
3. Specify both the type of organisation and its jurisdictional level within the country, i.e. federal, state, etc.

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3.1.4 Was there a public consultation before establishing countermeasure guidelines?

3.2 General points concerning the implementation of short-term countermeasures

3.2.1 What information or criteria are considered necessary and sufficient to justify the implementation of short-term countermeasures?

3.2.2 What physical zones are pre-established for the purposes of countermeasure implementation (ex: 5 km evacuation zone, 20 km sheltering zone)

3.2.3 What are the reasons for the sizes of these zones?

3.2.4 Has a phased implementation of countermeasures been considered in emergency plans, for example

Close area followed by further expansion of the restricted area	Yes ff	No ff
Specific population followed by general population	Yes ff	No ff
Schools followed by general population	Yes ff	No ff
Other (specify)	Yes ff	No ff

3.2.5 Which factors are likely to be taken into account at the time of a nuclear accident when selecting which countermeasures to implement?

	Evacuation	**Sheltering**	**Stable iodine**
Averted dose			
Expected dose without protection			
Operational intervention criteria			
Weather conditions			
Time of day			
Release in progress			
Time delay for the countermeasure			
Level of preparedness of the population			
Media impact			
Psychological impact on the public			
Phased implementation or targeted populations			
Other			

Answer "Yes" or "No", give priorities if possible.

3.2.6 Among the above listed factors, which is the most important when deciding whether or not to implement a countermeasure?

Evacuation	
Sheltering	
Stable iodine	

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3.3 Specific countermeasure: Evacuation

3.3.1 Has your country ever experienced evacuation for an actual or potential radiological emergency?

Yes ff No ff

If so, what was the size of the population and of the area affected?

What was the impact on the evacuated population?

3.3.2 Has your country ever experienced evacuation as a result of non-radiological emergencies, such as a hurricane?

Yes ff No ff

If so, what was the size of the population and of the area affected?

Did you apply this non-nuclear experience to your nuclear emergency planning and preparations?

3.3.3 Has your country ever implemented real evacuation as part of an exercise?

Yes ff No ff

If yes, explain the results.

3.3.4 Do you foresee evacuation:

As your initial countermeasure	ff
Only before nuclear release and contamination	ff
Only after nuclear release and contamination	ff
Either before or after release and contamination	ff

Explain.

3.3.5 Is evacuation executed:

As a planned operation	Yes ff	No ff
As a spontaneous reaction of the population	Yes ff	No ff
By organised transport	Yes ff	No ff
By individual cars	Yes ff	No ff

Other.

3.3.6 Is evacuation applied differently for different groups within the population, such as children, pregnant women, etc?

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3.4 Specific countermeasure: Sheltering

3.4.1 Has your country ever experienced sheltering for an actual or potential radiological emergency?

Yes ff No ff

If so, what was the size of the population and of the area affected?

What was the impact on the sheltered population?

3.4.2 Has your country ever experienced sheltering as a result of non-radiological emergencies, such as chemical spill or threat?

Yes ff No ff

If so, what was the size of the population and of the area affected?

Did you apply this non-nuclear experience to your nuclear emergency planning and preparations?

3.4.3 Has your country ever implemented real sheltering as part of an exercise?

Yes ff No ff

If yes, explain the results.

3.4.4 Do you foresee sheltering as your initial countermeasure?

Yes ff No ff

Explain.

3.4.5 What countermeasure(s) accompany or follow sheltering?

3.4.6 Is sheltering applied differently for different groups within the population, such as children, pregnant women, etc?

3.4.7 What criteria are used when selecting between sheltering and evacuation?

3.5 Specific countermeasure: **Use of stable iodine**

3.5.1 Has your country ever experienced stable iodine distribution for an actual or potential radiological emergency?

Yes ff No ff

If so, what was the size of the population and of the area affected?

What was the health impact on the affected population?

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3.5.2 Has your country ever implemented distribution of "simulated" stable iodine tablets (made of sugar for example) as part of an exercise?

Yes ff No ff

If so, explain the results.

3.5.3 How is stable iodine distributed to individual members of the population?

At their residence before an emergency	Yes ff	No ff
At their businesses before an emergency	Yes ff	No ff
At their residence during an emergency	Yes ff	No ff
At a pharmacy or other location before an emergency	Yes ff	No ff
At a pre-designated location during the emergency	Yes ff	No ff
At a public shelter during the emergency	Yes ff	No ff
At a road control point during evacuation	Yes ff	No ff
By the emergency services	Yes ff	No ff
Others	Yes ff	No ff

3.5.4 Is there an area around nuclear power plant where stable iodine is pre-distributed to the population?

Yes	ff
No	ff
Depends on the nuclear power plant	ff
Other	ff

If so, what is the size of the area?

What is the average population around nuclear power plants with pre-distributed stable iodine?

3.5.5. Where is stable iodine stockpiled?

Home	ff
Schools	ff
Place of business	ff
Public shelter	ff
Pharmacies	ff
Local authorities	ff
National authorities	ff
Others	ff

3.5.6 Who pays for stable iodine

Individual member of the public if they want some	ff
Only individual member of the public	ff
Businesses	ff
Nuclear power plant	ff
Local authority	ff
National authority	ff
Others	ff

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3.5.7 What form of stable iodine is used?

KI tablets	ff
KIO_3 tablets	ff
Others	ff

3.5.8 Are stable iodine tablets commercially available at pharmacies?

3.5.9 What iodine dose (mg), ingestion frequency and duration are recommended in case of a nuclear emergency in your country for various populations?

Population	Dose (mg)	Frequency	Duration
Infants			
Children			
Adults			
Pregnant women			
Others			

3.5.10 Do you recommend implementation differences, in term of dose (mg), duration or frequency, for territories with low dietary iodine levels?

Yes ff No ff

If so, what are the recommendations?

3.5.11 Are any precautions taken for members of the public who may suffer severe side effects from a high dose of stable iodine or may have thyroid disease?

3.5.12 What is the assumed shelf life of the stable iodine tablets?

3.5.13 Is stable iodine used as an isolated countermeasure or only together with sheltering or evacuation?

Isolated	ff
With sheltering	ff
With evacuation	ff

4. Information for the population around a nuclear power plant

4.1 Does your country have educational programmes on nuclear energy and its associated risks?

Yes ff No ff

What kind of educational programme has been or should be developed?

What type of organisation is responsible for these educational programs?

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4.2 Is specific information issued to populations around nuclear power plants concerning possible nuclear emergencies and planned responses?

Yes ff No ff

If so, what kind of information is delivered and for which population?

Are there specific presentations or courses?

Yes ff No ff

If so, who gives the courses and who pays for them?

Is the decision to give courses made locally or nationally?

4.3 How is the population around a nuclear power plant educated concerning the possibility and manner of implementation of a countermeasure by the authorities?

4.4 In case of an accident, how is the population around a nuclear power plant alerted and kept informed concerning the practical implementation of countermeasures?

4.5 Is there a legal basis or obligation for the information of the public before or during an emergency?

Yes ff No ff

If yes, specify.

5. Countermeasures for special groups

5.1 Are there established dosimetric criteria for emergency workers?

Yes ff No ff

If yes, specify.

5.2 Are there different countermeasures planned (stable iodine, dosimetry, protective clothing…) for emergency workers who may need to be outside in an affected area?

Which countermeasures?	For whom?

5.3 Have other special groups been identified in your country for the implementation of short term countermeasures

Yes ff No ff

If yes, specify.

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5.4 Are there plans for early warning of farmers, hospitals or others needing extra-time to prepare for:

Evacuation Yes ff Non ff

If so, explain.

Sheltering Yes ff No ff

If so, explain.

5.5 Are there different countermeasures planned (stable iodine, dosimetry, protective clothing…) for farmers or other non-emergency workers who may need to be outside in an affected area?

Which countermeasures?	For whom?

6. Harmonisation of the countermeasures[4]

6.1 Has an attempt been made to harmonise basic rules or specific emergency plans with neighbouring countries (or states, provinces, Länder …)?

Yes ff No ff

If so, which parts of the emergency plan are (will be) harmonised?

With which country (or region)?

6.2 For nuclear power plants near a border of a country (or states, provinces, Länder …), is there co-operation/co-ordination between emergency management in the emergency planning zones of both countries (or states, provinces, Länder …)?

Which organisations (type and jurisdictional level) are responsible for maintaining co-operation and co-ordination across such borders?

6.3 In case of an accident occurring in a neighbouring country (region), near the border, would information from the accident country (region) be sufficient for the implementation of harmonised countermeasures?

4. Due to differences in regulations and other boundary conditions real harmonisation on both sides of a national border may not always be possible, but each side should be aware of the concepts of the other in order to understand possible differences and communicate these to the public.

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7. Economic consequences of countermeasures

7.1 Were costs of implementing various countermeasures, such as cost for transportation, ffffiffl┘├•◘♂♂□├•◘ –□ ♬ ├☼├ ├• ┼◄┘☼ffi↕‼ ffi¶☼ff♂┴ffl♂ ffi ffffl♬ – ┬♂┴┬f f)l,♂considered in developing the emergency plan?

7.2 Do cost estimates have an influence on the decision to implement a countermeasure?

7.3 Does your country have a system to register and monitor people who will be affected by countermeasures for the purpose of determining costs and appropriate compensation?

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Annex 2

ORGANISATIONS INVOLVED IN COMPLETING THE QUESTIONNAIRE

Table 1. Organisations involved in completing the questionnaire

Country	Organisations involved	Remarks
Australia	• ARPANSA • Emergency Management Australia • Various state regulators	Commonwealth Regulator and Advisory body Commonwealth emergency co-ordinating body
Canada	• Health Canada • Gouvernement du Québec • Ministère de la Sécurité publique, Direction générale de la sécurité civile et de la sécurité incendie, Ministère de la Santé et des Services sociaux, Régie régionale de la santé et des services sociaux (RRSSS)	
Czech Republic	• State Office for Nuclear Safety (SUJB) • CEZ (NPP Dukovany, NPP Temelin) • Ministry of Interior of the Czech Republic, General Directorate of Fire Rescue Service (GRHZS)	
Finland	• Radiation and Nuclear Safety Authority Finland, STUK • Local rescue authorities in municipalities (Loviisa and Rauma) where nuclear power plants are situated	STUK is the regulatory authority on the use of nuclear energy and radiation practices, the national warning point and the national competent authority for domestic nuclear accidents, radiological emergencies or accidents in foreign countries .
Germany	• Federal Ministry of the Environment, Nature Conservation and Nuclear Safety • Federal Office for Radiation Protection	Both federal organisations are responsible for precautionary countermeasures.
Hungary	• Hungarian Atomic Energy Authority (HAEA)	National regulatory body on nuclear safety
Ireland	• Radiological Protection Institute of Ireland (RPII)	National Competent Authority
Japan	• Science and Technology Policy Bureau • Ministry of Education, Culture, Science and Technology • Agency for Nuclear and Industrial Safety, Ministry of Economy, Trade and Industry	

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Country	Organisations involved	Remarks
Luxembourg	• Radiation Protection Department	This Department is the competent body from the Ministry of Health charged with all technical aspects in relation to radiation protection.
Netherlands	• Dutch National Emergency Centre • Ministry of Environment and Internal Affairs in agreement with other ministries involved • National Institute of Health and the Environment (RIVM) for models and calculations	Policy (norms etc) is set by the Ministry of Environment, Division of Radiation, Nuclear and Bio Safety
Norway	• Norwegian Radiation Protection Authority (NRPA)	NRPA is the Secretariat for the nuclear emergency response organisation and the national competent authority on nuclear safety and radiation protection
Sweden	• Swedish Radiation Protection Authority	
Switzerland	• Swiss National Emergency Operations Centre. General Secretariat of the Department of Defence, Protection of the Population and Sports, federal level • Swiss Nuclear Safety Inspectorate HSK, federal level	
United Kingdom		
United States	• Environmental Protection Agency • Nuclear Regulatory Commission • Department of Health and Human Services • Department of Agriculture • Department of Energy	These are just a few of the organisations that have significant responsibilities in preparing for and responding to nuclear or radiological emergencies in the United States

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Annex 3

NATIONAL ORGANISATIONS FOR NUCLEAR ACCIDENTS

The member countries were asked to specify both the type of organisation and its jurisdictional level within the country, i.e. federal, state, etc, in detail:

- What organisation(s) developed the legal framework for these intervention levels?
- What organisation(s) makes recommendation concerning the implementation of countermeasures in case of a nuclear emergency?
- What organisation(s) has the authority to make the decision whether or not to implement countermeasures in case of a nuclear emergency?

Australia

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), the Commonwealth regulatory and advisory body, produces guidance documents, and the state governments are responsible for their implementation.

ARPANSA also recommends, through a working group convened by the nuclear codes committee, the implementation of countermeasures in case of a nuclear emergency. The State Government Radiation Health Department is also involved in this recommendation process.

Only the state authority, i.e. the relevant emergency organisation – usually the police – makes the decision on whether or not to implement countermeasures.

Canada

The primary legal responsibility for intervention lies within the Provincial governmental organisations responsible for emergency measures, with the exemption of areas which are under federal jurisdiction, such as protection of nuclear workers and food safety. Within the federal government the Canadian Nuclear Safety Commission is responsible for the protection of nuclear workers, Health Canada for food safety. There is no legal framework for intervention at the federal level. Recommended intervention levels are considered as guidelines.

Recommendations concerning the implementation of countermeasures at provincial level, are made by provincial emergency measures organisations. At the federal level, recommendations are made by Health Canada and the Canadian Nuclear Safety Commission. The decision on whether or not to implement countermeasures is made by provincial emergency measures organisations at the provincial level and by the Minister of Health Canada, as lead minister for the Federal Nuclear Emergency Plan.

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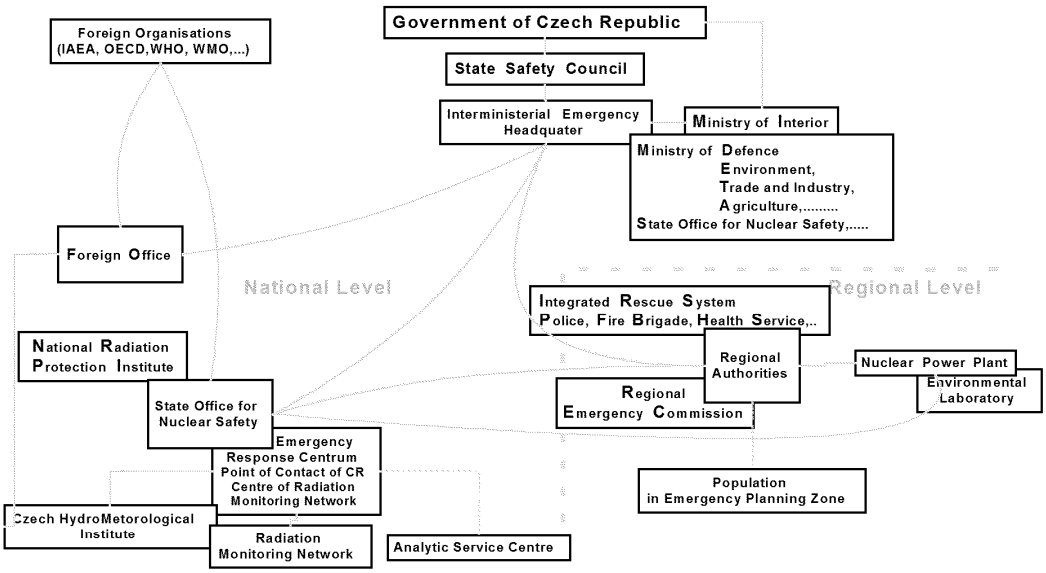
Czech Republic

The legal framework was developed by SUJB. Recommendations for implementing sheltering or stable iodine will be given by the Nuclear Power Plant and, for all other countermeasures, by SUJB.

The decision on whether to implement countermeasures will be taken either by the Regional (District) Office or the government. A graphical presentation of the Czech emergency response organisation is given in Figure 1.

Figure 1. The emergency response organisation of the Czech Republic



Finland

Legal frameworks for intervention levels are developed by STUK, the national competent authority for nuclear accidents or radiological emergencies.

In the very early phase of an accident in the domestic NPP, the licensee is responsible for giving recommendations to local authorities until STUK announces its readiness to take over the responsibility. In all other cases, STUK is responsible.

Depending on the severity of the hazard situation, decisions concerning safety operations are taken by the rescue authorities at municipal, provincial or governmental level. Other measures required by the situation shall be decided by the relevant administrative sectors. The rescue authority will be the general supervisor co-ordinating operations between the various authorities. The responsibilities are, briefly:

The Ministry of the Interior:

- Protective measures in severe hazards situations affecting widespread areas.
- Establishing a command centre with governmental authorities for co-ordinating activities.

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The Ministry of Agriculture and Forestry:

- Orders and instructions concerning, e.g. milk, meat, crops, and forestry and agricultural products.

The Ministry of Trade and Industry:

- Energy management, storage of reserve supplies and foreign trade.

The National Food Agency:

- Supervision of purity of foodstuffs in processing and delivery and supervision of retail food.

The Ministry of Social Affairs and Health:

- General safety of public health and social security, also in radiation hazards.
- Orders concerning the monitoring and quality of drinking water.

The Ministry of Transport and Communication:

- Matters concerning traffic, transport and communication links.

The Ministry of Foreign Affairs:

- Communication to Finnish embassies abroad and to embassies of foreign countries in Finland.

The State Provincial Offices with other regional administrative authorities:

- Monitoring the accident situation, supervise rescue activities and direct the activities of their subordinate authorities.

The municipalities in the endangered area:

- Implementation of decisions and instructions pertaining to rescue activities and other areas of administration.
- Issue of information to the residents in their own area.
- Directing the activities and co-ordination in their own area.

Germany

The basis for the German intervention levels are laid down in the "Radiological Basis for decisions on Measures for the Protection of the Population against Accidental Releases of Radionuclides", which were approved by the Radiological Protection Commission (federal level) and the Länder Committee for Nuclear Energy – Executive Committee (federal states level).

The Federal Ministry of the Environment, Nature Conservation and Nuclear Safety, together with the Federal Ministries of Agriculture and Health, recommend the implementation of agricultural short-term countermeasures. The Länder Ministries of Interior have agreed on the "Basic Recommendations for Disaster Response in Areas Surrounding Nuclear Facilities" as a frame in which

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the Länder develop the emergency preparedness plans for the different utilities. In Germany, the responsibility for emergency response stays with the Länder.

The disaster response organisations of the Länder decide on and are responsible for the implementation of countermeasures. Depending on the Land, the competence can be distributed differently within these organisations. In some Länder, the county district magistrates and the district authorities, as a "lower level disaster response authority", are responsible while in other Länder, such competence is assigned to the regional government as intermediate authority.

Hungary

The Ministry for Public Health developed the legal framework, with the consent of the other ministries and national organisations involved in nuclear emergencies.

A Defence Committee – including the representatives of every involved ministry and national organisation – has been set up, to be called upon in case of a nuclear emergency. This Committee makes the recommendations.

A Governmental Co-ordination Commission (GCC) – including high ranking officials from the involved ministries and national organisations – is called together in case of any type of emergency. The Commission is headed by the Minister of Interior. In case of a nuclear emergency, the Director General of the Hungarian Atomic Energy Authority will be the Deputy Head. The GCC makes decisions concerning countermeasures.

Ireland

The legal framework for intervention levels was developed by the Radiological Protection Institute of Ireland (RPII), the national competent authority for matters relating to ionising radiation, in conjunction with the Department of Public Enterprise, the Governmental Department responsible for the National Emergency Plan for Nuclear Accidents.

Legislation relating to intervention levels is set out in Article 36 of the Irish Statutory Instrument 125 (SI 125) of 2000. This SI gives effect to Council Directive 96/29/EURATOM laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation.

RPII recommends the need for certain countermeasures to a committee of senior officials from key Government departments and national agencies. This Committee considers the practicalities of these recommendations and makes its recommendations to a committee of government ministers that in turn decides on whether to implement the countermeasure(s) or not.

Japan

Within the legal framework established by the Basic Law for Emergency Preparedness and the Special Law for Nuclear Emergency Preparedness, such technical and specific details as intervention levels are provided by the Guidelines on Emergency Preparedness for Nuclear Installations issued by the Nuclear Safety Commission.

In case of a nuclear emergency, the competent minister reports to the Prime Minister and recommends any necessary emergency response. The Prime Minister, as the head of Nuclear Emergency Response Headquarters, directs or recommends local governments to implement sheltering or evacuation of local residents, and directs other relevant organisations to take necessary measures, obtaining advice from the Nuclear Safety Commission.

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Luxembourg

The Radiation Protection Department (Ministry of Health) and the Civil Defence Organisation (Ministry of Interior) developed the legal framework for intervention levels for nuclear accidents. These organisations also make the recommendation concerning the implementation of countermeasures in case of a nuclear emergency. Only the government or the different ministers may take the final decision whether or not to implement countermeasures.

Netherlands

The Ministry of the Environment (VROM) prepared the law and the "Plan for Emergency Preparedness" (NPK) in co-operation with the Ministry of Internal Affairs and consulting other relevant Ministries.

The Technical Advisory Group (TIG) recommends based on the dose and other calculations of the RIVM.

A "Policy Team" existing of representatives from the Ministries of Environment (VROM) and Internal Affairs and the Inspectorate for Nuclear Installations (KFD – VROM) and other relevant Ministries like the Ministries of Health, Agriculture and Traffic and Water works makes the final decisions.

Norway

The legal basis for the nuclear emergency preparedness is given in a Royal Decree dated 26 June 1998. The authority to implement countermeasures has through this decree been given to the Crisis Committee for nuclear accidents. No specific levels have been given.

Norwegian Radiation Protection Authority (NRPA) and other advisors with relevant competence in case of a nuclear accident will make recommendations to the Crisis Committee, which decide upon which countermeasures to implement.

The Crisis Committee for nuclear accidents has the authority to decide upon implementation of countermeasures. The legal basis for each countermeasure is covered by police legislation (evacuation etc) and food control legislation. Other countermeasures (iodine prophylaxis, sheltering, etc) will be implemented by advice only.

Switzerland

The Federal Commission on NRBC-Protection (Eidgenössische Kommission für AC-Schutz KOMAC) is in charge of elaborating procedures and criteria for countermeasures. This commission is composed of experts in the field of radiation protection and emergency preparedness.

The Swiss Federal Nuclear Safety Inspectorate (HSK) will assess the situation based on the plant status and provide advice regarding early countermeasures to the National Emergency Operations Centre (NEOC).

In urgent situations, the competence lies with the NEOC. Later, the countermeasures are elaborated by the Centre and submitted to the Radiation Emergency Management Board LAR. At this level, criteria other than dose or radiation protection are taken into account. Finally, the decisions are taken by the government.

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Sweden

There are numerous laws and decrees formulating the legal framework that governs the emergency response to nuclear and radiological accidents. Sweden also follows several international conventions in this field. The Swedish Radiation Protection Authority has – as national competent authority – developed the guidelines for intervention levels.

The decisions regarding the implementation of countermeasures are taken by the county administrative boards, and they are responsible for the management and co-ordination of the rescue services in their counties. They also answer for the alarm and information to the public. In the case of a severe and extensive accident, the responsibility for the rescue services may be taken over by another authority, especially appointed by the government.

Central authorities give support, advice and recommendations to the county administrative boards, regarding e.g. countermeasures.

The Swedish Radiation Protection Authority gives advice on countermeasures aiming at minimizing the malicious effects of radiation. Other central authorities give advice within their area of competence, e.g. the National Food Administration give counselling on actions taken in order to protect the public from contaminated foodstuff. SSI co-ordinates the information and recommendations given by all central authorities.

United Kingdom

The National Radiological Protection Board (NRPB) has a statutory duty to recommend intervention levels. The Health Safety Inspectorate (HSE) and the Nuclear Installations Inspectorate (NII) have the statutory authority for developing the legal framework and approving emergency plans.

During the early stages of an emergency the operator makes recommendations concerning the implementation of countermeasures. This is then co-ordinated through the Government Technical Advisor and Regional Health Authority at the Local Emergency Centre where the Police co-ordinates measures to protect the public.

The police, in consultation with other interested agencies, will decide and co-ordinate what actions should be taken to protect the public.

United States

The primary responsibility for developing the legal framework for establishing intervention levels lies within several Federal governmental organisations. The Environmental Protection Agency (EPA) is responsible for establishing acceptable levels of radiation in the environment. The Food and Drug Administration (FDA) within the Department of Health and Human Services (HHS) has established intervention levels for food. The United States Department of Agriculture establishes intervention levels for crops and animal feeds. The establishment of these intervention levels is accomplished through the Federal Radiological Preparedness Co-ordinating Committee (FRPCC), an inter-agency workgroup consisting of 17 Federal departments and agencies with nuclear or radiological emergency response functions and capabilities.

In response to a nuclear or radiological emergency, recommendations for implementing countermeasures can come from a number of different sources. In most cases the recommendations come from the Lead Federal Agency (LFA) as established in the Federal Radiological Emergency Response Plan, the National Contingency Plan, or the Federal Response Plan. The designation of the

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LFA is based on who owns, operates or regulates the radioactive material. The table below identifies the different LFAs for emergencies involving nuclear or radioactive material in the United States.

Regardless of which Federal department or agency is the LFA, only state or local governments, have the authority to make the decision on whether or not to implement the countermeasures. The state or local governments may implement the recommendations without any changes or may decide to implement more or less protective countermeasures based on their analysis of the situation and its unique characteristics.

Type of Emergency	LFA
1. Nuclear Facility	
a. Licensed by the Nuclear Regulatory Commission (NRC) or an Agreement State	NRC
b. Owned or Operated by the Department of Defense (DOD)	DOD
c. Owned or operated by the Department of Energy (DOE)	DOE
d. Not Licensed, Owned, or Operated by a Federal Agency	EPA
2. Transportation of Radioactive Materials	
a. Shipment of Materials by the NRC or an Agreement State	NRC
b. Materials Shipped by or for the DOD	DOD
c. Materials Shipped by or for DOE the	DOE
d. Shipment of Materials Not Licensed or Owned by a Federal Agency or an Agreement State	EPA
3. United States Satellites Containing DOD Radioactive Material	DOD
4. Other United States Satellites Containing Radioactive Material	NASA[1]
5. Impacts from Foreign Accidents or Unknown Sources of Radiation	EPA
6. Terrorist Use of Nuclear or Radioactive Material	
a. Crisis Management	FBI[2]
b. Consequence Management	FEMA[3]

1. National Aeronautic and Space Administration.
2. Federal Bureau of Investigation.
3. Federal Emergency Management Agency.

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Annex 4

THE GERMAN OPERATIONAL INTERVENTION CRITERIA FOR THE COUNTERMEASURE "EVACUATION"

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Table 1. Released activity which at a distance of 1 km from the source may lead to an effective dose of 100 mSv within 7 days, and the proportion of the partial doses to each other

Nuclide	Released activity (Bq)		Contribution of the exposure pathway to the effective dose (%)					
	Release		Gamma submersion	Inhalation	Gamma soil radiation	Gamma submersion	Inhalation	Gamma soil radiation
	Early (6 h after shut-down)	Late (120 h after shut-down)	Early release (6 h after shut-down of the reactor)			Late release (120 h after shut-down of the reactor)		
Dry deposition								
^{131}I*	7.4E+14	8.8E+14	2.7	69.2	28.1	1.1	87.2	11.8
^{131}I**	2.4E+15	3.0E+15	0.4	74.3	25.3	0.5	93.5	6.0
^{132}Te	4.6E+15	4.6E+15	0.4	42.3	57.2	0.4	42.3	57.2
^{137}Cs	2.6E+15	2.6E+15	0.4	85.4	14.2	0.4	85.4	14.2
Wet deposition (rainfall rate 1 mm/h)								
^{131}I*	3.2E+14	4.8E+14	1.2	30.3	68.5	0.6	46.8	52.6
^{131}I**	1.5E+15	2.8E+15	0.2	47.5	52.3	0.4	86.8	12.8
^{132}Te	8.0E+14	8.0E+14	0.1	7.2	92.7	0.1	7.2	92.7
^{137}Cs	1.2E+15	1.2E+15	0.2	38.6	61.2	0.2	38.6	61.2
Wet deposition (rainfall rate 5 mm/h)								
^{131}I*	1.3E+14	2.2E+14	0.5	12.3	87.3	0.3	21.1	78.6
^{131}I**	8.0E+14	2.4E+15	0.1	24.4	75.5	0.4	73.0	26.6
^{132}Te	2.4E+14	2.4E+14	0.0	2.3	97.7	0.0	2.3	97.7
^{137}Cs	4.8E+14	4.8E+14	0.1	15.9	84.1	0.1	15.9	84.1
Exposure pathway gamma submersion								
Noble gases	1.3E+18	6.0E+18	100.0			100.0		
^{133}Xe	5.8E+18	5.8E+18	100.0			100.0		

* Reference nuclide; ** Note, see p. 98.

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Table 2. Released activity which at a distance of 5 000 m from the source may lead to an effective dose of 100 mSv within 7 days, and the proportion of the partial doses to each other

Nuclide	Released activity (Bq)		Contribution of the exposure pathway to the effective dose (%)					
	Release		Gamma submersion	Inhalation	Gamma soil radiation	Gamma submersion	Inhalation	Gamma soil radiation
	Early (6 h after shut-down)	Late (120 h after shut-down)	Early release (6 h after shut-down of the reactor)			Late release (120 h after shut-down of the reactor)		
Dry deposition								
^{131}I*	9.4E+15	1.1E+16	4.1	68.2	27.7	1.6	86.6	11.7
^{131}I**	3.2E+16	4.0E+16	0.6	74.1	25.3	0.7	93.2	6.0
^{132}Te	6.0E+16	6.0E+16	0.7	42.2	57.1	0.7	42.2	57.1
^{137}Cs	3.4E+16	3.4E+16	0.6	85.3	14.1	0.6	85.3	14.1
Wet deposition (rainfall rate 1 mm/h)								
^{131}I*	1.6E+15	2.6E+15	0.7	11.8	87.5	0.4	20.4	79.2
^{131}I**	1.0E+16	3.0E+16	0.2	23.7	76.1	0.6	72.1	27.3
^{132}Te	3.2E+15	3.2E+15	0.0	2.2	97.8	0.0	2.2	97.8
^{137}Cs	6.2E+15	6.2E+15	0.1	15.3	84.6	0.1	15.3	84.6
Wet deposition (rainfall rate 5 mm/h)								
^{131}I*	5.2E+14	9.0E+14	0.2	3.7	96.1	0.1	6.8	93.1
^{131}I**	3.6E+15	1.9E+16	0.1	8.5	91.4	0.4	45.3	54.4
^{132}Te	9.0E+14	9.0E+14	0.0	0.6	99.4	0.0	0.6	99.4
^{137}Cs	1.9E+15	1.9E+15	0.0	4.9	95.1	0.0	4.9	95.1
Exposure pathway gamma submersion								
Noble gases	1.1E+19	5.0E+19	100.0			100.0		
^{133}Xe	5.0E+19	5.0E+19	100.0			100.0		

* Reference nuclide, ** Note, see p. 98.

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Note:

Exposure pathways:	Gamma submersion, inhalation, gamma soil radiation
Diffusion category:	D
Wind speed:	1 m/s at 10 m height
Building release:	Width 80 m, height 60 m, height of release 50 m
Soil correction factor:	Negligible, b = 1 (see Chapter 8)
Integration time for Gamma soil radiation:	7 days
Breathing rate:	$3.5 \cdot 10^{-4}$ m^3/s for normal activity
Inhalation dose, integration time:	50 years
Reference group:	Adults

Note: Information about the deviations as compared with the emission limits laid down in the criteria for alarming the disaster response authority [SSK 95] in Section 7.11.

** Due to deposition processes within the nuclear facility, radio-iodine forms change from iodine in aerosol form to organically-bound iodine if the release takes place after a delay. Due to the different velocities of dry and wet deposition on the soil for aerosol and organically-bound iodine, with increasing stay time of the fission products in the containment, higher releases of ^{131}I result in the same effective doses.

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Table 3. Time-integrated air concentrations which may lead to an effective dose of 100 mSv within 7 days

Nuclide	Deposition	Time-integrated air concentration (Bqffffiff) Release	
		Early (6 h after shut-down of the reactor)	Late (120 h after shut-down of the reactor)
^{131}I*	dry	1.7E+06	2.7E+06
^{131}I**	dry	7.3E+06	9.2E+06
^{132}Te	dry	1.4E+07	1.4E+07
^{137}Cs	dry	7.9E+06	7.9E+06
^{131}I*	1 mm/h rain	3.0E+05	2.8E+06
^{131}I**	1 mm/h rain	2.2E+06	1.3E+07
^{132}Te	1 mm/h rain	5.1E+05	5.1E+05
^{137}Cs	1 mm/h rain	1.1E+06	1.1E+06
^{131}I*	5 mm/h rain	8.4E+04	9.9E+05
^{131}I**	5 mm/h rain	6.3E+05	5.1E+06
^{132}Te	5 mm/h rain	1.4E+05	1.4E+05
^{137}Cs	5 mm/h rain	3.3E+05	3.3E+05
Noble gases	none	2.8E+09	1.9E+10
^{133}Xe	none	1.9E+10	1.9E+10

* Reference nuclide.

Exposure pathways:	Gamma submersion, inhalation, gamma soil radiation
Diffusion category:	D
Wind speed:	1 m/s at 10 m height
Rain formation height:	1 000 m
Soil correction factor:	Negligible, b = 1 (see Chapter 8)
Integration time for Gamma soil radiation:	7 days
Breathing rate:	$3.5 \cdot 10^{-4}$ m^3/s for normal activity
Inhalation dose, integration time:	50 years
Reference group:	Adults

** Due to deposition processes within the nuclear facility, radio-iodine forms change from iodine in aerosol form to organically-bound iodine if the release takes place after a delay. Due to the different velocities of dry and wet deposition on the soil for aerosol and organically-bound iodine, with increasing stay time of the fission products in the containment, higher releases of ^{131}I result in the same effective doses.

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Table 4. Soil contamination which may lead to an effective dose of 100 mSv within 7 days

Nuclide	Soil contamination (Bq/m^2)
^{131}I*	7.7E+07
^{131}I	6.0E+08
^{132}Te	1.3E+08
^{137}Cs	3.0E+08

* Reference nuclide.

Exposure pathway: Gamma soil radiation
Integration time: 7 days
Soil correction factor: Negligible, b = 1 (see Chapter 8)
Reference group: Adults

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Annex 5

THE GERMAN OPERATIONAL INTERVENTION CRITERIA FOR THE COUNTERMEASURE "SHELTERING"

Table 1. Released activities which at a distance of 1 km from the source may lead to an effective dose of 10 mSv within 7 days

Nuclide	Released activity (Bq)/Time of release	
	Early (6 h after shut-down of the reactor)	Late (120 h after shut-down of the reactor)
Dry deposition		
^{131}I*	7.4E+13	8.8E+13
^{131}I	2.4E+14	3.0E+14
^{132}Te	4.6E+14	4.6E+14
^{137}Cs	2.6E+14	2.6E+14
Wet deposition (rainfall rate 1 mm/h)		
^{131}I*	3.2E+13	4.8E+13
^{131}I	1.5E+14	2.8E+14
^{132}Te	8.0E+13	8.0E+13
^{137}Cs	1.2E+14	1.2E+14
Wet deposition (rainfall rate 5 mm/h)		
^{131}I*	1.3E+13	2.2E+13
^{131}I	8.0E+13	2.4E+14
^{132}Te	2.4E+13	2.4E+13
^{137}Cs	4.8E+13	4.8E+13
Noble gases	1.3E+17	6.0E+17
^{133}Xe	5.8E+17	5.8E+17

* Reference nuclide.

Exposure pathways:	Gamma submersion, inhalation, gamma soil radiation
Diffusion category:	D
Wind speed:	1 m/s at 10 m height
Building release:	Width 80 m, height 60 m, height of release 50 m
Soil correction factor:	Negligible, b = 1 (see Chapter 8)
Integration time for Gamma soil radiation:	7 days
Breathing rate:	$3.5 \cdot 10^{-4}$ m^3/s for normal activity
Inhalation dose, integration time:	50 years
Reference group:	Adults

The proportion of the partial doses corresponds to the values give in Table 4.1-1.

Note: Information about the deviations as compared with the emission limits laid down in the criteria for alarming the disaster response authority [SSK 95] in Section 7.11.

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Table 2. Released activities which at a distance of 5 000 m from the source may lead to an effective dose of 10 mSv within 7 days

Nuclide	Released activity (Bq)/Time of release	
	Early (6 h after shut-down of the reactor)	Late (120 h after shut-down of the reactor)
Dry deposition		
^{131}I*	9.4E+14	1.1E+15
^{131}I	3.2E+15	4.0E+15
^{132}Te	6.0E+15	6.0E+15
^{137}Cs	3.4E+15	3.4E+15
Wet deposition (rainfall rate 1 mm/h)		
^{131}I*	1.6E+14	2.6E+14
^{131}I	1.0E+15	3.0E+15
^{132}Te	3.2E+14	3.2E+14
^{137}Cs	6.2E+14	6.2E+14
Wet deposition (rainfall rate 5 mm/h)		
^{131}I*	5.2E+13	9.0E+13
^{131}I	3.6E+14	1.9E+15
^{132}Te	9.0E+13	9.0E+13
^{137}Cs	1.9E+14	1.9E+14
Noble gases	1.1E+18	5.0E+18
^{133}Xe	5.0E+18	5.0E+18

* Reference nuclide.

Exposure pathways:	Gamma submersion, inhalation, gamma soil radiation
Diffusion category:	D
Wind speed:	1 m/s at 10 m height
Building release:	Width 80 m, height 60 m, height of release 50 m
Soil correction factor:	Negligible, b = 1 (see Chapter 8)
Integration time for Gamma soil radiation:	7 days
Breathing rate:	$3.5 \cdot 10^{-4}$ m^3/s for normal activity
Inhalation dose, integration time:	50 years
Reference group:	Adults

The proportion of the partial doses corresponds to the values give in Table 4.1-1.

Note: Information about the deviations as compared with the emission limits laid down in the criteria for alarming the disaster response authority [SSK 95] in Section 7.11.

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Table 3. Time-integrated air concentrations which may lead to an effective dose of 10 mSv within 7 days

Nuclide	Deposition	Time-integrated air concentration (Bqffffiffl)	
		Release	
		early (6 h after shut-down of the reactor)	late (120 h after shut-down of the reactor)
^{131}I*	dry	1.7E+05	2.7E+05
^{131}I	dry	7.3E+05	9.2E+05
^{132}Te	dry	1.4E+06	1.4E+06
^{137}Cs	dry	7.9E+05	7.9E+05
^{131}I*	1 mm/h rain	2.8E+04	1.7E+05
^{131}I	1 mm/h rain	1.9E+05	6.7E+05
^{132}Te	1 mm/h rain	5.2E+04	5.2E+04
^{137}Cs	1 mm/h rain	1.1E+05	1.1E+05
^{131}I*	5 mm/h rain	8.2E+03	8.2E+04
^{131}I	5 mm/h rain	6.1E+04	3.7E+05
^{132}Te	5 mm/h rain	1.4E+04	1.4E+04
^{137}Cs	5 mm/h rain	3.2E+04	3.2E+04
Noble gases	none	2.8E+08	1.9E+09
^{133}Xe	none	1.9E+09	1.9E+09

* Reference nuclide.

Exposure pathways:	Gamma submersion, inhalation, gamma soil radiation
Soil correction factor:	Negligible, b = 1 (see Chapter 8)
Integration time for Gamma soil radiation:	7 days
Breathing rate:	$3.5 \cdot 10^{-4}$ m^3/s for normal activity
Inhalation dose, integration time:	50 years
Reference group:	Adults

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Table 4. Released activities which at distances of 100 km and 300 km, respectively, may lead to an effective dose of 10 mSv within 7 days

Nuclide	Deposition	Released activity at the source (Bq)	
		Time of release	
		Early (6 h after shut-down of the reactor)	Late (120 h after shut-down of the reactor)
Distance source – receiving point: 100 km (receiving point along trajectory)			
^{131}I*	dry	3.2E+17	5.2E+17
^{131}I	dry	1.4E+18	1.8E+18
^{132}Te	dry	2.7E+18	2.7E+18
^{137}Cs	dry	1.5E+18	1.5E+18
^{131}I*	5 mm/h rain	1.6E+16	1.6E+17
^{131}I	5 mm/h rain	1.2E+17	7.1E+17
^{132}Te	5 mm/h rain	2.8E+16	2.8E+16
^{137}Cs	5 mm/h rain	6.1E+16	6.1E+16
^{133}Xe	none	3.5E+21	3.5E+21
Distance source – receiving point: 300 km (receiving point along trajectory)			
^{131}I*	dry	8.3E+17	1.4E+18
^{131}I	dry	3.6E+18	4.5E+18
^{132}Te	dry	6.9E+18	6.9E+18
^{137}Cs	dry	3.9E+18	3.9E+18
^{131}I*	5 mm/h rain	4.1E+16	4.0E+17
^{131}I	5 mm/h rain	3.0E+17	1.8E+18
^{132}Te	5 mm/h rain	7.1E+16	7.1E+16
^{137}Cs	5 mm/h rain	1.6E+17	1.6E+17
Noble gases	none	1.4E+21	9.2E+21
^{133}Xe	none	9.2E+21	9.2E+21

* Reference nuclide.

Exposure pathways:	Gamma submersion, inhalation, gamma soil radiation
Remote area transport:	NRPB model
Wind speed:	10 m/s
Mixing layer height:	1000 m
Soil correction factor:	negligible, b = 1 (see Chapter 8)
Integration time for Gamma soil radiation:	7 days
Breathing rate:	$3.5 \cdot 10^{-4}$ m^3/s for normal activity
Inhalation dose integration time:	50 years
Reference group:	Adults

Note: The partly higher operational intervention levels (released activity) compared with the inventory (assumption: equilibrium core of a power reactor with approx. 3 700 MW_{th}) show that at distances of 300 km and more sheltering is no longer necessary.

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Table 5. Soil contamination which may lead to an external radiation exposure of 10 mSv effective dose within 7 days

Nuclide	Soil contamination (Bq/m^2)
^{131}I*	7.7E+06
^{131}I	6.0E+07
^{132}Te	1.3E+07
^{137}Cs	3.0E+07

* Reference nuclide.

Exposure pathways: Gamma soil radiation
Integration time: 7 days
Soil correction factor: Negligible, b = 1 (see Chapter 8)
Reference group: Adults

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Annex 6

THE GERMAN OPERATIONAL INTERVENTION CRITERIA FOR THE COUNTERMEASURE "STABLE IODINE"

Table 1. Time-integrated air concentrations of ^{131}I which may lead to a thyroid dose of 250 mSv (adults) and 50 mSv (children/pregnant women) due to inhalation

Nuclide	Time-integrated air concentration (Bq·h/m^3)			
	Early (6 h after shut-down)		Late (120 h after shut-down)	
	Adults (250 mSv)	**Children/Pregnant women[1] (50 mSv)**	**Adults (250 mSv)**	**Children/Pregnant women[1] (50 mSv**
^{131}I*	5.0E+05	4.8E+04	6.9E+05	6.6E+04
^{131}I	7.4E+05	7.0E+04	7.4E+05	7.0E+04

1. Calculation performed for children. Pregnant women should take iodine tablets as soon as the criterion for children has been reached.

Exposure pathways: Inhalation
Breathing rate: Adults $3.5 \cdot 10^{-4}$ m^3/s for normal activity
Children $9.05 \cdot 10^{-5}$ m^3/s for normal activity

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Table 2. Released activities of ^{131}I which at a distance of 100 km and 300 km resp. may lead to a thyroid dose of 250 mSv (adults) and 50 mSv (children/pregnant women[1]) due to inhalation

Nuclide	Released activity at the source (Bq)			
	Early (6 h after shut-down)		Late (120 h after shut-down)	
	Reference group		Reference group	
	Adults (250 mSv)	Children/Pregnant women[1] (50 mSv)	Adults (250 mSv)	Children/Pregnant women[1] (50 mSv)
Distance source – receiving point: 100 km (along trajectory)				
^{131}I*	9.5E+17	9.2E+16	1.3E+18	1.3E+17
^{131}I	1.4E+18	1.3E+17	1.4E+18	1.3E+17
Distance source – receiving point: 300 km (along trajectory)				
^{131}I*	2.5E+18	2.4E+17	3.4E+18	3.3E+17
^{131}I	3.6E+18	3.4E+17	3.6E+18	3.4E+17

1. Calculation performed for children. Pregnant women should take iodine tablets as soon as the criterion for children has been reached.

Exposure pathways:	Inhalation
Breathing rate:	Adults $3.5 \cdot 10^{-4}$ m^3/s for normal activity Children $9.05 \cdot 10^{-5}$ m^3/s for normal activity
Release period:	12 hours
Average wind speed:	10 m/s
Mixing stratum height:	1 000 m height

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Radiological Protection

INTERNATIONAL SHORT-TERM COUNTERMEASURES SURVEY
2012 UPDATE

(FINAL)

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NUCLEAR ENERGY AGENCY
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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FOREWORD

The Working Party on Nuclear Emergency Matters (WPNEM) of the CRPPH has contributed to the field of emergency planning and preparedness, and emergency management with its program of work to improve nuclear emergency management systems within the NEA member states, and to share its knowledge and experience widely. Within this framework, WPNEM activities focus on identified needs in planning, preparedness and response for the "early" and "intermediate" phases of a nuclear/radiological emergency. The 2003 report of the NEA on Short-term Countermeasures in Case of a Nuclear or Radiological Emergency presents the results of relevant activities and survey findings in order to establish an overview of short-term countermeasures used at that time. Although much improvement in these areas has been made since the Chernobyl accident in 1986, governments continue to strive to test and update their programmes, and to find better methods for the practical implementation of countermeasures in case of an accident.

National practices regarding short-term countermeasures have subsequently evolved, thus inciting the WPNEM to modify the questionnaire and to redistribute it in February 2012 with the aim of preparing an updated overview of these practices to re-evaluate the country approaches in light with the early Fukushima Dai-ichi NPP accident lessons learnt.

During the 34th meeting of the WPNEM, a proposal to update the NEA report on Short-term Countermeasures in Case of a Nuclear or Radiological Emergency, which was published in 2003, was discussed by exploring the current approaches of the member states with a new survey. The UK delegate of the WPNEM was asked to review and prepare a new questionnaire with necessary updates in collaboration with the Secretariat. The proposal was reviewed and approved by the WPNEM.

The resulting questionnaire includes eight sections to explore the different aspects, covering the following topics; member information, general objectives and criteria, national organization, emergency planning zones, emergency plans, implementation of short-term counter-measures, and information for the public, countermeasures for special groups and harmonization. It is aimed at comparing countries current approach to nuclear emergency planning, and excludes proposed arrangements for new build.

The WPNEM received completed questionnaires from 20 countries: Austria, Canada, Czech Republic, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Republic of Korea, the Netherlands, Poland, Romania, Slovak Republic, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Grant Ingham evaluated the completed questionnaires and prepared a draft report. His report was further elaborated and finalized by the NEA Working Party on Nuclear Emergency Matters, the results of which are reproduced herein.

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INTRODUCTION

Nuclear emergency planning, preparedness, response and management, in general, are essential elements of any country's nuclear power programme. Part of nuclear emergency planning and preparedness is the implementation of national emergency plans, including detailed procedures for the implementation of short-term countermeasures, before during and after the release of radioactive substances.

The timely and appropriate implementation of short-term countermeasures, such as sheltering, evacuation and iodine prophylaxis, can, in case of a nuclear emergency with a release of radioactive material, considerably reduce the doses to the public in the vicinity of the nuclear installation.

Although international guidelines exist, national procedures and practices may differ due to different national habits, cultural specificity and societal needs. Different national procedures and practices, however, may, in the case of a radioactive release affecting two neighbouring countries, lead to different decisions in the implementation of countermeasures.

In order to better understand existing approaches and to facilitate the comparison of national practices, the NEA decided to launch a questionnaire on current practices regarding short-term countermeasures, updating a similar survey performed in 1994 and 2003, as countries' practices have since evolved and been modified. In 2012, it was decided to re-evaluate the country approaches in light with the early Fukushima Dai-ichi NPP accident lessons learnt.

The information collected may be used to understand the basis for decisions in various countries, and, if deemed appropriate, as a basis for international harmonisation. This may also assist member countries to explain to the public affected by an emergency why the decisions in neighbouring countries may vary.

This report summarises the information given by member countries and includes eight sections to explore the different aspects, covering the following topics; member information, general objectives and criteria, national organization, emergency planning zones, emergency plans, implementation of short-term counter-measures, and information for the public, countermeasures for special groups and harmonization. It is aimed at comparing countries current approach to nuclear emergency planning, and excludes proposed arrangements for new build.

In February 2012, a questionnaire was sent to NEA members to gather information on the countermeasure provisions in place. Data was obtained from 20 countries (listed in appendix A) and this report presents the findings from this survey. The full questionnaire can be found in appendix B.

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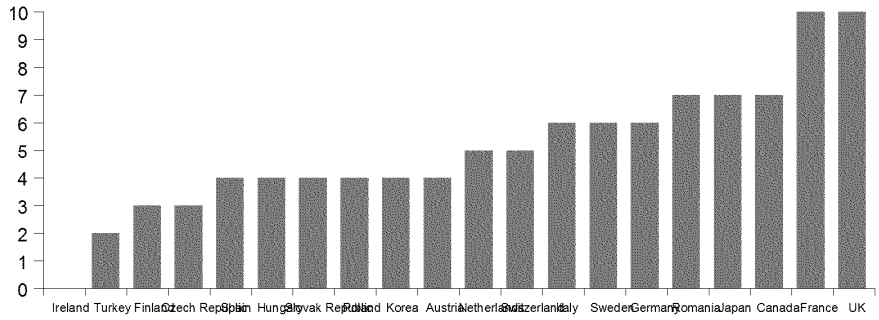
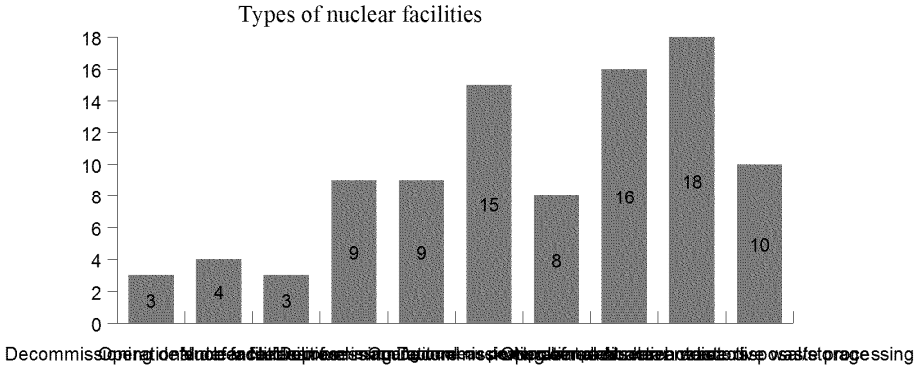
1.0 NEA MEMBER INFORMATION

1.1 What types of nuclear facilities/applications are located / conducted within your country?

All countries except Ireland reported some form of nuclear facility, with the majority having a range of different types of facility. France and the UK show the greatest diversity of nuclear facilities.





Types of facilities/practices

The most common types of facility were waste disposal/storage, operational research reactors and operational power plants. 15 countries have operational nuclear power plants, 9 of these also have decommissioning power plants. 9 countries have facilities involved in Nuclear Fuel manufacture, 3 of these also have reprocessing facilities. 16 countries have operational research reactors, 8 of these also report decommissioned research reactors. Only 4 countries report operational defence facilities, 3 of these also have decommissioned defence facilities. 10 countries have facilities involved in nuclear waste processing, all of these, and an additional 18 countries have disposal or storage facilities.

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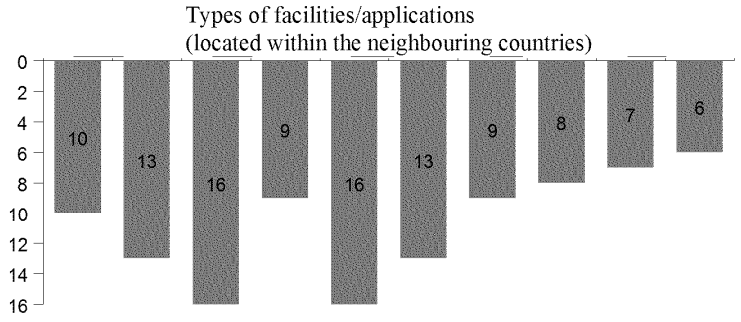
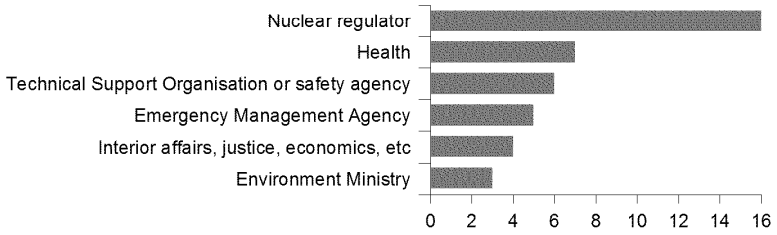
1.2 What type of facilities/applications are located within your neighbouring countries?

When asked about nuclear facilities in neighbouring countries, most submissions reported operational power plants (16) and research reactors (16), with slightly fewer reporting waste disposal and storage sites. 13 submissions reported decommissioning power plants in neighbouring countries.



Sweden, Canada, Switzerland and the UK reported the greatest diversity of nuclear facilities in neighbouring countries. While there are no nuclear facilities in Ireland they reported a wide range in neighbouring countries.

1.3 What organizations (type and jurisdictional level) were involved in completing this questionnaire?



The nuclear regulator was involved in completing the questionnaire for all countries.

In many cases other key government departments such as health, environment or emergency management agencies contributed to the response. In some countries the technical nuclear agencies provided expertise where required, with submissions from Ireland and Korea completed solely by these agencies.

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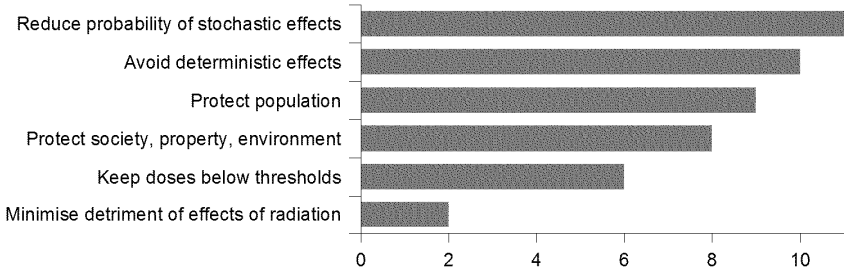
2.0 General objectives and criteria for Short-term Countermeasures

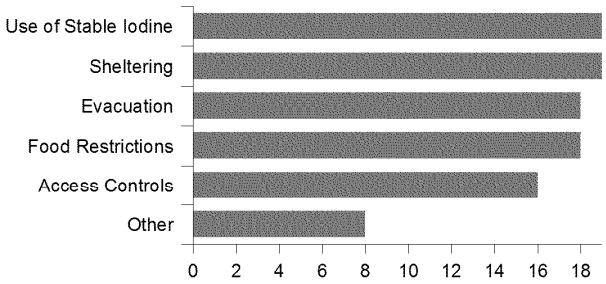
2.1 What are the objectives of implementing short-term countermeasures in the case of a nuclear emergency?



For most countries, the key objectives when implementing countermeasures are reducing the probability of stochastic effects, avoiding deterministic effects and generally protecting the population.

Several countries noted that the benefits of preventing harm from radiation must be balanced against potential detrimental effects from the countermeasures themselves.

2.2.1 Describe the urgent countermeasures for the general public which are planned in your country to protect the public FROM NEAR FIELD ACCIDENTS, agriculture, food manufacturing?



Most countries plan to use stable iodine, sheltering, evacuation, access controls and food restrictions in the case of a near field accident. Some countries described additional measures in the 'Other' field, these included instructions to farmers, decontamination, temporary relocation or permanent settlement, partial sheltering, traffic restrictions and activation of centres for radiological control/decontamination.

Stable iodine is pre-distributed up to 15 km around power plants in Sweden, 20 km in Switzerland, and in predefined planning zones in Hungary and in Slovak Republic. Poland advises consumption of stable iodine if doses are expected to exceed defined levels, as does Canada, where the level is 100 mSv.

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In Switzerland, sheltering is advised up to 20 km around the incident, Hungary will advise sheltering within predefined planning zones. Poland advises sheltering where doses are expected to exceed predefined levels, as does Canada where the levels are set at 10 mSv.

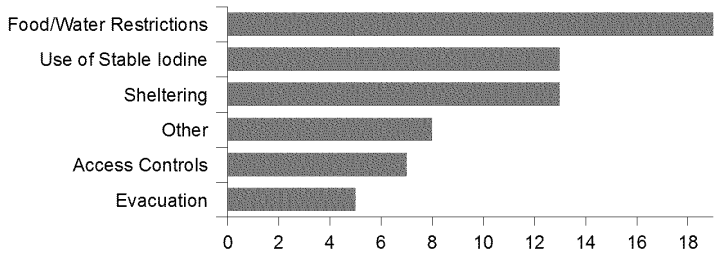
Evacuation is foreseen as a potential countermeasure in Switzerland; however, no specific plans are in place. Hungary will advise evacuation within predefined planning zones. Poland advises evacuation where doses are expected to exceed predefined levels, as does Canada where the levels are set at 100 mSv.

Netherlands includes access restrictions in emergency plans, but has no specific implementation measures in place. Switzerland plans access controls for a 4km radius, whereas Poland specifies a dose rate level of 100 µSv/h for the implementation of access controls.

Food producers in Switzerland and Poland are expected to comply with legal dose limits; Hungary imposes 300 km food restriction zones around power plants, 3 km around spent fuel storage and 1km around research reactors. Canada specified protective action levels between 1 and 100 Bq per kg for foodstuffs, infant food, milk and water, depending on the specific radionuclide involved.

Sweden provides instructions to farmers within 50 km, and Switzerland restricts harvesting and grazing in the plume direction up to the national border. Hungary also restricts harvesting and grazing, but also provides advice to the general public on washing produce. Netherlands and UK have decontamination plans in place, whereas Korea foresees temporary relocation or permanent resettlement as a potential response. Spain foresees evacuation, sheltering, use of stable iodine, food/water restriction and also access control, whereas Italy has off-site emergency plan to implement urgent countermeasures including sheltering and use of stable iodine only for the research reactors.

2.2.2 Describe the urgent countermeasures for the general public which are planned in your country to protect the public FROM FAR FIELD ACCIDENTS, agriculture, food manufacturing?



Countries are more likely to have planned food and water restrictions in the case of a far field accident, although many still do not rule out use of iodine and sheltering. Evacuation is much less likely but still considered. 'Other' countermeasures considered in the case of a far field accident include instructions to farmers, restrictions on traffic, transport and trade, and decontamination.

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Poland, Canada and Hungary use the same criteria for applying food and water restrictions as in a near field accident, Austria works within EC limits.
Neither sheltering, nor use of stable iodine is explicitly planned for far field accidents in Hungary, Sweden, and Switzerland. Spain foresees evacuation, sheltering, use of stable iodine and food/water restriction for far field accidents. Iodine is not pre-distributed for far field accidents but stocks are available for use if doses are expected to exceed defined levels.

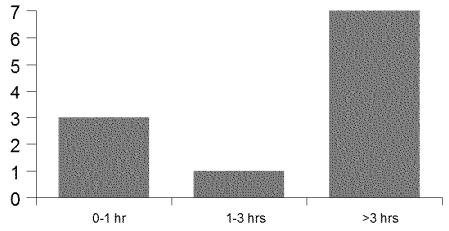
Switzerland, Austria, Finland and Hungary will all provide advice to farmers, and Sweden will do the same for farmers within 50km of an incident. Turkey, Switzerland, Germany and Hungary would implement traffic, trade and travel restrictions, Finland would advise partial sheltering, while UK and Austria would provide decontamination facilities.

Sweden has no specific plans for access controls in a far field accident, although recognises this may be required in extreme circumstances. Poland would exercise access controls if exposure levels were likely to exceed 100 µSv/h.

Evacuation is considered up to 50 km in emergency plans in Sweden, and is possible in Poland if doses are predicted to exceed defined levels, but many countries do not anticipate using evacuation as a countermeasure in the event of a far field incident.

2.3 What intervention levels and operational intervention criteria are used to initiate countermeasures, and how quickly should they be implemented?

Intervention levels for evacuation vary by country, from 10 to 500 mSv. Many countries give a range within which evacuation would be considered, depending on the situation. Canada considers evacuation in a range of 10-100 mSv, above 100 mSv evacuation is mandatory. UK and Romania define a range of 30-300 mSv. Spain, Korea and Turkey state intervention levels of 50 mSv, as do France Sweden, Ireland and Hungary. Ireland, Hungary and Sweden specify that this is within 7 days, while France specifies that this is calculated using the duration of the release or by default over 24 hours. Intervention levels for evacuation in Slovak Republic range from 50-500 mSv over 7 days. Czech Republic, Germany and Japan use intervention levels of 100 mSv for evacuation. Poland and Switzerland also use 100 mSv, but Poland specifies within 7 days, and Switzerland within 2 days. Netherlands specifies intervention levels of 200 mSv within 2 days. Italy specifies intervention level for evacuation from a few tens to a few hundred avertable effective doses, following the adoption of the specific measure, where the lower values represent the level below which it is not considered justified the adoption of the countermeasure, while the upper one indicates the level above which the activation of the countermeasure should be guaranteed.



Time to implement evacuation

Sweden, Poland, Slovak Republic, Spain, Italy and Switzerland do not define operational intervention criteria for evacuation, while in the UK it varies between sites. Romania, Korea, Japan, Turkey and Hungary set their operational intervention criteria for evacuation at 1 mSv/h, whilst Finland works with 20 mSv over 1 week. Other countries use a

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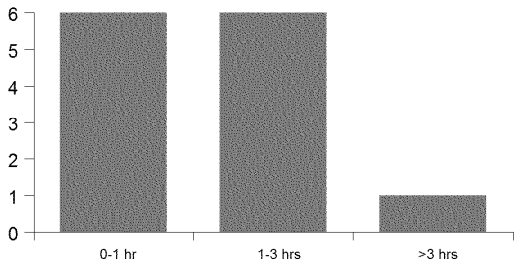
variety of factors in setting operational intervention levels; Canada uses real-time modelling data, France considers the time of day, weather conditions and duration of release, Germany uses release data, contamination readings and dose rates, and Czech Republic uses the averted effective dose in setting operational intervention levels for evacuation.

UK, Finland and Poland plan to implement evacuation as soon as possible, and Germany would like to implement significantly before a release. Japan and Ireland plan to implement within the first hour of an emergency, and Korea 1-3 hours into an emergency. Spain, Sweden, Romania, Canada, Turkey, Switzerland and Czech Republic would all implement evacuation over three hours into an emergency.



Time to implement sheltering

Intervention levels for sheltering were expressed by some countries in terms of effective dose, and by others in terms of equivalent dose, however Korea, Turkey, Germany and Czech Republic all stated intervention levels of 10 mSv but did not specify which measure. Japan gave levels of 100 mSv, UK of 3-30 mSv, Canada of 1-10 mSv and Sweden specified 10 mSv over 2 days. Netherlands and Poland stated intervention levels of 10 mSv effective doses over 2 days, while Spain and France gave levels of 10 mSv effective dose but France states that effective dose is calculated using the duration of the release or by default over 24 hours. Ireland and Hungary stated intervention levels for sheltering of 10 mSv averted dose over 2 days. Slovak Republic uses a range of 5-50 mSv averted dose over 2 days, while Romania gave ranges of 3-30 mSv effective dose, and 30-300 mSv equivalent dose. Austria and Switzerland specify effective doses of 1 mSv for children (and pregnant women) and 10 mSv for adults over 7 days.

Sweden, Slovak Republic, Poland, Japan, and Switzerland do not define operational intervention criteria for sheltering. Criteria differ by site in the UK, whereas Germany and Canada would use monitoring data to make decisions in the event of an emergency. Czech Republic relies on the averted effective dose, but does not advise sheltering for longer than 2 days. Korea and Turkey set levels of 0.1 mSv/h, Romania 1 mSv/h and Finland 10 mSv over 2 days.

Most countries see sheltering as a slightly earlier countermeasure than evacuation, with UK, Finland and Poland implementing as soon as possible. Slovak Republic, Japan, Switzerland, Ireland and Czech Republic would all implement sheltering (in houses) in the first hour of an emergency, whereas Sweden, Romania, Korea, Turkey and Austria would implement between 1-3 hours. Canada would implement after 3 hours following an emergency. France would implement in the first hour if in the reflex phase, and at later points if ordered by the Prefect (the national government representative in the region).

Most countries consider thyroid dose when setting intervention levels for the use of stable iodine: Sweden, Poland, Hungary and Korea use criteria of 100 mGy, whereas Austria specifies 10 mGy for children, 100 mGy for adults and 500 mGy for those aged 40+. UK and Romania use a range from 30-300 mSv thyroid dose, and Slovak Republic 50-500 mSv. Japan, France, Spain, Switzerland and Ireland use 50 mSv, while Germany sets limits at 50 mSv for children, 100 mSv

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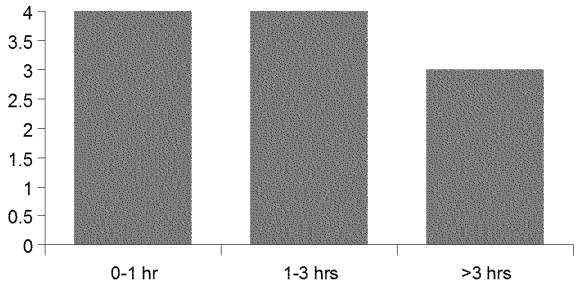
for adults. Czech Republic, Turkey, and Canada set levels at 100 mSv, whilst Netherlands uses 100 mSv for children and 1000 mSv for adults.
Sweden, Slovak Republic, Poland, Japan and Switzerland do not define operational intervention criteria for stable iodine. Romania, Korea and Hungary use 0.1 mSv/h, whereas Turkey uses 1 mSv/h. Finland uses projected doses of 10 mSv for children and 100 mSv for adults, Germany and Czech Republic intend to use monitoring data to aid decision making, and levels vary by site in the UK.

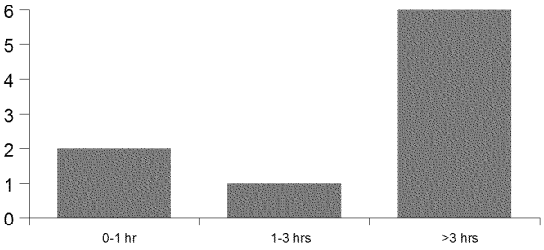


Time to implement/ administration of stable iodine

Poland, Finland and UK would advise people to take stable iodine as soon as possible in an emergency. Slovak Republic, Japan and Czech Republic would implement within the first hour as a preventative measure, while in France iodine can be implemented following the reflex phase if ordered by the Prefect. Switzerland implements within an hour in the planning zones, but over 3 hours outside of planning zones. Ireland, Austria, Sweden and Korea anticipate implementing stable iodine regimes within 1-3 hours of an emergency. Canada, Romania, Spain and Turkey would implement over 3 hours after the emergency has begun.

Spain, Sweden, Netherlands, Germany, Poland, Austria, Italy, Ireland and UK use intervention levels defined at EU level for food and water restrictions. Switzerland has no dose criteria, Turkey will judge whether restrictions are necessary based on contamination levels. Romania uses criteria of 5 mSv committed effective dose over a year and Slovak Republic uses a range of 5-50 mSv per year. Czech Republic uses 10 mSv, Japan 100 mSv and Canada has a range between 1-100 Bq per kg depending on the radionuclide.

Sweden and Slovak Republic do not have defined operational intervention levels for food and water restrictions. UK and Ireland comply with EU advice, and Canada plans to use monitoring data in decision-making. Turkey sets levels of 0.1 mSv/h, Romania, Korea and Japan use 1 µSv/h, and Finland uses 10 µSv/h.



Time to implement food/water restriction

Food and water restrictions are implemented later in an emergency than other countermeasures. Only Sweden and Switzerland would implement in the first hour. The UK would implement at 1-3 hours with the rest of the respondents stating they would implement after 3 hours.

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2.4 What criteria are used for ending countermeasures?

Germany, Hungary, Italy and Japan have no specified criteria, Austria ends countermeasures based on intervention levels, and Netherlands has no specific policy, ending countermeasures depending on individual situations, although intervention level for relocation and return is 50-250 mSv effective dose (50 years). New legislation in Spain, which is under preparation, intends to establish a criteria and new legislation in Switzerland gives power for ending countermeasures to a crisis management board. Other countries provided specific comments:

Evacuation – Hungary states there are no defined criteria in their plans for ending evacuation. Turkey and Czech Republic would end evacuation when the level of doses dropped below intervention levels, but did not specify the doses. Sweden, Finland and Poland would end evacuation when monthly doses drop below 10 mSv, although Finland adds that the dose should be expected to decrease rapidly, and that total annual residual dose should remain below 20 mSv. Slovak Republic have thresholds of 30 mSv within the first month and 10 mSv in subsequent months, while Romania use dose criteria between 20 and 100 mSv per year, scaled for 1 month. Korea, France, Canada, Ireland and UK base their decision to end evacuation on a combination of measures – the end of releases, stability of the facility, and monitoring readings below intervention levels. Residual contamination levels are considered in UK, and public acceptance levels are important in Korea.

Sheltering – Hungary and Romania set a maximum timescale of 2 days for sheltering, while Czech Republic, Ireland and Turkey end sheltering when measurements are below intervention levels. Finland ends sheltering based on dose criteria of 10mSv per month, Poland uses criteria of 10 mSv over the following 2 days, and Slovak Republic work with 30mSv in the first month and 10mSv after that. France, Canada, Korea and UK end sheltering based on the end of releases, stability, contamination and other practical considerations.

Stable iodine – Sweden, Finland, Ireland, Czech Republic and UK would only advise one dose of stable iodine, and if a second became necessary would consider evacuation instead. France and Romania have no defined criteria for a second dose, Turkey and Canada use operational intervention levels, and Poland uses a thyroid dose criterion of less than 100 mGy.

Food and water restrictions – UK, Ireland, Turkey, Canada, France and Poland all lift food and water restrictions based on intervention levels. Sweden, Finland and Czech Republic plan to assess the situation and take account of recommendations made based on measurements, whilst Slovak Republic uses a dose criterion of 5-50 mSv, and Poland uses measurements between 1 and 2000 Bq/kg depending on the radionuclide and foodstuff involved.

Access controls – Canada and Ireland lift access controls when measurements fall below intervention levels, Czech Republic specifies a dose of 10mSv/month, and Finland and Poland specify a dose rate level of 100 µSv/h for commencing the lifting of access controls. Turkey ends access controls depending on the level of contamination, France when all other protection measures are ended and Sweden will end access controls when the criteria are no longer fulfilled or the measure is replaced by another.

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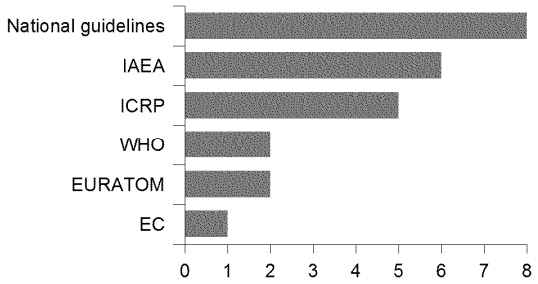
2.5 On which bases did you develop your intervention levels?



Most countries have national legislation that defines their intervention levels. Many also used IAEA or ICRP guidance, while others turned to WHO, EURATOM / EC guidelines.

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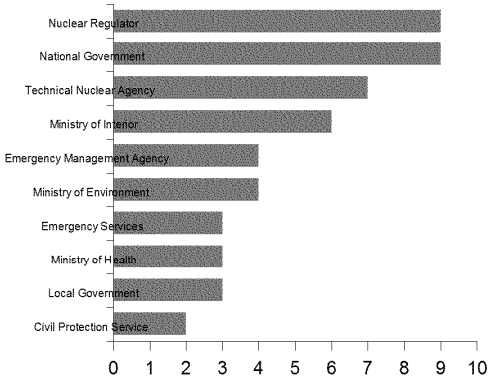
3.0 NATIONAL ORGANISATION FOR NUCLEAR ACCIDENTS

3.1 What organization(s) developed the legal framework for your emergency preparedness and response system?

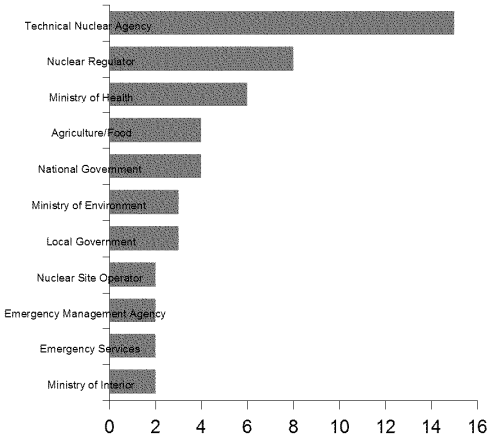


In around half of the countries who responded to this questionnaire the Nuclear Regulator or the National Government were responsible for developing the legal framework around emergency preparedness.

The majority of responses indicated that development of the framework was a collaborative effort, involving a range of different organisations.

Where only one organisation was cited this was usually the national government, which may represent the efforts of several departments.

3.2 What organization(s) makes recommendations concerning the implementation of countermeasures in case of a nuclear emergency?



Most countries stated that they rely on the expertise of technical, nuclear specific agency to make countermeasure recommendations. The nature of the agencies cited ranged from Atomic Energy Authorities to Radiation Protection Agencies or Nuclear Safety Agencies. Nuclear regulators were also involved in several countries.

Relevant government departments, such as Ministries of Health, Agriculture or Environment and also national institutes may also have a role in developing countermeasure recommendations where an emergency may affect areas for which they are responsible.

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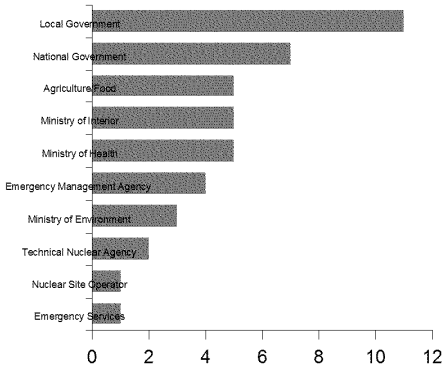
3.3 What organization(s) has the authority to make the decision whether or not to implement countermeasures in case of a nuclear emergency?



In around half of the countries who responded to the questionnaire the decision whether to implement countermeasures involves the local authorities, as they have authority in an initial response to an emergency.

In all cases however, there was more than one organisation (in case of the activation of a national plan or representation in a committee) listed, with relevant ministries, government departments providing advice on their policy areas, e.g. food, transport, health.

In the UK the Site Operator may be responsible for initial countermeasures decisions, where actions have been pre-agreed.

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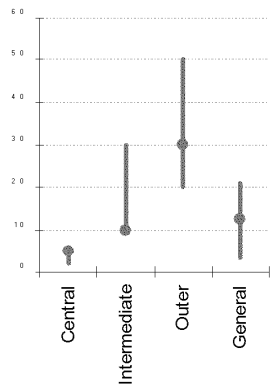
4.0 EMERGENCY PLANNING ZONES FOR NUCLEAR FACILITIES

4.1. What physical zones are pre-established for the purposes of countermeasure implementation (ex: 5 km evacuation zone, 20 km sheltering zone)



This chart indicates the range of sizes for inner, intermediate and outer zones for power plants only; as most countries have these facilities the information received was more robust than for other types of nuclear facility. Information was still not available in every case, so this chart shows the information as provided, and includes a column for general zone size if only one figure was supplied.

As expected, the central, intermediate and outer zones increase in size, with median values of 5, 10 and 30 km respectively. Hungary applies a 300km outer zone for food restrictions, but this has been removed from the data as an outlier.
Central and intermediate zones were most often associated with evacuation, sheltering and stable iodine, whilst outer zones defined areas where food restrictions would be in place.

Where countries supplied general exclusion zones, they tended to be similar to intermediate zones in size, with a median value of 12.5 km.

Austria, Ireland, Poland and Turkey either do not have pre-established zones (which would not be unexpected for those countries with no nuclear facilities that could give rise to off-site consequences) or did not provide information about them. Canada confirmed that they do have pre-established zones, but did not give any detail on the size.

Czech Republic has zones of 13 km and 20 km around two power plants within which sheltering and stable iodine will be advised, similarly Slovak Republic has 20 km and 21 km planning zones around two sites where power plants are located. Korea has 8-10 km emergency planning zone around nuclear power plants, however for fuel manufacture, research reactors and waste storage sites the emergency planning zones extend only to the site fence. Finland has a 5 km exclusion zone and 20 km planning zone around operational power plants, whereas planning zones around research reactors only extend to the building perimeter. Italy conducts environmental radiological monitoring and food restriction/agriculture countermeasure within a few kilometers from the plants. Spain has 10 km zone for the implementation of urgent countermeasures (including control access, sheltering and evacuation), 30 km zone for long term countermeasures, such as food and water restriction and a study is ongoing for decommissioning plants, storage facility and nuclear fuel manufacture site. Planning zones in the UK vary by facility, from 1-3.4 km, and include extendibility zones out to 15 km (although the requirements are being reviewed).

Switzerland has inner planning zones of 3-5 km and an outer zone of 20 km around power plants, with 5 km sheltering zone around waste storage facilities. Sweden has pre-established zones of 12-15 km for power plants, however no specific zones are in place around nuclear manufacture or decommissioning research reactor sites. Their nuclear waste storage site falls within the planning

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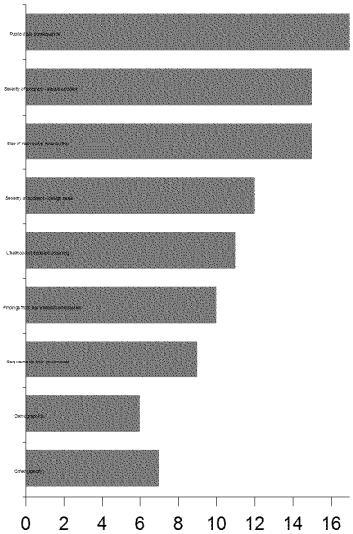
zones of another nuclear site.
Netherlands has pre-established zones of 5 km for evacuation, 10 km for iodine prophylaxis and 20 km for sheltering around power plants. One research reactor has a 2.1 km iodine prophylaxis zone and a 3 km sheltering zone, and around decommissioning research reactors there is a pre-established zone of 0.3 km for sheltering. There are no pre-established zones for decommissioning power plants, fuel manufacture or waste disposal.

Romania plans for zones of 3 km precautionary action for evacuation, sheltering and use of stable iodine, 10 km for urgent protective action including evacuation, sheltering and iodine, and 50 km long term protective action for food bans around power plants. Zones around operational research reactors are 1.6km for precautionary action, 12 km urgent protective zone and 30 km long-term protective action zone. Around decommissioning research reactors there is a 1km protective action zone for evacuation and sheltering, and a 20 km long-term protective action zone where food bans would be in place.

Hungary has a 3 km precautionary zone, 30 km urgent protective zone and 300 km food restriction zone around power plants. For research reactors the urgent protective zone covers the site, and the food restriction zone is 1 km radius from the site fence. For waste treatment and storage (including spent fuel) the urgent protective zone covers the sites, with food restriction zones of 3 km from the site fences.

Japan recognises 5 km precautionary action zones, and 30 km urgent protective action zones around nuclear facilities. France has 5 km evacuation zones and 10 km sheltering and iodine zones around power plants, with specific zoning around other facilities. Germany defines three zones – a 2 km central zone and 10 km intermediate zone for evacuation, sheltering and iodine, and a 25 km outer zone for distribution of stable iodine.

4.2 What factors do you consider when determining the size of emergency planning zones?



The most commonly considered factor was the public dose consequence. Some countries noted that this was part of the regulations, and Canada noted that their public dose consequence planning was based on design base accident set at 250 mSv at the nuclear power plant boundary (which may be reduced in certain circumstances). In Switzerland, possible acute health effects without countermeasures must be restricted to the PAZ, and in the UK a "dose contour" is created for 5 mSv whole body effective dose to the public (assuming no countermeasures are used in first 24 hours).

Severity of accident and size of release were also commonly considered factors. Netherlands specified iodine release 1% of inventory; in Poland

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and Switzerland the maximum release is determined for each facility. The UK does not directly use size of release in determining the size of emergency planning zones, but it is used in estimating public dose consequence.

Severity of accident – design basis, and the likelihood of an accident occurring are often considered. Some countries state that likelihood must be below regulatory levels, but Canada specifies a probability of 1×10^{-5} and Netherlands 1×10^{-7} probability of 1% iodine release.

Findings from risk assessments are also important to many countries, as are government requirements. Demographics seem to be considered less, although Finland stated in the 'Other' category that it considers population centres to avoid drawing a planning zone boundary through settlements, and the UK also considers vulnerable groups. Communication networks, contamination, emergency capabilities, advice from local government and geographical factors were also cited as 'Other' considerations.

4.3 Does your country have a strategy for extending countermeasures beyond the planning zone for a very severe accident?

Fourteen of the 20 countries who responded to the questionnaire have strategies for extending countermeasures in the event of a severe accident.

Slovak Republic anticipates using radiological assessment and forecast data to make necessary decisions concerning protective measures. Romania acknowledge that evacuation may extend past the planned zone for domestic accidents, and that the long term protective action zone could be extended for cross-border incidents, again radiological measurements would be used to make these decisions. Netherlands also would use source term information and meteorological data when considering extending the zones. Korea would extend countermeasures based on operational and general intervention levels, with a similar situation in Japan where the duration of the exposure and intervention levels would be considered. France, Finland, Canada, Switzerland and Turkey also have provisions for decision makers to use monitoring data to decide whether to extend countermeasures beyond the planning zones. In Spain, the evaluation of countermeasures depending on accident severity may be performed by the regulatory authority according to the national plan. The UK is the only country to specify guideline distances - stable iodine and sheltering out to 15 km, and evacuation out to 4 km; although these guidelines are currently being reviewed.

The situation in Germany and Sweden is less clear, while there are no specific plans to extend countermeasures they do acknowledge that a situation may arise where this is required.

Poland bases their countermeasure decisions purely on expected doses and contamination. Czech Republic and Italy have no plans for extending countermeasures beyond planning zones. This question was not applicable in Ireland, and Austria did not respond to this question.

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4.4 Are there special permissions required for the construction of new residential settlements or industrial facilities within emergency planning zones?

Six out of the 20 countries who responded restrict construction within emergency planning zones. Romania bans any residential or industrial development within 900 m of power plants, Czech Republic within 3 km. Proposed developments inside Finnish exclusion zones (about 5 km) undergo individual assessments, in Canada this applies up to 10 km, and construction within 1 km of the facility requires an additional environmental assessment. In France, developers must prove there is no alternative, that they are informed of the risks and emergency plans must be updated. This is similar to the UK, where any proposed developments are reviewed to ensure emergency plans remain adequate.

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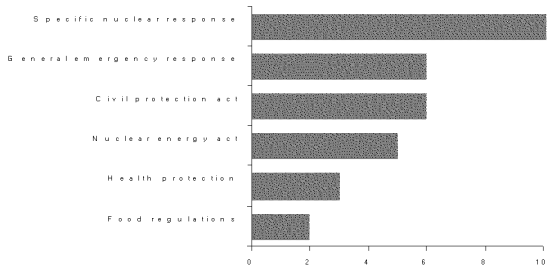
5.0 OFF-SITE EMERGENCY PLANS

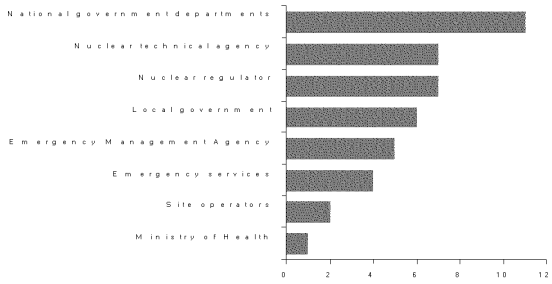
5.1 Describe the national legal framework for the provision of off-site emergency plans.



In most countries, the requirements for off-site emergency plans was covered in legislation or regulations specifically relating to nuclear emergency response, although several countries included these requirements in general emergency response legislation, or civil protection acts.

Poland, Switzerland, Netherlands and Hungary also refer to off-site emergency plans in nuclear energy acts, whereas Switzerland covers some aspects of the off-site planning under food regulations. Canada and Finland cover other aspects in health protection legislation.

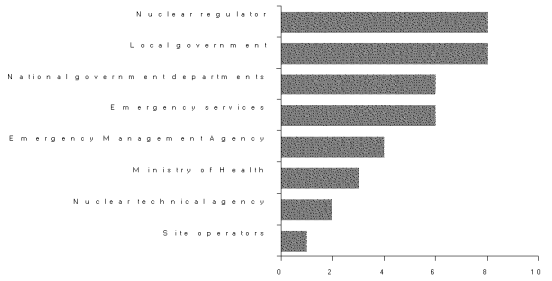
5.2 What organization(s) developed the guidance for the implementation of the emergency plan?



In around half of countries, central government departments such as the Ministry of Interior, Agriculture, Economics or Energy were involved in developing guidance for implementation of the emergency plan. In many countries nuclear regulators or safety agencies were also involved.

Sweden, France, Germany, Spain, Austria and the UK all involve local authorities in developing the guidance, and Canada and the UK involve the nuclear site operators.

5.3 What organization(s) developed the procedures for the implementation of short-term countermeasures?



Fewer countries involve national government departments such as ministry of agriculture or interior affairs, in the implementation of short-term countermeasures. While the nuclear regulator still has a role to play in nearly half of countries who reported, there is a local emphasis, with regional authorities and emergency services playing a role in several countries.

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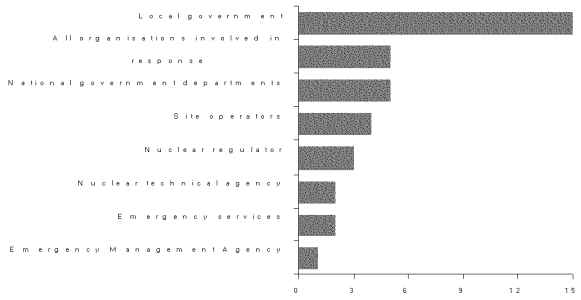
Although guidance may be developed at a national level, implementation is planned at a local level with those who would be directly involved in the response.

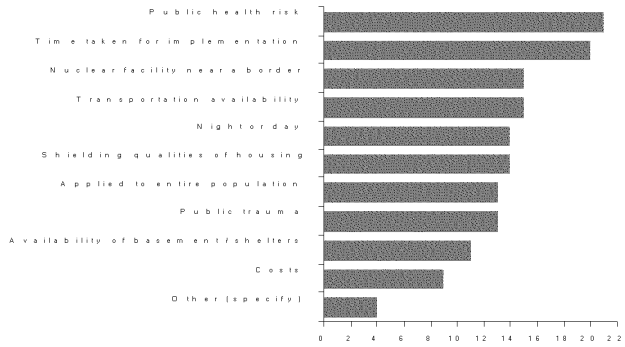
5.4 What organization(s) are responsible for creating and maintaining the emergency plan?



In most countries local authorities are responsible for creating and maintaining the plan, although only in Spain and France are they solely responsible. Sweden, Romania, Finland, Ireland and Hungary expect all organisations who would be involved in a response to maintain their sections of the plan.

Slovak Republic, Hungary, Turkey and UK involve site operators in maintaining emergency plans, and nuclear regulators or technical agencies are involved in Korea, Japan, Switzerland and Ireland.

5.5 Which factors were considered in developing emergency plan guidelines?



All countries considered public health risk when developing their guidelines. Most also considered the time it would take to implement countermeasures. Similar numbers of countries considered whether the facility was near a border, whether transportation was available, whether an incident occurred at night or in daytime, and the shielding qualities of the average house.

Slightly fewer countries considered whether countermeasures would be applied to the whole population, or the public trauma it would cause. Fewer again considered the availability of shelters or the costs involved.

There were several 'Other' responses received; Finland noted that they considered many other factors besides the ones listed, Ireland considered protection of agricultural produce, and Italy considered environmental, agricultural and food contamination.

5.6 What stakeholders, including the public, are consulted in preparation or review of emergency plans?

Responses to this question were mixed, with many countries stating that those who were involved

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in developing and maintaining emergency plans were consulted and had opportunity to contribute during the development phase.

Romania reported that stakeholders are not usually involved in preparation of emergency plans, whereas in Slovak Republic the general public and institutions have the right to see and comment on emergency plans. Netherlands state that citizens are consulted along with a range of institutions involved in the response, and in Switzerland the public can comment on the legal rather than operational aspects of emergency plans. In the UK the public are consulted via local councillors or members of parliament, or through residents groups in the vicinity of nuclear sites.

5.7 What legal requirements are there for stakeholder consultation?

In many countries, particularly Italy, Austria, Spain, Switzerland and Sweden there are no specific requirements for consultation, although in Sweden the collaborative nature of their planning efforts ensures that stakeholders are consulted in the planning process. Canada also has no legal requirements but good practice dictates that they consult with those who would have a role to play in response to a nuclear emergency.

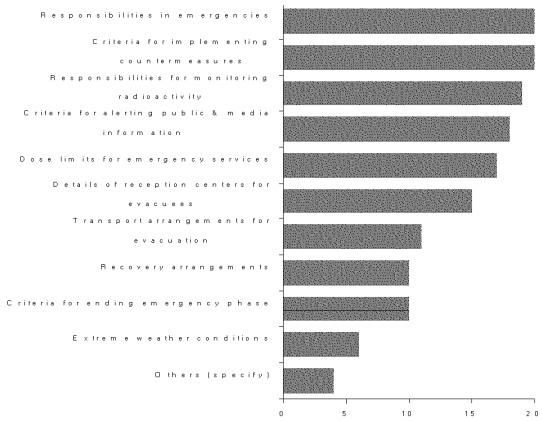
France and Slovak Republic reported that any plans were generally available through their transparency laws, whereas Poland, Netherlands, Finland, Ireland, Czech Republic, Hungary and UK have specific provisions in their emergency planning legislation relating to stakeholder consultation or to make plans available to the public.

5.8 What legislation and guidance details what should be included in emergency plans?

Answers to this question were varied, with some countries giving details of the plans rather than the legislation or guidance relating to them, and some left this section blank.

Of those who answered the majority stated that there was specific, nuclear-related legislation which set out the coverage of emergency plans; either as part of nuclear energy acts or in legislation relating specifically to response to a nuclear emergency. In Sweden, France, Slovak Republic and Czech Republic there are certain aspects covered under civil protection legislation, and Czech Republic and Poland also have provision in their general emergency response guidance.

5.9 What details are required by legislation/guidance to be included in emergency plans?



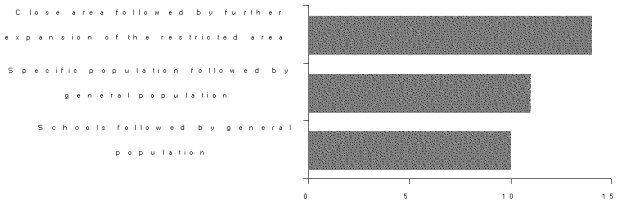
In all countries, plans are required to cover roles and responsibilities in an emergency, and the criteria for implementing countermeasures. All countries except Netherlands include roles and responsibilities relating to radiation monitoring.

All except Netherlands and Spain include criteria for alerting the public, and providing

information, including to the media. All except Netherlands, Turkey and Germany include emergency dose limits for rescue service personnel.
Around three quarters of countries include evacuation details such as transportation or reception centres, and around half include details on recovery arrangements and the criteria for ending the emergency phase.

Sweden, Slovak Republic, Czech Republic, Finland, Korea and Canada all include information relating to severe weather conditions, and there were several 'Other' answers received: Canada includes details of mass public decontamination, and Ireland includes procedures for assessment of technical information, consequences and effectiveness of interventions. Austria includes further detail and templates to be used in areas such as communication, information flows and decision support. Plans in Italy are very detailed concerning radiological monitoring and provide details of reception centres that can be used without evacuation for local contamination control.

5.10 Has a phased implementation of countermeasures been considered in emergency plans?



Turkey, Switzerland, Italy and Spain had not considered any phased implementation. Around three quarters of countries considered implementation in the closest area, followed by expansion of the restricted area, and around half considered specific populations or schools followed by the general population. In the UK specific populations referred to vulnerable groups.

5.11 How often do you undertake full exercises to test emergency plans for scenarios that form the basis of the emergency plan?

Exercise Type	Frequency
On-site	Every year
Off-site	Every year
National	Every 3-5 years
International	Dependant on international agencies

This table summarises the most common answers given, although not all countries responded to all sections.

Most countries test on-site plans annually, although Korea and Poland do this every 2 years. Turkey does not undertake exercises on a regular basis, and this is not applicable in Ireland as there are no nuclear facilities.

Off-site plans are tested annually in Romania, Japan, Finland, Canada, Hungary and Spain, whereas Switzerland tests every 2 years. Slovak Republic, Czech Republic and UK test every 3 years, Korea tests every 4 years and Sweden every 5-6 years.

National exercises are conducted every year in Japan and approximately every year and a half in Finland. In Switzerland it is every two years, and every 2-3 years in Czech Republic. UK, Spain

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and Poland run national exercises every 3 years, and Romania every 3-4 years. Ireland tests national response every 3-5 years, Hungary every 4-5 years. Netherlands, Korea and Germany run national exercises every 5 years, and Sweden every 5-6 years.

Canada participates in international exercises every year, Netherlands and Switzerland every 2 years, Ireland every 3 years and Finland every 3-4 years. Most other countries state that participation at an international level is dependent on exercises organised by international agencies such as OECD/NEA (INEX) or IAEA (ConvEx), etc.

Answers relating to regional exercises are not shown due to ambiguity in question responses.

5.12 How often do you undertake full exercises to test the extension of the arrangements in the emergency plan to deal with a more severe accident?

Switzerland, Canada and Japan have never tested the extension of emergency arrangements, and Turkey does not do so on a regular basis. Austria and Ireland are not in the near range of any NPPs, so all exercises tend to use severe accident scenarios. In Romania and Poland, it depends on the exercise scenario, and is more likely to form part of national or international exercises. The table below shows the most common responses received from countries that gave more detail on frequency.

Exercise Type	Frequency
On-site	Every year
Off-site	Every 3 years
National	Every 3-5 years
International	Dependant on international agencies

Sweden, Slovak Republic, Finland, Czech Republic and Hungary test extension of on-site arrangements every year, Korea every 2 years and Germany every 2-3 years. Frequency is variable in the UK.

Finland and Hungary test extension of off-site plans every year, Czech Republic and Slovak Republic every 3 years, Korea every 4 years and Sweden every 5-6 years. Germany has no defined frequency.

France and Finland test extension of national plans every 1-2 years, Germany and Czech Republic every 2-3 years and Hungary every 4-5 years. Netherlands and Korea test national extension plans every 5 years, and Sweden every 5-6 years. Slovak Republic does not have any legislation requiring a test of national extension plans.

Czech Republic, Slovak Republic and Ireland attempt to participate in international tests of extension plans when the opportunity arises. Netherlands participates every 2 years, Hungary every 2-3 years, Finland every 3-4 years and Sweden every 5-6 years.

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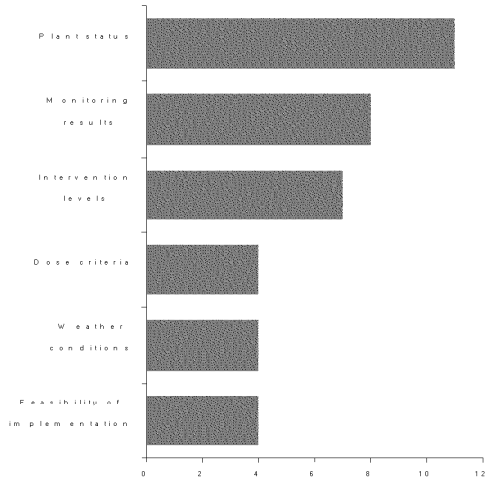
6.0 IMPLEMENTATION OF SHORT-TERM COUNTERMEASURES

6.1 General points concerning the implementation of short-term countermeasures

6.1.1 What information or criteria are considered necessary and sufficient to justify the implementation of short-term countermeasures?



Around half of countries considered plant status when deciding whether to implement short term countermeasures. Together with monitoring results, most countries would use the available technical information about the accident in order to decide whether short term countermeasures were necessary.

Many countries would refer to their defined operational intervention levels that specify when each countermeasure should be implemented.

Dose criteria are considered by Romania, Poland, Germany, the Netherlands and Hungary, weather conditions would be considered by Sweden, Finland, Switzerland, the Netherlands and Germany, and the practical aspects of application of countermeasures would also play a part in the decision making process for Netherlands, France and Switzerland.

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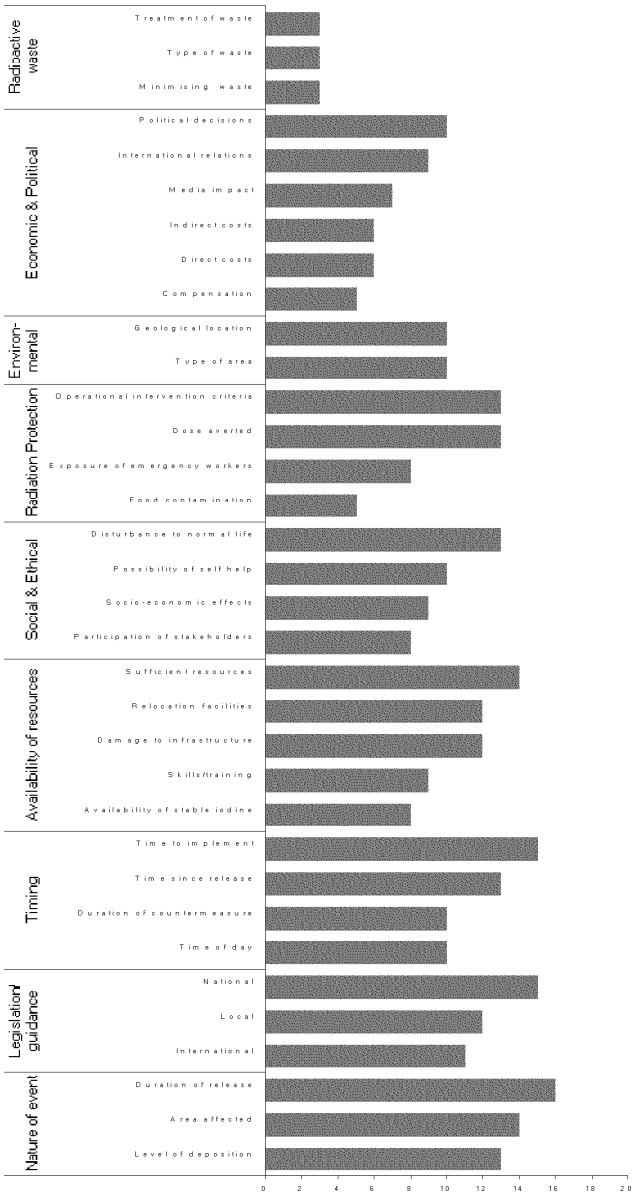
6.1.2 Which factors are likely to be taken into account at the time of a nuclear accident when selecting which countermeasures to implement?

Evacuation



Treatment, type and amount of waste is not considered by many countries when deciding whether to implement evacuation, but Korea, Canada and Turkey would take all three of these matters into consideration.

Over half of countries would consider political decisions and international relations when deciding whether to implement evacuation. Media impact, costs and compensation would be considered by around a third.

Environmental considerations such as the local geology, geography and land use are important considerations for around half of countries.

Nearly three quarters of countries would rely on operational intervention criteria and averted dose. Around half of countries would consider potential exposure of emergency workers, and around a third would consider food safety.

Disturbance to normal life was a key social consideration for three quarters of countries, with around half considering whether citizens were able to help themselves.

Availability of resources is important in decision making in three quarters of countries, with availability of relocation centres and potential damage to infrastructure close behind.

Time to implement evacuation is a key consideration for most countries, along with the time since release. Around half would take account of the expected duration of evacuation, and similar numbers would consider the time of day.

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National legislation would be considered by most countries, with local and international guidance being important to around half of those who responded.

The nature of the event is an important factor in decision making for nearly all countries, duration of release was the most commonly cited factor of all, with over three quarters of countries stating they would consider it when deciding whether to evacuate. Location affected and the levels of deposition were important factors in the decision to evacuate for more than half of countries.

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Sheltering

Waste is only a consideration when deciding whether to implement sheltering for Korea, Canada and Turkey.

Around half of countries would consider international relations, political decisions and media impact when deciding whether to implement sheltering, although slightly fewer than take account of these issues when deciding whether to evacuate.

Environmental issues are less important than when considering evacuation, and the land use of the area (recreational, industrial or residential) is important to more countries than the geological features when deciding whether to implement sheltering.

Around half of countries consider the level of disturbance to normal life, and whether citizens are able to help themselves, this is fewer countries than consider these factors when deciding on evacuation.

Almost three quarters of countries would take account of the time since release and the expected duration of sheltering.

Almost three quarters of countries would consider potential damage to infrastructure. Sufficient resources are less of a concern than when considering evacuation, possibly because less resource is needed. Availability of stable iodine is a consideration for around half of countries when considering implementation of sheltering. Weather conditions are important for three quarters of countries, and the vulnerability of the population is also a concern. The number of people affected would be considered by around half of countries, with the level of preparedness of the population being important to fewer countries.
Three quarters of countries consider averted dose, and around two thirds would refer to operational intervention levels. National guidance is important to almost all countries, with international and local legislation considered by around two thirds. The nature of the event is again a key consideration for many countries, with all stating they would consider the estimated duration of release when deciding whether to implement sheltering. The level of deposition and the area affected would be considered by around two thirds of countries.

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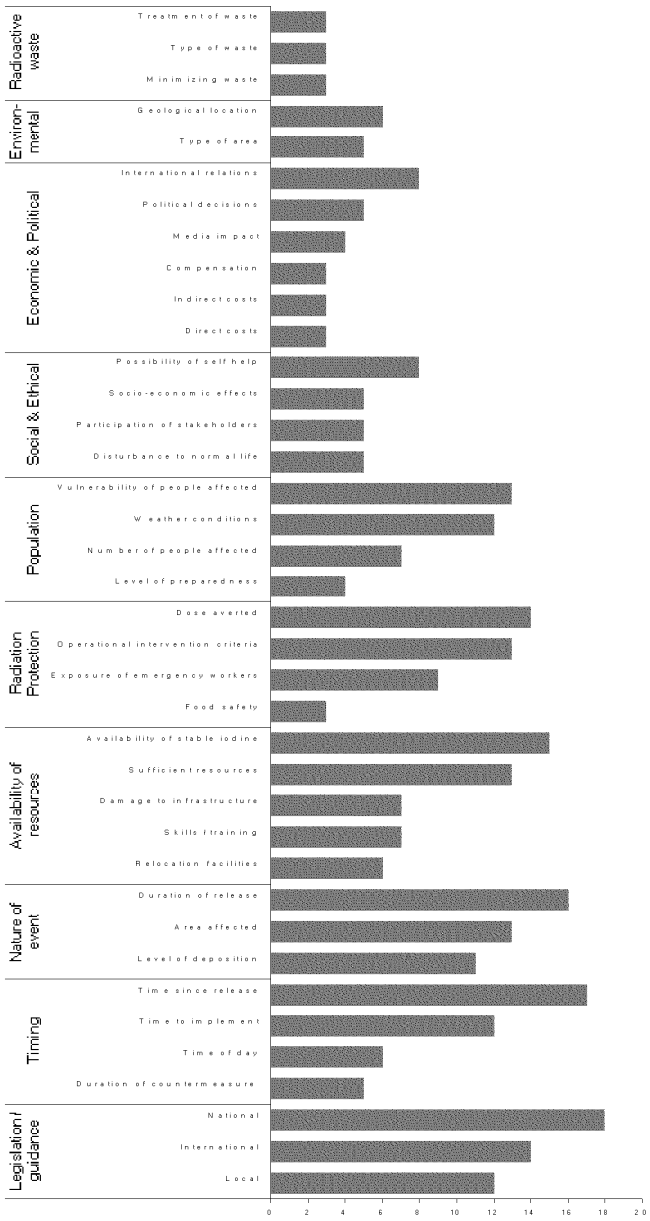
Stable Iodine



Korea, Canada and Turkey are the only countries who would consider waste issues when deciding whether to implement stable iodine.

Around a third of countries would take into account the local geography and geology when deciding whether to implement stable iodine, this is fewer countries than would consider this factor when planning sheltering or evacuation.

International relations would be considered by around a third of countries, but the other economic and political factors are taken into account by fewer countries.

Around a third of countries would take into account whether citizens could help themselves, but consideration of socio-economic effects or disruption to normal life was less common.

Around half of countries would consider the vulnerability of the population affected, as well as the weather conditions. The numbers affected and level of preparedness is considered by fewer countries.

Averted dose and operational intervention levels are again important, with nearly three quarters of countries stating these factors would play a role in decision-making.

As expected, a key consideration for this countermeasure is the availability of stable iodine, with three quarters of countries saying this would be a factor in their decision to implement. The duration of release and the area affected would be considered by around three quarters of countries, with half considering the level of deposition. Time since release is a key consideration, with most countries using this as a factor in deciding whether to implement stable iodine, just over

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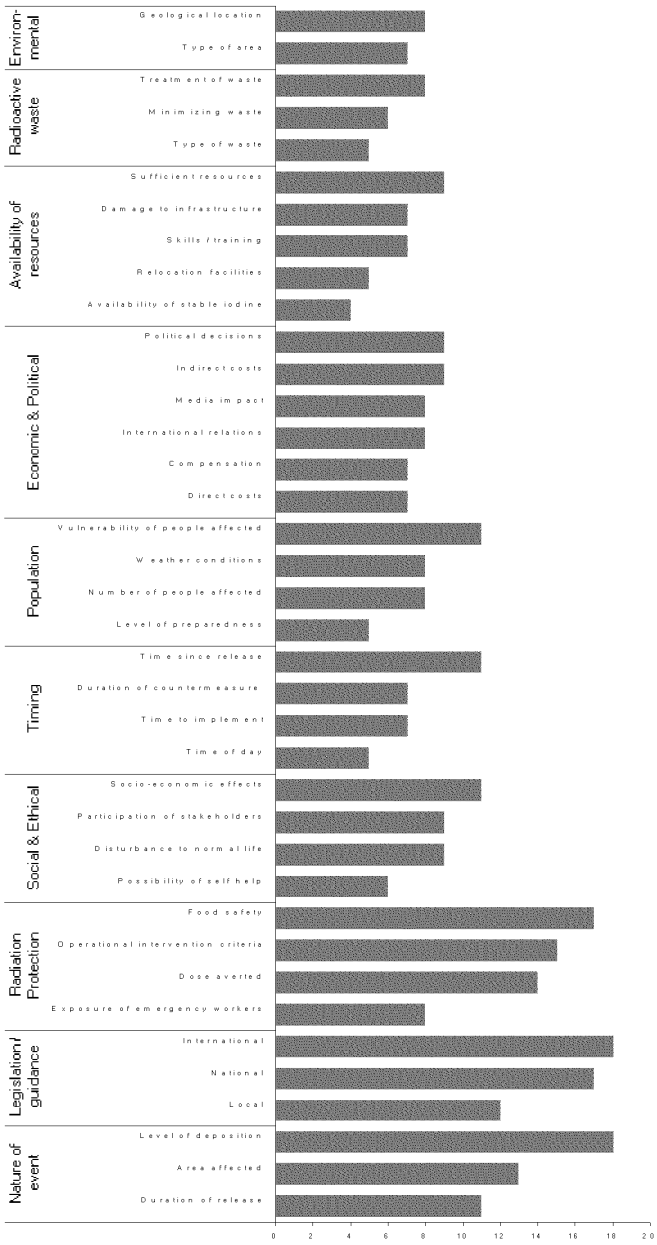
half would also take account of the time it would take to implement. Most countries also consider national guidance when deciding whether to implement stable iodine as a countermeasure.

Food/Water Restrictions

Around a third of countries would consider the geology or geography of an area when deciding whether to implement food and water restrictions.



Slightly more countries would consider waste issues when deciding whether to implement food and water restrictions than with other countermeasures, around a third of countries would be concerned with treatment of waste and minimising the amount generated.

Nearly half of countries would consider resources when deciding whether to implement food restrictions, and around a third would be concerned with skills and training, or damage to infrastructure.

Nearly half of countries would take account of political decisions and indirect costs, with slightly fewer considering media impact and international relations. Compensation is an issue for more countries when deciding on food restrictions than for other countermeasures.

Around half of countries would consider vulnerable groups in the population, such as children, and around a third would take the weather and number of people affected into account.

Time since release was important to around half of countries, and time to implement would be considered by around a third.

Socio-economic effects are considered by around a third of countries, and in this case the possibility for self help is

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considered by fewer countries.

Food safety is a key consideration, with three quarters of countries taking this into account when deciding whether to set up food restrictions. Operational intervention criteria and averted dose are also important to many countries.

International legislation is considered by nearly all countries, with national legislation considered by slightly fewer.

The level of deposition is a key consideration when deciding whether to apply food and water restrictions, with almost all countries taking this factor into account. The size of the area affected and duration of release are important to over half of countries.

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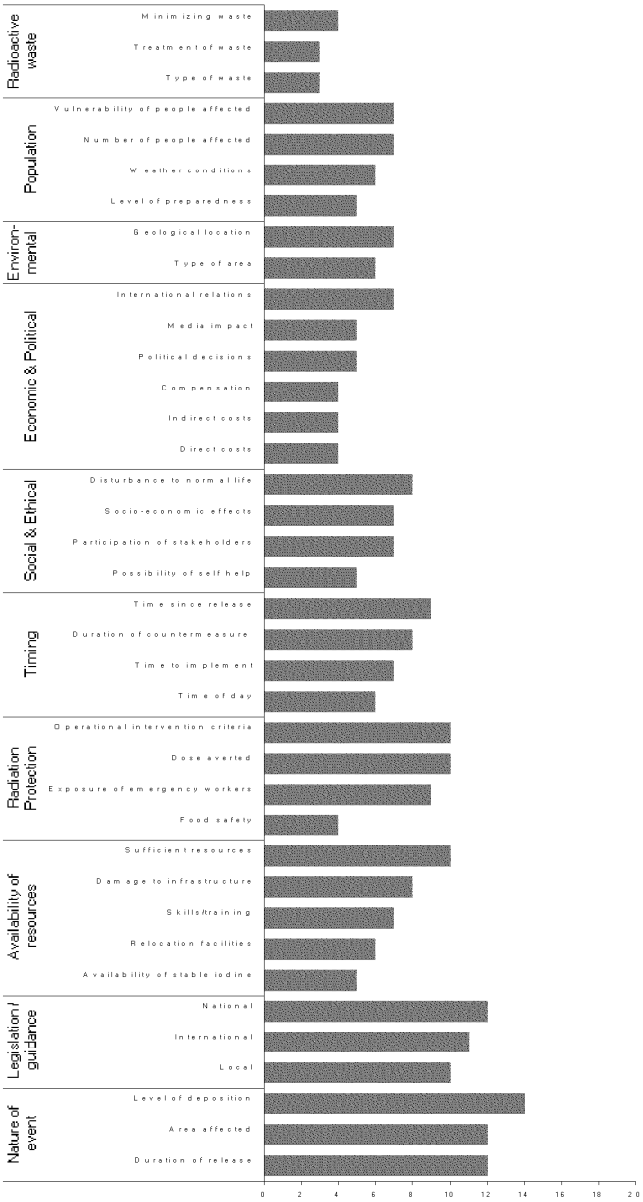

Access Controls

Turkey, Korea and Canada consider all waste issues when deciding to implement access controls; Romania would aim to minimise the amount of waste.

Around a third of countries would take into account population factors such as weather, the numbers affected, level of preparedness and any vulnerable groups in the population.

Around a third of countries would also consider geological and geographical features of the affected area.

International relations are important to around a third of countries, with media impact, costs and compensation being considered by fewer countries.

Around a third of countries take into account the disturbance to normal life, socio-economic conditions or participation of stakeholders when deciding whether to implement access controls.

Time since release is important to around half of countries, along with the expected duration of the access controls. Around a third of countries use the time to implement access controls as part of the decision making process.

Half of countries take into account operational intervention criteria and averted dose, and slightly fewer use the potential dose of emergency workers as a factor in decision making.

Half of countries would consider whether they had sufficient resources before implementing access controls, and around a third would be concerned with damage to infrastructure.

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Just over half would refer to national or international guidance or legislation.
Around two thirds of countries would take account of the level of deposition, and just over half would be concerned with the size and type of area affected or the duration of release when deciding whether to implement access controls.

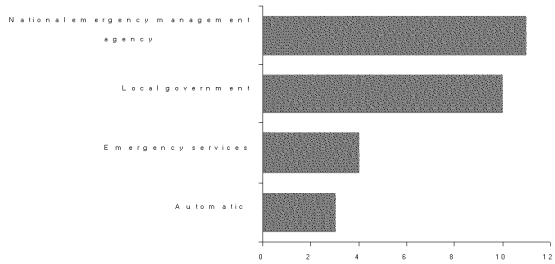
6.1.3 Among the above listed factors, which is the most important when deciding whether or not to implement a countermeasure?

In Japan, the nature of the event was the most important factor when considering evacuation, sheltering or stable iodine, in all other countries radiation protection issues were the most important.

When considering food and water restrictions, radiation protection was the most important factor for most countries, except UK who consider the nature of the event to be most important, and Netherlands who would follow international guidance as a priority.

Again, for most countries radiation protection was the most important factor when considering access controls, except in Switzerland, where availability of resource and other practical considerations would be the most important factors, and Czech Republic, where environmental concerns such as the type of area are thought to be most important.

6.1.4 Describe how your country coordinates the implementation of countermeasures



Around half of countries who responded involve local government, or central government emergency management agencies. This can depend on the type of accident, or control can begin at local level and be handed over to national agencies if the situation escalates.

UK, Canada, France and Romania state that the emergency services are a key part of co-ordination of countermeasures, with Slovak Republic, Poland and Korea stating that countermeasures are implemented automatically, according to existing plans.

6.2 Specific countermeasure: Evacuation

6.2.1 Has your country ever experienced evacuation for an actual or potential radiological emergency?

Only Japan has ever implemented evacuation for a radiological emergency. Around 78,000 people were evacuated within a 20 km radius following the Fukushima Dai-ichi NPP accident.

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6.2.2 Has your country ever experienced evacuation as a result of non-radiological emergencies, such as a hurricane?

All of the countries who responded have experienced evacuation for non-radiological emergencies such as chemical spills, flooding, extreme weather, fires etc. The affected populations ranged from a few hundred to thousands; over 100,000 people evacuated due to flooding in Poland, 1000 due to flooding in Hungary, a few hundred for a typhoon in Korea. In Canada around 225,000 people were evacuated due to a chemical spill from a derailed train, and there have been several, smaller evacuations (few thousands) due to floods, fires and tornadoes.

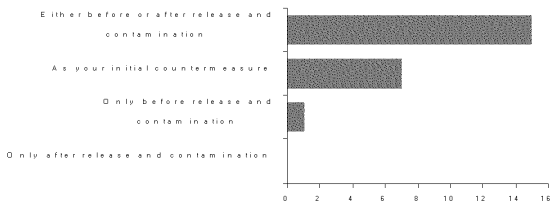
Main learning points emphasised the importance of proper planning and preparation, and defined roles to avoid delays in decision-making. Public information was highlighted by Poland and Korea, emphasising that the public need to know how to evacuate in a safe manner. Canada and Poland both experienced problems with residents that refused to evacuate, and getting them to complete waiver forms took valuable time. In Canada, people evacuated without thought for valuable items or pets, which left the agencies in charge with extra duties in caring for the animals left behind. The main learning point for Hungary was planning for the acceptance of evacuees in neighbouring areas.

6.2.3 Has your country ever implemented real evacuation as part of an exercise? If yes, please identify whether actors or real members of the public were evacuated and provide significant learning points.

UK and Austria have carried out on-site evacuations as part of exercises, whereas Hungary, Czech Republic, Slovak Republic and Canada have all carried out test evacuations with various groups, usually schools. Czech Republic found that this confirmed the thoroughness of their evacuation planning, and that it would be feasible in a real event. In 2008 Romania evacuated around 100 key players as part of an exercise, which highlighted the importance of good planning and support from emergency services. Major problems were experienced when evacuating important equipment and goods, and when making emergency funds available to evacuees.

Sweden, Netherlands, Korea, Japan and Spain have all evacuated members of the public as part of exercises. Spain experienced problems evacuating school children without their parents, and also with arranging police protection of evacuated areas.

6.2.4 Do you foresee evacuation?



Italy, Ireland and Austria, given their distance from large nuclear facilities, do not foresee evacuation being necessary, but most countries are flexible about when they would implement evacuation, either before or after release or contamination. When or whether to evacuate will be decided based on individual events, taking into account the severity of the accident and whether there is time to evacuate people safely.

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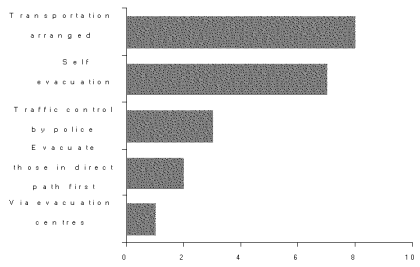
Japan was the only country to specify evacuation only before release, and also as an initial countermeasure, as they feel it is the most effective. Sweden, Slovak Republic, Korea, Romania, Netherlands, Finland also consider evacuation to be an initial countermeasure.

6.2.5 Describe how evacuation within the emergency planning zone would be executed:



Most countries would arrange transportation, many using existing public transport provision, although many acknowledge that a large proportion of citizens will choose to evacuate using their own vehicles, and some may do so without being instructed. Slovak Republic, Netherlands and Canada have provisions for local police to control traffic in these situations.

Slovak Republic and Netherlands would prioritise those directly downwind of the accident, in line with keyhole theory. Sweden would evacuate everyone via evacuation centres for registration and decontamination purposes.

6.2.6 Describe how you identify and prioritize different groups within the population such as children, medically infirm etc:

Sweden, Slovak Republic, Netherlands, Turkey, Finland and UK have all made provision in emergency plans to prioritise evacuation of vulnerable groups, whereas France, Switzerland, Czech Republic, Hungary and Spain have not. Children, the elderly, hospitalised patients and pregnant women are some of the groups identified for prioritisation. Finland organises transport specifically for vulnerable groups, while the UK uses maps of demographic data to help prioritise the evacuation.

6.3 Specific countermeasure: Sheltering

6.3.1 Has your country ever experienced sheltering for an actual or potential radiological emergency?

Only Japan has ever implemented sheltering due to a radiological emergency. Around 310,000 people within a 10km radius were advised to shelter following the Fukushima Dai-ichi NPP accident.

6.3.2 Has your country ever experienced sheltering as a result of non-radiological emergencies, such as chemical spill or threat?

14 out of the 20 countries who responded have implemented sheltering for a non-radiological emergency such as fires, chemical spills, flooding or pollution. Although these tended to be smaller scale events, some of the learning has proved useful for planning nuclear responses; Czech Republic highlighted the importance of thorough planning, Ireland considered methods of initiation and communication, and Italy learned lessons around contingency planning, global

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coordination and definition of roles.

6.3.3 Has your country ever implemented real sheltering as part of an exercise? If yes please explain the results.

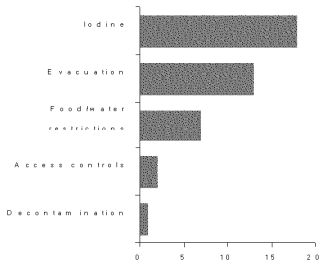
Slovak Republic and UK have both implemented on-site sheltering as part of an exercise, whereas Romania, Japan, Czech Republic, Finland, Hungary and Spain have all implemented sheltering of members of the public as part of exercises. In most cases this involved only sheltering within houses, but Finland has also tested sheltering in civil defence shelters.

6.3.4 Do you foresee sheltering as an initial countermeasure? Please explain.

All countries except Poland, Japan and Italy see sheltering as an initial countermeasure. In Poland the law does not define initial countermeasures, and Japan would use evacuation rather than sheltering.

In Sweden, Slovak Republic and Canada sheltering is the first instruction given in case of emergency. Residents are advised to stay indoors and await further information from TV or radio broadcasts. Ireland advises sheltering as a first instruction to avoid residents taking their own decisions to evacuate. In Czech Republic the first instruction is to stay indoors and take stable iodine. In France it depends on the nature of the incident; an accident with fast kinetics would indicate sheltering as an initial measure, with evacuation to follow if sheltering is expected to last more than 1-2 days. In an accident with slow kinetics it may be more appropriate to evacuate as soon as possible. Finland advises sheltering as an initial measure as it is simpler than evacuation and can be applied to a larger population, whereas Romania and Switzerland only advise sheltering where evacuation is not possible.

6.3.5 What countermeasure(s) accompany or follow sheltering?



Almost all countries would accompany sheltering with stable iodine consumption, and in situations where sheltering is expected to continue for a prolonged period, most would follow with evacuation.

Poland, France, Finland, Ireland, Austria, Hungary and UK would also consider imposing food and water restrictions alongside sheltering. Korea and Finland would also implement access controls along with sheltering. The UK was the only country who reported that decontamination could follow sheltering.

6.3.6 May sheltering be applied differently for different groups within the population, such as children, pregnant women, etc?

Around half of countries would consider applying sheltering differently for specific groups. Slovak Republic, Romania, Netherlands, Turkey and Italy do not have specific plans to treat

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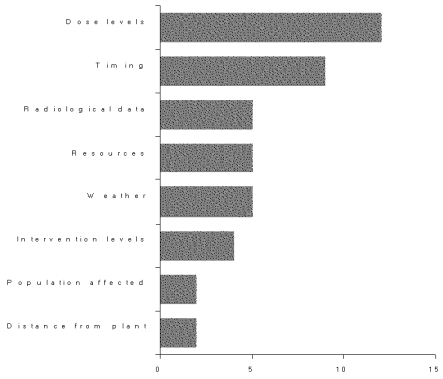
vulnerable groups differently but state that it is possible that plans could be adapted depending on conditions during an emergency. Children and pregnant women have higher priority in Korea, Canada has specific plans for schools and day-care centres within the planning zones, and Finland would impose tighter restrictions on children in situations of partial sheltering. Switzerland and Austria have different dose criteria for children and pregnant women; 1 mSv compared to 10 mSv for the general population.



6.3.7 What criteria are used when selecting between sheltering and evacuation?

Around half of the countries consider dose levels when deciding between evacuation and sheltering, with Romania, Turkey and Spain specifying that the operational intervention levels are set differently for the two countermeasures.

Timing was an important consideration for many countries, whether it was the time since release, or whether there was enough time to safely evacuate the population.

Monitoring data on the progress of the incident, available resources and the weather conditions were considered by about a quarter of countries. The size of the population affected was a consideration for Netherlands and Korea, while Sweden and Finland consider the distances from the source of release.

6.4 Specific countermeasure: Use of stable iodine

6.4.1 Has your country ever experienced an actual or potential radiological emergency that has resulted in the consumption of stable iodine by the population?

Slovak Republic, Romania and Poland have all experienced an emergency resulting in stable iodine consumption. Romania distributed stable iodine to a few thousand people following the Chernobyl accident, while Poland administered Lugol's iodine solution to around 18.5 million of their population, mainly children. Sweden administered stable iodine to Swedish nationals in Japan following the Fukushima accident; there were no reported health effects.

6.4.2 Has your country ever implemented distribution of "simulated" stable iodine tablets (made of sugar for example) as part of an exercise? If so, explain the results.

Slovak Republic, Poland, Korea, Czech Republic, Hungary and Spain have all distributed simulated iodine tablets. Slovak Republic used sweets during an onsite exercise as a visual representation of iodine pills, while Poland, Czech Republic and Hungary used sweets to simulate iodine with the general public, mostly schools. Hungary identified some problems with tablets being provided at a single location and no further dissemination, and distribution was limited by age which was felt to be unjustified.

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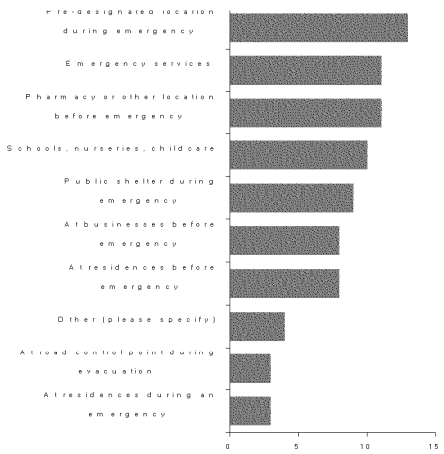
6.4.3 How is stable iodine distributed to individual members of the population?



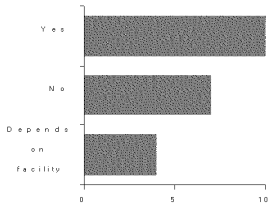
Over half of countries make stable iodine available at a pre-arranged location during an emergency. Around half distribute stable iodine through emergency services in an emergency, or make it available at a pharmacy or other community location prior to an emergency.

More countries distribute stable iodine through schools, nurseries and childcare centres than at businesses or residences, indicating a slight prioritisation for children.

Few countries envisage distributing iodine at road control points during evacuation or directly to residences in an emergency.

There were four 'Other' answers stated; Canada makes iodine available at health units, hospitals in Ireland hold some stocks for local incidents. Czech Republic holds stable iodine at all hospitals and social units, and Hungary would distribute stable iodine through the mayor's office.

6.4.4 Is there an area in which stable iodine is pre-distributed to the population?



Half of countries who responded state that there is an area where stable iodine is pre-distributed around nuclear facilities and a fifth state that it depends on the facility.

Estimates of the areas involved range from 5 to 20km radius, usually in line with emergency planning zones around each facility. Countries such as Finland and Germany will pre-distribute iodine within a certain radius, but make iodine available at community locations in a slightly larger radius, and have national stockpiles or commercially available iodine in the event it is needed in a larger area.

The size of the population affected varies widely across countries, with estimates per site ranging from a few hundred to tens of thousands. When considering all affected populations around all sites within each country, the estimates can be up to half a million people.

6.4.5 If stable iodine is not pre-distributed to the population within the emergency planning zone, how quickly do you assume it be distributed? If this varies according to the size of the population or any other factors, please explain.

Estimates ranged from 2-3 hours to 24 hours, but this depended on the population targeted and the method of distribution; Spain assumes distribution to take 2-3 hours after the decision to implement, Germany estimates 2-4 hours for those within 25km and 12 hours for those within

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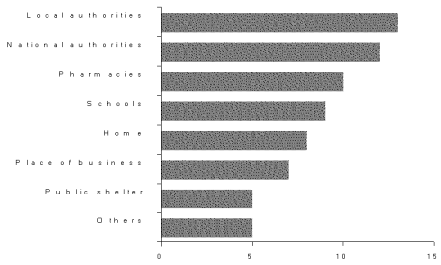
100km. Korea will distribute stable iodine as part of the public evacuation plan, which is estimated to take 4 hours, while Romania plans to distribute stable iodine by emergency helicopters within 6 hours. Poland estimates the whole country could be covered within 24 hours, whereas Canada have never tested how long it might take to cover the estimated 250,000 people affected.

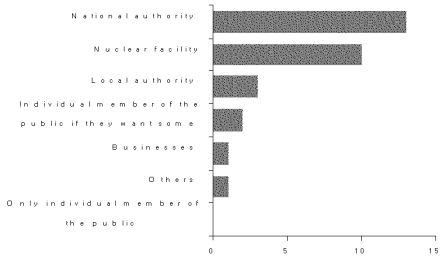


6.4.6. Where is stable iodine stockpiled?

Most countries stockpile stable iodine with local or national authorities. Stable iodine is also stockpiled at pharmacies in around half of the countries reporting. Schools store stable iodine in almost half of the countries reporting, while slightly fewer also provide stocks of stable iodine for homes and businesses.

A quarter of countries stockpile stable iodine at public shelters, and a quarter also stated that iodine is stockpiled at other locations; Sweden keeps central stores, France has complementary stores in several regions and also at the national army pharmacy, and Romania keeps stores at personnel assembly points on sites, and in local hospitals.

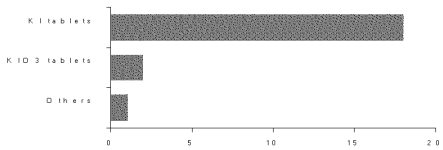
6.4.7 Who pays for stable iodine?



In most countries the national authorities and nuclear facilities fund stable iodine provision. No country expects members of the public to pay for iodine themselves if the countermeasure is recommended, but in Finland and Austria the public can purchase their own stock.

Only one 'Other' answer was reported – in Switzerland the cantons of zone 3 also help fund stable iodine provision.

6.4.8 What form of stable iodine is used?



Almost all countries use KI tablets, Japan indicated that they use others alongside KI tablets, but did not specify what tablets these might be.

Ireland and the UK are the only countries using KIO_3.

6.4.9 Are stable iodine tablets commercially available at pharmacies?

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Stable iodine is commercially available at pharmacies in Finland, Canada, Austria, Germany, Switzerland, Czech Republic, and Hungary. Some pharmacies in Sweden stock stable iodine, and Spanish pharmacies have stable iodine but in different doses to the tablets distributed in an emergency. In France and Japan stable iodine is only available with a doctor's prescription, except for those in pre-distribution zones in France who are given a voucher to access the tablets through pharmacies.

6.4.10 What iodine dose (mg), is recommended in case of a nuclear emergency in your country for various populations?

Group	Dose
Adults & pregnant women	2 pills
Children (3+)	1 pill
Children 3 months- 3yrs	½ pill
Babies under 3 months	¼ pill

Dose limits vary by country but generally countries seem to decrease doses by half for the more vulnerable groups, this table summarises the general pattern. For example, children will be advised to take half the adult dose, and babies half of the children's dose. Sweden, Slovak Republic, Germany, Czech Republic, Korea, France, Finland, Canada, Turkey and Italy all specify a dose of 130 mg for adults and pregnant women, in the form of two 65mg pills. Most of these countries then advise children to take one 65mg pill, Sweden and Slovak Republic specify that this is aimed at children aged over 3 years. France, Turkey and Italy specify that all those under 3 years take half a pill, resulting in a dose of 32mg. France, Finland, Germany, Canada, Czech Republic, Slovak Republic and Sweden specify half a pill (32mg) for children aged 3 months to 3 years, and quarter of a pill (16mg) for babies between 0 and 3 months.

Romania, Poland, Netherlands, Japan, Switzerland, Austria, Hungary and UK all suggest a maximum dose of 100mg for adults and pregnant women. UK, Hungary, Austria, Switzerland, Romania, Netherlands and Poland all recommend a reduced dose of 50mg for children, although the definitions are slightly different; Austria applies this to children under 12, Netherlands to children under 4 and Poland to children under 6. A recommended dose for infants in Switzerland, Hungary and UK is half of the child's dose – 25 mg, in other countries the definition varies slightly; Austria advises a 25mg dose for those aged 1 month to 3 years, Poland for those aged 3 months to 2 years. Romania, Poland and Austria apply a further dose reduction for newborns; down to 12.5 mg. Spain applies a maximum dose of 50 mg for adults, reduced to 25 mg for children and pregnant women, with a further reduction to 12.5 mg for infants.

Netherlands, France, Finland, Canada, Czech Republic, Japan, Austria, Hungary, UK and Italy only advise one dose of stable iodine for any group in the population. Sweden would define dose frequency and duration on advice from authorities, with a maximum of two tablets for infants and pregnant women. Romania would define frequency and duration according to exposures. Slovak Republic would advise a maximum of two doses for all groups except babies, who should only take one. Germany would also normally advise a single dose, with a maximum of two in exceptional circumstances, to exclude babies. In Switzerland there is no KI dose restriction on adults or children, but pregnant women and babies should only receive one dose.

6.4.11 Do you recommend maximum limits on intake for iodine for the general population?

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If so, what are the recommendations?

Sweden, Slovak Republic and Italy recommend no more than two KI doses for the general population, and only one for babies and pregnant women, while France and Netherlands anticipate only one dose for everyone. Canada restricts dosage for babies and pregnant women, while Poland enforces a 100mg dose limit for the entire population. Romania restricts dosage to 1000mg for the general population and 12.5mg for newborn babies.

6.4.12 Do you recommend implementation differences, in term of dose (mg), duration or frequency, for territories with low dietary iodine levels? If so, what are the recommendations?

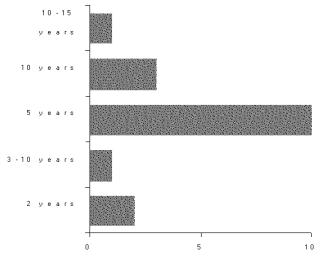
No country recommends different implementation levels for those with low dietary iodine as many feel it is not applicable. Switzerland, Austria and Hungary add iodine to salt, therefore eliminating the risk of low levels of dietary iodine. Slovak Republic does not set generic rules but would advise individuals to consult with a physician.

6.4.13 Are any precautions taken for members of the public who may suffer severe side effects from a high dose of stable iodine or may have thyroid disease?

Most countries have given this some sort of consideration, with most relying on the patient information leaflet distributed with the tablets to give appropriate advice. Patients with known problems are expected to consult a doctor before taking the tablets in Netherlands, Slovak Republic, Czech Republic, Spain, Korea, Japan, and France. Poland keeps medical staff on hand when implementing stable iodine to provide advice on health impacts.

In Finland, the information leaflet advises against taking the tablets for those with iodine dysfunction, allergies etc, while in Canada, Turkey and UK the leaflets present the contraindications and may advise medical supervision. In Switzerland the information leaflet advises those who may have side effects to contact their doctor after the end of the emergency. In Germany those aged 45 and over are advised not to take stable iodine, and Sweden, Ireland, Hungary and Italy do not plan for any precautions of this type.

6.4.14 What is the assumed shelf life of the stable iodine tablets?



The majority of countries state that iodine tablets have a shelf life of 5 years if stored correctly. Germany report a shelf life of 10-15 years, similar to Austria and Switzerland who both report a shelf life of 10 years but see no reason why this could not be extended.

In France, tests have shown that tablets remain active for a very long time, and they now state a production date rather than expiry date.

Tablets last 3-10 years in Korea depending on the manufacturer, and 4 years in Poland.

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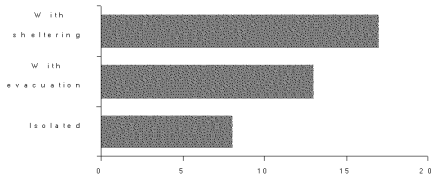
6.4.15 May stable iodine be used as an isolated countermeasure or only together with sheltering or evacuation?



Almost all countries would implement stable iodine along with sheltering or evacuation in certain circumstances.

France would implement alongside food restrictions.

Slovak Republic, Japan, Poland, Turkey, Germany, Czech Republic and Italy would also consider it as an isolated countermeasure, and Sweden would do so for emergency workers or citizens abroad.

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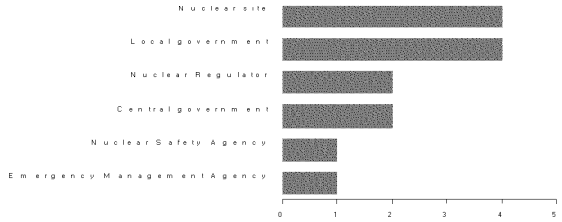
7.0 INFORMATION FOR THE POPULATION AROUND A NUCLEAR FACILITY

7.1 Does your country have educational programmes on the hazards and risks associated with the nuclear industry?

Of the 17 countries who responded to this question, around half had an educational programme of some kind and half did not. There seemed to be no obvious relationship between the range of nuclear facilities in a country and whether they provided educational programmes.

Around half of the countries who responded focus on providing written information, including Ireland, Romania, Spain, Switzerland, Sweden and Netherlands. Other countries take more varied approaches including public meetings and local training courses.



Local government and the nuclear providers are responsible for the education programmes in many countries, with support in some cases from central government (education, environment) and from nuclear regulators or safety agencies.

7.2 How are the public informed of the information detailed within emergency plans?

Around half of the countries who responded focus on providing written information, largely about general emergency management rather than specific nuclear information.

Ireland provides written information on emergency planning to every household. Romania and Sweden also provide written public information on emergency procedures. Switzerland provides written information on emergency procedures to those in emergency planning zones.

Netherlands run national campaigns on emergency preparedness, as well as providing nuclear information for those near the nuclear power plant. The public can visit a nuclear storage facility if they want to learn more. Poland is just beginning an educational programme relating to their nuclear power development programme.

Other countries have more varied approaches to their education programmes, some incorporating practical aspects of emergency management:

Czech Republic distributes a 'Public Protection Manual' as well as holding lectures based on Off-Site emergency plans. Similarly, Slovak Republic provides written information to the population, as well as training local mayors in emergency procedures and providing a national PR centre for information and advice.

Hungary provides written information on emergency procedures to those near nuclear sites. A social association exists to communicate directly with the mayors of affected populations around nuclear sites to exchange specific information. General education for the population is provided

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through a museum and visitor centre at nuclear power sites, as well as a road show bus and promotion at festivals.

Italy provides the national and local plans to the public and institutional web sites are used for public information. Spain provides public meetings and training courses. Korea requires emergency workers to undergo legal education, and provides an outreach program for the public and volunteers in case of radiological accidents. Japan provides elementary courses for affected residents. Canada has developed a training programme for those living near nuclear power plants, to educate them on risks and emergency procedures. France concentrates its education programme at school students, with exhibitions, teacher training and a voluntary radiation protection workshop.

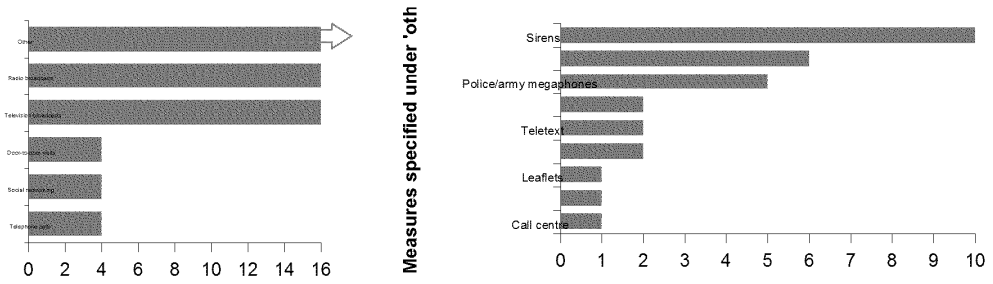
7.3 How is the population around a nuclear facility educated concerning the possibility and manner of implementation of a countermeasure by the authorities?

In addition to the public information described in 7.2, some countries provide specific information on countermeasures.

Sweden holds public meetings for affected populations to give specific information on emergencies related to nuclear power plants. Switzerland provides affected populations with written information during annual testing of sirens and iodine tablet distribution. Netherlands provides specific nuclear information for those near the power plant, including where to access stable iodine. Spain provides courses for public information and Japan provides technical courses for countermeasures operators.

7.4 In case of an accident, how is the population around a nuclear facility alerted and kept informed concerning the practical implementation of countermeasures?

Most countries use radio and television broadcasts to alert the local population in case of an accident, although a similar number of countries also stated that they employed other methods.



The most popular method specified in the 'Other' category was sirens, followed by fixed public address systems and then mobile public address methods carried out by police, army or other emergency responders. In the Netherlands they are installing an SMS broadcasting system, and also have call centres and a website for people to access information themselves. In Italy, teletext and SMS broadcasting systems are used.

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7.5 Is there a legal basis or obligation for the information of the public before and/or during an emergency?

All of the countries who responded reported that there was a legal basis for providing public information. Just under half of countries stated that the basis was in general civil protection laws, whereas just over half cited more specific regulations relating to nuclear matters.

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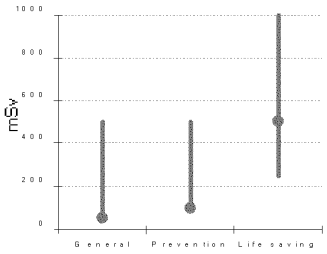
8.0 COUNTERMEASURES FOR SPECIAL GROUPS

8.1 Are there established dosimetric criteria for emergency workers?



All states except Turkey have established dosimetric criteria for emergency workers. The limits specified vary in different situations, this chart shows the range of dose limits (in mSv) from general guidelines for emergency workers, to those involved in prevention of catastrophe, to those involved in saving human life. The lines show the range of limits set across countries, while the dots on each line show the median value for that situation. Most countries made it clear that exposure to higher doses than general levels is completely voluntary, and must be undertaken only by workers who are fully aware of the risks.

General limits for emergency services workers range from 10 mSv in France, 20 mSv in Austria, to 500 mSv in Korea. Spain, Sweden, Switzerland and Hungary set their effective dose limits at 50 mSv effective dose. Canada and Poland have the same threshold but also include a stipulation that the dose should not exceed 100 mSv, effective dose over 5 years. Germany, Italy, Japan and Netherlands set their general doses at 100 mSv, while Czech Republic sets a limit of 200 mSv per year.

Limits are slightly increased for those involved in actions preventing catastrophe or irradiation of large numbers of people; Slovak Republic, Poland, Hungary, Austria and France all set levels of 100mSv, with France including a 1Sv lifetime limit. Japan has temporarily increased the limit to 250mSv following events at Fukushima, this is in line with the limits in Netherlands. Korea specifies no limits for this situation, so their general limit of 500 mSv will apply.

If emergency workers are involved in saving lives, the limits are higher again; Switzerland, Austria and Hungary set limits at 250 mSv, although in Hungary low risk workers (older males) may go up to 1Sv. France is the only country to set the limit for lifesaving actions at 300 mSv. Spain, Slovak Republic, Poland and Canada set this limit at 500 mSv, while the voluntary limit in Netherlands is 750 mSv, and Germany has the highest specified level at 1000 mSv. Korea, Romania and Czech Republic do not have an advised limit for life saving, although they do specify that general or preventative limits can be exceeded on a voluntary basis.

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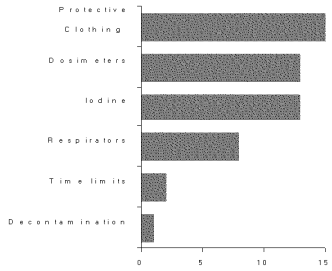
8.2 Are there different countermeasures planned (stable iodine, dosimetry, protective clothing…) for emergency workers who may need to be outside in an affected area?



Most countries provide some sort of protective clothing for workers who may have to be outdoors during an emergency. Most also provide dosimeters and iodine (where appropriate).

Respirators are provided to emergency workers by around half of the countries who responded, Poland and Netherlands attempt to limit the exposure times, and Hungary considers providing decontamination facilities.

8.3 Have other special groups been identified in your country for the implementation of short term countermeasures?

In addition to emergency services personnel, five countries identified other groups considered for short term protective measures. Sweden includes bus drivers and evacuation centre personnel, similarly Romania considers protective measures for those support workers involved in the response. Poland considers teachers and care workers in the affected region; Finland includes hospital workers, social workers and utility workers. Canada includes hospitals and schools, and Ireland includes farmers.

8.4 Are there plans for early warning of farmers, hospitals or others needing extra-time to prepare for Evacuation or Sheltering?

Less than half of the countries who responded to the questionnaire had plans for early warning to specific groups. Netherlands currently does not include this aspect in their plans but it may be updated in light of learning from exercises, and from Fukushima and Eyjafjallajökull. Finland plans early warning and countermeasures for farmers, social workers and utilities workers, Switzerland will advise farmers and hospitals on what action to take. In Germany and the UK emergency plans for each site should include provision for hospitals, schools, prisons etc., but in the UK this may vary between sites. Ireland plans to use existing networks for communication with farmers in the event that advice conflicts with that given to the general public.

8.5 Are there different countermeasures planned (stable iodine, dosimetry, protective clothing…) for farmers or other non-emergency workers who may need to be outside in an affected area?

Netherlands provides respirators and dosimeters for those in vital industries, and limits exposure times where possible. Farmers and individuals living outside the primary zone in Canada will be given stable iodine, protective clothing, dosimeters and may be advised to shelter or evacuate. UK, Ireland and Finland have no firm plans in place but would react depending on individual situations.

Around half of the countries who responded include special provisions for livestock, guidelines advise bringing them indoors where possible, and avoiding contaminated feed.

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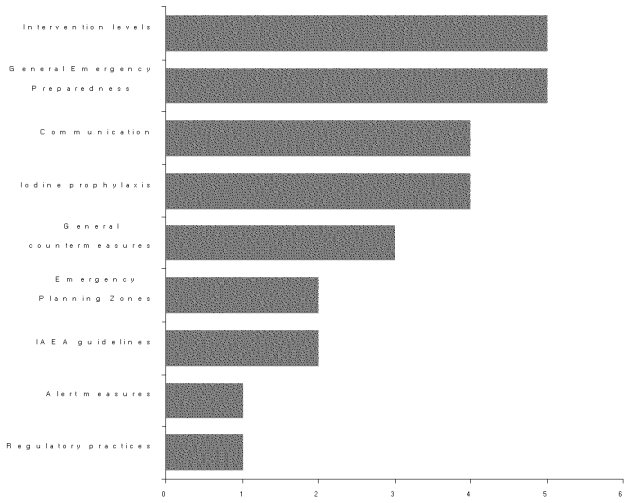
9.0 HARMONISATION OF COUNTERMEASURES

9.1 Has an attempt been made to harmonize basic rules or specific emergency plans, or intervention criteria with neighbouring countries (or states, provinces, Länder …)?

12 of the 20 countries reported that harmonisation attempts had been made to various extents. Czech Republic, Hungary, Italy, Korea and Japan stated that no efforts had been made; Poland reported that harmonisation was not necessary as there was no relevant facility within the vicinity of Polish borders. Ireland stated that no harmonisation methods were currently agreed but that this was under consideration. Spain stated the collaboration with the Working Group on Emergencies of HERCA, which is currently working on a harmonised approach with regard to the management of nuclear and radiological emergency situations.



Intervention levels and general emergency preparedness were the most common areas countries reported attempting to harmonise. Communication and iodine prophylaxis were also common responses. Two countries reported that they were following IAEA guidelines in an attempt to harmonise their responses with neighbours and others in the international community, whereas other countries reported local agreements over harmonisation.

Generally countries reported harmonisation with their direct neighbours – Canada with USA, or Germany with France, Switzerland and the Netherlands. The UK response reported internal co-operation between England, Scotland and Wales, but no further abroad, and the Nordic countries have drawn up a manual relating to co-operation in the event of a radiological emergency.

9.2 For nuclear facilities near a border of a country (or states, provinces, Länder …), is there co-operation/co-ordination between emergency management in the emergency planning zones of both countries (or states, provinces, Länder …)? Which organizations (type and jurisdictional level) are responsible for maintaining co-operation and co-ordination across such borders?

Most countries have bilateral agreements in place where there are nuclear facilities near a border. Canada plans co-operation in all aspects of emergency planning where the primary zone of a facility extends over a border. Slovak Republic, Netherlands and Switzerland report bilateral information sharing, and France adds that joint exercises are undertaken to test these processes.

Poland, Finland and Austria have early notification systems in place with their neighbours despite

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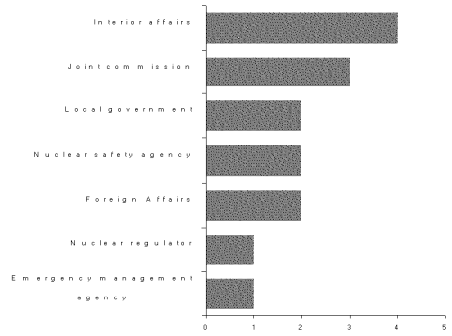
the fact there are no relevant facilities near their borders.



Perhaps surprisingly, Ministries of the Interior are most commonly reported to be involved in maintaining cross border co-operation. There are joint commissions in place between Netherlands, Germany, France and Switzerland specifically for this purpose and a variety of other organisations are involved in various other countries, including nuclear regulators and emergency management agencies.

9.3 In case of an accident occurring in a neighbouring country (region), near the border, could information from the accident country (region) be sufficient for the implementation of harmonized countermeasures?

Most of the countries that completed this section felt that information from the affected country would not only be sufficient but would be the best source of information. Slovakia referred to bilateral agreements on data sharing already in place, Switzerland outlined web based methods for sharing information with neighbours if they experience a nuclear incident, and Romania stated that they were happy to implement protective actions for their population based on information gathered by the affected country. The Canadian submission draws on experience from exercises to conclude that data from the USA would be sufficient in the event of an incident.

Turkey did not feel that information gathered by the affected country would be sufficient, nor did France who felt that there is further work needed to agree common procedures, exchange information and conduct exercises to test this aspect of the response.

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10. CONCLUSIONS AND PERSPECTIVES

Twenty NEA member countries completed the questionnaire on short-term countermeasures, providing an updated overview of current practices and regulations regarding short-term countermeasures, as well as some insights into short-term countermeasure planning and implementation.

The information given in this report allows NEA member countries to compare national practices with other countries, and identify areas for further review and co-ordination. The information may also be used to understand the basis for decisions in various countries, and, if deemed necessary, as a basis for international harmonization. This may help to explain to the public affected by an emergency why the decisions in neighboring countries may vary.

The nuclear regulator was involved in completing the questionnaire for all countries. In many cases other key government departments such as health, environment or emergency management agencies contributed to the response. In some countries the technical nuclear agencies provided expertise where required. In some countries, competencies and duties in connection with short-term countermeasures are shared between different levels, e.g. federal and regional levels such as Länder or Provinces.

Most countries plan to use stable iodine, sheltering, evacuation, access controls and food restrictions in the case of a near field accident. Countries are more likely to have planned food and water restrictions in the case of a far field accident, although many still do not rule out use of iodine and sheltering. Evacuation is much less likely but still considered. Most countries have national legislation that defines their intervention levels. Many also used IAEA or ICRP guidance, while others turned to WHO, EURATOM or EC guidelines.

In terms of harmonisation of the countermeasures, more than half of the respondent countries reported that harmonisation attempts had been made to various extents. Most countries have bilateral agreements in place where there are nuclear facilities near a border. It was pointed out that further work needed to agree common procedures, exchange information and conduct exercises to test this aspect of the response.

The WPNEM supports to update of this survey of national policies regarding short-term countermeasures in a regularly base, e.g. every five years.

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APPENDIX A

LIST OF NEA MEMBERS RESPONDING TO SURVEY

Austria	Federal Ministry of Agriculture, Forestry, Environment and Water Management, Division V/7, Radiation Protection
Canada	Canadian Nuclear Safety Commission (CNSC) Emergency Management Programs Division
Czech Republic	State Office for Nuclear Safety (SÚJB)
Finland	Radiation and Nuclear Safety Authority (STUK)
France	Nuclear Safety Authority (ASN) Directorate for Environment Protection and Emergency Preparedness International Cooperation for Radiological Emergency Preparedness and Response
Germany	Bundesamt für Strahlenschutz (BfS)
Hungary	Hungarian Atomic Energy Authority (HAEA) Nuclear Safety Inspectorate
Ireland	Radiological Protection Institute of Ireland (RPII) Environmental Surveillance and Assessment
Italy	National Institute for Environmental Protection and Research Department of Nuclear (ISPRA) Technological and Industrial Risks Division of Nuclear Activities Control
Japan	Japan Nuclear Energy Safety Organization (JNES) Nuclear Emergency Preparedness and Response Division Office of Radiation Regulations, Nuclear Safety Division Science and Technology Policy Bureau
Republic of Korea	Korea Institute of Nuclear Safety (KINS) Nuclear Emergency Preparedness Department Emergency Management Division
Netherlands	Ministry of Infrastructure and Environment Crisis Management Department
Poland	National Atomic Energy Agency Radiation Emergency Centre "CEZAR"
Romania	National Commission for Nuclear Activities Control (CNCAN)
Slovak Republic	Slovak Nuclear Regulatory Authority (UJD SR) Department of Emergency Planning, Informatics and Personnel Training
Spain	Consejo de Seguridad Nuclear (CSN) Deputy Direction of Emergencies, Emergency Planning and Preparedness
Sweden	Swedish Radiation Safety Authority (SSM) Department of Radiation Protection Section for Emergency preparedness and Response
Switzerland	Federal Department of Defence, Civil Protection and Sports Federal Office for Civil Protection National Emergency Operations Centre
Turkey	Turkish Atomic Energy Authority (TAEK)
United Kingdom	Office for Nuclear Regulation (ONR)

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APPENDIX B

SURVEY ON SHORT TERM COUNTERMEASURES

1. NEA Member Information

1.1 What types of nuclear facilities/applications are located/conducted within your country?

Practice	Own Country
Operational nuclear power plant	
Decommissioning nuclear power plant	
Nuclear Fuel manufacture	
Nuclear Fuel reprocessing	
Operational research reactors	
Decommissioning of research reactors	
Operational defence[1] facilities	
Decommissioning defence facilities	
Nuclear radioactive waste processing	
Nuclear radioactive waste disposal/storage	
None	
Other (specify)	

1.2 What type of facilities/applications are located within your neighbouring countries?

Practice	Neighbouring Country
Operational nuclear power plant	
Decommissioning nuclear power plant	
Nuclear Fuel manufacture	
Nuclear Fuel reprocessing	
Operational research reactors	
Decommissioning of research reactors	
Operational defence facilities	
Decommissioning defence facilities	
Nuclear radioactive waste processing	
Nuclear radioactive waste disposal/storage	
None	
Other (specify)	

1.3 What organisations (type and jurisdictional level) were involved in completing this questionnaire?

[1] Defence facilities including weapons and naval reactors

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2. General objectives and criteria for short-term Countermeasures

2.1 What are the objectives of implementing short-term countermeasures in the case of a nuclear emergency?

2.2 Describe the urgent countermeasures for the general public are planned in your country to protect the public, agriculture, food manufacturing?

	Near Field[2] Accident	Far Field[2] Accident
Evacuation		
Sheltering		
Use of Stable Iodine		
Food/Water Restrictions		
Access Controls		
Other (specify)		

2.3 What intervention levels and operational intervention criteria are used to initiate countermeasures, and how quickly should they be implemented?

	Intervention levels in mSv[3]	Operational intervention criteria	Time to Implement		
			0-1hr	1-3hrs	>3hrs
Evacuation					
Sheltering					
Use of Stable Iodine					
Food/Water Restrictions					
Access Controls					
Other (specify)					

2.4 What criteria are used for ending countermeasures?

	Criteria for ending a countermeasure
Evacuation	
Sheltering	
Use of Stable Iodine	
Food/Water Restrictions	

[2] A near field accident is defined as an accident that takes place in close proximity to the affected population. These locations are likely to be covered by detailed emergency plans which are exercised regularly. Far field accidents are accidents that take place at a greater distance to the affected populations (including in a neighbouring country), and these populations are only likely to be affected during a severe accident. These locations are likely to be covered by less-detailed emergency plans and are not routinely exercised.

[3] Describe intervention applied e.g. if intervention is dose, specify which dose is used: averted dose for an unprotected person, anticipated dose, effective dose, organ dose, and give integration period (one day, one week?). Please also include any information regarding particular consideration taken into account e.g. pathways, integration time etc.

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Access Controls
Other (specify)

2.5 On which bases did you develop your intervention levels?

3. National Organisation for Nuclear Accidents

3.1 What organisation(s)[4] developed the legal framework for your emergency preparedness and response system?

3.2 What organisation(s)[4] makes recommendations concerning the implementation of countermeasures in case of a nuclear emergency?

3.3 What organisation(s)[4] has the authority to make the decision whether or not to implement countermeasures in case of a nuclear emergency?

4. Emergency Planning Zones for nuclear facilities

4.1 What physical zones are pre-established for the purposes of countermeasure implementation (ex: 5 km evacuation zone, 20 km sheltering zone)

Type of Facility	Pre-established zones for countermeasure implementation
Operational nuclear power plant	
Decommissioning nuclear power plant	
Nuclear Fuel manufacture	
Nuclear Fuel reprocessing	
Operational research reactors	
Decommissioning of research reactors	
Operational defence facilities[5]	
Decommissioning defence facilities	
Nuclear radioactive waste processing	
Nuclear radioactive waste disposal/storage	
Other (specify)	

[4] Specify both the type of organisation and its jurisdictional level within the country, i.e. federal, state, etc.
[5] Defence facilities including weapons and naval reactors

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4.2 What factors do you consider when determining the size of emergency planning zones?

Factor	**Y/N**	**Comment (ex: frequency of likelihood applied)**
Likelihood of accident occurring		
Size of radioactive release (Bq)		
Public Dose Consequence		
Severity of accident – design basis		
Severity of accident – severe accident		
Prescriptive requirements from Government		
Findings from risk assessments/studies		
Demographics		
Other (specify)		

4.3 Does your country have a strategy for extending countermeasures beyond the planning zone for a very severe accident?

Yes ☐ No ☐

If so, please describe:

4.4 Are there special permissions required for the construction of new residential settlements or industrial facilities within emergency planning zones?

Yes ☐ No ☐

If so, what criteria are used to determine whether the construction will be permitted?

5. Off-Site Emergency Plans

5.1 Describe the national legal framework for the provision of off-site emergency plans.

5.2 What organisation(s)[5] developed the guidance[6] for the implementation of the emergency plan?

5.3 What organisation(s)[5] developed the procedures for the implementation of short-term countermeasures?

5.4 What organisation(s)[5] are responsible for creating and maintaining the emergency plan?

[5] Specify both the type of organisation and its jurisdictional level within the country, i.e. federal, state, etc.
[6] Includes both legislative and non-legally-binding guidance/advice.

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5.5 Which factors were considered in developing emergency plan guidelines (general rules)?

Public health risk	Yes ☐	No ☐
Time necessary for the implementation	Yes ☐	No ☐
Shielding qualities of average house	Yes ☐	No ☐
Availability of basement and shelters	Yes ☐	No ☐
Transportation availability	Yes ☐	No ☐
Public trauma	Yes ☐	No ☐
Night or day	Yes ☐	No ☐
Nuclear facility near a border	Yes ☐	No ☐
Costs	Yes ☐	No ☐
Countermeasure applied to entire population	Yes ☐	No ☐
Other (specify)		

5.6 What stakeholders, including the public, are consulted in preparation or review of emergency plans?

5.7 What legal requirements are there for stakeholder consultation?

5.8 What legislation and guidance details what should be included in emergency plans?

5.9 What details are required by legislation/guidance to be included in emergency plans?

Criteria for implementing countermeasures	☐
Roles and responsibilities in emergencies	☐
Roles and responsibilities for monitoring radioactivity	☐
Details of reception centres for evacuated members of the public	☐
Transport arrangements for evacuation	☐
Criteria for alerting/providing information to the public (including media interactions)	☐
Criteria for determining the end of the emergency phase	☐
Recovery arrangements	☐
Emergency dose limits for emergency services personnel	☐
Extreme weather conditions	☐
Others (specify)	☐

5.10 Has a phased implementation of countermeasures been considered in emergency plans, for example

Close area followed by further expansion of the restricted area	Yes ☐	No ☐
Specific population followed by general population	Yes ☐	No ☐
Schools followed by general population	Yes ☐	No ☐
Other (specify)		

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5.11 How often do you undertake full exercises to test emergency plans for scenarios that form the basis of the emergency plan?

Level of exercise	Frequency
On-Site	
Off-Site	
National	
International	
Regional	

5.12 How often do you undertake full exercises to test the extension of the arrangements in the emergency plan to deal with a more severe accident?

Level of exercise	Frequency
On-Site	
Off-Site	
National	
International	
Regional	

6. Implementation of Short-Term Countermeasures

6.1 General points concerning the implementation of short-term countermeasures

6.1.1 What information or criteria are considered necessary and sufficient to justify the implementation of short-term countermeasures?

6.1.2 Which factors are likely to be taken into account at the time of a nuclear accident when selecting which countermeasures to implement?

	Evacuation	Sheltering	Stable iodine	Food/Water Restrictions	Access Control
Legislation, agreement, guidance					
International					
National					
Local					
Nature of event					
Estimated duration of release					
Level of deposition					
Location and size of area affected					

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Population

Number of people affected

Vulnerability of people affected e.g. children
Level of preparedness of the population
Weather conditions

Timing

Time of day

Time elapsed since release/contamination
Time it would take to implement
Acceptability of duration of countermeasure

Radiation Protection

Exposure of emergency workers to implement
Food safety, contamination of food stuffs
Dose averted by implementing
Operational intervention criteria

Availability of resources/infrastructure/tools

Sufficient resources

Sufficient skills/training

Damage to infrastructure

Availability of stable iodine tablets
Availability of relocation facilities

Environmental Concerns

Type of area; residential, industrial, recreational
Geological location; coast, mountainous.

Economic & Political

Direct costs

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Indirect costs

International relations

Political decisions

Media impact

Compensation

Waste containing radioactive substances

Minimising amount of waste
Type of waste

Treatment of waste

Social & Ethical aspects

Disturbance to normal life conditions
Possibility of self help

Participation of stakeholders (population, groups of interest)
Socio-economic effects

Other

Answer "Yes" or "No", give priorities if possible.

6.1.3 Among the above listed factors, which is the most important when deciding whether or not to implement a countermeasure?

Evacuation
Sheltering
Stable iodine
Food/Water Restrictions
Access Controls

6.1.4 Describe how your country coordinates the implementation of countermeasures:

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6.2 Specific countermeasure: Evacuation

6.2.1 Has your country ever experienced evacuation for an actual or potential radiological emergency?

Yes ☐ No ☐

If so, what was the size of the population and of the area affected?

What was the impact on the evacuated population?

6.2.2 Has your country ever experienced evacuation as a result of non-radiological emergencies, such as a hurricane?

Yes ☐ No ☐

If so, what was the size of the population and of the area affected?

Did you apply this non-nuclear experience to your nuclear emergency planning and preparations?

If so, please provide details of significant learning points from these events.

6.2.3 Has your country ever implemented real evacuation as part of an exercise?

Yes ☐ No ☐

If yes, please identify whether actors or real members of the public were evacuated and provide significant learning points.

6.2.4 Do you foresee evacuation?

As your initial countermeasure	☐
Only before nuclear release and contamination	☐
Only after nuclear release and contamination	☐
Either before or after release and contamination	☐

Explain.

6.2.5 Describe how evacuation within the emergency planning zone would be executed:

6.2.6 Describe how you identify and prioritise different groups within the population such as children, medically infirm etc:

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6.3 Specific countermeasure: Sheltering

6.3.1 Has your country ever experienced sheltering for an actual or potential radiological emergency?

Yes ☐ No ☐

If so, what was the size of the population and of the area affected?

What was the impact on the sheltered population?

6.3.2 Has your country ever experienced sheltering as a result of non-radiological emergencies, such as chemical spill or threat?

Yes ☐ No ☐

If so, what was the size of the population and of the area affected?

Did you apply this non-nuclear experience to your nuclear emergency planning and preparations?

6.3.3 Has your country ever implemented real sheltering as part of an exercise?

Yes ☐ No ☐

If yes, explain the results.

6.3.4 Do you foresee sheltering as an initial countermeasure?

Yes ☐ No ☐

Explain.

6.3.5 What countermeasure(s) accompany or follow sheltering?

6.3.6 May sheltering be applied differently for different groups within the population, such as children, pregnant women, etc?

6.3.7 What criteria are used when selecting between sheltering and evacuation?

6.4 Specific countermeasure: Use of stable iodine

6.4.1 Has your country ever experienced an actual or potential radiological emergency that has resulted in the consumption of stable iodine by the population?

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Yes ☐ No ☐

If so, what was the size of the population and of the area affected?

Were there any identifiable health impacts on the affected population resulting from the consumption of stable iodine?

6.4.2 Has your country ever implemented distribution of "simulated" stable iodine tablets (made of sugar for example) as part of an exercise?

Yes ☐ No ☐
If so, explain the results.

6.4.3 How is stable iodine distributed to individual members of the population?

At their residence before an emergency	Yes ☐	No ☐
At their businesses before an emergency	Yes ☐	No ☐
At their residence during an emergency	Yes ☐	No ☐
At schools, nursery schools and other childcare	Yes ☐	No ☐
At a pharmacy or other location before an emergency	Yes ☐	No ☐
At a pre-designated location during the emergency	Yes ☐	No ☐
At a public shelter during the emergency	Yes ☐	No ☐
At a road control point during evacuation	Yes ☐	No ☐
By the emergency services	Yes ☐	No ☐
Others (please specify)		

6.4.4 Is there an area in which stable iodine is pre-distributed to the population?

Yes	☐
No	☐
Depends on the nuclear facility	☐
Other	☐

If so, what is the size of the area?

What is the range of population, in numbers, around nuclear facilities with pre-distributed stable iodine?

6.4.5 If stable iodine is not pre-distributed to the population within the emergency planning zone, how quickly do you assume it be distributed? If this varies according to the size of the population or any other factors, please explain.

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6.4.6. Where is stable iodine stockpiled?

Home ☐
Schools ☐
Place of business ☐
Public shelter ☐
Pharmacies ☐
Local authorities ☐
National authorities ☐
Others ☐

6.4.7 Who pays for stable iodine?

Individual member of the public if they want some ☐
Only individual member of the public ☐
Businesses ☐
Nuclear facility ☐
Local authority ☐
National authority ☐
Others ☐

6.4.8 What form of stable iodine is used?

KI tablets ☐
KIO3 tablets ☐
Others ☐

6.4.9 Are stable iodine tablets commercially available at pharmacies?

6.4.10 What iodine dose (mg), ingestion frequency and duration are recommended in case of a nuclear emergency in your country for various populations?

Population	Dose (mg)	Frequency	Duration
Infants			
Children			
Adults			
Pregnant women			
Others			

6.4.11 Do you recommend maximum limits on intake for iodine for the general population?

Yes ☐ No ☐

If so, what are the recommendations?

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6.4.12 Do you recommend implementation differences, in term of dose (mg), duration or frequency, for territories with low dietary iodine levels?

Yes ☐ No ☐ Not applicable ☐

If so, what are the recommendations?

6.4.13 Are any precautions taken for members of the public who may suffer severe side effects from a high dose of stable iodine or may have thyroid disease?

6.4.14 What is the assumed shelf life of the stable iodine tablets?

6.4.15 May stable iodine be used as an isolated countermeasure or only together with sheltering or evacuation?

Isolated ☐
With sheltering ☐
With evacuation ☐

7. Information for the population around a nuclear facility

7.1 Does your country have educational programmes on the hazards and risks associated with the nuclear industry?

Yes ☐ No ☐

What kind of educational programme has been developed?

What type of organisation is responsible for these educational programs?

7.2 How are the public informed of the information detailed within emergency plans?

Leaflets/documentation ☐
Public meetings ☐
Training courses ☐
Other (please specify) ☐

7.3 How is the population around a nuclear facility educated concerning the possibility and manner of implementation of a countermeasure by the authorities?

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7.4 In case of an accident how the population around a nuclear facility is alerted and kept informed concerning the practical implementation of countermeasures?

Telephone calls ☐
Television broadcasts ☐
Radio broadcasts ☐
Social networking ☐
Door-to-door visits ☐
Other (please specify) ☐

7.5 Is there a legal basis or obligation for the information of the public before and/or during an emergency?

Yes ☐ No ☐

If yes, specify.

8. Countermeasures for special groups

8.1 Are there established dosimetric criteria for emergency workers?

Yes ☐ No ☐

If yes, specify.

8.2 Are there different countermeasures planned (stable iodine, dosimetry, protective clothing…) for emergency workers who may need to be outside in an affected area?

Which countermeasures? **For whom?**

8.3 Have other special groups been identified in your country for the implementation of short term countermeasures

Yes ☐ No ☐

If yes, specify.

8.4 Are there plans for early warning of farmers, hospitals or others needing extra-time to prepare for:

Evacuation Yes ☐ No ☐

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If so, explain.

Sheltering Yes ☐ No ☐

If so, explain.

8.5 Are there different countermeasures planned (stable iodine, dosimetry, protective clothing…) for farmers or other non-emergency workers who may need to be outside in an affected area?

Which countermeasures? **For whom?**

Are there any special requirements for the welfare of livestock during the emergency or recovery phases?

9. Harmonisation of the countermeasures[7]

9.1 Has an attempt been made to harmonise basic rules or specific emergency plans, or intervention criteria with neighbouring countries (or states, provinces, Länder …)?

Yes ☐ No ☐

If so, which parts of the emergency plan are (will be) harmonised?

With which country (or region)?

9.2 For nuclear facilities near a border of a country (or states, provinces, Länder …), is there co-operation/co-ordination between emergency management in the emergency planning zones of both countries (or states, provinces, Länder …)?

Which organisations (type and jurisdictional level) are responsible for maintaining co-operation and co-ordination across such borders?

9.3 In case of an accident occurring in a neighbouring country (region), near the border, could information from the accident country (region) be sufficient for the implementation of harmonised countermeasures?

[7] Due to differences in regulations and other boundary conditions real harmonisation on both sides of a national border may not always be possible, but each side should be aware of the concepts of the other in order to understand possible differences and communicate these to the public.

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To: Thornton, Marisa[Savoy.Marisa@epa.gov]
From: DeCair, Sara
Sent: Wed 7/17/2013 5:17:32 PM
Subject: Re: Changed: Radiation Protection: Protective Action Guides

I think not -- we just made the fr the official one, so it's not really news. Thanks!
S.

From: Thornton, Marisa
Sent: Wednesday, July 17, 2013 12:08:58 PM
To: DeCair, Sara
Subject: FW: Changed: Radiation Protection: Protective Action Guides

Sara,

Do you want me to send out this notice?

From: U.S. EPA Office of Radiation and Indoor Air [mailto:usaepa@service.govdelivery.com]
Sent: Wednesday, July 17, 2013 12:03 PM
To: Thornton, Marisa
Subject: Changed: Radiation Protection: Protective Action Guides

You are a designated administrator for the U.S. EPA Office of Radiation and Indoor Air (ORIA) Radiation Protection: Protective Action Guides topic. GovDelivery recently detected changes to the topic's Page Watch URL(s).

If you would like to notify 30758 subscribers of this change, please follow this link.

If you do not wish to notify these subscribers, please disregard this message.

The topic Page Watch URL(s) that changed are:

- http://www.epa.gov/radiation/rert/pags.html

See below for a detailed report of the changes that were detected.

To view Page Watch settings and other topic information, please follow this link.

Need Help? Check out our knowledge base article on

Setting Up Page Watch.

If you have further questions, contact

Customer Support.

Change Report

http://www.epa.gov/radiation/rert/pags.html

<<<< 16 REMOVED <meta name="DC.Date.modified" content="2013-06-20"/> >>>> 16 ADDED <meta name="DC.Date.modified" content="2013-07-17"/> <<<< 174 REMOVED <!-- #EndLibraryItem --> Get e-mail updates when this information changes. >>>> 174 ADDED <!-- #EndLibraryItem --> >>>> 175 ADDED Get e-mail updates when this information changes. <<<< 187 REMOVED Comment Period Extended 60 Days! (5 pp, 31.23Kb, July 2013) <script type="text/javascript"><![CDATA[<!-- >>>> 187 ADDED Comment Period Extended 60 Days! (5 pp, 31.23Kb, July 2013) <script type="text/javascript"><![CDATA[<!--

STAY CONNECTED:

This email was sent by GovDelivery, Inc. · 408 St. Peter Street, Suite 600 · Saint Paul, MN 55102

To: Thornton, Marisa[Savoy.Marisa@epa.gov]
From: DeCair, Sara
Sent: Wed 7/10/2013 8:49:02 PM
Subject: FR to put on PAGs web page as soon as you can
PAGs Comment Period Extension FR pre-pub 7-9-2013.doc

Thanks for helping to post this as soon as possible, Marisa!

The Word version is attached, but it needs to be PDF'ed with an announcement up top on the PAGs web page like "Comment Period Extended 60 days!" And a "NEW" bubble too, right by where the highlighted comment deadline should be changed to Sept. 16, 2013. Many thanks!!

US EPA Web Application Access | Profile | US EPA Protective Action Guides | Ra

www.epa.gov/radiation/rert/pags.html

Radiation Protection

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  - Cleanup & Multi-Agency
  - Risk Assessment & Federal Guidance
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- Frequent Questions
- Site Map
- A-Z Subject Index

Protective Action Guides (PAGs)

Get e-mail updates when this information changes.

In the event of a radiological emergency, responders can instruct the public to take prote indoors to prevent exposure to unhealthy amounts of radiation. EPA developed a manual help responders plan for radiation emergencies.

On this page:

- Updates to the PAG Manual
- Protective Action Guides (PAGs)
- About the PAG Manual
- Training
- Other Radiation Response Guidance

Updates to the PAG Manual

EPA is seeking public comment on a proposed revision of the current PAG Manual: The up Protective Action Guides and Planning Guidance for Radiological Incidents," includes new s document's relevancy to more than just nuclear power plants and incorporates recent gui and waste disposal. Comments must be received by 07/15/2013.

- Federal Register Notice of Availability - Updates to Protective Action Guides Manua (PAGs) and Planning Guidance for Radiological Incidents
- Draft PAG Manual for Interim Use and Public Comment (PDF)(86 pp, 842.86KB, March
- Submit Comments On Line
- About the Proposed Revisions

Protective Action Guides (PAGs)

Protective Action Guides (PAGs) suggest precautions that state and local authorities can t of radiation that might be dangerous to their healt

federalregister.gov/.../updates-to-protective-action-guides-manual-protective-...

S.

Sara D. DeCair, Health Physicist

EPA's Center for Radiological Emergency Management

202-343-9108

Gina McCarthy, the Assistant Administrator for the Office of Air and Radiation, signed the following Notice on 07/09/2013, and EPA is submitting it for publication in the Federal Register (FR). While we have taken steps to ensure the accuracy of this Internet version of the Notice, it is not the official version of the Agency's authorization decision. Please refer to the official version in a forthcoming FR publication, which will appear on the Government Printing Office's FDSys website (www.gpo.gov/fdsys/search/home.action) and on Regulations.gov (www.regulations.gov) in Docket No. EPA-HQ-OAR-2007-0268. Once the official version of this document is published in the FR, this version will be removed from the Internet and replaced with a link to the official version.

ENVIRONMENTAL PROTECTION AGENCY

[EPA-HQ-OAR-2007-0268; FRL-XXXX-X]

Updates to Protective Action Guides Manual: Protective Action Guides (PAGs) and Planning Guidance for Radiological Incidents

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed Guidance; extension of comment period.

SUMMARY: The U.S. Environmental Protection Agency is announcing an extension of the public comment period for the proposed guidance "PAG Manual: Protective Action Guides (PAGs) and Planning Guidance for Radiological Incidents" (the proposed guidance is hereinafter referred to as "PAGs"). The EPA published the proposed guidance in the Federal Register, which included a request for comment, on April 15, 2013. The public comment period was to end on July 15, 2013. The purpose of this notice is to extend the public comment period an additional 60 days.

DATES: Written comments must be received on or before September 16, 2013.

ADDRESSES: Submit your comments, identified by Docket ID No. EPA-HQ-OAR-2007-0268, by one of the following methods:

- *www.regulations.gov:* Follow the on-line instructions for submitting comments.

- *Email:* a-and-r-docket@epa.gov.
- *Mail:* Air and Radiation Docket and Information Center, U.S. Environmental Protection Agency, Mailcode: 2822T, 1200 Pennsylvania Ave., NW., Washington, DC 20460.
- *Hand Delivery:* EPA Docket Center, EPA West Building, Room 3334, 1301 Constitution Ave., NW., Washington, DC 20460. Such deliveries are only accepted during the Docket's normal hours of operation, and special arrangements should be made for deliveries of boxed information.

Instructions: Direct your comments to Docket ID No. EPA-HQ-OAR-2007-0268. The EPA's policy is that all comments received will be included in the public docket without change and may be made available online at www.regulations.gov, including any personal information provided, unless the comment includes information claimed to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through www.regulations.gov or e-mail. The www.regulations.gov website is an "anonymous access" system, which means the EPA will not know your identity or contact information unless you provide it in the body of your comment. If you send an e-mail comment directly to the Agency without going through www.regulations.gov your e-mail address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the Internet. If you submit an electronic comment, the EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD-ROM you submit. If the EPA cannot read your comment due to technical difficulties and cannot contact you

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for clarification, the Agency may not be able to consider your comment. Electronic files should avoid the use of special characters, any form of encryption, and be free of any defects or viruses. For additional information about the Agency's public docket visit the EPA Docket Center homepage at http://www.epa.gov/epahome/dockets.htm. For additional instructions on submitting comments, please refer to the notice of proposed rulemaking (Section XI, Public Participation, of the **SUPPLEMENTARY INFORMATION** section of the proposed rulemaking document).

Docket: All documents in the docket are listed in the www.regulations.gov index. Although listed in the index, some information is not publicly available, e.g., CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy. Publicly available docket materials are available either electronically in www.regulations.gov or in hard copy at the Air and Radiation Docket and Information Center, EPA/DC, EPA West, Room 3334, 1301 Constitution Ave., NW, Washington DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the Air Docket is (202) 566-1742.

FOR FURTHER INFORMATION CONTACT: Sara DeCair, Radiation Protection Division, Center for Radiological Emergency Management, Mail Code 6608J, U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue NW, Washington, DC 20460; telephone number: (202) 343-9108 ; fax number: (202) 343-2304; E-mail: decair.sara@epa.gov.

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SUPPLEMENTARY INFORMATION:

A. What Should I Consider as I Prepare My Comments for the EPA?

1. *Submitting Confidential Business Information (CBI).* Do not submit this information to the EPA through www.regulations.gov or e-mail. Clearly mark all of the information that you claim to be CBI. For CBI information in a disk or CD ROM that you mail to the EPA, mark the outside of the disk or CD ROM as CBI and then identify electronically within the disk or CD ROM the specific information that is claimed as CBI. In addition to one complete version of the comment that includes information claimed as CBI, a copy of the comment that does not contain the information claimed as CBI must be submitted for inclusion in the public docket. Information marked as CBI will not be disclosed except in accordance with procedures set forth in 40 CFR Part 2.

2. *Tips for Preparing Your Comments.* When submitting comments, remember to:

- Identify the rulemaking by docket number, subject heading, Federal Register date and page number.
- Follow directions—the EPA may ask you to respond to specific questions or organize comments by referencing the chapter number.
- Explain why you agree or disagree; suggest alternatives and substitute language for your requested changes.
- Describe any assumptions and provide any technical information and/or data that you used.
- If you estimate potential costs or burdens, explain how you arrived at your estimate in sufficient detail to allow it to be reproduced.

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- Illustrate your concerns with specific examples and suggest alternatives.
- Explain your views as clearly as possible, avoiding the use of profanity or personal threats.
- Make sure to submit your comments by the comment period deadline identified.

B. How Can I Get Copies of This Document, the Proposed Rule and Other Related Information?

The EPA has established a docket for this action under Docket ID No. EPA–HQ–OAR-2007-0268. The EPA has also developed a web site for the proposed PAGs updates at: http://www.epa.gov/radiation/rert/pags.html. Please refer to the original Federal Register notice on the proposed guidance for detailed information on accessing information related to the proposal.

In response to requests for an extension, we are extending the public comment period for the PAGs updates through September 16, 2013. This extension will provide the public additional time to provide comment on the proposed guidance.

Dated:

Gina McCarthy

Assistant Administrator, Office of Air and Radiation

ED_001057_00013748

To: Schultheisz, Daniel[Schultheisz.Daniel@epa.gov]
From: DeCair, Sara
Sent: Tue 6/25/2013 1:49:14 PM
Subject: RE: State Waste Disposal Plans (Focus group meeting / webinar) - OHS Conference Room (ARN 6426) or call 1-866-299-3188 and then dial Ex. 6 - Personal Privacy

That looks great. You're going to send it to this list of attendees? Then also the Region 5 workshop attendees? Great idea!

From: Schultheisz, Daniel
Sent: Tuesday, June 25, 2013 9:30 AM
To: DeCair, Sara
Subject: FW: State Waste Disposal Plans (Focus group meeting / webinar) - OHS Conference Room (ARN 6426) or call 1-866-299-3188 and then dial Ex. 6 - Personal Privacy

This is the report from the workshop done with Region 3 attendees in April (I missed it). List of attendees is in Appendix A. I think the coordination on this one wasn't all it could have been, but the Region 5 workshop last week seemed to be better attended.

Here's a suggested message to highlight PAG review opportunity (note that one participant in the workshop commented that it might be helpful to provide PAGs with this planning tool – page 11):

We would also like to make sure you are aware that EPA recently issued for public comment proposed revisions to the Protective Action Guides Manual (PAG Manual) for nuclear and radiological incidents. The proposed revisions update the 1992 Manual, which focused on nuclear power plant accidents, and extends coverage to address other radiological incidents, such as the use of radiological dispersal devices. The proposed revisions also include planning guidance for late phase activities such as cleanup and waste management. The waste management discussion touches on many aspects that were raised during the workshop and we encourage you to provide your insights and identify the activities underway in your state that would support the necessary planning and decision-making in the aftermath of a nuclear or radiological incident.

Review of the proposed revisions to the PAG Manual is likely being led by your state's radiation or emergency response program, so you may want to coordinate your review. The proposed revisions and other information can be found at http://www.epa.gov/radiation/rert/pags.html.

Public comments are being requested by July 15; however, EPA intends to extend this deadline by 60 days. For more information on the revisions to the PAG Manual, please contact Sara DeCair in EPA's Radiation Protection Division at decair.sara@epa.gov.

Sound okay?

From: Parrish, Cayce
Sent: Thursday, June 20, 2013 5:42 PM
To: Ierardi, Mario; Tschursin, Anna; Kaps, Melissa; Schultheisz, Daniel; Deamer, Eileen; Geyer, Rebecca; Lemieux, Paul; Steuteville, William; 'Snee, Elizabeth [USA]'; 'Ludwa, Christopher [USA]'
Cc: Reyes, Juan
Subject: State Waste Disposal Plans (Focus group meeting / webinar) - OHS Conference Room (ARN 6426) or call 1-866-299-3188 and then dial Ex. 6 - Personal Privacy

Waste Planning Workgroup:

Please find attached the final version of the Region 3 workshop. Bill, I will assume you want to send to the R3 state participants. If not, just let me know and we can send directly to them.

Hope to have the DRAFT R5 report done soon for you all to review.

Cayce

To: Ferguson, Rafaela[Ferguson.Rafaela@epa.gov]
From: DeCair, Sara
Sent: Mon 4/29/2013 8:17:51 PM
Subject: RE: PAGs UPdate for CRCPD

Rafie,

Just some picky points I edited below – see if you think they are okay. Thank you!!

S.

From: Ferguson, Rafaela
Sent: Monday, April 29, 2013 4:08 PM
To: DeCair, Sara
Subject: PAGs UPdate for CRCPD
Importance: High

Sara,

Is this write-up okay for the annual ORIA update for CRPD Board of Directors? Please make any changes you deem appropriate and send back to me by Thursday. Thanks!

Rafie

Proposed Draft "Protective Action Guides and Planning Guidance for Radiological Incidents" (PAG Manual): Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Rafaela Ferguson

Special Assistant/Regional Coordinator

Radiation Protection Division

Office of Radiation and Indoor Air

Tel: 202-343-9362

Email: ferguson.rafaela@epa.gov

Fax: 202-343-2304

To: Greene, Ashley[Greene.Ashley@epa.gov]
From: Grevatt, Peter
Sent: Tue 9/13/2016 9:11:00 PM
Subject: Re: Items to Review and WEFTEC Info
Testimony of Joel Beauvais SEPW DRAFT SEP 28 2016_AG PCG.docx

Suggested edits to testimony - thanks for sending the draft!

From: Greene, Ashley
Sent: Tuesday, September 13, 2016 3:24:52 PM
To: Grevatt, Peter
Subject: Re: Items to Review and WEFTEC Info

Same place as earlier?

Sent from my iPhone

On Sep 13, 2016, at 3:19 PM, Grevatt, Peter <Grevatt.Peter@epa.gov> wrote:

Meet where?

From: Greene, Ashley
Sent: Tuesday, September 13, 2016 11:36:18 AM
To: Grevatt, Peter
Subject: Items to Review and WEFTEC Info

1) Items to review (latest versions attached)

a. Legionella Comms Rollout

b. Legionella Document

c. Tiering Memo Comms Rollout

d. Joel's SEPW Testimony

e. DW PAGs SEPW Hearing factsheet

2) Take a look at Danny Gogal's email from yesterday and respond to his request for review

3) ULO Info to Joel (Anita sent you email on 9/6 at 7:53pm) – this contains draft messages from Joel to RAM as well as message to WDDs

4) WEFTEC Utility Leaders Morning Session Agenda attached – this is the session where you will be giving 5/10 minute update on OGWDW initiatives. As I mentioned, you will also be doing the Clean Water Policy session with the other ODs where you have approximately 10-15 minutes for remarks on OGWDW priorities. Let me know what specific topics you may want to cover during these sessions.

****

Ashley Greene

Special Assistant

Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

Phone: (202) 566-1738

Email: greene.ashley@epa.gov

****

To: Grevatt, Peter[Grevatt.Peter@epa.gov]; Greene, Ashley[Greene.Ashley@epa.gov]
Cc: Burneson, Eric[Burneson.Eric@epa.gov]; Rodgers-Jenkins, Crystal[Rodgers-Jenkins.Crystal@epa.gov]
From: Wadlington, Christina
Sent: Wed 9/14/2016 4:49:06 PM
Subject: RE: Items to Review and WEFTEC Info
Legionella_RollOut_9.14.16.BackToOW..docx

Thank you Peter,

Provided is an updated roll out that addresses your comments and Gina's request to highlight who this applies to. I've sent this forward to Travis and Allison.

Please let Crystal/I know if you have any questions.

Christina Wadlington

Communications Director

Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

Tel: 202.566.1859

Email: wadlington.christina@epa.gov

Webpage: www.epa.gov/safewater

From: Grevatt, Peter
Sent: Tuesday, September 13, 2016 5:52 PM
To: Greene, Ashley <Greene.Ashley@epa.gov>; Wadlington, Christina <Wadlington.Christina@epa.gov>
Cc: Burneson, Eric <Burneson.Eric@epa.gov>; Rodgers-Jenkins, Crystal <Rodgers-Jenkins.Crystal@epa.gov>
Subject: Re: Items to Review and WEFTEC Info

Please see comments on Legionella roll-out materials attached

---

From: Greene, Ashley
Sent: Tuesday, September 13, 2016 11:36:18 AM
To: Grevatt, Peter
Subject: Items to Review and WEFTEC Info

1) Items to review (latest versions attached)

a. Legionella Comms Rollout

b. Legionella Document

c. Tiering Memo Comms Rollout

d. Joel's SEPW Testimony

e. DW PAGs SEPW Hearing factsheet

2) Take a look at Danny Gogal's email from yesterday and respond to his request for review

3) ULO Info to Joel (Anita sent you email on 9/6 at 7:53pm) – this contains draft messages from Joel to RAM as well as message to WDDs

4) WEFTEC Utility Leaders Morning Session Agenda attached – this is the session where you will be giving 5/10 minute update on OGWDW initiatives. As I mentioned, you will also be doing the Clean Water Policy session with the other ODs where you have approximately 10-15 minutes for remarks on OGWDW priorities. Let me know what specific topics you may want to cover during these sessions.

****

Ashley Greene

Special Assistant

Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

Phone: (202) 566-1738

Email: greene.ashley@epa.gov

****

To: Harris, Adrienne[Harris.Adrienne@epa.gov]
Cc: Greene, Ashley[Greene.Ashley@epa.gov]
From: Gude, Karen
Sent: Fri 5/20/2016 4:31:55 PM
Subject: RE: Draft Topics List for 5/20 Administrator Weekly Email -- Deadline 12 PM Thursday

Ashley/Adrienne,

Just a heads up that I edited the PAGs write up for the Administrator Weekly Email, given that we've cleared OMB review. My revised version is below in redline text. I hope this works, if not, please let me know. I left the FRN timing vague (within the next few weeks), as it sounds like we're still figuring out timing of the FRN package and communications.

Drinking Water Protective Action Guidelines: This week OMB cleared our proposed Drinking Water Protective Action Guideline (PAG). We will be seeking public comment on the proposed drinking water PAG via a Federal Register notice, which we anticipate will be ready for release within the next few weeks. A cost analysis will be shared as a separate document for public review in addition to the PAG on the EPA's website. The purpose of a PAG is to guide the first year of planning and decision-making efforts by local and state officials following a radiological emergency. The proposed PAG does not affect EPA's drinking water standards for radionuclides. The proposal consists of a two-tier drinking water PAG that would be used during the intermediate phase following a radiation incident: 500 millirem (mrem) (5 milliSievert (mSv)) projected dose for the general population (defined as anyone over age 15, excluding pregnant women and nursing women), and 100 mrem (1 mSv) projected dose for pregnant women, nursing women and children age 15 and under. The tiered approach may help officials prioritize potentially scarce water resources for those most at risk in a disaster response. Once public comments have been addressed, the DW PAG will be folded into the broader PAG Manual – *Protective Action Guides and Planning Guidance for Radiological Incidents* that addresses additional media to provide a comprehensive resource to state and local emergency planning officials.

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

From: Harris, Adrienne
Sent: Wednesday, May 18, 2016 11:16 AM
To: Gude, Karen <Gude.Karen@epa.gov>
Cc: Greene, Ashley <Greene.Ashley@epa.gov>
Subject: RE: Draft Topics List for 5/20 Administrator Weekly Email -- Deadline 12 PM Thursday

Hi Karen,

Here's the PAGs write-up for the weekly email.

Drinking Water Protective Action Guidelines

OW anticipates OMB's clearance on our proposed Drinking Water Protective Action Guideline (PAG) within the next few days. We will be seeking public comment on the proposed drinking water PAG via FRN. A cost analysis will be shared as a separate document for public review in addition to the PAG on the EPA's website. The purpose of a PAG is to guide the first year of planning and decision-making efforts by local and state officials following a radiological emergency. The proposed PAG does not affect EPA's drinking water standards for radionuclides.

The proposal consists of a two-tier drinking water PAG that would be used during the intermediate phase following a radiation incident: 500 millirem (mrem) (5 milliSievert (mSv)) projected dose for the general population (defined as anyone over age 15, excluding pregnant women and nursing women), and 100 mrem (1 mSv) projected dose for pregnant women, nursing women and children age 15 and under. The tiered approach may help officials prioritize potentially scarce water resources for those most at risk in a disaster response. Once public comments have been addressed, the DW PAG will be folded into the broader PAG Manual – *Protective Action Guides and Planning Guidance for Radiological Incidents* that addresses additional media to provide a comprehensive resource to state and local emergency planning officials.

Adrienne O. Harris
Acting Special Assistant

Office of Ground Water and Drinking Water
(202) 250-8793 (office)

From: Gude, Karen
Sent: Monday, May 16, 2016 9:15 AM
To: Greene, Ashley <Greene.Ashley@epa.gov>; Nandi, Romell <Nandi.Romell@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>; Ruf, Christine <Ruf.Christine@epa.gov>; Klasen, Matthew <Klasen.Matthew@epa.gov>; Orvin, Chris <Orvin.Chris@epa.gov>; Vonfeck, Stephanie <Vonfeck.Stephanie@epa.gov>; Harris, Adrienne <Harris.Adrienne@epa.gov>; Rose, Bob <Rose.Bob@epa.gov>
Cc: Lousberg, Macara <Lousberg.Macara@epa.gov>; Evalenko, Sandy <Evalenko.Sandy@epa.gov>; Campbell, Ann <Campbell.Ann@epa.gov>; Loop, Travis <Loop.Travis@epa.gov>
Subject: Draft Topics List for 5/20 Administrator Weekly Email -- Deadline 12 PM Thursday

Dear Special Assistants,

Hi. Below/attached please find a list of possible topics for the 5/20 Administrator Weekly Email. Please provide write-ups no later than noon on Thursday.

Ann/Travis/Chris/Macara/Sandy – If it looks like I might be missing anything for this week, please let me know.

Thank you,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

Draft Topics List for 5/20 Administrator Weekly Email

Possible Topics for 5/20 Administrator Weekly Email:

1. Speeches:

a. **5/24 - Children's Health Protection Advisory Committee**: Need a sentence or two on what Joel intends to say. (**Travis)**

2. **DW Stakeholder Meetings Kick Off (OGWDW)** – States call on May 26, and tee up June 1 (utilities) and 2 (NGOs) meetings.

3. **PAGs (OGWDW)** – If there's been any movement with OMB

4. Marine Beach Sanitary Survey App Launch (OST)

5. **IL CZARA (OWOW)** – Update if FRN is signed by NOAA this week

6. WIFIA ICR (OWM)

7. **Coordinated Federal Permitting of Offshore Aquaculture Operations in the Gulf of Mexico (OWM)** – Has the MOU signature date be scheduled?

8. **Summary Report for Workshop on Water Quality Markets (WPS)** – Only if we anticipate that the report will be issued next week.

a. *Write-up:* As early as next week, OW will jointly release with USDA a summary report of the September 2015 workshop, *National Workshop on Water Quality Markets*, which was co-hosted by EPA and USDA. The report presents a summary of the discussions among the 200 participants on a broad variety of issues related to the development and operation of water quality markets. It also outlines actions that EPA and USDA are pursuing to advance market-based approaches to improve water quality. Positive reactions are expected from stakeholders interested in trading.

Ex. 1 - Deliberative Process

To: Nandi, Romell[Nandi.Romell@epa.gov]; Telleen, Katherine[Telleen.Katherine@epa.gov]; Greene, Ashley[Greene.Ashley@epa.gov]; Skane, Elizabeth[Skane.Elizabeth@epa.gov]
Cc: Lopez-Carbo, Maria[Lopez-Carbo.Maria@epa.gov]; Ruf, Christine[Ruf.Christine@epa.gov]
From: Bethel, Heidi
Sent: Tue 11/18/2014 6:38:36 PM
Subject: Weekly Meeting Summary - Ken's Calendar
Nov. 18-Nov. 25 meetings.docx

Hi,

I know Ashley won't be at our meeting today. I'm sending along the meeting summary, in case others might be out too. I hope most of you are there as we will have Mary Jo on the phone to try and jump start planning for the WDD meeting in January.

Thanks,

Heidi

Ashley,

Important meetings for OGWDW coming up:

- **11/20:** 5-5:45 pm: Proposed Drinking Water Protective Action Guides (PAGs) Discussion (McCarthy, OW, OAR)

- **11/25:** Class II to VI Guidance Manual (McCarthy, Feldt, Kopocis, OGWDW, OAR, OGC)

- **11/21:** OW Leadership Meeting: All Day, All Office Directors participate

- **11/25:** 10:30-11:30 am: Quarterly OP/OW Meeting – Please let me know if there are changes to the agenda recommended by OGWDW

Thanks!

Ken Kopocis' Meetings November 18 – November 25

Ellen in St. Petersburg, FL for NACWA meeting, November 19-20

OST

- **11/20:** 11 am – 12 pm: Response to lawsuit on Maine's WQS Revisions (POC: Elizabeth Skane, *materials due by 3 p.m. on 11/19)*

IO

- **11/20:** 9:30 – 10 am: Pre-brief for Rule Effectiveness (Best-Wong, Sawyers)

OGWDW

Administrator/ Deputy Administrator/ OA Meetings

- **11/19:** 4 – 4:30 pm: Briefing: Adaptation in Clean Water Act Enforcement Cases (Keyes-Fleming, OECA, OW, OP)
- **11/20:** 3 – 4: 30 pm: FY 2014 End-of-Year Administrator Goal Performance Progress Review (Meiburg)
- **11/20:** 3:30-5 pm: End-of-Year Deputy Administrator Goal Performance Progress Review – Goal 2: Protecting America's Waters (Meiburg, OCFO, OW)
- **11/20:** 5-5:45 pm: Proposed Drinking Water Protective Action Guides (PAGs) Discussion (McCarthy, OW, OAR)
- **11/24:** 10-10:45 am: Rule Effectiveness (McCarthy, OA, OAR, OECA, OW, OSWER, OCSPP, OGC, R5, R6, R7)
- **11/24:** 1-2 pm: Senior Staff Meeting
- **11/25:** 12-12:45 pm: WOTUS (McCarthy, OA, OPE, OCIR, OGC, OW, ORD, OP)
- **11/25:** King Coal/ Buffalo Mountain Briefing (Meiburg, Kopocis, Garvin, Vaught)
- **11/25:** Class II to VI Guidance Manual (McCarthy, Feldt, Kopocis, OGWDW, OAR, OGC)

Other:

- **11/18:** 3-4 pm: WOTUS Bi-Weekly Call with Ken Kopocis / Regions
- **11/19:** 8-8:30 am: WOTUS Rollout Follow-up meeting (Beauvais)
- **11/19:** 10-11:30 am: MOU for Decentralized Wastewater Management Renewal Ceremony
- **11/19:** 10-11 am: WOTUS weekly (Ganesan)
- **11/20:** 3-4 pm: Build America Workgroup Meeting
- **11/20:** 3:30 – 4:30 pm: Internal Headquarters Conference Call: Discussion: EPA's Participation in Dec. 4, 2014 Brown Bag with Mayors (Re: Affordability Framework)
- **11/21:** OW Leadership Meeting: All Day, All Office Directors participate
- **11/24:** 12-12:45 pm: Brownbag: WOTUS Strategy
- **11/24:** 3-3:30 pm: BNA End of Year Interview
- **11/25:** 10:30-11:30 am: Quarterly OP/OW Meeting
- **11/25:** 3-4 pm: ACE Climate/ Water Senior Management Briefing (ORD Meeting)

To: Harris, Adrienne[Harris.Adrienne@epa.gov]
Cc: Greene, Ashley[Greene.Ashley@epa.gov]
From: Gude, Karen
Sent: Fri 6/3/2016 4:25:15 PM
Subject: RE: Draft Topics List for 6/03 Administrator Weekly Email -- Deadline Noon on Thursday

Many thanks!

From: Harris, Adrienne
Sent: Friday, June 03, 2016 11:10 AM
To: Gude, Karen <Gude.Karen@epa.gov>
Cc: Greene, Ashley <Greene.Ashley@epa.gov>
Subject: RE: Draft Topics List for 6/03 Administrator Weekly Email -- Deadline Noon on Thursday

Karen: Sorry, for the delay.

-

Drinking Water Protective Action Guidelines Signature and Release

We anticipate the proposed PAG to be announced on Monday, June 6; a pre-publication version of the signed notice will be posted on EPA's website. The proposed PAG does not affect EPA's drinking water standards for radionuclides. It consists of a two-tier drinking water PAG that would be used during the intermediate phase following a radiation incident: 500 millirem (mrem) (5 milliSievert (mSv)) projected dose for the general population (defined as anyone over age 15, excluding pregnant women and nursing women), and 100 mrem (1 mSv) projected dose for pregnant women, nursing women and children age 15 and under. We anticipate a lot of attention on this action from environmental groups, and we are coordinating with OPA on the rollout. Once public comments have been addressed, the DW PAG will be folded into the broader PAG Manual – Protective Action Guides and Planning Guidance for Radiological Incidents Manual that OAR has been developing.

LCR Implementation:

All states provided responses to the February 29 letters that EPA sent to state environment and public health commissioners outlining specific steps to enhance oversight of LCR implementation. On June 8, we plan to post a summary of the state responses to the 2/29 LCR

Implementation letters and the actual letters received from all state primacy agencies. While many states provided examples of best practices that that go beyond the minimum rule requirements, other states have identified challenges with some of these same activities. Through the Regions, We will continue to work closely with the states to ensure that the proper steps are being taken to implement the current rule.

Adrienne O. Harris
Acting Special Assistant

Office of Ground Water and Drinking Water
(202) 250-8793 (office)

From: Gude, Karen
Sent: Friday, June 03, 2016 9:24 AM
To: Harris, Adrienne <Harris.Adrienne@epa.gov>
Cc: Greene, Ashley <Greene.Ashley@epa.gov>
Subject: RE: Draft Topics List for 6/03 Administrator Weekly Email -- Deadline Noon on Thursday

Hi Adrienne,

Just checking in to see when the Administrator weekly items might be approved and ready to go today.

Thanks,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

From: Harris, Adrienne
Sent: Thursday, June 02, 2016 8:24 AM
To: Gude, Karen <Gude.Karen@epa.gov>
Cc: Greene, Ashley <Greene.Ashley@epa.gov>
Subject: RE: Draft Topics List for 6/03 Administrator Weekly Email -- Deadline Noon on Thursday

Hi Karen,

As you know, Peter has been out of the office yesterday and today. He has the weekly items for his review but I may be delayed in sending them to you by noon.

Adrienne O. Harris
Acting Special Assistant

Office of Ground Water and Drinking Water
(202) 250-8793 (office)

From: Gude, Karen
Sent: Tuesday, May 31, 2016 10:20 AM
To: Greene, Ashley <Greene.Ashley@epa.gov>; Nandi, Romell <Nandi.Romell@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>; Ruf, Christine <Ruf.Christine@epa.gov>; Klasen, Matthew <Klasen.Matthew@epa.gov>; Orvin, Chris <Orvin.Chris@epa.gov>; Vonfeck, Stephanie <Vonfeck.Stephanie@epa.gov>; Harris, Adrienne <Harris.Adrienne@epa.gov>; Rose, Bob <Rose.Bob@epa.gov>
Cc: Lousberg, Macara <Lousberg.Macara@epa.gov>; Evalenko, Sandy <Evalenko.Sandy@epa.gov>; Campbell, Ann <Campbell.Ann@epa.gov>; Loop, Travis <Loop.Travis@epa.gov>
Subject: Draft Topics List for 6/03 Administrator Weekly Email -- Deadline Noon on Thursday

Dear Special Assistants,

Hi. Below/attached please find a list of possible topics for the 6/03 Administrator Weekly Email. Please note that I'll need write-ups by noon on Thursday.

Ann/Matt/Travis/Chris/Macara/Sandy – If it looks like I might be missing anything for this week, please let me know.

Thank you,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

Draft Topics List for 6/03 Administrator Weekly Email

Possible Topics for 6/03 Administrator Weekly Email:

1. Speaking Engagements:

a. NTOC Meeting

b. US Water Alliance's One Water Summit 2016 (Atlanta)

2. **PAGs signature and release (OGWDW)**

3. Posting States Responses to EPA LCR letter to Governors and Commissioners (OGWDW)

4. **Unconventional Oil & Gas signature and prepublication (OST)**

5. **Summary Report for Workshop on Water Quality Markets (WPS/Bob)** – Only if we anticipate that the report will be issued next week.

a. *Write-up:* As early as next week, OW will jointly release with USDA a summary report of the September 2015 workshop, *National Workshop on Water Quality Markets*, which was co-hosted by EPA and USDA. The report presents a summary of the discussions among the 200 participants on a broad variety of issues related to the development and operation of water quality markets. It also outlines actions that EPA and USDA are pursuing to advance market-based approaches to improve water quality. Positive reactions are expected from stakeholders interested in trading.

To: Greene, Ashley[Greene.Ashley@epa.gov]
From: Fuld, John
Sent: Fri 8/5/2016 3:59:03 PM
Subject: RE: Media Inquiry: Wall Street Journal. Deadline noon tomorrow

Thanks

From: Greene, Ashley
Sent: Friday, August 05, 2016 11:58 AM
To: Fuld, John <Fuld.John@epa.gov>
Cc: Wadlington, Christina <Wadlington.Christina@epa.gov>
Subject: RE: Media Inquiry: Wall Street Journal. Deadline noon tomorrow

Hi John,

Below are responses to the follow-up WSJ inquiry.

Thanks,
Ashley

Q. In the June 2016 EPA document titled "Draft Protective Action Guide (PAG) for Drinking Water", on page 18 in Table 1, the agency gives DRLs for three Sr-90/Y-90, Cs-137 and I-131. Are the numbers in that chart with radioactive decay or without radioactive decay?

Response:

In its DRL calculation methodology EPA opted for a conservative approach which does not account for radioactive decay. Making the assumption of no radioactive decay and spreading the exposure for 1 year essentially results in a lower DRL concentration that would otherwise be obtained if radioactive decay was accounted for.

Q. Earlier this year, the EPA issued an emergency administrative order in connection with the drinking-water supply of Flint, Mich. It is my understanding that this action was in part prompted by concerns that the tap water in many homes in Flint exceeded the federal action level for lead of 15 ppb. It is also my understanding that many of those exceedances were in the range of 25 ppb and most were under 150 pbb. Some critics of the EPA's drinking-water PAGs for radioactive contaminants argue that the agency felt emergency action was needed in Flint when the level of a dangerous contaminant was roughly two to ten times above an action level. However, these critics say, the EPA in the PAGs is advocating allowing people to drink water for months or more that contain radioactive contaminants at levels hundreds or even thousands of times greater than the normal action levels. These critics argue that EPA seems to be much more vigorous in its protection of the public from lead than it is in its protection of the public from radiation. I'd like to get the EPA's response to such criticisms.

Response:

In Flint, the EPA issued an emergency order under SDWA 1431 in which the Administrator in a situation that is an "imminent and substantial endangerment to the health of persons, and that the appropriate State and local authorities have not acted to protect the health of persons, may take such actions as he may deem necessary in order to protect the health of such persons." Lead contamination was confirmed in the Flint water system and "EPA determined that the City of Flint's and the State of Michigan's responses to the drinking water crisis in Flint have been inadequate to protect public health and that these failures continue". For more information on the order go to:

https://www.epa.gov/sites/production/files/2016-01/documents/1_21_sdwa_1431_emergency_admin_order_012116.pdf

The drinking water Protective Action Guide is a health-based value that can be used in the event of an emergency to determine when alternative drinking water should be provided and the use of contaminated water supplies be restricted. The drinking water PAG are doses of radiation that should be avoided during an emergency event. They do not represent acceptable routine exposures. PAGs trigger safety measures—in this case, provision of alternative drinking water -- to keep doses to the public as low as possible during emergency situations only. Since this is only guidance, local decision makers may choose to implement the proposed PAGs or select a different level based on the needs and resources for the community.

To: Greene, Ashley[Greene.Ashley@epa.gov]
Cc: Harris, Adrienne[Harris.Adrienne@epa.gov]; Ruf, Christine[Ruf.Christine@epa.gov]
From: Gude, Karen
Sent: Mon 10/17/2016 8:10:18 PM
Subject: RE: Reminder and Request: Additional Transition Issue Paper Requests -- for Regulatory Information -- due 10/13 - 10/14
LCR Transition Paper_10_14_16 Gude edits 10-17-16.docx
LCR Transition Paper_10-17-16 clean.docx

Ashley,

My apologies to do this, but after re-reviewing the LCR paper, I think that not including LCR rule revisions in the paper will be considered a glaring omission by OP. Using the language from the draft LCR White Paper Roll Out plan (Travis cc'd me on a copy), I added brief text relating to the LCR rulemaking. The additions are highlighted in blue. (Note: to allow room, I deleted the specific results of the LCR implementation review by primacy agencies – shortening it to "challenged to implement them fully due to the large number of water systems, the complexity of the LCR provisions, and a lack of technical knowledge." If the deleted text is critical, please let me know.)

Please take a look and let me know if the revisions are acceptable --- It's fine to get back to me tomorrow…if more time is needed, please let me know. If there are questions/concerns, please let me know.

Thanks again

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

From: Harris, Adrienne
Sent: Monday, October 17, 2016 10:01 AM
To: Greene, Ashley <Greene.Ashley@epa.gov>; Gude, Karen <Gude.Karen@epa.gov>
Subject: RE: Reminder and Request: Additional Transition Issue Paper Requests -- for Regulatory Information -- due 10/13 - 10/14

Hi Karen,

Apologies if I misunderstood. I was under the impression a link to the Lead paper would be added for more information regarding the rule revisions, if needed.

Adrienne O. Harris
Sustainable Systems Team Leader

Office of Ground Water and Drinking Water
U.S. Environmental Protection Agency

Washington, DC

Office Phone: 202-250-8793

From: Greene, Ashley
Sent: Sunday, October 16, 2016 5:31 PM
To: Gude, Karen <Gude.Karen@epa.gov>
Cc: Harris, Adrienne <Harris.Adrienne@epa.gov>
Subject: RE: Reminder and Request: Additional Transition Issue Paper Requests -- for Regulatory Information -- due 10/13 - 10/14

Hi Karen,

The revisions to the Action Plan paper are fine. For the PAG paper, I am checking in with the relevant management to make sure they are comfortable with the edits and will let you know on Monday.

For the LCR paper, it was my understanding (and Adrienne was covering the transition papers at that time so copying her here) that the Lead transition paper would cover more of the upcoming revisions to the rule and the LCR paper would focus on current rule implementation

and oversight (as to not make them repetitive). As far as the White Paper, I'm not sure we knew the direction that was actually going to take (and somewhat still do not until it's actually released) so we did not include in current lead and LCR papers.

Please let me know if we misunderstood. I'm guessing we can just take language from the Lead paper and add it to the LCR paper if that's requested.

Thanks,
Ashley

From: Gude, Karen
Sent: Saturday, October 15, 2016 10:03 PM
To: Greene, Ashley <Greene.Ashley@epa.gov>
Subject: Re: Reminder and Request: Additional Transition Issue Paper Requests -- for Regulatory Information -- due 10/13 - 10/14

Ashley,

Hi. Attached are my proposed revisions to the PAGs and DWAP papers. For PAGs, I pulled additional background and context from the proposal FRN. For DWAP, I mostly just reorganized what you'd sent a bit, though I did edit the language on the actual plan a bit...If I'm mischaracterizing anything there, please let me know. I'll be sending drafts to Mike and Joel for review by COB Monday; I know that you'll be tied up with ASDWA, but if you have any feedback/info before then, please let me know.

Finally, on the LCR paper, just looking through it again, was there a reason that we focused solely on implementation of the current LCR, and didn't include info on the continued development of the LCR/soon to be released white paper? Just want to make sure I understand the thinking.

Thanks again for your help/work on these.

Karen

From: Greene, Ashley
Sent: Friday, October 14, 2016 8:00 AM
To: Gude, Karen
Subject: RE: Reminder and Request: Additional Transition Issue Paper Requests -- for Regulatory Information -- due 10/13 - 10/14

I almost got these to you by COB yesterday – hopefully 8am the next day counts!

From: Gude, Karen
Sent: Thursday, October 06, 2016 10:45 AM
To: Harris, Adrienne <Harris.Adrienne@epa.gov>; Greene, Ashley <Greene.Ashley@epa.gov>; Farris, Erika D. <Farris.Erika@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>
Cc: Ruf, Christine <Ruf.Christine@epa.gov>
Subject: RE: Reminder and Request: Additional Transition Issue Paper Requests -- for Regulatory Information -- due 10/13 - 10/14

And apologies to OGWDW! I forgot to also include the DWAP on the list of Round 2 Issue Papers due on 10/13-10/14. I included DWAP to the list below in redline text. This should be the full and final list of additional issue papers that are needed. Thanks again, and apologies for any confusion!

Karen

From: Gude, Karen
Sent: Thursday, October 06, 2016 10:25 AM

To: Harris, Adrienne <Harris.Adrienne@epa.gov>; Greene, Ashley <Greene.Ashley@epa.gov>; Farris, Erika D. <Farris.Erika@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>
Cc: Ruf, Christine <Ruf.Christine@epa.gov>
Subject: Reminder and Request: Additional Transition Issue Paper Requests -- for Regulatory Information -- due 10/13 - 10/14

Dear Special Assistants,

As you are helping to coordinate the reviews/drafts of the transition issue papers within your offices, I wanted to send a quick reminder that the Round 2 (and final round!) of the draft transition issue paper will be due to me next week.

As a reminder, the papers include:

- **Drinking Water Action Plan (OGWDW)**
- **Drinking Water PAG (OGWDW)**
- **Lead and Copper Rule (OGWDW)**
- **Fees for Water Infrastructure Project Applications under WIFIA (OWM)**
- **Water Quality Standards for Indian Country and in Individual States (OST**)

We recently had a few program offices indicate that they would like to collaborate on (i.e., review and comment on) two of our upcoming draft issue papers:

- **Lead and Copper Rule (OGWDW) –** Both ORD and OECA have requested review/comment.
- **Water Quality Standards for Indian Country and in Individual States (OST**) – OITA has requested review/comment.

Given that I'll need to build a little extra time in the review schedule to accommodate their review, **I wanted to see if it might be possible to get these two draft papers a day early – So, by COB Thursday, 10/13, rather than Friday**, to help facilitate this review. If this won't be possible, and the additional time will be needed, please let me know.

If there are any questions/concerns, please let me know. And thanks again for all of your help!

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

From: Gude, Karen
Sent: Tuesday, September 27, 2016 3:04 PM
To: Grevatt, Peter <Grevatt.Peter@epa.gov>; Southerland, Elizabeth <Southerland.Elizabeth@epa.gov>; Sawyers, Andrew <Sawyers.Andrew@epa.gov>
Cc: Osegueda, Carlos <Osegueda.Carlos@epa.gov>; Lape, Jeff <lape.jeff@epa.gov>; Frace, Sheila <Frace.Sheila@epa.gov>; Greene, Ashley <Greene.Ashley@epa.gov>; Harris, Adrienne <Harris.Adrienne@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>; Farris, Erika D. <Farris.Erika@epa.gov>; Beauvais, Joel <Beauvais.Joel@epa.gov>; Shapiro, Mike <Shapiro.Mike@epa.gov>; Gilinsky, Ellen <Gilinsky.Ellen@epa.gov>; Campbell, Ann <Campbell.Ann@epa.gov>; Ruf, Christine <Ruf.Christine@epa.gov>; Evalenko, Sandy <Evalenko.Sandy@epa.gov>; Arrigoni, Holly <Arrigoni.Holly@epa.gov>; Macara Lousberg <Lousberg.Macara@epa.gov>
Subject: Additional Transition Issue Paper Requests -- for Regulatory Information -- due 10/14

Peter, Betsy, and Andrew,

In addition to the initial call for transition issue papers that I sent out last week, OP has requested that an additional set of transition issue papers be developed on several key regulatory actions. As noted below, these actions are:

- **Drinking Water PAG (OGWDW)**
- **Lead and Copper Rule (OGWDW)**
- **Fees for Water Infrastructure Project Applications under WIFIA (OWM)**

- **Water Quality Standards for Indian Country and in Individual States (OST)**

As noted below, for the actions where your office is the lead, please:

- By COB October 14, prepare a brief 1-2 page write-up of the regulatory, using the attached template (It's the same template used for the previous transition issue paper request.)

and email the draft to me for Mike/Joel's review.

- Per Shannon's direction, for Drinking Water PAG, because the rule is scheduled to be finalized before Inauguration Day, please share only public information. For those with activity in the first 100 days after Inauguration Day, please be more forthcoming about the choices that may be available to the incoming Administration.

If you should have any questions, please let me know.

Thank you,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

From: Kenny, Shannon
Sent: Monday, September 26, 2016 6:27 PM
To: Shaw, Betsy <Shaw.Betsy@epa.gov>; Shapiro, Mike <Shapiro.Mike@epa.gov>; Breen, Barry <Breen.Barry@epa.gov>; Wise, Louise <Wise.Louise@epa.gov>
Cc: 2016OPTransitionTeam <2016OPTransitionTeam@epa.gov>; Lewis, Josh <Lewis.Josh@epa.gov>; Bergman, Shawna <Bergman.Shawna@epa.gov>; Gude, Karen <Gude.Karen@epa.gov>
Subject: Rule Information for the Transition

Betsy, Barry, Mike, and Louise,

As one of the final steps in our transition preparation, I ask that your offices prepare 1-2 page write-ups by October 18 on some of the key regulatory actions in the queue.

I have divided the regulatory actions into two sets -- those that will be proposed or finalized before Inauguration Day, and those where major rule development activity will likely occur in the first 100 days of the new Administration.

For the set of rules that will be proposed or finalized before Inauguration Day, please share only public information. I realize the extra sensitivity surrounding these actions. For those with activity in the first 100 days after Inauguration Day, please be more forthcoming about the choices that may be available to the incoming Administration.

As time goes on, it may be that rules shift from the first list to the second. For example, if a rule is proposed in December, the initial write up could be revised in January to talk in more detail about the proposal and possible options for finalization. We can easily make updates in the electronic system as needed.

We will use the Agency's regulatory tracking system, ADP Tracker, to provide key milestone dates to the landing team and the incoming Administration, so I ask that you please ensure all dates in that system are kept up-to-date.

The two lists are below, and we ask that write-ups follow the same template as other issue papers. I should also note that key regulatory actions related to broader policy issues, such as CPP, RFS, and TSCA, will be covered as part of the issue papers devoted to those topics, so I did not include them on the lists below.

Thank you,

Shannon

Key Regulatory Actions:

Rules projected to be proposed or finalized before Inauguration

Rule	Lead Author
TCE use in Dry Cleaning and Aerosol Degreasing	OCSPP
TCE use in Vapor Degreasing	OCSPP
NMP and Methylene Chloride	OCSPP
PCBs in light ballasts in schools and daycares	OCSPP
CERCLA 108(b) rule and additional classes notice	OLEM
Risk Management Modernization	OLEM
Drinking Water PAG	OW

Rules with major development activity likely in the first 100 days

Rule	Lead Author
GHG emissions from aircraft	OAR
Endangerment finding for leaded aviation gas	OAR
Renewables Enhancement and Growth Support Rule	OAR
Lead and Copper Rule	OW
Fees for Water Infrastructure Project Applications under WIFIA	OW
Water Quality Standards for Indian Country and in individual States	OW
Lead RRP Public and Commercial Buildings	OCSPP

December 13, 2016

The Honorable Gina McCarthy (McCarthy.Gina@epa.gov) Administrator United States Environmental Protection Agency William Jefferson Clinton Building 1200 Pennsylvania Avenue, N.W. Mail Code 1101A Washington, D.C. 20460	Dr. Carmine F. Vasile, B.S.E.E., M.S. & Ph.D. Electrophysics 60 Herbert Circle Patchogue, NY 11772 631-807-7839

Objection

Re: Draft Protective Action Guides for Radionuclides in Drinking Water

(Docket Number (EPA-HQ-OAR-2007-0268; FRL-9947-55-OW) FR 81:112 page 37589-37592, June 10, 2016)

Hon. Gina McCarthy & PEER Members ***Listed in the July 25, 2016 letter to the EPA @***

www.peer.org/assets/docs/7-26-63OrganizationsPAGsComments.pdf

In support of PEER's comments, I hereby object to your Agency's PAG notice as published in the 6/10/16 Federal Register with this false claim: " ***The proposed PAG is designed to work in concert with the other Protective Action Guides currently in place for other media in the intermediate phase (i.e., the Food and Drug Administration's 500 mrem PAG for ingestion of food) and provides an additional level of protection for the most sensitive life stages.***"

First, the FDA has no Alpha, Beta or Gamma MCLs for bottled radioactive water or beverages.

Second, as illustrated in Exhibit A, your Agency's ***Sum-of-the-Fractions*** method indicates doses to teenagers & adults will exceed **500 mrem/yr** if they drink only 2 liters/day of water containing a fraction of the p roposed PAG concentrations for Sr-90, I-131, Cs-137 . In fact, if their decay products are included, the dose to tho usands of people could exceed the current MCL of **4 mrem/yr** by over **18,320 mrem/yr (0.183 Sv/yr)**, as illustrated in Table I.

Table I: Sum-of-the-Fractions Method Indicates Worst Case Doses Can Exceed 500 mrem/yr (5 mSv/yr)

Emitter	(X) Proposed PAG Concertration (pCi/L)	(Y) Dose Conversion Factor (pCi/4mrem)	(X/Y = A) Calculated Fraction	(A*4) Calculated Total mrem	Half-Life
Stronyium-90 (Sr-90)	7,400	8	925	3,700	28.79 yr
Yttrium-90 (Y-90)	7,400 (T>20 days)	60	123.3	493.2	2.761 d
Iodine-131 (I-131)	10,350	3	3,450	13,800	8.023 d
Xenon-131m (Xn-131m)	75.5 (T=10 days)	n/a	n/a	n/a	11.93 d
Cesium-137 (Cs-137)	16,570	200	82.85	331.4	30.04 yr
Barium-137m (Ba-137m)	15,642 (T>20 min)	n/a	n/a	n/a	2.552 min
		Sum-of-the-Fractions	**>4,581**	**>18,324**	**>183.24 mSv/yr**
Gross Beta	**57,438 pCi/L**	**MCL Exceedance**		**>18,320 mrem/yr**	**>183.2 mSv/yr**

NY State Officials Cannot Be Trusted

Contrary to EPA-propaga nda cited in Footnote # **1**, my water quality reports indicate corrupt NY State officials cannot be trusted to use the Sum-of-the Fractions Method [2] in the event of an emergency to determine when alternative drinking water should be provided and the use of contaminated w ater supplies should be re stricted. Consequently, thousands of men, women & children could be ingesting atomic-energy doses far in excess of **500 mrem/yr**. Exhibits A-I indicate the proponents of this heinous scam failed to use mode rn analysis tools like Nucleonica to estimate radiation doses delivered by 2 liters per day of water that may contain d ozens of fission products in addition to dozens of naturally occurring radionuclides having no proposed PAG values, as discussed in the pending PEER lawsuit cited in Footnote **#3**.

Many corrupt state & county health departments, including mine, have never imposed the Sum-of-the-Fractions method on any public water company, despite numerous complaints to EPA, state & county officials.

Fraudulent Use of EPA Method 900 Alters Test Samples To Suppress In-growth

Water quality reports @ www.scwa.com, www.gfxtechnology.com/Radon.html, www.gfxtechnology.com/SCL.pdf, www.gfxtechnology.com/CCE.pdf contain false Gross Alpha & Gross Beta t est results obtained by EPA Met hod 900, which can suppress in-growth of decay products from both man-made & n aturally occurring radionuc lides dissolved in tap or bottled water. For example, as shown in the enclosed graphs for Cs-137 & Sr-90, total activit y quickly exceeds the initial activity of either a parent after being dissolved in water. (See other graphs @ www.gfxtechnology.com/1-Ci.pdf)

Therefore, you must reject the proposed PAGs and add MCLs for Radon gases to the Safe Drinking Water Act as Congress ordered decades ago. [***Radon in Drinking Water Rule***, Federal Register on November 2, 1999 (64 FR 59246)]

Yours truly,

Dr. Carmine F. Vasile

---

[1] **At what point and what concentrations will I be told to stop drinking tap water during a radiological emergency?**

State and local officials will make decisions about continued use of tap water based upon the conditions on-site during a radiological emergency. The proposed drinking water PAG provides information they will consider, including two scientifically-based levels to be avoided (100 mrem for infants, children aged 15 and under, pregnant women and nursing women; 500 mrem for anyone over age 15 excluding pregnant women and nursing women) for periods up to one year. Since this is only guidance, the levels selected by your state or local officials will depend on the type and severity of the incident.You may not be instructed to stop drinking tap water. Your water department—in coordination with state/local officials and emergency managers—may choose to either use water from storage tanks that have not been impacted by radiation, purchase water from a neighboring town, transport water in tanker trucks or provide [unregulated, radioactive] bottled water to the community. (From: https://www.epa.gov/radiation/proposed-drinking-water-protective-action-guide-paq-radiological-emergencies-information)

[2] **See EPA ILLUSTRATION II-1 "Conversion of Beta Particle and Photon Emitters" @** https://nepis.epa.gov/Exe/ZyPDF.cgi/P1009DJN.PDF?Dockey=P1009DJN.PDF .

[3] **See PEER Lawsuit @** http://www.peer.org/assets/docs/epa/10_24_16_Complaint_EPA-radionuclides.pdf .

Exhibit A: Erroneous example of "Sum-of-the-Fractions" method mandated by the EPAs Radionuclides Rule to determine if a public water system is in compliance with the 4 mrem/yr MCL for beta particle and photon radioactivity (40 CFR 141.66(d))[4,5].

ILLUSTRATION II-1
Conversion of Beta Particle and Photon Emitters

A water system near a nuclear power facility collects a sample which the laboratory speciates by EPA method 902.0 (gamma spectrometry analysis). The laboratory also analyses for strontium-90 using EPA method 905.0. The analysis indicates the following:

Cesium-134 (Cs-134): 5,023 pCi/L
Cesium-137 (Cs-137): 30 pCi/L
Strontium-90 (Sr-90): 4 pCi/L
Iodine-131 (I-131): 2 pCi/L

To determine compliance the following calculations are completed:

Emitter	(X) Lab Analysis (pCi/L)	(Y) Conversion from table (pCi/4mrem)	(X/Y=A) Calculated Fraction[1]	(A*4) Calculated Total mrem[2]
Cs-134	5,023	20,000	0.25115	
I-131	2	3	0.7	
Cs-137	30	200	0.150	
Sr-90	4	8	0.5	
		Sum-of-the-fractions	1.60115	7

[1] To ensure accuracy, the results were rounded to the number of figures in the conversion table. See Appendix I.
[2] Since data reported to the State or EPA should be in a form containing the same number of significant digits as the MCL, the results were rounded to one significant digit. The last significant digit was increased by one unit if the digit dropped was a 5, 6, 7, 8, or 9; and was not altered if the preceding number was a 0, 1, 2, 3, or 4.

The system is in violation of the MCL because the "sum-of-the-fractions" is 7 mrem, which means that the sum of the annual dose equivalent to the total body, or to any internal organ, exceeds 4 mrems/year.

From: EPA Implementation Guidance for Radionuclides, Page II-2 @ https://nepis.epa.gov/Exe/ZyPDF.cgi/P1009DJN.PDF?Dockey=P1009DJN.PDF

Exhibit B. Corrected version of Table A using Cs-134m; parent of Cs-134.

Emitter	(X) Lab Analysis (pCi/L)	(Y) Conversion from Table (pCi/4mrem)	(X/Y = A) Calculated Fraction	(A*4) Calculated Total mrem	Half-Life
Cs-134m	5,023	20,000	0.25115		2.908 hr
I-131	2	3	0.7		8.023 d
Cs-137	30	200	0.15		30.04 yr
Sr-90	4	8	0.5		28.79 yr
		Sum-of-the-Fractions	1.6015	**7**	**.07 mSv/yr**
Gross Beta	**5,059 pCi/L**	**MCL Exceedance**		**3 mrem/yr**	**0.03 mSv/yr**

[4] To determine compliance, each beta and photon emitter must be converted from pCi/L to millirems using the conversion tables listed in "***Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air or Water for Occupational Exposure***" [National Bureau of Standards (NBS) Handbook 69 as amended August, 1963, U.S. Department of Commerce and/or ***Radionuclides in Drinking Water: A Small Entity Compliance Guide***; pg 13 @ https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=20001ZIN.txt]
ff

[5] Each Curie of ingested Alpha radiation delivers 20 times the atomic energy of a Curie of Beta or Photon radiation. One Joule per Kilogram = 1 Sievert (Sv) = 100 Rem
ff

Exhibit C. Modified version of Table B including time-dependant radioactive decay products.*

Parent Emitter	Lab Analysis of Parents (pCi/L)	Radioactive Decay Products	Calculated Fraction of Parent Activity Using Nucleonica
Cs-134m	5,023	Cs-134	1.58e-3 (after 10 hours of in-growth)
I-131	2	Xn-131m gas	7.29e-3 (after 10 days of in-growth)
Cs-137	30	Ba-137m	0.944 (after 20 min of in-growth)
Sr-90	4	Y-90	1.00 (after 20 days of in-growth)

Emitter	(X) Lab & Nucleonica Analysis (pCi/L)	(Y) Conversion from Table (pCi/4mrem)	(X/Y = A) Calculated Fraction	(A*4) Calculated Total mrem	Half-Life
Cs-134m	5,023	20,000	0.25115		2.908hr
Cs-134	7.94 (T=10 hr)	80	0.09925	0.397	2.065 yr
I-131	2	3	0.7		8.023 d
Xn-131m	0.0146 (T=10 days)	n/a	n/a	n/a	11.93 d
Cs-137	30	200	0.15		30.04 yr
Ba-137m	28.3 (T>20 min)	n/a	n/a	n/a	2.552 min
Sr-90	4	8	0.5		28.79 yr
Y-90	4 (T>20 days)	60	0.0667	0.2668	2.761 d
		Sum-of-the-Fractions	**>2.26495**	**>9**	**>0.09 mSv/yr**
Gross Beta	**5,071 pCi/L**	**MCL Exceedance**		**>9 mrem/yr**	**>0.09 mSv/yr**

* Decay product Activity & Half-Life values from tables @ www.gfxtechnology.com/1-Ci.pdf.

Exhibit D. Modified version of Table C corresponding to Water-PAG concentrations proposed by President Obama for I-131, Cs-137 & Sr-90, which excluded ingested radiation doses from their highly radioactive decay products: Xn-131m, Ba-137m & Y-90, respectively.

Emitter	Lab Analysis (pCi/L)	Radioactive Decay Products	Calculated Fraction of Parent Activity Using Nucleonica
Cs-134	5,023	None	n/a
I-131	10,350	Xn-131m gas	0.64e-3 (after 1 day of in-growth) 7.29e-3 (after 10 days of in-growth)
Cs-137	16,370	Ba-137m	0.944 (after 20 min of in-growth)
Sr-90	7,400	Y-90	1.00 (after 20 days of in-growth)

Emitter	(X) Lab Analysis (pCi/L)	(Y) Conversion from Table (pCi/4mrem)	(X/Y = A) Calculated Fraction	(A*4) Calculated Total mrem	Half-Life
Cs-134	n/a	20,000	n/a		2.908 hr
Cs-134m	n/a	80	n/a		2.065 yr
I-131	10,350	3	3,450		8.023 d
Xn-131m	75.5 (T=10 days)	n/a	n/a		11.93 d
Cs-137	16,570	200	82.85		30.04 yr
Ba-137m	15,642 (T>20 min)	n/a	n/a		2.552 min
Sr-90	7,400	8	925		28.79 yr
Y-90	7,400 (T>20 days)	60	123.3		2.761 d
		Sum-of-the-Fractions	**>4,581**	**>18,324**	**>183.24 mSv/yr**
Gross Beta	**57,438 pCi/L**	**MCL Exceedance**		**>18,320 mrem/yr**	**>183.2 mSv/yr**

Exhibit E. Nucleonica Analysis of 1-Ci of Sr-90

Nucleonica Results @ 20 Days Table A: Total & Beta Activity corresponding to Table D, Figs. 3 & 4		
Curve	Name	Activity (Ci)
	38 Sr90	0.9987
	39 Y90	0.9937
	40 Zr90 Stable	0
	Total:	1.992

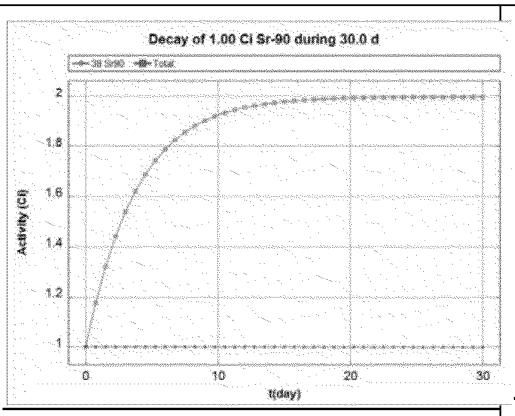


Fig. 2 Total Radioactivity produced by 1 Curie of Sr-90, a Beta Emitter; 0 to 30 days.

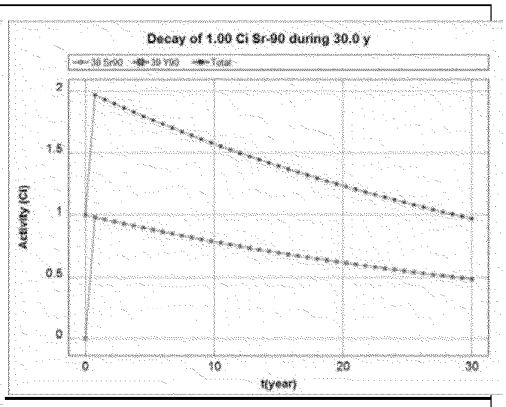


Fig. 3 Beta activity produced by 1 Curie of Sr-90; 0 to 30 years (1/2-Life = 27.9).

Table B: Radioactivity & atomic energy from 1-Curie of 30-day old Sr-90

ID	Nuclides	Half-Life	Decay Modes	N (Atoms)	Mass (g)	Mass Fractions	A (Ci)	A/ Aparent	A_α (Ci)	$A_{\beta\square}$ (Ci)	Energy (J)
1	38 Sr90	28.79 y	β-	4.84e+19	7.23e-3	0.998	0.998	1.00	0	0.998	8.38e+3
2	39 Y90	2.671 d	β-	1.23e+16	1.84e-6	2.53e-4	0.998	1.00	0	0.998	3.05e+4
3	40 Zr90	Stable		8.35e+16	1.25e-5	1.72e-3	0	0	0	0	0
	Total: 3			**4.85e+19**	**7.24e-3**	**1.00**	**1.99**	**2.00**	**0**	**1.99**	**3.89e+4**

Exhibit F. Nucleonica Analysis of 1-Ci of I-131

Nucleonica Results @ 12 hr Table A: Total & Beta Activity corresponding to Table B, Figs. 1 & 2		
Curve	Name	Activity (Ci)
	53 I131	0.9615
	54 Xe131 Stable	0
	54 Xe131 m	2.772e-4
	Total:	0.9618

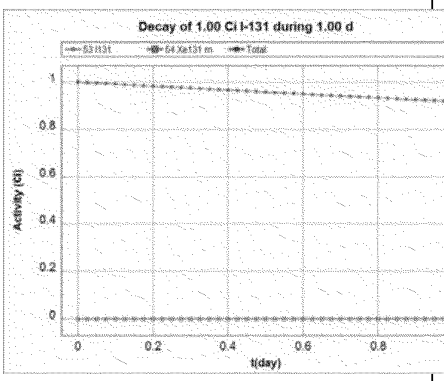
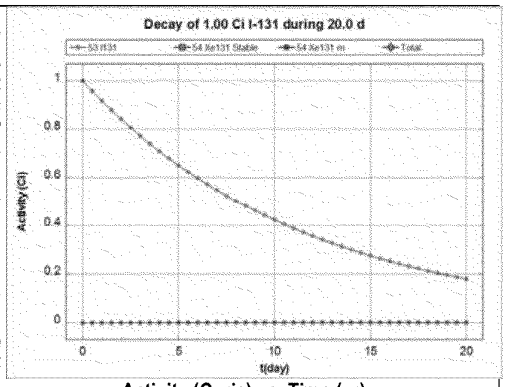


Fig. 1 Total Radioactivity produced by 1 Curie of I-131, a Beta Emitter; 0 to 1 day.



Activity (Curie) vs. Time (yr)

Fig. 2 Beta activity produced by 1 Curie of Cs-134; 0 to 20 day (1/2-Life = 8.0233 day).

Table B: Radioactivity & atomic energy 1-Curie of 1 day old I-131

ID	Nuclides	Half-Life	Decay Modes	N (Atoms)	Mass (g)	Mass Fractions	A (Ci)	A/ Aparent	A_α (Ci)	$A_{\beta\square}$ (Ci)	Energy (J)
1	53 I131	8.0233 d	β-; β-	3.39e+16	7.38e-6	0.918	0.917	1.00	0	0.917	475
2	54 Xe131	Stable		3.03e+15	6.59e-7	0.0819	0	0	0	0	0
3	54 Xe131 m	11.930 d	IT	3.23e+13	7.02e-9	8.73e-4	5.87e-4	6.40e-4	0	0	0.0253
	Total: 3			**3.70e+16**	**8.04e-6**	**1.00**	**0.919**	**1.00**	**0**	**0.916**	**476**

Exhibit G. Nucleonica Analysis of 1-Ci of Cs-134m

Nucleonica Results @ 1/2 hr Table A: Total & Beta Activity corresponding to Table B, Figs. 1 & 2		
Curve	Name	Activity (Ci)
	55 Cs134 m	0.8875
	55 Cs134	1.808e-5
	Total:	0.8875

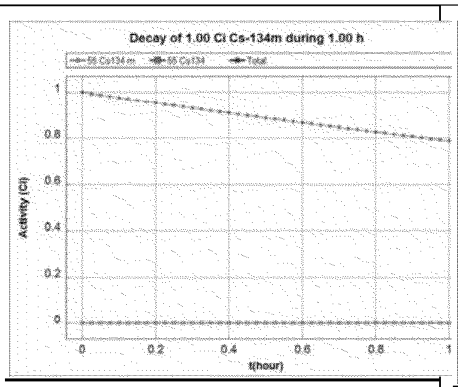


Fig. 1 Total Radioactivity produced by 1 Curie of Cs-134m, a Beta Emitter; 0 to 1 Hour.

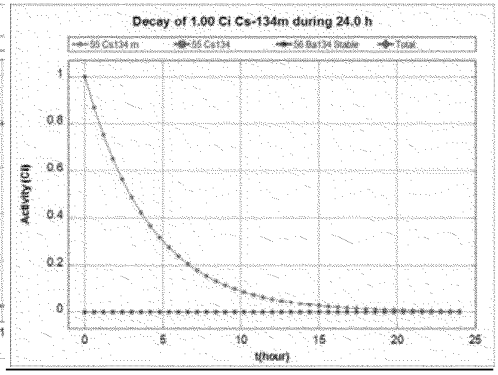


Fig. 2 Beta activity produced by 1 Curie of Cs-134m; 0 to 1 day (1/2-Life = 2.908 hr).

Table B: Radioactivity & atomic energy 1-Curie of 1 day old Cs-134m.

ID	Nuclides	Half-Life	Decay Modes	N (Atoms)	Mass (g)	Mass Fractions	A (Ci)	A/ Aparent	A_α (Ci)	$A_{\beta\square}$ (Ci)	Energy (J)
1	55 Cs134 m	2.908 h	IT	1.83e+12	4.07e-10	3.28e-3	3.28e-3	1.00	0	0	12.4
2	55 Cs134	2.0651 y	β-; ec	5.57e+14	1.24e-7	0.998	1.60e-4	0.0488	0	1.60e-4	0.140
3	56 Ba134 Stable	Stable		4.24e+11	9.43e-11	7.60e-4	0	0	0	0	0
	Total: 3			**5.59e+14**	**1.24e-7**	**1.00**	**3.43e-3**	**1.05**	**0**	**1.60e-4**	**12.5**

Exhibit H. Nucleonica Analysis of 1-Ci of Cs-134

Nucleonica Results @ 12 hr Table A: Total & Beta Activity corresponding to Table B, Figs. 1 & 2		
Curve	Name	Activity (Ci)
	55 Cs134	0.9995
	56 Ba134 Stable	0
	Total:	0.9995

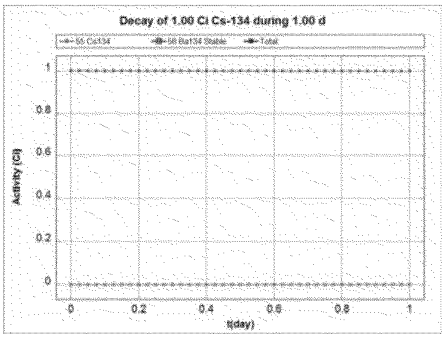
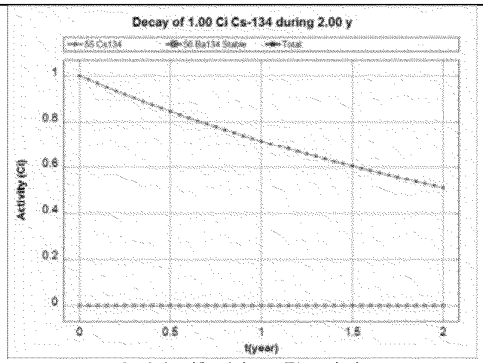


Fig. 1 Total Radioactivity produced by 1 Curie of Cs-134, a Beta Emitter; 0 to 1 day.



Activity (Curie) vs. Time (yr)

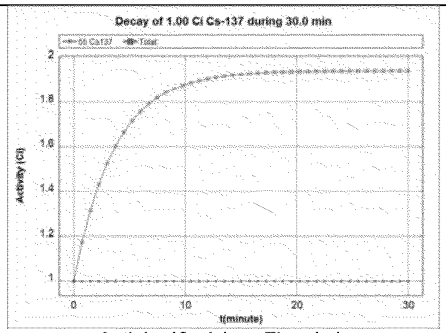
Fig. 2 Beta activity produced by 1 Curie of Cs-134; 0 to 2 yr (1/2-Life = 2.065 yr).

Table B: Radioactivity & atomic energy 1-Curie of 1 day old Cs-134.

ID	Nuclides	Half-Life	Decay Modes	N (Atoms)	Mass (g)	Mass Fractions	A (Ci)	A/ Aparent	A_α (Ci)	$A_{\beta\square}$ (Ci)	Energy (J)
1	55 Cs134	2.0651 y	β-; ec	3.48e+18	7.73e-4	0.998	0.999	1.00	0	0.999	1.05e+3
2	56 Ba134	Stable		3.20e+15	7.10e-7	9.18e-4	0	0	0	0	0
	Total: 2			**3.48e+18**	**7.74e-4**	**1.00**	**1.00**	**1.00**	**0**	**1.00**	**1.05e+3**

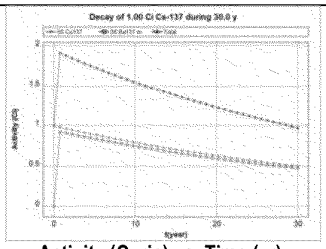
Exhibit I. Nucleonica Analysis of 1-Ci of Cs-137

Nucleonica Results @ 20 Minutes		
Table A: Total & Beta Acctivity corresponding to Table B, Figs. 1 & 2		
Curve	Name	Activity (Ci)
	55 Cs137	1.000
	56 Ba137 m	0.9398
	56 Ba137 Stable	0
	Total:	1.940



Activity (Curie) vs. Time (yr)

Fig. 1 Total Radioactivity produced by 1 Curie of Cs-137, a Beta Emitter; 0 to 30 minutes (1/2-Life = 30.03 yr).



Activity (Curie) vs. Time (yr)

Fig. 2 Beta activity produced by 1 Curie of Cs-137; 0 to 30 yr (1/2-Life = 30.03 yr).

Table B: Radioactivity & atomic energy 1-Curie of 30-minute old C-137

ID	Nuclides	Half-Life	Decay Modes	N (Atoms)	Mass (g)	Mass Fractions	A (Ci)	A/ Aparent	A_α (Ci)	A_β (Ci)	Energy (J)
1	55 Cs137	30.04 y	β-; β-	5.06e+19	0.0115	1.00	1.00	1.00	0	1.00	5.88
2	56 Ba137 m	2.552 m	IT	7.71e+12	1.75e-9	1.52e-7	0.944	0.944	0	0	5.85
3	56 Ba137	Stable		5.89e+13	1.34e-8	1.16e-6	0	0	0	0	0
	Total: 3			**5.06e+19**	**0.0115**	**1.00**	**1.94**	**1.94**	**0**	**1.00**	**11.7**

Table C: Falsified Gross Beta test results from the 2002 Water Quality Report; Table 31 @ http://www.gfxtechnology.com/Radon.html [1] [2]

Component	Low Value	High Value	Avg. Value	Number of Tests
Gross Alpha Activity pci/l	ND	1.5	ND	9
Gross Beta Activity pci/l	ND	2.0	ND	9
Cesium-137 pci/l	ND	10.1	ND	9
Lead-210 pci/l	ND	ND	ND	9
Radon	NA	NA	NA	0

Table C: The excerpt below is from the 2003 water quality report by the Suffolk County Water Authority (SCWA) and shows 232 pCi/L Alpha activity from Radon-222, but only 4.0 pCi/L Alpha activity from Rn-222, Po-210, Po-214 & Po-218 & only 5.1 pCi/L of of Gross Beta from 10.1 pCi/L of Cs-137 & 1,080 pCi/L of Lead-210, which emit a total of 2,160 pCi/L of Gross Beta & 1,080 of Polonium-210; far above is MCL.

Distribution Area 20

Radioactivity	Range of Readings Low Value	High Value	Avg. Value	No. of Tests
Gross Alpha activity pCi/l	ND	4.0	ND	59
Gross Beta activity pCi/l	ND	5.1	ND	59
Cesium-137 pCi/l	ND	10.1	ND	53
Lead-210 pCi/l	ND	1080	20.8	53
Radon pCi/l	ND	232	ND	50

NOTES

[1] Tables A & Fig. 1 indicate the total Beta Activity produced by one Curie of Cs-137 grows to 1.94 Curies in less than 20 minutes after being dissolved in water. Table B & Fig. 2 show it takes about 30 years for the total Beta activity to reach the initial activity of Cs-137. Therefore the Gross Beta activity reported by the SCWA should have been 1.94 x 10.1 = 19.6 pCi/L not 2.0 pCi/L.

[2] The SCWA's RAILROAD AVE well field is located south of the BNL & Grumman Superfund sites. It had 2 wells ##S-32359, S-81473 located in Center Moriches in 2001; SCWA Distribution Area # 20 in 2002 serving: Mastic, Mastic Beach, Moriches, North Shirley, Ridge, Shoreham, South Manor, South Ridge & Westhampton Beach with radioactive water.

To: Greene, Ashley[Greene.Ashley@epa.gov]
From: Flaharty, Stephanie
Sent: Fri 11/18/2016 3:50:31 PM
Subject: FW: PAGs DW draft FRN
FRN EPA Drinking Water PAG 11-15-16.sf.docm
Public Comments Draft DW PAG_v3 11-10-16 - Comments (002).docx
FRN EPA Drinking Water PAG 11-14-16_w OCG comments.docx

Ashley,

I'm [Ex. 6 - Personal Privacy]. If Peter signs-off on this, please deliver the folder to Wanda Fields in OW.

Thanks,

Steph

From: Flaharty, Stephanie
Sent: Thursday, November 17, 2016 7:01 AM
To: Grevatt, Peter <Grevatt.Peter@epa.gov>
Cc: Greene, Ashley <Greene.Ashley@epa.gov>
Subject: PAGs DW draft FRN

Peter,

I'm passing to you this morning, the attached draft PAGs FRN, which announces the release of the drinking water section. With your approval, the draft will be sent to Joel for approval to move to OP/OMB for review as requested.

I've attached (FYI) an FRN markup that reflects changes to the notice in response to comments by OGC.

Also attached is the draft response to public comments document, which reflects OGC's

comments.

We have received concurrence from OGC on these drafts.

Thanks,

Steph

6560-50-P

ENVIRONMENTAL PROTECTION AGENCY

[EPA-HQ-OAR-2007-0268; FRL -]

Revision to the PAG Manual: Protective Action Guide (PAG) for Drinking Water after a Radiological Incident

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of document availability.

SUMMARY: As part of its mission to protect human health and the environment, the U.S. Environmental Protection Agency publishes protective action guides to help federal, state, local and tribal emergency response officials make radiation protection decisions during emergencies. EPA, in coordination with a multi-agency working group within the Federal Radiological Preparedness Coordinating Committee, recently updated its guidance manual on this topic, titled "Protective Action Guides and Planning Guidance for Radiological Incidents" (2016 PAG Manual). In this notice, EPA is announcing that it has amended the Intermediate Phase Protective Action Guides Chapter of the 2016 PAG Manual to incorporate guidance for radiation protection decisions concerning drinking water. The revised PAG Manual is now available at www.regulations.gov, under ID No. EPA-HQ-OAR-2007-0268.

DATES: The revised PAG Manual is available for use upon publication of this Notice in the Federal Register.

FOR FURTHER INFORMATION CONTACT: Samuel Hernandez, Standards and Risk Management Division, Office of Ground Water and Drinking Water, Mail Code 4607M, U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue NW, Washington, DC 20460; telephone number: (202) 564-1735; E-mail: hernandez.samuel@epa.gov.

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SUPPLEMENTARY INFORMATION:

A. How can I get copies of the PAG Manual and supporting information?

Docket: All documents in the docket are listed in the www.regulations.gov index. Although listed in the index, some information is not publicly available, e.g., CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy. The EPA has established a docket for this action under Docket ID No. EPA-HQ-OAR-2007-0268. Publicly available docket materials are available either electronically through www.regulations.gov or in hard copy at the Air and Radiation Docket in the EPA Docket Center, (EPA/DC) EPA West, Room 3334, 1301 Constitution Ave., NW, Washington, DC 20004. The EPA Docket Center Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566-1744 and the telephone number for the Air and Radiation Docket is (202) 566-1742. In accordance with normal EPA docket procedures, if copies of any docket materials are requested, a reasonable fee may be charged for photocopying.

Electronic access: The PAG Manual in electronic form suitable for printing, as well as related guidelines and further information, can be found on the PAGs web page at http://www.epa.gov/radiation/protective-action-guides-pags.

B. What authority does EPA have to provide Protective Action Guidance?

The historical and legal basis of EPA's role in the PAG Manual begins with Reorganization Plan No. 3 of 1970, in which the Administrator of the EPA assumed all the functions of the Federal Radiation Council (FRC), including the charge to "…advise the President with respect to radiation matters, directly or indirectly affecting health, including guidance for all federal

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agencies in the formulation of radiation standards and in the establishment and execution of programs of cooperation with [s]tates." (Reorg. Plan No. 3 of 1970, sec. 2(a) (7), 6(a) (2); § 274.h of the Atomic Energy Act of 1954, as amended (AEA), codified at 42 U.S.C. § 2021(h)). Recognizing this role, the Federal Emergency Management Agency (FEMA) directed EPA, in its Radiological Emergency Planning and Preparedness Regulations, to "establish Protective Action Guides (PAGs) for all aspects of radiological emergency planning in coordination with appropriate federal agencies." (44 CFR 351.22(a)). FEMA also tasked EPA with preparing "guidance for state and local governments on implementing PAGs, including recommendations on protective actions which can be taken to mitigate the potential radiation dose to the population." (44 CFR 351.22(b)). All of this information was to "be presented in the Environmental Protection Agency (EPA) 'Manual of Protective Action Guides and Protective Actions for Nuclear Incidents.'" (44 CFR 351.22(b)).

Additionally, section 2021(h) charged the Administrator with performing "such other functions as the President may assign to him [or her] by Executive Order." Executive Order 12656 states that the Administrator shall "[d]evelop, for national security emergencies, guidance on acceptable emergency levels of nuclear radiation…." (Executive Order No. 12656, sec. 1601(2)). EPA's role in PAGs development was recognized by the National Response Framework, Nuclear/Radiological Incident Annex of June 2008.

C. What is the PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents?

The PAG Manual provides federal, state and local emergency management officials with guidance for responding to radiological emergencies. A protective action guide (PAG) is the projected dose to an individual from a release of radioactive material at which a specific

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protective action to reduce or avoid that dose is recommended. Emergency management officials use PAGs for making decisions regarding actions to protect the public from exposure to radiation during an emergency. Such actions include, but are not limited to, evacuation, shelter-in-place, temporary relocation and food restrictions.

Development of the PAGs was based on the following essential principles, which also apply to the selection of any protective action during an incident:

- Prevent acute effects.
- Balance protection with other important factors and ensure that actions result in more benefit than harm.
- Reduce risk of chronic effects.

The PAG Manual is not a legally binding regulation or standard and does not supersede any environmental laws. This guidance does not address or impact site cleanups occurring under other statutory authorities such as the EPA's Superfund program, the Nuclear Regulatory Commission's (NRC) decommissioning program, or other federal or state cleanup programs. As indicated by the use of non-mandatory language such as "may," "should" and "can," the PAG Manual only provides recommendations and does not confer any legal rights or impose any legally binding requirements upon any member of the public, states or any other federal agency. Rather, the PAG Manual recommends projected radiation doses at which specific actions may be warranted in order to reduce or avoid that dose. The PAG Manual is designed to provide flexibility to be more or less restrictive as deemed appropriate by decision makers based on the unique characteristics of the incident and the local situation.

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D. How did EPA respond to public comments on the proposed Draft Protective Action Guide for Drinking Water?

On June 10, 2016, EPA published a Federal Register notice requesting public comments on the proposed drinking water PAG and the guidance for advance planning (81 FR 37589). EPA sought specific comments and feedback on the appropriateness of the drinking water PAG and possible implementation challenges associated with the two-tiered approach. In addition, EPA asked whether a single-tier drinking water PAG should be considered rather than using the tiered approach.

In response, the Agency received over 60,000 comment letters from members of the public, state and local emergency response and health organizations, environmental advocates, industry associations and other stakeholders. Most of the comment letters expressed concerns with the proposal. Commenters wrote that the proposal could weaken the regulatory requirements of the Safe Drinking Water Act. In addition, environmental advocacy organizations indicated that the drinking water PAG dose levels were too high and insufficient to be protective of human health, asked EPA to withdraw the proposal and in its place, use the National Primary Drinking Water Regulations for Radionuclides as the basis for any emergency response measures regarding drinking water.

Commenters also asserted that the proposed drinking water PAG did not conform to the National Environmental Policy Act (NEPA) as well as other regulations dealing with cleanup and waste management of radioactive contaminants. Commenters expressed doubts regarding the duration that the drinking water PAG would be implemented after an incident, claiming that the drinking water PAG could be in place for timeframes exceeding one year.

In response to comments, EPA has amended the drinking water guidance to emphasize, with

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regards to the scope of the drinking water PAG recommendations, that they are meant to apply to nationally significant radiological contamination incidents, such as a disaster at a nuclear power plant, a radiological dispersal device or an improvised nuclear device, and for a duration which may last for weeks to months but not longer than one year.

Some commenters expressed concerns that PAGs would weaken drinking water standards and regulations. Environmental regulations or standards are legal limits designed to prevent health effects from everyday exposure to low levels of radiation over long periods. The PAG levels are guidance for emergency situations; they do not supplant any standards or regulations, nor do they affect the stringency or enforcement of any standards or regulations. The PAG levels are intended to be used only in an emergency when radiation levels have already exceeded environmental standards and could be high enough to cause health effects unless protective actions are taken. The PAG levels trigger public safety measures to minimize or avoid radiation exposures during an emergency.

To develop guidance on drinking water considerations, EPA based its assessment on assumptions limiting exposures to a one-year timeframe. EPA expects that the responsible party for any drinking water system adversely impacted during a radiation incident will take action to return to compliance with Safe Drinking Water Act levels as soon as practicable.

The National Primary Drinking Water Regulations establish regulatory limits designed to minimize health effects from everyday exposure to low levels of radiation over long periods and they are not changing with this action. Emergency guides are temporary measures to minimize risk while enabling prioritization of limited resources during an emergency response.

Estimated risk of excess cancer cases for lifetime exposure (70 years) to beta emitting radioactive contaminants in drinking water at 4 mrem/yr (the MCL) generally falls in a range of

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risks deemed acceptable by EPA. Estimated risks associated with a shorter (one-year) exposure to radioactivity in drinking water at the proposed PAG levels fall within a similar risk range.

Further, the EPA drinking water PAG meets NEPA policy goals because it is based on analyses, documentation and review procedures that are functionally equivalent to NEPA. "Activities for the development of federal radiation regulations and guidance in accordance with the Atomic Energy Act of 1954 are functionally equivalent to NEPA (63 Fed. Reg. 58045 [1998])"

Commenters questioned whether the EPA considered cumulative effects in developing the drinking water PAG. In developing the PAG Manual, the Agency considered the potential for cumulative exposure from multiple exposure pathways including: plume inhalation, immersion, ground shine, drinking water ingestions and food, among others. However, EPA has determined that for implementation purposes, it is impractical to compartmentalize joint protective actions, since allocations of dose to different segments of the population based on individual exposure routes will depend on site-specific circumstances and is impossible to quantify. While the PAGS for the various pathways are separate, emergency management officials should consider all relevant exposure routes when making protective action decisions in an emergency. In addition, incident-specific factors like geographical location, ongoing weather and population affected should be considered after a contamination event, and specific exposure routes should be identified to allow different types of protective actions to be aimed at the specific risks to be avoided.

PAGS do not represent "acceptable" routine exposure in the way that regulatory standards such as maximum contaminant levels do. PAGS are guidance levels to support emergency decision making by response authorities to avoid unnecessary radiation exposure. Development

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and implementation of PAGs is always guided by three basic principles: Prevent acute effects, balance protection with other important factors, ensure that actions result in more benefit than harm and reduce risk of chronic effects.

Several commenters from state emergency management agencies and radiation control programs expressed support for EPA's proposal, stating that the guidance was well developed and technically sound; and that the incorporation of the drinking water PAG into the PAG Manual is a critical aspect of a coordinated emergency response after a radiation contamination incident.

Some commenters suggested that while they support the incorporation of the drinking water PAG, they believe the proposed PAG was too conservative and that EPA should consider establishing the PAG in the 2,000 to 10,000 mrem range.

EPA believes that the drinking water PAG should be consistent with and within the range of currently available guidance for other exposure pathways during the intermediate phase. Also, when possible, the drinking water PAG recommendations should be based on an additional level of protection to sensitive life-stages. For short-term incidents, as explained in the PAG Manual, it is appropriate to have a 500 mrem PAG level for drinking water for the general population and a lower-tier PAG level of 100 mrem for persons at sensitive life-stages, including pregnant women, nursing women, and children 15 years old and under. This approach of setting a two-tier level of protection incorporates suggestions submitted by commenters regarding the adequate consideration of children and sensitive subpopulations.

There is an abundance of caution built into the derivation of the drinking water PAG through a variety of assumptions, including conservative dose-response modeling, selection of the most sensitive life stages to derive the PAG for children through age 15 years, and by not taking into

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account reductions to radiation exposure due to radionuclide decay over time. This action ensures that the protective measures it recommends are appropriate for all members of the public, including sensitive subpopulations.

E. What is the timeframe for implementation of this PAG Manual?

Emergency management and radiation protection organizations that use the PAGs in their emergency plans are encouraged to incorporate this updated guidance as soon as possible. This may entail training, as well as the update of plans and procedures. Outreach and technical training will be conducted by the EPA, the Federal Radiological Monitoring and Assessment Center and interagency partners of the PAG Subcommittee.

FEMA expects certain organizations associated with nuclear power plant operations to use the PAG Manual in developing their emergency management plans. FEMA plans to begin using the new PAG Manual during their evaluation of offsite response organizations around nuclear power facilities 12 months after the publication of this notice in the Federal Register.

For further information and related guidelines, see the PAGs web page: http://www.epa.gov/radiation/protective-action-guides-pags.

Dated: _____

_____

A. Stanley Meiburg,

ED_001057_00014931

Acting Deputy Administrator.

ED_001057_00014931

To: Hernandez-Quinones, Samuel[Hernandez.Samuel@epa.gov]
Cc: Greene, Ashley[Greene.Ashley@epa.gov]
From: Flaharty, Stephanie
Sent: Wed 10/26/2016 1:46:22 PM
Subject: FW: Latest Thinking on DW PAGs Release Date?

Sam, please check with your counterpart in OAR to see if they have an internal time frame, thanks!

From: Flaharty, Stephanie
Sent: Wednesday, October 26, 2016 9:45 AM
To: Evalenko, Sandy <Evalenko.Sandy@epa.gov>
Cc: Gude, Karen <Gude.Karen@epa.gov>; Greene, Ashley <Greene.Ashley@epa.gov>; Wadlington, Christina <Wadlington.Christina@epa.gov>; Arrigoni, Holly <Arrigoni.Holly@epa.gov>
Subject: RE: Latest Thinking on DW PAGs Release Date?

Sandy, per our discussion, OAR plans to release the full guide by year-end. Their part is still at OMB. If it looks like our section will be delayed, they intend to release it with a placeholder for water. I have a staffer checking with his OAR counterpart to see if OAR has an anticipated internal time frame.

From: Evalenko, Sandy
Sent: Wednesday, October 26, 2016 9:23 AM
To: Flaharty, Stephanie <Flaharty.Stephanie@epa.gov>
Cc: Gude, Karen <Gude.Karen@epa.gov>; Greene, Ashley <Greene.Ashley@epa.gov>; Wadlington, Christina <Wadlington.Christina@epa.gov>; Arrigoni, Holly <Arrigoni.Holly@epa.gov>
Subject: RE: Latest Thinking on DW PAGs Release Date?

Steph – Thanks for the update. When Lisa Christ returns, please let us know if the plan is still to release the PAGs DW guide with the Air Pags guide and if so, what is the tentative release date.

Thanks,

Sandy

From: Flaharty, Stephanie
Sent: Wednesday, October 26, 2016 8:26 AM
To: Arrigoni, Holly <Arrigoni.Holly@epa.gov>
Cc: Evalenko, Sandy <Evalenko.Sandy@epa.gov>; Gude, Karen <Gude.Karen@epa.gov>; Greene, Ashley <Greene.Ashley@epa.gov>; Wadlington, Christina <Wadlington.Christina@epa.gov>
Subject: RE: Latest Thinking on DW PAGs Release Date?

Lisa Christ is out until 11/4. Since this just went to OMB, and looking at our priority planner and Action Tracker, it is listed for DAA sign-off by Dec. 16, with OMB release around Dec. 21.

I heard that we're shooting for a 15-day review from OMB. We will know more once OMB completes its review… Ashley?

From: Arrigoni, Holly
Sent: Tuesday, October 25, 2016 4:05 PM
To: Flaharty, Stephanie <Flaharty.Stephanie@epa.gov>
Cc: Evalenko, Sandy <Evalenko.Sandy@epa.gov>
Subject: FW: Latest Thinking on DW PAGs Release Date?

Hi Steph,

Apologies if Sandy already sent this. Do you have any information we can share with Karen? Thanks!

From: Gude, Karen
Sent: Tuesday, October 25, 2016 12:45 PM
To: Evalenko, Sandy <Evalenko.Sandy@epa.gov>; Arrigoni, Holly <Arrigoni.Holly@epa.gov>; Campbell, Ann <Campbell.Ann@epa.gov>
Subject: Latest Thinking on DW PAGs Release Date?

Also, do we have a new target date for the DW PAGs release? In the original transition issue paper on PAGs, we had indicated that publication was anticipated in October. We need to certify all the transition issue papers by 11/1. If it looks like we're targeting early/mid/late Nov, I should revise the paper accordingly. Any info on timing is appreciated.

Thanks,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

To: Wadlington, Christina[Wadlington.Christina@epa.gov]
Cc: Greene, Ashley[Greene.Ashley@epa.gov]
From: Harris, Adrienne
Sent: Mon 9/19/2016 11:54:34 AM
Subject: Re: Items to Review and WEFTEC Info

When is it needed by? I am in training Tuesday - Thursday this week.

Adrienne Harris
Special Assistant (Acting)
Office of Ground Water and Drinking Water
202-250-8793

On Sep 19, 2016, at 7:53 AM, Wadlington, Christina <Wadlington.Christina@epa.gov> wrote:

Adrienne,

Do you have any time to do this this week?

This basically combines the GWPC and NRWA TPs from the week before.

Can you assist?

Christina Wadlington

Communications Director

Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

Tel: 202.566.1859

Email: wadlington.christina@epa.gov

Webpage: www.epa.gov/safewater

From: Grevatt, Peter
Sent: Thursday, September 15, 2016 8:59 AM
To: Greene, Ashley <Greene.Ashley@epa.gov>
Cc: Wadlington, Christina <Wadlington.Christina@epa.gov>
Subject: RE: Items to Review and WEFTEC Info

Utility leaders session – need to reflect broadly on drinking water quality in the U.S. as well as threats to maintaining the high level of service that is provided today. For this session I would emphasize the key areas of the drinking water action plan, including oversight, infrastructure in underserved communities, emerging contaminants with a focus on cyanotoxins, nutrients and source water protection, LCR.

The second session should be more of a regulatory update also hitting on non-reg actions such as legionella.

Thanks.

From: Greene, Ashley
Sent: Tuesday, September 13, 2016 11:36 AM
To: Grevatt, Peter <Grevatt.Peter@epa.gov>
Subject: Items to Review and WEFTEC Info

1) Items to review (latest versions attached)

a. Legionella Comms Rollout

b. Legionella Document

c. Tiering Memo Comms Rollout

d. Joel's SEPW Testimony

e. DW PAGs SEPW Hearing factsheet

2) Take a look at Danny Gogal's email from yesterday and respond to his request for

review

3) ULO Info to Joel (Anita sent you email on 9/6 at 7:53pm) – this contains draft messages from Joel to RAM as well as message to WDDs

4) WEFTEC Utility Leaders Morning Session Agenda attached – this is the session where you will be giving 5/10 minute update on OGWDW initiatives. As I mentioned, you will also be doing the Clean Water Policy session with the other ODs where you have approximately 10-15 minutes for remarks on OGWDW priorities. Let me know what specific topics you may want to cover during these sessions.

****

Ashley Greene

Special Assistant

Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

Phone: (202) 566-1738

Email: greene.ashley@epa.gov

****

To: Greene, Ashley[Greene.Ashley@epa.gov]
From: Grevatt, Peter
Sent: Thur 9/15/2016 12:46:18 PM
Subject: RE: Items to Review and WEFTEC Info
DW PAG - SEPW Hearing Factsheet - 09-15-16.docx

Rad PAG fact sheet. Please make sure our PAG team is aware of the changes I have recommended.

From: Greene, Ashley
Sent: Tuesday, September 13, 2016 11:36 AM
To: Grevatt, Peter <Grevatt.Peter@epa.gov>
Subject: Items to Review and WEFTEC Info

1) Items to review (latest versions attached)

a. Legionella Comms Rollout

b. Legionella Document

c. Tiering Memo Comms Rollout

d. Joel's SEPW Testimony

e. DW PAGs SEPW Hearing factsheet

2) Take a look at Danny Gogal's email from yesterday and respond to his request for review

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****

Ashley Greene

Special Assistant

Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

Phone: (202) 566-1738

Email: greene.ashley@epa.gov

****

To: Greene, Ashley[Greene.Ashley@epa.gov]
From: Wadlington, Christina
Sent: Thur 8/4/2016 8:46:55 PM
Subject: FW: Media Inquiry: Wall Street Journal. Deadline noon tomorrow

When this is done, please just send to John, he can coordinate.

Christina Wadlington

Communications Director

Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

Tel: 202.566.1859

Email: wadlington.christina@epa.gov

Webpage: www.epa.gov/safewater

From: Wadlington, Christina
Sent: Thursday, August 04, 2016 4:38 PM
To: Christ, Lisa <Christ.Lisa@epa.gov>; Hernandez-Quinones, Samuel <Hernandez.Samuel@epa.gov>
Subject: Media Inquiry: Wall Street Journal. Deadline noon tomorrow

Lisa/Sam,

Provided are (2) additional follow up, questions that the reporter sent over. The last series is with Peter and I hope to get that out asap. These aren't due until tomorrow. Can you please send the responses to Ashley in the morning to give Peter time to review?

THANK YOU!

**

Q. In the June 2016 EPA document titled "Draft Protective Action Guide (PAG) for Drinking Water", on page 18 in Table 1, the agency gives DRLs for three Sr-90/Y-90, Cs-137 and I-131. Are the numbers in that chart with radioactive decay or without radioactive decay?

Q. Earlier this year, the EPA issued an emergency administrative order in connection with the drinking-water supply of Flint, Mich. It is my understanding that this action was in part prompted by concerns that the tap water in many homes in Flint exceeded the federal action level for lead of 15 ppb. It is also my understanding that many of those exceedances were in the range of 25 ppb and most were under 150 pbb. Some critics of the EPA's drinking-water PAGs for radioactive contaminants argue that the agency felt emergency action was needed in Flint when the level of a dangerous contaminant was roughly two to ten times above an action level. However, these critics say, the EPA in the PAGs is advocating allowing people to drink water for months or more that contain radioactive contaminants at levels hundreds or even thousands of times greater than the normal action levels. These critics argue that EPA seems to be much more vigorous in its protection of the public from lead than it is in its protection of the public from radiation. I'd like to get the EPA's response to such criticisms.

Christina Wadlington

Communications Director

Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

Tel: 202.566.1859

Email: wadlington.christina@epa.gov

Webpage: www.epa.gov/safewater

To: Greene, Ashley[Greene.Ashley@epa.gov]
Cc: Harris, Adrienne[Harris.Adrienne@epa.gov]
From: Gude, Karen
Sent: Mon 7/18/2016 4:57:43 PM
Subject: FW: Docket Number (EPA-HQ-OAR-2007-0268; FRL-9947-55-OW)
PAG H2O ext req2016.pdf
ATT00001.htm

Ashley,

Just a heads up, you may be getting a call from Diane D'Arrigo (NIRS) seeking status on a request to extend the public comment period for the PAGs guidance. When I asked Joel about this this AM, he indicated that he was aware of the request and that it was with OGWDW…I conveyed this to Diane, but she is calling and email anyone she can reach for additional info. I don't know if there is a status update that can be provided to her.

Thanks,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

From: Penman, Crystal
Sent: Monday, July 18, 2016 8:29 AM
To: Gude, Karen <Gude.Karen@epa.gov>
Subject: FW: Docket Number (EPA-HQ-OAR-2007-0268; FRL-9947-55-OW)

From: Diane D'Arrigo [mailto:dianed@nirs.org]

Sent: Monday, July 18, 2016 8:23 AM
To: Penman, Crystal <Penman.Crystal@epa.gov>; Beauvais, Joel <Beauvais.Joel@epa.gov>
Cc: Diane D'Arrigo <dianed@nirs.org>
Subject: Fwd: Docket Number (EPA-HQ-OAR-2007-0268; FRL-9947-55-OW)

Sent from my iPhone

Begin forwarded message:

From: Diane D'Arrigo <dianed@nirs.org>
Date: July 15, 2016 at 5:49:02 PM EDT
To: "Beauvais.joel@Epa.gov" <Beauvais.joel@Epa.gov>
Cc: Diane D'Arrigo <dianed@nirs.org>
Subject: FW: Docket Number (EPA-HQ-OAR-2007-0268; FRL-9947-55-OW)

Joel Beauvais, Deputy Assistant Administrator

Office of Water

US Environmental Protection Agency

202 564 5700

Beauvais.joel@epa.gov

Dear Joel Beauvais:

Below and attached are requests sent last week from 60 organizations and elected officials for extension on the comment period for the EPA Water Protective Action Guides for 120 more days.

We understand you will decide on this request. We had asked to know by Friday July 15th (today) but have not heard and it is at close of business.

Please do let us know your decision.

Thank you,

Diane D'Arrigo

NIRS

301 270 6477 x 15

Mobile 202 841 8588

dianed@nirs.org

From: Mary Olson
Sent: Friday, July 08, 2016 10:09 AM
To: a-and-r-docket@epa.gov
Subject: FW: Docket Number (EPA-HQ-OAR-2007-0268; FRL-9947-55-OW)

Same attached as PDF

To: Office of Ground Water and Drinking Water (draft Radioactive Water PAGs) Docket Number **(EPA-HQ-OAR-2007-0268; FRL-9947-55-OW)**

From: Fifty-Eight Organizations and two elected officials (undersigned) via Nuclear Information and Resource Service (NIRS) Contact: Mary Olson maryo@nirs.org 828-252-8409, Diane D'Arrigo (Primary Contact after July 13) dianed@nirs.org 301-270-6477

NOTE: the co-signers to this request have been compiled as a courtesy to the Agency. We have emails from each organization requesting they be signed on this request.

RE: Request for 120 day extension to comment on EPA's Draft Protective Action Guide (PAG) for Drinking Water After a Radiological Incident, EPA-HQ-OAR-2007-0268; FRL-9947-55-OW

Dear Lisa Christ, Office of Air and Radiation, and Office of Water:

We ask that EPA extend the public comment period on the Draft Protective Action Guide (PAG) for Drinking Water After a Radiological Incident (draft Radioactive Water PAGs) for 120 days beyond the July 25th deadline.

The changes proposed in the EPA draft Radioactive Water PAGs are extremely significant. They are complicated on their own and additionally by their proposed inclusion in the Draft PAGs (2013 PAG Manual at https://www.epa.gov/radiation/protective-action-guides-pags) on which many of us commented in 2013. Commenting must be done in conjunction with the existing PAG Manual since they would be combined in practice. Since radiation's effects are multiple, additive, cumulative and synergistic, we need to consider the impacts of proposed 100 to 500 millirems/year from water (Water PAG) in light of that from food, air, etc. (PAG) and bioaccumulation.

We appreciate EPA's acknowledgement in this draft of the reality that different life stages are differently impacted by radiation. The portion of the proposal recommending different levels of radioactive water contamination for different life stages adds complexity requiring more than technical analysis and discussion to comment meaningfully, especially when developing organizational positions and responses. Practical and philosophical issues must be considered as well. It appears that the life stage sensitivity is only being addressed in the Water PAG, not the whole PAG so this must be considered and assessed as well.

Excerpts to one of the supporting documents (NCRP-174) on which the proposed Water PAG is based have just been put up on the www.regulations.gov website (in July) but not the whole document in its entirety. The excerpts were not publically available for nearly half of the current comment period. We request this report and all other information used and supporting the Water PAGs be made publicly available, free of charge and that the comment period be extended to accommodate full review.

There are some confusing legal implications that need clarification before submitting comments. The length of time for which PAG guidance would apply is not expressly limited yet assumptions are made that it will be for limited periods only. Although the Federal Register says the PAG guidance levels don't supersede the Safe Drinking Water Act levels (maximum concentration levels) does the PAG relieve the polluter from legal liability? Clarification of these questions would be helpful and certainly additional time is needed to provide meaningful comments.

We request a 120 day extension. We also respectfully ask that you decide and notify us of your decision by July 15th.

Thank you for consideration of this extension request.

Sincerely,

Timothy Judson, Executive Director

Barbara Gottlieb, Environment & Health Director

Nuclear Information and Resource Service

Takoma Park, MD

Physicians for Social Responsibility

Washington, DC

Lynn Thorp

Clean Water Action

Washington, DC

Catherine Lincoln

Committee to Bridge the Gap

Ben Lomond, CA

Ken Bossong
SUN DAY Campaign

Takoma Park, MD

Cindy Folkers

Beyond Nuclear

Takoma Park, MD

Deb Katz

Citizen Awareness Network

Rowe, MA

Dr. Gwen DuBois, President

Chesapeake Physicians for Social Responsibility

Baltimore, MD

Toni Iseeman, Mayor pro tem of Laguna Beach

Laguna Beach, CA

Pam Patterson, Mayor

San Juan Capistrano, CA

Elaine Holder, President

San Luis Obispo Mothers for Peace

San Luis Obispo, CA

Jane Williams, Executive Director

California Communities Against Toxics

Rosamond, CA

Marylia Kelley,

Tri-Valley Communities Against a Radioactive Environment

Livermore, CA

Joni Arends
Concerned Citizens for Nuclear Safety
Santa Fe, NM

Don Safer

Tennessee Environmental Coalition

Nashville, Tennessee

Dave Kraft

Nuclear Energy Information Service

Chicago, IL

Robert K. Musil, Ph.D., M.P.H.

President & CEO, Rachel Carson Council

Bethesda, MD

Sarah Fields

Uranium Watch

Moab, Utah

Jessica Azulay, Program Director

Alliance for a Green Economy

Syracuse, NY

Pamela Hughes

Sierra Club Niagara Group Chair

Becky D. Rafter, MPA, Executive Director

Georgia Women's Action for New Directions

Atlanta, GA

Robert M. Gould, MD, President

San Francisco Bay Area Chapter

Physicians for Social Responsibility

Ruth Thomas

Environmentalists Inc.

Columbus, NC

Louis A. Zeller

Blue Ridge Environmental Defense League

VA, NC, SC, TN, AL, GA

Connie Kline

Ohio CARE - Citizens Against a Radioactive Environment

Cleveland, OH

Bob Ciesielski, Energy Committee Chair
Sierra Club Atlantic Chapter

Albany, NY

New York State, Atlantic Chapter

Iris Marie Bloom
Executive Director
Protecting Our Waters

NY, NJ, PA

Jenny Lisak, Co-director

Pennsylvania Alliance for Clean Water and Air

Punxsutawney, PA

Debra Borowiecki, Co-coordinator
LAWPA - Local Authority Western PA
Murrysville, PA

Dr. Lewis Cuthbert

Alliance for a Clean Environment

Pottstown, PA. 19465

Paula Gotsch

Grandmothers, Mothers and More for Energy Safety

Normandy Beach, NJ

Priscilla Star

Coalition Against Nukes

Wainscott, NY

Barbara Warren

Citizens' Environmental Coalition

New York

Michael J. Keegan

Coalition for a Nuclear Free Great Lakes

Monroe, MI

Alice Hirt

Don't Waste Michigan

Holland, MI

Regina Minniss

Crabshell Alliance

Baltimore, Maryland

Wes Raymond - Administrator
Citizens for Alternatives to Chemical Contamination
Lake, Michigan

Lynda Schneekloth, Advocacy Chair

Western New York Environmental Alliance

Buffalo, New York

Ed Oles, President

Citizens To Preserve Ligonier Valley

Ligonier, PA

Jan Milburn, President

Westmoreland Marcellus Citizens' Group

Westmoreland County , PA

Kristen Combs

Green Party of Pennsylvania

Philadelphia, PA

Briget Shields

Marcellus Protest/Protect Our Parks Pittsburgh

Pittsburgh, PA

Gillian Graber

Protect PT

Trafford, PA

Ellen Connett

Fluoride Action Network

Canton, New York

Susan Gordon, Coordinator

Multicultural Alliance for a Safe Environment

New Mexico

Stephen Brittle

Don't Waste Arizona

Phoenix, Arizona

Greg Wingard, Executive Director

Waste Action Project

Covington, WA

Mark Haim

Mid-Missouri Peaceworks/

Missourians for Safe Energy

Columbia, Missouri

Rita M Conn

Let Laguna Vote, and, Secure Nuclear Waste

Laguna Beach, California

Michael Welch

Redwood Alliance

Arcata, CA

Gary Headrick
San Clemente Green

Jessie Collins

San Clemente, CA

Faye More, Chair

Port Hope Community Health Concerns Committee

Port Hope, Ontario

Citizens' Resistance at Fermi Two (CRAFT)

MI
Ziggy Kleinau,

Co-founder and Outreach Director (BPEG)

Binbrook, Ontario

Theresa A. McClenaghan
Executive Director and Counsel
Canadian Environmental Law Association

Toronto, ON

Ryan Metcalfe

KIMO Denmark

Kommunernes Internationale Miljøorganisation

(Local authorities environmental organisation)

Tanya Keefe

Great Lakes Environmental Alliance

Port Huron, MI

Mary Olson

Nuclear Information and Resource Service, Southeast

maryo@nirs.org

www.nirs.org

828-252-8409 / 828-242-5621 cell

To: Grevatt, Peter[Grevatt.Peter@epa.gov]
Cc: Greene, Ashley[Greene.Ashley@epa.gov]
From: Burneson, Eric
Sent: Mon 6/20/2016 8:08:54 PM
Subject: Re: Mayors

I am in the innovation session now and can meet you when you are done.

Sent from my iPhone

On Jun 20, 2016, at 1:13 PM, Grevatt, Peter <Grevatt.Peter@epa.gov> wrote:

If we can find time it would be good for us to connect on a number of issues including LGAC, PAGs and SY3. Please let me know whether you could do so after my innovation session or tonight at Tetratech.

Sent from my iPhone

Begin forwarded message:

From: "Beauvais, Joel" <Beauvais.Joel@epa.gov>
Date: June 20, 2016 at 12:56:43 PM CDT
To: "Grevatt, Peter" <Grevatt.Peter@epa.gov>, "Travers, David" <Travers.David@epa.gov>, "Greene, Ashley" <Greene.Ashley@epa.gov>
Subject: Mayors

Hi, Peter – Mark R and I did a call with Rich Anderson from USCM last Friday regarding this Friday's meeting with the Mayors Water Council in Indianapolis, where I'll be speaking for 15 minutes regarding the DW NAP and then meeting with a smaller group on that and other issues.

Rich said basically if we want input from the mayors we'll have to be fairly direct in providing background info and specifying what input we want in what time frame. I thought we could provide a version of the blog and Mark R suggested we could provide the 2-pagers we did for the other engagements, together with a request for input in a particular time frame. I'm not sure whether the latter will be manageable or how it relates to what we're planning to do with the LGAC (btw can you bring me up to speed on any conversations on that?). Can I get your advice on options/how best to proceed in the next day or so in advance of heading out there? We will need to reengage with Mark on this.

Joel

To: Osegueda, Carlos[Osegueda.Carlos@epa.gov]; Burneson, Eric[Burneson.Eric@epa.gov]; Harris, Adrienne[Harris.Adrienne@epa.gov]; Greene, Ashley[Greene.Ashley@epa.gov]
From: Grevatt, Peter
Sent: Mon 6/20/2016 4:53:38 PM
Subject: Fwd: PAG Manual

FYI.

Sent from my iPhone

Begin forwarded message:

> **From:** "Burneson, Eric" <Burneson.Eric@epa.gov>
> **Date:** June 20, 2016 at 11:28:10 AM CDT
> **To:** "Christ, Lisa" <Christ.Lisa@epa.gov>
> **Cc:** "Grevatt, Peter" <Grevatt.Peter@epa.gov>
> **Subject: Fwd: PAG Manual**
>
> Can you get an update to Peter and I
>
> Sent from my iPhone
>
> Begin forwarded message:
>
> > **From:** "Beauvais, Joel" <Beauvais.Joel@epa.gov>
> > **Date:** June 20, 2016 at 10:55:02 AM CDT
> > **To:** "Grevatt, Peter" <Grevatt.Peter@epa.gov>
> > **Cc:** "Burneson, Eric" <Burneson.Eric@epa.gov>
> > **Subject: RE: PAG Manual**
> >
> > This is going to come up in a meeting with the Administrator tomorrow. Can you let me know if there are any updates, including on OAR's planned schedule? Thanks.
> >
> > **From:** Beauvais, Joel
> > **Sent:** Monday, May 23, 2016 12:01 PM
> > **To:** Grevatt, Peter <Grevatt.Peter@epa.gov>
> > **Cc:** Burneson, Eric <Burneson.Eric@epa.gov>
> > **Subject:** Re: PAG Manual

Well that is less than a week and a half away so it may not make a difference. I just need to know how it fits into the overall schedule.

On May 23, 2016, at 11:26 AM, Grevatt, Peter <Grevatt.Peter@epa.gov> wrote:

> Will do. I was thinking it would be good to avoid putting her in the room with NGOs that had expressed concern with the PAGs on June 2, but if that's not a concern we can press.
>
> Sent from my iPhone
>
> On May 23, 2016, at 9:10 AM, Beauvais, Joel <Beauvais.Joel@epa.gov> wrote:
>
> > OK, let's revisit this soon. Given the Administrator's interest, I would like to streamline this as possible. We can get help from her and OP on OIRA process, but we need to look at opportunities to speed things internally as well – including proposal signature timing (?), speeding internal process with OLEM, etc. Is the below the best we can do, meaning we would be asking for a 60-75 day review at OMB to get this out, or can we shave any more internally? I will need to go back to Gina and Janet on this.
> >
> > **From:** Burneson, Eric
> > **Sent:** Monday, May 23, 2016 10:49 AM
> > **To:** Beauvais, Joel <Beauvais.Joel@epa.gov>; Grevatt, Peter <Grevatt.Peter@epa.gov>
> > **Subject:** RE: PAG Manual
> >
> > Joel:
> >
> > We are getting the signature package for the draft drinking water PAG up to your office this week, and the coms materials were shared with Travis last week.
> >
> > •□□□□□□□□ We hope to publish for comment in early june.
> >
> > •□□□□□□□□ There is a 45 day comment period that will end in mid July
> >
> > •□□□□□□□□ We had planned 1month for the evaluation of comments and revisions to the PAG by mid August (note that this could be optimistic given likely significant opposition from environmental community)

•□□□□□□□□ Followed by 1 month internal review process (again also an optimistic timeframe given significant previous intra agency concern (OLEM) with the proposal) by mid September

•□□□□□□□□ We would submit the final to OMB by the end of September.

•□□□□□□□□ Our ability to meet these timeframes and the duration of OMB review will determine whether we

o incorporate the Drinking Water Chapter into the final PAG manual (which just began OMB review) or

o publish a separate final DW PAG chapter at a later date from the rest of the manual.

I spoke to colleagues in OAR and their hope is that we can still publish one final PAG document that includes the DW PAG, however they are going to wait and see how much progress we have made once their document has cleared OMB and they are ready for publication. I should be getting a copy of their latest schedule later today.

Eric

From: Beauvais, Joel
Sent: Monday, May 23, 2016 8:47 AM
To: Grevatt, Peter <Grevatt.Peter@epa.gov>; Burneson, Eric <Burneson.Eric@epa.gov>
Subject: FW: PAG Manual

Thoughts? It would be helpful for me to understand our expected timing for milestones for getting this done.

From: McCabe, Janet
Sent: Monday, May 23, 2016 8:36 AM
To: Adm13McCarthy, Gina <Adm13McCarthy.Gina@epa.gov>; Beauvais, Joel <Beauvais.Joel@epa.gov>

Subject: RE: PAG Manual

I am somewhat frustrated as well. OIRA just uploaded the rest of the Manual final (everything but the DW piece), which despite my nagging they wouldn't do until they'd cleared the DW proposal, which happened last week as reported below. I am pretty confident that the "rest" will get finalized this year, but as I'm sure you remember, the DW piece is where a lot of the action is.

From: Adm13McCarthy, Gina
Sent: Monday, May 23, 2016 8:27 AM
To: McCabe, Janet <McCabe.Janet@epa.gov>; Beauvais, Joel <Beauvais.Joel@epa.gov>
Subject: PAG Manual

I just wanted to ask both of you to do what you can to get the final manual done this year. If I need to intervene on any reviews etc, please let me know. I consider this manual to be a really important product that states need and we have an obligation to provide. So let's see how we gear up to drive this home. The interagency process has gone on long enough and we cannot let the next step follow in the same path. .

Drinking Water Protective Action Guidelines: This week OMB cleared our proposed Drinking Water Protective Action Guideline (PAG). We anticipate the draft PAG will be ready for release within the next couple weeks. The proposed PAG does not affect EPA's drinking water standards for radionuclides. It consists of a two-tier drinking water PAG that would be used during the intermediate phase following a radiation incident: 500 millirem (mrem) (5 milliSievert (mSv)) projected dose for the general population (defined as anyone over age 15, excluding pregnant women and nursing women), and 100 mrem (1 mSv) projected dose for pregnant women, nursing women and children age 15 and under. We anticipate a lot of attention on this action from environmental groups, and will be coordinating with OPA on the rollout. Once public comments have been addressed, the DW PAG will be folded into the broader PAG Manual that OAR has been developing.

To: Grevatt, Peter[Grevatt.Peter@epa.gov]
Cc: Greene, Ashley[Greene.Ashley@epa.gov]
From: Harris, Adrienne
Sent: Wed 6/1/2016 9:38:03 PM
Subject: Administrator Weekly from Joel (12 NOON Thursday)

Hi Peter,

Below are two entries for Joel's email to the Administrator for your review. Each are largely adopted from previous entries. Thanks!

LCR Implementation:

All states provided responses to the February 29 letters that EPA sent to state environment and public health commissioners outlining specific steps to enhance oversight of LCR implementation. On June 8, we plan to post a summary of the state responses to the 2/29 LCR Implementation letters and the actual letters received from all state primacy agencies. While many states provided examples of best practices that that go beyond the minimum rule requirements, other states have identified challenges with some of these same activities. Through the Regions, We will continue to work closely with the states to ensure that the proper steps are being taken to implement the current rule.

Drinking Water Protective Action Guidelines Signature and Release

We anticipate the proposed PAG to be released on Monday, June 6. The proposed PAG does not affect EPA's drinking water standards for radionuclides. It consists of a two-tier drinking water PAG that would be used during the intermediate phase following a radiation incident: 500 millirem (mrem) (5 milliSievert (mSv)) projected dose for the general population (defined as anyone over age 15, excluding pregnant women and nursing women), and 100 mrem (1 mSv) projected dose for pregnant women, nursing women and children age 15 and under. We anticipate a lot of attention on this action from environmental groups, and will be coordinating with OPA on the rollout. Once public comments have been addressed, the DW PAG will be folded into the broader PAG Manual – Protective Action Guides and Planning Guidance for Radiological Incidents Manual that OAR has been developing.

Adrienne O. Harris

Acting Special Assistant

Office of Ground Water and Drinking Water
(202) 250-8793 (office)

To: Wadlington, Christina[Wadlington.Christina@epa.gov]; Greene, Ashley[Greene.Ashley@epa.gov]
From: Flaharty, Stephanie
Sent: Wed 5/25/2016 5:20:30 PM
Subject: RE: any edits to press planner?
Posting Docs on the Website - frdocs-onweb10-04-11.docx

Christina, see Item D. in the attached guidance for the pre-pub….

From: Wadlington, Christina
Sent: Wednesday, May 25, 2016 11:52 AM
To: Flaharty, Stephanie <Flaharty.Stephanie@epa.gov>; Greene, Ashley <Greene.Ashley@epa.gov>
Subject: Fwd: any edits to press planner?

Sent from my iPhone

Begin forwarded message:

From: "Loop, Travis" <Loop.Travis@epa.gov>
Date: May 25, 2016 at 11:50:45 AM EDT
To: "Wadlington, Christina" <Wadlington.Christina@epa.gov>, "Dennis, Allison" <Dennis.Allison@epa.gov>
Subject: RE: any edits to press planner?

Just spoke to Joel. Aiming for June 3 for PAGS via prepub and June 7 for LCR letter.

Allison – please confirm PAGS date with Monica and Julia. I will review the LCR roll out doc that you sent this morning after you make a pass and send to me, okay?

Travis Loop

Director of Communications
Office of Water

U.S. Environmental Protection Agency

202-870-6922

loop.travis@epa.gov

From: Loop, Travis
Sent: Wednesday, May 25, 2016 11:24 AM
To: Wadlington, Christina <Wadlington.Christina@epa.gov>; Dennis, Allison <Dennis.Allison@epa.gov>
Subject: RE: any edits to press planner?

Roger that. Will talk to Joel and OPA to confirm.

Travis Loop

Director of Communications
Office of Water

U.S. Environmental Protection Agency

202-870-6922

loop.travis@epa.gov

From: Wadlington, Christina
Sent: Wednesday, May 25, 2016 11:23 AM
To: Loop, Travis <Loop.Travis@epa.gov>; Dennis, Allison <Dennis.Allison@epa.gov>
Subject: RE: any edits to press planner?

It was about timing. We were going to try to get it out by any desired date. Depending on that preferred date we would either go prepbu or FRN. It just depends.

Christina Wadlington

Communications Director

Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

Tel: 202.566.1859

Email: wadlington.christina@epa.gov

From: Loop, Travis
Sent: Wednesday, May 25, 2016 11:20 AM
To: Wadlington, Christina <Wadlington.Christina@epa.gov>; Dennis, Allison <Dennis.Allison@epa.gov>
Subject: RE: any edits to press planner?

Is the plan to sign it this week and they it goes public with FR notice or was it going to be signed and "announced" through pre-pub version?

Travis Loop

Director of Communications
Office of Water

U.S. Environmental Protection Agency

202-870-6922

loop.travis@epa.gov

From: Wadlington, Christina
Sent: Wednesday, May 25, 2016 11:16 AM

To: Dennis, Allison <Dennis.Allison@epa.gov>; Loop, Travis <Loop.Travis@epa.gov>
Subject: RE: any edits to press planner?

Ok please let me know. We are really turning the wheels on this one. Having a later date would help.

Christina Wadlington

Communications Director

Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

Tel: 202.566.1859

Email: wadlington.christina@epa.gov

From: Dennis, Allison
Sent: Wednesday, May 25, 2016 11:03 AM
To: Loop, Travis <Loop.Travis@epa.gov>; Wadlington, Christina <Wadlington.Christina@epa.gov>
Subject: RE: any edits to press planner?

We could get it signed on Friday and announce on Monday….

From: Loop, Travis
Sent: Wednesday, May 25, 2016 11:03 AM
To: Wadlington, Christina <Wadlington.Christina@epa.gov>
Cc: Dennis, Allison <Dennis.Allison@epa.gov>

Subject: Re: any edits to press planner?

No, but we usually avoid Fridays. Let me talk to Joel and OPA

Travis Loop

Communications Director for Water

U.S. Environmental Protection Agency

Phone: 202.870.6922

Follow us on Twitter @EPAwater

On May 25, 2016, at 10:55 AM, Wadlington, Christina <Wadlington.Christina@epa.gov> wrote:

Is this hard guidance? We are pushing to get it done by the 3rd with the FR staff.

Christina Wadlington

Communications Director

Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

Tel: 202.566.1859

Email: wadlington.christina@epa.gov

From: Dennis, Allison
Sent: Wednesday, May 25, 2016 10:53 AM
To: Loop, Travis <Loop.Travis@epa.gov>

Cc: Wadlington, Christina <Wadlington.Christina@epa.gov>
Subject: RE: any edits to press planner?

Will do.

From: Loop, Travis
Sent: Wednesday, May 25, 2016 10:34 AM
To: Dennis, Allison <Dennis.Allison@epa.gov>
Cc: Schollhamer, Mary <Schollhamer.Mary@epa.gov>; Bravo, Antonio <Bravo.Antonio@epa.gov>; Harper, Ashley <harper.ashley@epa.gov>; Wadlington, Christina <Wadlington.Christina@epa.gov>; Lalley, Cara <Lalley.Cara@epa.gov>
Subject: Re: any edits to press planner?

I think PAGS will not be on a Friday so maybe move to 6th

Travis Loop

Communications Director for Water

U.S. Environmental Protection Agency

Phone: 202.870.6922

Follow us on Twitter @EPAwater

On May 25, 2016, at 10:25 AM, Dennis, Allison <Dennis.Allison@epa.gov> wrote:

Date	Event Name/Topic	Detailed Description	Lead Press Ofcr.	Regiona Amp
6/1	SOCIAL: Marine Beach Sanitary Survey App Launch	EPA is releasing a free mobile app for the Marine Beach Sanitary Survey form.The app allows states to gather electronically the same environmental, meteorological, physical and biological data previously collected with a paper form.	Enesta Jones	Yes

6/1	STATEMENT: SMART Report	On June 1st EPA will release the 2013 National Ocean Dumping Site Monitoring Assessment Report (SMART) which summarizes the agency's monitoring activities at 20 ocean dredged material disposal sites. At 14 of those sites, EPA found that disposal could continue without changes in the management of the site. At three other sites, monitoring results indicated that EPA needs to conduct additional investigation to determine if disposal is adversely impacting the environment. And at the last three sites, EPA will modify site use or boundaries based on monitoring results to prevent environmental impacts.	Enesta Jones	No
6/3	STATEMENT: PAGS for Drinking Water	The proposed drinking water PAG is non-regulatory guidance for emergencies only. The proposed PAG does not affect EPA's drinking water standards for radionuclides. Affected public water systems are expected to take actions to return to drinking water standards as soon as practicable	Julia Valentine	No
6/8	STATEMENT: Response to state letters	On February 29, 2015, EPA sent letters to the Governors and state environment and public health commissioners outlining specific steps to enhance oversight of LCR implementation. Today, EPA is providing the EPA's response to the letters as well as the letters received from primacy agencies. Currently, every state has responded and has provided information on how they are ensuring consistency with the LCR and EPA guidance. All of the state responses expressly confirmed that state protocols and procedures are fully consistent with LCR and applicable EPA guidance.	Julia Valentine	No
6/10	STATEMENT: Final Effluent Limitations Guidelines and Standards for the Oil and Gas Extraction Point Source Category	EPA is issuing a final Clean Water Act regulation that would strengthen the controls on pollutant discharges from certain oil and gas extraction facilities by establishing pretreatment standards that would prevent the discharge of pollutants in unconventional oil and gas (UOG) extraction wastewater from onshore UOG facilities to publicly owned treatment works (POTWs). EPA is moving forward with several initiatives, including this rule, to provide regulatory clarity with respect to existing laws and using existing authorities where appropriate to enhance public health and environmental safeguards.	Enesta Jones	No
Week of 6/13	BLOG: Tools for Climate Ready Water Utilities	EPA is releasing two tools for Climate Water Ready Utilities: a Workshop Planner and an Adaptation Case Study and Information Exchange to help utilities with their adaptation planning efforts.	Julia Valentine	Yes
6/14-6/15	SPEECH: Water Summit	Joel Beauvais will speak at The Water Council's Water Summit opening session about resilient health on Tuesday at 9 am in Milwaukee. Open to press. Joel may tour Kohler's manufacturing plant (a WaterSense partner) and speak to local press		

		the following day.		
6/15	SOCIAL: Aircraft Reporting and Compliance System (ARCS) Release	EPA is releasing a webpage (traditional and smart phone mobile ready) that for the first time, will provide the general public with access to aircraft drinking water compliance information. Users will be able to find compliance information about water that is used for drinking, food preparation, brushing teeth, dishwashing, and hand washing. Once released, citizens at any location, including those at airports, will be able to easily obtain information about their particular carrier and learn about water sample results, disinfecting and flushing operations, violations and public notices	Julia Valentine	Yes
Mid June (tentative)	STATEMENT: Coordinated Federal Permitting of Offshore Aquaculture Operations in the Gulf of Mexico	EPA has formalized in a Memorandum of Understanding with other federal agencies to permit offshore aquaculture operations in the Gulf of Mexico. The goal of this MOU is to develop and implement procedures that facilitate efficient, synchronized interagency reviews of permit applications that reduce the time required to permit while minimizing environmental impacts and ensuring a transparent process.	Enesta Jones	Yes
6/21	STATEMENT: WaterSense 10th Anniversary	WaterSense will announce its water, energy, and utility bill savings results through 2015 during the AWWA Annual Conference. WaterSense is also recognizing the 10th anniversary of the launch of the program at the conference.	Enesta Jones	Yes
week of 6/27	SOCIAL: Citizen Science Watershed Sleuth Launch	EPA and the National Environmental Education Foundation are teaming up to provide Watershed Sleuth certificates to K-12 students and other citizen scientists who successfully complete online activities that increase their awareness of water quality issues.	Enesta Jones	Yes
7/25	RELEASE: 2016 Campus RainWorks Challenge Launch	EPA launched the Campus RainWorks Challenge in 2012 as an annual competition to encourage faculty and students on college campuses to develop innovative approaches to sustainable stormwater management. In 2016 the challenge will focus on both master planning and demonstration projects.	Enesta Jones	Yes

<OW Press Planner.xlsx>

To: Gude, Karen[Gude.Karen@epa.gov]
Cc: Greene, Ashley[Greene.Ashley@epa.gov]
From: Harris, Adrienne
Sent: Wed 5/18/2016 3:16:14 PM
Subject: RE: Draft Topics List for 5/20 Administrator Weekly Email -- Deadline 12 PM Thursday

Hi Karen,

Here's the PAGs write-up for the weekly email.

Drinking Water Protective Action Guidelines

OW anticipates OMB's clearance on our proposed Drinking Water Protective Action Guideline (PAG) within the next few days. We will be seeking public comment on the proposed drinking water PAG via FRN. A cost analysis will be shared as a separate document for public review in addition to the PAG on the EPA's website. The purpose of a PAG is to guide the first year of planning and decision-making efforts by local and state officials following a radiological emergency. The proposed PAG does not affect EPA's drinking water standards for radionuclides.

The proposal consists of a two-tier drinking water PAG that would be used during the intermediate phase following a radiation incident: 500 millirem (mrem) (5 milliSievert (mSv)) projected dose for the general population (defined as anyone over age 15, excluding pregnant women and nursing women), and 100 mrem (1 mSv) projected dose for pregnant women, nursing women and children age 15 and under. The tiered approach may help officials prioritize potentially scarce water resources for those most at risk in a disaster response. Once public comments have been addressed, the DW PAG will be folded into the broader PAG Manual – *Protective Action Guides and Planning Guidance for Radiological Incidents* that addresses additional media to provide a comprehensive resource to state and local emergency planning officials.

Adrienne O. Harris
Acting Special Assistant

Office of Ground Water and Drinking Water
(202) 250-8793 (office)

From: Gude, Karen
Sent: Monday, May 16, 2016 9:15 AM
To: Greene, Ashley <Greene.Ashley@epa.gov>; Nandi, Romell <Nandi.Romell@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>; Ruf, Christine <Ruf.Christine@epa.gov>; Klasen, Matthew <Klasen.Matthew@epa.gov>; Orvin, Chris <Orvin.Chris@epa.gov>; Vonfeck, Stephanie <Vonfeck.Stephanie@epa.gov>; Harris, Adrienne <Harris.Adrienne@epa.gov>; Rose, Bob <Rose.Bob@epa.gov>
Cc: Lousberg, Macara <Lousberg.Macara@epa.gov>; Evalenko, Sandy <Evalenko.Sandy@epa.gov>; Campbell, Ann <Campbell.Ann@epa.gov>; Loop, Travis <Loop.Travis@epa.gov>
Subject: Draft Topics List for 5/20 Administrator Weekly Email -- Deadline 12 PM Thursday

Dear Special Assistants,

Hi. Below/attached please find a list of possible topics for the 5/20 Administrator Weekly Email. Please provide write-ups no later than noon on Thursday.

Ann/Travis/Chris/Macara/Sandy – If it looks like I might be missing anything for this week, please let me know.

Thank you,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

Draft Topics List for 5/20 Administrator Weekly Email

Possible Topics for 5/20 Administrator Weekly Email:

1. Speeches:

a. **5/24 - Children's Health Protection Advisory Committee**: Need a sentence or two on what Joel intends to say. (**Travis**)

2. **DW Stakeholder Meetings Kick Off (OGWDW)** – States call on May 26, and tee up June 1 (utilities) and 2 (NGOs) meetings.

3. **PAGs (OGWDW)** – If there's been any movement with OMB

4. Marine Beach Sanitary Survey App Launch (OST)

5. **IL CZARA (OWOW)** – Update if FRN is signed by NOAA this week

6. WIFIA ICR (OWM)

7. **Coordinated Federal Permitting of Offshore Aquaculture Operations in the Gulf of Mexico (OWM)** – Has the MOU signature date be scheduled?

8. **Summary Report for Workshop on Water Quality Markets (WPS)** – Only if we anticipate that the report will be issued next week.

a. *Write-up:* As early as next week, OW will jointly release with USDA a summary report of the September 2015 workshop, *National Workshop on Water Quality Markets*, which was co-hosted by EPA and USDA. The report presents a summary of the discussions among the 200 participants on a broad variety of issues related to the development and operation of water quality markets. It also outlines actions that EPA and USDA are pursuing to advance market-based approaches to improve water quality. Positive reactions are expected from stakeholders interested in trading.

To: Grevatt, Peter[Grevatt.Peter@epa.gov]
Cc: Greene, Ashley[Greene.Ashley@epa.gov]
From: Harris, Adrienne
Sent: Tue 5/17/2016 9:30:29 PM
Subject: Administrator Weekly Email: PAGs (DRAFT)

Hi Peter,

I updated a past weekly to reflect the expected release of PAGs from OMB. Please let me know if you have any edits. It is due by noon Thursday to OW IO. Thanks!

-

Drinking Water Protective Action Guidelines

OW anticipates OMB's clearance on our proposed Drinking Water Protective Action Guideline (PAG) within the next few days. We will be seeking public comment on the proposed drinking water PAG via FRN. A cost analysis will be shared as a separate document for public review in addition to the PAG on the EPA's website. The purpose of a PAG is to guide the first year of planning and decision-making efforts by local and state officials following a radiological emergency. The proposed PAG does not affect EPA's drinking water standards for radionuclides.

The proposal consists of a two-tier drinking water PAG that would be used during the intermediate phase following a radiation incident: 500 millirem (mrem) (5 milliSievert (mSv)) projected dose for the general population (defined as anyone over age 15, excluding pregnant women and nursing women), and 100 mrem (1 mSv) projected dose for pregnant women, nursing women and children age 15 and under. The tiered approach may help officials prioritize potentially scarce water resources for those most at risk in a disaster response.

Adrienne O. Harris
Acting Special Assistant

Office of Ground Water and Drinking Water
(202) 250-8793 (office)

To: Greene, Ashley[Greene.Ashley@epa.gov]
From: Grevatt, Peter
Sent: Wed 4/20/2016 5:52:37 PM
Subject: Re: Draft Administrator Weekly Email Items

Thanks. I think we should only send the PAGS piece if the document goes to OMB.

Sent from my iPhone

On Apr 20, 2016, at 12:49 PM, Greene, Ashley <Greene.Ashley@epa.gov> wrote:

For your review for the Administrator weekly email (due tomorrow at noon). Note, for the PAG summary, the first sentence may need to be edited if the comments are actually sent to OMB.

Public Meeting on Strategies for Managing Cyanotoxin Risks

OW is hosting a half-day public meeting and webinar on April 29, in Chicago, IL, to seek feedback from the public on strategies for managing cyanotoxin risks to drinking water, as well as requesting information on state and utility experiences in managing risks from cyanotoxins in drinking water. Additionally, we are also seeking input on lessons learned after the release of the June 2015 recommendations document, *Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water*. The meeting will be held in conjunction with an OW-supported, Region 5-led cyanotoxin source water protection workshop scheduled for April 27-28.

Drinking Water Protective Action Guidelines

OW provided OP with the proposed responses to interagency comments on our proposed Drinking Water Protective Action Guideline (PAG) document to send to OMB this week. The purpose of a PAG is to guide the first year of planning and decision-making efforts by local and state officials following a radiological emergency. The proposed PAG does not affect EPA's drinking water standards for radionuclides.

The proposal consists of a two-tier drinking water PAG that would be used during the intermediate phase following a radiation incident: 500 millirem (mrem) (5 milliSievert (mSv)) projected dose for the general population (defined as anyone over age 15, excluding

pregnant women and nursing women), and 100 mrem (1 mSv) projected dose for pregnant women, nursing women and children age 15 and under. The tiered approach may help officials prioritize potentially scarce water resources for those most at risk in a disaster response. Following OMBs approval, we will be seeking public comment on the proposed drinking water PAG via FRN.

****

Ashley Greene

Special Assistant

Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

Phone: (202) 566-1738

Email: greene.ashley@epa.gov

****

To: Greene, Ashley[Greene.Ashley@epa.gov]
From: Gude, Karen
Sent: Wed 3/9/2016 2:29:29 PM
Subject: RE: Draft Topics List for 3/11 Administrator Weekly Email & Communiques -- please send items by Thursday at noon

Hi Ashley,

Thanks for the info. I'm also not sure about repeating actions that were included in previous Admin emails. I'll try and get some additional clarity on this moving forward. But in the interim, it might be good to include a quick note that the report was released, along with a link to the document. I could include this in a note to Joel, in case he would like to include this info this week.

Thanks,

Karen Gude

Water Policy Staff, Office of Water

U.S. Environmental Protection Agency

Phone: (202) 564-0831

From: Greene, Ashley
Sent: Wednesday, March 09, 2016 9:27 AM
To: Gude, Karen <Gude.Karen@epa.gov>
Subject: RE: Draft Topics List for 3/11 Administrator Weekly Email & Communiques -- please send items by Thursday at noon

Hi Karen,

For the drinking water PAGs, we are still working with OMB on some issues/comments they have, so it is highly doubtful we'll have a release in the next couple of weeks. We'll push this

off until we have a clearer picture with OMB.

I'm not sure we're going to have any other items this week. We could include the Drought Guide which is scheduled to be released tomorrow, but I know it also went up a few weeks ago as in a weekly email as a head's up to the Administrator, so not sure about the repeat.

Thanks,

Ashley

From: Gude, Karen
Sent: Monday, March 07, 2016 4:47 PM
To: Greene, Ashley <Greene.Ashley@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>; Nandi, Romell <Nandi.Romell@epa.gov>; Farris, Erika D. <Farris.Erika@epa.gov>; Klasen, Matthew <Klasen.Matthew@epa.gov>
Cc: Campbell, Ann <Campbell.Ann@epa.gov>; Ruf, Christine <Ruf.Christine@epa.gov>; Lousberg, Macara <Lousberg.Macara@epa.gov>; Loop, Travis <Loop.Travis@epa.gov>; Orvin, Chris <Orvin.Chris@epa.gov>
Subject: Draft Topics List for 3/11 Administrator Weekly Email & Communiques -- please send items by Thursday at noon

Dear Special Assistants,

Attached please find a list of possible topics for the 3/11 Administrator Weekly Email and communiques list. If you could please send the Administrator Weekly Email write-ups no later than noon on Thursday (3/10).

-

-

Possible Topics for 3/11 Administrator Weekly Email:

•□□□□□□□□ **National Rivers and Streams Assessment:** (OWOW) This action has been listed a number of times in the weekly email. The FRN package is scheduled to go to Joel for review/signature today. If this comes forward this week, and with a (tentative) scheduled release date, we should consider including it in the weekly email.

•□□□□□□□□ **WaterSense Fix-a-Leak Week:** (OWM) March 14-20

•□□□□□□□□ **Protective Action Guide for Drinking Water after a Radiological Incident**: (OGWDW) Anticipated release in mid-March

•□□□□□□□□ **Walker River Paiute Tribe Receive TAS:** (OST)

•□□□□□□□□ **Beach Modeling:** (OST) Scheduled to be released 3/16. *The write-up from last week was held. We will put it forward this week in the Admin. email.*

•□□□□□□□□ **Cadmium ALC:** (OST) DAA signature anticipated 3/24. *Developed for Admin weekly email on 3/04; held until week before it is ready to be released/signed.*

Communiques:

•□□□□□□□□ **NPDES Construction General Permit:** (OWM) Anticipate RAs signature 3/15.

•□□□□□□□□ **Dental Amalgam:** (OST) Communique needed in advance of 3/15 EG meeting.

•□□□□□□□□ **Conductivity:** (OST) DAA signature anticipated 3/22. ***NOTE: Received communique from Betsy 3/2.***

•□□□□□□□□ **Oregon ALC:** (OST) Administrator signature anticipated 3/31.

Thank you,

Karen Gude

Water Policy Staff, Office of Water

U.S. Environmental Protection Agency

Phone: (202) 564-0831

To: Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]; Fitz-James, Schatzi[Fitz-James.Schatzi@epa.gov]; Anderson, RobinM[Anderson.RobinM@epa.gov]; Bartenfelder, David[Bartenfelder.David@epa.gov]
Cc: Shubayr, Nasser[shubayr.nasser@epa.gov]; Mageid, Allaa[Mageid.Allaa@epa.gov]
From: Walker, Stuart
Sent: Wed 1/18/2017 11:09:44 PM
Subject: Inside EPA article on Water PAGs release

https://insideepa.com/daily-news/epa-issues-water-radiation-guide-over-environmentalists-objections

DAILY NEWS

EPA Issues Water Radiation Guide Over Environmentalists' Objections

January 17, 2017

EPA has issued a final drinking water guide for radiological emergencies that generally retains highly controversial measures from a draft version, despite a continuing outcry from environmental groups that the guide's allowance of concentrations far in exceedance of Safe Drinking Water Act (SDWA) limits undermines clean water protections.

EPA Deputy Assistant Administrator for the Office of Water Joel Beauvais Jan. 11 signed a protective action guide (PAG) for drinking water after a radiological incident that EPA is inserting as a chapter into a recently finalized PAG manual for radiological incidents. The manual, which EPA updated last month, sets radiological protection criteria for federal, state, local and tribal emergency response officials to use in a wide variety of incidents involving a radiological release.

The water PAG "is a level that can be used to determine when alternative drinking water should be provided and the use of contaminated water supplies be restricted," EPA says on its website.

EPA's finalization of the water PAG -- the most controversial aspect of the PAG manual -- comes not long after the White House Office of Management & Budget approved the chapter and comes even as environmentalists have relentlessly pushed for EPA to withdraw the section, arguing it "would upend decades of clean water protections." The New York Attorney General's office in recent months also urged the Obama administration to reject the water chapter.

The final water PAG largely appears to echo what EPA proposed last year. It sets up a two-tiered approach -- deeming protective action dose levels of 500 millirems/year (mrem/yr) in the first year after an incident for the general population, and 100 mrem/yr in the first year for infants, children age 15 and under, and pregnant or nursing women.

Environmentalists are weighing the possibility of litigation over the water PAG, an environmentalist says, noting that it appears to directly violate the SDWA, Superfund law, National Environmental Policy Act and Administrative Procedure Act.

"I am stunned that the Obama administration, which pulled back an even less bad proposal from the Bush administration in its last days in office, is now racing to shovel out the door this even more dangerous decision," the source says. "People will die because of this huge increase in permissible radioactivity in drinking water."

Contaminant Levels

Beauvais and other EPA staff met as recently as Jan. 5 with several environmental groups on the water PAG, with the latter attempting to convince the agency to reverse course. Environmentalists contend that the new levels EPA is supporting as protective during the intermediate period after a radiological incident would -- according to a graph included in a recent Freedom of Information Act release from EPA on the matter -- allow for the presence of two radionuclides in water at more than 10,000 times the SDWA limits, while other radionuclides would be allowed at hundreds or thousands of times in exceedance of the SDWA levels. But the environmentalist says the meeting was "just a waste of time," as EPA held to its position.

The SDWA's maximum contaminant levels (MCLs) restrict radioactive doses to no more than 4 mrem/year over 70 years to meet cancer risk range requirements. In the pre-publication version of the notice of availability for the water PAG, EPA says the PAG levels -- allowed for up to one year -- would also fall within a "similar risk range."

But the environmentalist says this is false, pointing out EPA in the water PAG is not only moving the allowable dose from 4 mrem to 500 mrem for the general population, but is altering the unit of measurement. The source points to EPA's own data that show the concentrations allowed are not just 70 times in exceedance of the MCL, but thousands, and in some cases even tens of thousands times less stringent.

While the MCLs are based on a dose to any organ, the water PAGs use an "effective dose equivalent" (EDE), according to the source. This divides the actual dose received by an arbitrary organ weighting factor, which makes it appear the dose is vastly less than it actually is, the source points out. According to slides environmentalists presented at the Jan. 5 meeting, EPA more than a decade ago considered moving from the organ dose limit to an EDE for SDWA limits but determined that such a move would violate the SDWA anti-backsliding provision. That 1996 amendment to the SDWA bars weakening existing drinking water regulations. Shifting to an MCL of 4 mrem-EDE/year from the organ dose limit of 4 mrem/year would have resulted in concentration limits outside EPA's cancer risk range, the agency says in a 2000 *Federal Register* notice on the issue.

In the final water PAG, EPA says it received more than 60,000 comments -- most of which it says expressed concern over the proposal, particularly that it would weaken SDWA regulatory requirements. Also, environmentalists maintained that the PAG dose levels were not protective of human health and asked EPA to use SDWA levels for radionuclides as the basis for the emergency response measures.

Commenters also were skeptical of the duration for which the drinking water PAGs would be in effect. EPA has been criticized for defining the intermediate phase -- during which the concentration limits would apply -- to be as long as up to several years after an incident occurs. Environmentalists also raised concerns about the breadth of the water PAG -- that it could be applied to a wide variety of incidents.

PAG Amendments

EPA says in the pre-publication notice that in response it amended the draft water PAG to stress that the levels are "only intended to apply to nationally significant radiological contamination incidents, such as a disaster at a nuclear power plant, a radiological dispersal device or an improvised nuclear device, and for a duration that may last weeks to months but not longer than one year."

But the environmentalist says that the amendments to the water PAG on these two issues nonetheless contradict language in the main body of the manual. Also, an event of national significance is not defined, the source says.

EPA also says in the pre-publication notice the PAG levels provide guidance for emergency situations, and "do not supplant any standards or regulations, nor do they affect the stringency or enforcement of any standards or regulations." SDWA limits for radionuclides are not changing with this action, EPA says.

The agency also notes in the water PAG chapter that the water PAG is solely focused on drinking water exposures and does not account for cumulative exposures. It advises emergency response officials to consider potential doses from other pathways should a radiological event occur, such as from an airborne plume, ground contamination and food. "[D]ecision makers may want to adjust to account for cumulative doses," it says. -- *Suzanne Yohannan* (syohannan@iwpnews.com)

To: Walker, Stuart[Walker.Stuart@epa.gov]; Gartner, Lois[Gartner.Lois@epa.gov]; Fitz-James, Schatzi[Fitz-James.Schatzi@epa.gov]; Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]
Cc: Meier, Kathleen[meier.kathleen@epa.gov]; Adler, Kevn[adler.kevin@epa.gov]; Novak, Dion[novak.dion@epa.gov]
From: Cibulskis, Karen
Sent: Mon 1/9/2017 1:34:31 PM
Subject: RE: 900 Methods & Application at SF Sites
2002 EPA MEMO GROSS ALPHA AND BETA IN GW.pdf
2002 EPA MEMO PLUTONIUM IN GW.pdf
2002 EPA MEMO URANIUM IN GW.pdf

Hi, Here are the memos from EPA's NAREL I mentioned in my last email. They are from 2002.

From: Cibulskis, Karen
Sent: Wednesday, December 28, 2016 10:09 AM
To: Walker, Stuart <Walker.Stuart@epa.gov>; Gartner, Lois <Gartner.Lois@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>
Cc: Meier, Kathleen <meier.kathleen@epa.gov>; Adler, Kevn <adler.kevin@epa.gov>; Novak, Dion <novak.dion@epa.gov>
Subject: Re: 900 Methods & Application at SF Sites

Hi,

See pages 15-18 of the 2016 Five Year Review for the Industrial Excess Landfill (IEL) Site at the link below for a summary of Region 5's responses to comments concerning groundwater sampling, filtration and radiation results at IEL.

https://semspub.epa.gov/work/05/508650.pdf

A copy of the 2004 Office of Inspector General Report addressing this issue is also attached.

EPA also had the National Air and Radiation Environmental Laboratory (NAREL) review the data. NAREL's memos are in SEMS and should be dated around January 1999.

If anyone would like a copy of the NAREL's memos I will send them out when I return to the office and can access them on January 9th.

If you have any other questions or would like to discuss IEL further, just let me know.

Thanks, Karen.

From: Walker, Stuart
Sent: Thursday, December 22, 2016 9:20:11 AM
To: Cibulskis, Karen
Subject: FW: 900 Methods & Application at SF Sites

Per my voicemail

From: Gartner, Lois
Sent: Thursday, December 22, 2016 7:23 AM
To: Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Cc: Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>
Subject: Re: 900 Methods & Application at SF Sites

thanks, stuart. seems to me we need to ascertain whether the email author's assertion abt IEL is correct...whom can we can contact in Reg 5 for that info? they don't have to craft a response--we should just know one way or the other. if they are using it incorrectly, seems like we need to do something about that...assuming stuart's hunch about what should be happening is correct, then maybe we need to send out a reminder to regions about 900 method. if writer is wrong, then we should say that and point to what epa's guidance is --again, assuming the lab SME is going to say it shouldn't be used. i'll let OGWDW contact know we're working on our piece of response. what do people think?

From: Fitz-James, Schatzi

Sent: Monday, December 19, 2016 8:47:38 PM
To: Walker, Stuart
Cc: Gartner, Lois; Scozzafava, MichaelE
Subject: Re: 900 Methods & Application at SF Sites

Region 5 has already punted so don't think we should go there again. Do we have a policy? I would think a general approach would suffice.

Sent from my iPhone

On Dec 19, 2016, at 7:38 PM, Walker, Stuart <Walker.Stuart@epa.gov> wrote:

Are we supposed to answer what is Superfund's policy or general approach? Or what happened at IEL (which seems to be a R5 answer).

From: Gartner, Lois
Sent: Monday, December 19, 2016 4:27 PM
To: Walker, Stuart
Cc: Fitz-James, Schatzi
Subject: 900 Methods & Application at SF Sites

Stuart: OW is pushing back on us regarding that PAGs control, which references IEL and application of 900 Methods on untreated water. They are going to address the PAGs part but can't speak to the 900 Methods application at SF sites. SOOOO, Schatzi told me we need your input in order to draft a response to the Methods comment in the email, which I've excerpted below.

Ms. McCarthy, I believe that those same US EPA experts **who had long ago shared their worries about the PAGs being implemented all too well**

understood the "gaming" of the rad testing that had already been going on for years. .... - i.e, so called "compliance monitoring" - using the US EPA

"Finished Drinking Water 900 Methods" - methods meant for finished, treated water systems and they said was never meant to be used on raw, untreated water

sources found like at IEL. Please see numerous letters documenting these serious deviations away

from what is considered to be best available science in

letters to EPA found on our group's website: http://cclt.starksummit.org

Thus, the EPA scientists not simply expressed their fears of the PAGs being misused leaving Americans at risk to dangerous radiation, *but they likewise raised*

serious concerns to me about the US EPA's unscientific usage of the "EPA Finished Drinking Water 900 Methods" on raw, untreated water sources suspected of

containing radiation, which is what occurred at Uniontown IEL.

Lois Haas Gartner

Special Assistant

Office of Superfund Remediation

and Technology Innovation

U.S. Environmental Protection Agency

703.603.8711 (desk)

703.581.9794 (cell)

To: Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]; Fitz-James, Schatzi[Fitz-James.Schatzi@epa.gov]
From: Walker, Stuart
Sent: Fri 1/6/2017 5:30:43 PM
Subject: Re: Water PAGs meeting Thurs jan 5 at 3 PM

Well since PEER has been sending in most of the FOIAs on PAGs, I'll guess it was comments from this press release and the links below it

http://www.peer.org/news/news-releases/radiation-exposure-debate-rages-inside-epa.html

These were part of a massive FOIA released by ORIA

From: Scozzafava, MichaelE
Sent: Friday, January 6, 2017 9:43 AM
To: Walker, Stuart; Fitz-James, Schatzi
Subject: Re: Water PAGs meeting Thurs jan 5 at 3 PM

Apparently not. They brought up the emails from you and Charles from back in 2009, but apparent OGC Water Law Office was able to respond to that.

From: Walker, Stuart
Sent: Thursday, January 5, 2017 10:56 PM
To: Scozzafava, MichaelE; Fitz-James, Schatzi
Subject: Re: Water PAGs meeting Thurs jan 5 at 3 PM

Did anything happen at the meeting

From: Scozzafava, MichaelE
Sent: Thursday, January 5, 2017 7:10 AM
To: Walker, Stuart; Fitz-James, Schatzi
Subject: RE: Water PAGs meeting Thurs jan 5 at 3 PM

That's kind of the point.

From: Walker, Stuart
Sent: Wednesday, January 04, 2017 9:20 PM
To: Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>
Cc: Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>
Subject: Re: Water PAGs meeting Thurs jan 5 at 3 PM

ok, if you guys change your minds I can be reached at 202-262-9986. Pam knows the issue real well, Stiven I doubt it.

From: Fitz-James, Schatzi
Sent: Wednesday, January 4, 2017 6:53 PM
To: Walker, Stuart
Cc: Scozzafava, MichaelE
Subject: Re: Water PAGs meeting Thurs jan 5 at 3 PM

Dana will discuss stiven attending with Pam in the am. Think osrti should decline the invite and you should enjoy the rest of the your vacation.

Sent from my iPhone

> On Jan 4, 2017, at 5:26 PM, Walker, Stuart <Walker.Stuart@epa.gov> wrote:
>
> fyi, I am still on vacation but can call in if needed. Not sure if Jim or Pam are responding.
>
>
> _____
> From: Diane D'Arrigo <dianed@nirs.org>
> Sent: Wednesday, January 4, 2017 4:02 PM
> To: Woolford, James; Barr, Pamela
> Cc: Openchowski, Charles; Walker, Stuart
> Subject: FW: Water PAGs meeting Thurs jan 5 at 3 PM
>
>
> Dear James Woolford and Pamela Barr
>
> Cc: Walker Openchowski
>
>
>
> Dozens of organizations have been expressing concerns and opposition to the Water PAGs for over a decade nearly 2. We have a meeting with the Office of Water tomorrow at 3 and are requesting that Charles Openchowski and Stuart Walker be present because their comments are very relevant to the

decision.
>
>
>
> Sincerely,
>
>
>
> Diane D'Arrigo
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> NIRS
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> dianed@nirs.org<mailto:dianed@nirs.org>
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> 202 841 8588
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> From: Diane D'Arrigo
> Sent: Tuesday, January 03, 2017 2:47 PM
> To: 'Gude.Karen@epa.gov'
> Cc: Geoff Fettus; Emily Wurth; Paul Gallay; Damon Moglen; Catherine Thomasson; Dalal Aboulhosn; Cindy Folkers (cindy@beyondnuclear.org); Lynn Thorp CWA; Dan Hirsch 2; John Coequyt ; McKinzie, Matthew; Wenonah Hauter (whauter@fwwatch.org); Jeff Carter; Diane D'Arrigo
> Subject: Water PAGs meeting Thurs jan 5 at 3 PM
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> Karen Gude
>
> EPA Office of Water
>
> Gude, Karen <Gude.Karen@epa.gov<mailto:Gude.Karen@epa.gov>>
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>
> Jan 3, 2017
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> Thank you for setting up the meeting on WATER PAGs Jan 5th at 3 PM at the EPA East building at Federal Triangle with EPA Office of Water Assistant Administrator Joel Beauvais and Peter Grevatt, Director, Office of Ground Water & Drinking Water . The list of organizations attending is attached… and could be added to as I continue to receive responses. We will have several (3-5) people joining by speaker phone, 2 of whom are confirmed and listed.
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here] raising concerns about the Water PAGs back in 2010. http://www.peer.org/news/news-releases/radiation-exposure-debate-rages-inside-epa.html<http://www.peer.org/news/news-releases/radiation-exposure-debate-rages-inside-epa.html>
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> Nuclear Information and Resource Service
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> dianed@nirs.org<mailto:dianed@nirs.org>
>
> mobile 202 841 8588
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> office 302 270-6477 x 15
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> [PEER]
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> For Immediate Release: Apr 05, 2010
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> Contact: Kirsten Stade (202) 265-7337
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> RADIATION EXPOSURE DEBATE RAGES INSIDE EPA
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> Examine the Office of General Counsel e-mail<http://www.peer.org/assets/docs/epa/4_5_10_EPA_Office_Gen_Counsel_Email.pdf>
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> View the PEER lawsuit and additional background on the issue<http://www.peer.org/news/news-releases/suit-to-air-internal-epa-protests-on-radiation-exposure-plan.html>
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> <image001.gif>
> <WATER PAGs 12-18-16 letter to Lisa Christ.pdf>
> <attendees WATER PAGs jan 5 2017 meeting with Office of Water.pdf>

To: Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]; Fitz-James, Schatzi[Fitz-James.Schatzi@epa.gov]
From: Walker, Stuart
Sent: Fri 1/6/2017 3:56:25 AM
Subject: Re: Water PAGs meeting Thurs jan 5 at 3 PM

Did anything happen at the meeting

From: Scozzafava, MichaelE
Sent: Thursday, January 5, 2017 7:10 AM
To: Walker, Stuart; Fitz-James, Schatzi
Subject: RE: Water PAGs meeting Thurs jan 5 at 3 PM

That's kind of the point.

From: Walker, Stuart
Sent: Wednesday, January 04, 2017 9:20 PM
To: Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>
Cc: Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>
Subject: Re: Water PAGs meeting Thurs jan 5 at 3 PM

ok, if you guys change your minds I can be reached at 202-262-9986. Pam knows the issue real well, Stiven I doubt it.

From: Fitz-James, Schatzi
Sent: Wednesday, January 4, 2017 6:53 PM
To: Walker, Stuart
Cc: Scozzafava, MichaelE
Subject: Re: Water PAGs meeting Thurs jan 5 at 3 PM

Dana will discuss stiven attending with Pam in the am. Think osrti should decline the invite and you should enjoy the rest of the your vacation.

Sent from my iPhone

> On Jan 4, 2017, at 5:26 PM, Walker, Stuart <Walker.Stuart@epa.gov> wrote:
>

> fyi, I am still on vacation but can call in if needed. Not sure if Jim or Pam are responding.
>
>
> _____
> From: Diane D'Arrigo <dianed@nirs.org>
> Sent: Wednesday, January 4, 2017 4:02 PM
> To: Woolford, James; Barr, Pamela
> Cc: Openchowski, Charles; Walker, Stuart
> Subject: FW: Water PAGs meeting Thurs jan 5 at 3 PM
>
>
> Dear James Woolford and Pamela Barr
>
> Cc: Walker Openchowski
>
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>
> Dozens of organizations have been expressing concerns and opposition to the Water PAGs for over a decade nearly 2. We have a meeting with the Office of Water tomorrow at 3 and are requesting that Charles Openchowski and Stuart Walker be present because their comments are very relevant to the decision.
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> Sincerely,
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>
> Diane D'Arrigo
>
> NIRS
>
> dianed@nirs.org<mailto:dianed@nirs.org>
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> 202 841 8588
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> <image001.gif>
> <WATER PAGs 12-18-16 letter to Lisa Christ.pdf>
> <attendees WATER PAGs jan 5 2017 meeting with Office of Water.pdf>

To: Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]
From: Gude, Karen
Sent: Thur 1/5/2017 4:45:31 PM
Subject: RE: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

Mike,

Hi. I just wanted to confirm whether OLEM was planning to have anyone attend this afternoon's DW PAGs meeting at 3:00.

Thanks,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

From: Scozzafava, MichaelE
Sent: Wednesday, January 04, 2017 9:53 AM
To: Gude, Karen <Gude.Karen@epa.gov>
Cc: Gartner, Lois <Gartner.Lois@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>
Subject: RE: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

Karen,

I spoke to Eric and some folks in the OLEM IO. I still don't have an answer on who will attend because both Barbara Hostage and Kathy Raffaele are out. I'm working on somebody else to attend for OLEM. Will get back to you as soon as possible.

Mike

From: Gude, Karen
Sent: Wednesday, January 04, 2017 8:14 AM
To: Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>
Cc: Gartner, Lois <Gartner.Lois@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>
Subject: RE: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

Hi Mike,

From OGC, we have invited Carrie Wehling and Paul Bangser from the Water Law Office. We did not include Charles, but would be happy to if OLEM/others feel this is useful.

I'm sure Eric will have additional information, but I believe that we would want to leave it up to OLEM to decide who best should attend for the office, understanding that we will likely get questions on the PEER article.

There is a pre-brief scheduled with Joel and the EPA folks attending Thursday's meeting with the NGOs, which is scheduled for 2:00 PM today. The actual meeting with the NGOs is scheduled for tomorrow at 3:00 PM. If there are people that OLEM would like to include, I would be happy to include them in both meetings. Hope this helps. If you have additional questions/concerns, let me know.

Thanks,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

From: Scozzafava, MichaelE
Sent: Wednesday, January 04, 2017 8:07 AM
To: Gude, Karen <Gude.Karen@epa.gov>
Cc: Gartner, Lois <Gartner.Lois@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>
Subject: RE: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

Hi Karen and happy New Year. Do you know if Charles O is planning to attend? Is OW trying to be responsive to the specific request for their attendance from PEER?

From: Gude, Karen
Sent: Wednesday, January 04, 2017 8:03 AM
To: Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>
Cc: Gartner, Lois <Gartner.Lois@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>
Subject: RE: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

Mike,

Thanks. As background when you talk to Eric – Diane D'Arrigo, who is organizing the meeting for the NGOs, has specifically asked for Stuart and Charles Openchowski (OGC) to attend, as noted in an email (below) that she sent to me yesterday afternoon, which I shared with Eric, Peter Grevatt, and Joel. (Obviously, it is up to OLEM to decide who would participate.) Attached also are the attendee list for Thursday's meeting, and a letter Diane sent to OGWDW in December outlining some of her concerns.

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

Karen Gude

EPA Office of Water

Gude, Karen <Gude.Karen@epa.gov>

Jan 3, 2017

Dear Karen Gude:

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We believe it is essential to hear from them as well as our groups before the final decision.

Also I am attaching the letter I sent to Lisa Christ specifically outlining how the 2016 PAGs define Intermediate Phase and Incident important to the potential implementation of the Water PAGs.

THANK you so much,

Diane D'Arrigo

Nuclear Information and Resource Service

dianed@nirs.org

mobile 202 841 8588

office 302 270-6477 x 15

PEER PROTECTING EMPLOYEES WHO PROTECT OUR ENVIRONMENT

PUBLIC EMPLOYEES FOR ENVIRONMENTAL RESPONSIBILITY

For Immediate Release: Apr 05, 2010

Contact: Kirsten Stade (202) 265-7337

RADIATION EXPOSURE DEBATE RAGES INSIDE EPA

Plan to Radically Hike Post-Accident Radiation in Food & Water Sparks Hot Dissent

Posted on Apr 05, 2010 | Tags: EPA

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"[T]his guidance would allow cleanup levels that exceed MCLs [Maximum Contamination Limits under the Safe Drinking Water Act] by a factor of 100, 1000, and in two instances 7 million and there is nothing to prevent those levels from being the final cleanup achieved (i.e., it's not confined to immediate response of emergency phase)."

Another EPA official, **Stuart Walker** of the Office of Superfund Remediation and Technology Innovation, explains what the proposed new radiation limits in drinking water would mean:

"It also appears that drinking water at the PAG concentrations…may lead to subchronic (acute) effects following exposures of a day or a week. In a population, one should see some express acute effects…that is vomiting, fever, etc."

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###

Examine the Office of General Counsel e-mail

Look at the Office of Superfund Remediation and Technology Innovation concerns

Read the PEER letter to Administrator Jackson

See tables detailing how many times more radiation the PAG would allow

View the PEER lawsuit and additional background on the issue

From: Scozzafava, MichaelE
Sent: Wednesday, January 04, 2017 7:56 AM
To: Gartner, Lois <Gartner.Lois@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>
Cc: Gude, Karen <Gude.Karen@epa.gov>
Subject: RE: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

OK, I also received a call from Eric Burneson about this meeting. Wondering if they specifically want Stuart or I to attend to speak to something specific to our comment. Will follow up with him.

From: Gude, Karen
Sent: Wednesday, January 04, 2017 7:49 AM
To: Gartner, Lois <Gartner.Lois@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>
Subject: RE: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

Thanks, Lois. I'll reach out to Barbara regarding the meeting.

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

From: Gartner, Lois
Sent: Wednesday, January 04, 2017 7:47 AM
To: Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>
Cc: Gude, Karen <Gude.Karen@epa.gov>
Subject: Fwd: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

Barbara Hostage since Kathleen is out till next week?

Sent from my iPhone

Begin forwarded message:

From: "Raffaele, Kathleen" <raffaele.kathleen@epa.gov>
Date: January 4, 2017 at 7:35:33 AM EST
To: "Gartner, Lois" <Gartner.Lois@epa.gov>
Subject: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

I will be out of the office until Monday, January 9, and will not have acces to e-mail while I am out. If an immediate response is needed, please contact Stiven Foster (foster.stiven@epa.gov) or Gerain Cogliano (cogliano.gerain@epa.gov).

To: Barr, Pamela[Barr.Pamela@epa.gov]
Cc: Woolford, James[Woolford.James@epa.gov]; Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]; Fitz-James, Schatzi[Fitz-James.Schatzi@epa.gov]
From: Stalcup, Dana
Sent: Thur 1/5/2017 3:49:52 PM
Subject: Re: Water PAGs meeting Thurs jan 5 at 3 PM

I will be tied up until noon. I will ask Mike and/or Schatzi to stop by in a little while.

Sent from my iPhone

On Jan 5, 2017, at 10:47 AM, Barr, Pamela <Barr.Pamela@epa.gov> wrote:

Dana,

I spoke with Diane Durigo a few minutes ago. When you have a minute, please stop by. It was an interesting conversation.

From: Woolford, James
Sent: Thursday, January 05, 2017 10:37 AM
To: Barr, Pamela <Barr.Pamela@epa.gov>; Stalcup, Dana <Stalcup.Dana@epa.gov>
Cc: Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>
Subject: RE: Water PAGs meeting Thurs jan 5 at 3 PM

I just forwarded a couple VMs to you all on this.

Sent from my Windows Phone

From: Barr, Pamela
Sent: 1/4/2017 2:21 PM
To: Stalcup, Dana
Cc: Scozzafava, MichaelE; Woolford, James; Fitz-James, Schatzi
Subject: RE: Water PAGs meeting Thurs jan 5 at 3 PM

Sure. Thanks

From: Stalcup, Dana

Sent: Wednesday, January 04, 2017 5:02 PM
To: Barr, Pamela <Barr.Pamela@epa.gov>
Cc: Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>; Woolford, James <Woolford.James@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>
Subject: Re: Water PAGs meeting Thurs jan 5 at 3 PM

I'll stop by your office in the morning and discuss if that's okay

Sent from my iPhone

On Jan 4, 2017, at 4:50 PM, Barr, Pamela <Barr.Pamela@epa.gov> wrote:

> Are you comfortable having Stiven cover? Or do you think you should go or you and Stuart? I haven't met with these groups forseveral years but when I last did, they can get a little combative especially when they feel people aren't even listening.
>
> Thanks
>
> **From:** Scozzafava, MichaelE
> **Sent:** Wednesday, January 04, 2017 4:22 PM
> **To:** Woolford, James <Woolford.James@epa.gov>; Stalcup, Dana <Stalcup.Dana@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Barr, Pamela <Barr.Pamela@epa.gov>
> **Subject:** RE: Water PAGs meeting Thurs jan 5 at 3 PM
>
> Been working this throughout the day. It may be that Stiven covers for OLEM
>
> **From:** Woolford, James
> **Sent:** Wednesday, January 04, 2017 4:13 PM
> **To:** Stalcup, Dana <Stalcup.Dana@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>; Barr, Pamela <Barr.Pamela@epa.gov>
> **Subject:** FW: Water PAGs meeting Thurs jan 5 at 3 PM

Sent from my Windows Phone

From: Diane D'Arrigo
Sent: 1/4/2017 1:03 PM
To: Woolford, James; Barr, Pamela
Cc: Openchowski, Charles; Walker, Stuart
Subject: FW: Water PAGs meeting Thurs jan 5 at 3 PM

Dear James Woolford and Pamela Barr

Cc: Walker Openchowski

Dozens of organizations have been expressing concerns and opposition to the Water PAGs for over a decade nearly 2. We have a meeting with the Office of Water tomorrow at 3 and are requesting that Charles Openchowski and Stuart Walker be present because their comments are very relevant to the decision.

Sincerely,

Diane D'Arrigo

NIRS

dianed@nirs.org

202 841 8588

From: Diane D'Arrigo
Sent: Tuesday, January 03, 2017 2:47 PM
To: 'Gude.Karen@epa.gov'
Cc: Geoff Fettus; Emily Wurth; Paul Gallay; Damon Moglen; Catherine Thomasson; Dalal Aboulhosn; Cindy Folkers (cindy@beyondnuclear.org); Lynn Thorp CWA; Dan Hirsch 2; John Coequyt ; McKinzie, Matthew; Wenonah Hauter (whauter@fwwatch.org); Jeff Carter; Diane D'Arrigo
Subject: Water PAGs meeting Thurs jan 5 at 3 PM

Karen Gude

EPA Office of Water

Gude, Karen <Gude.Karen@epa.gov>

Jan 3, 2017

Dear Karen Gude:

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THANK you so much,

Diane D'Arrigo

Nuclear Information and Resource Service

dianed@nirs.org

mobile 202 841 8588

office 302 270-6477 x 15

<image002.jpg>

For Immediate Release: Apr 05, 2010

Contact: Kirsten Stade (202) 265-7337

RADIATION EXPOSURE DEBATE RAGES INSIDE EPA

Plan to Radically Hike Post-Accident Radiation in Food & Water Sparks Hot Dissent

Posted on Apr 05, 2010 | Tags: EPA

Washington, DC — A plan awaiting approval by the U.S. Environmental Protection Agency that would dramatically increase permissible radioactive releases in drinking water, food and soil after "radiological incidents" is drawing vigorous objections from agency experts, according to agency documents released today by Public Employees for Environmental Responsibility (PEER). At issue is the acceptable level of public health risk following a radiation release, whether an accidental spill or a "dirty bomb" attack.

The radiation arm of EPA, called the Office of Radiation and Indoor Air (ORIA), has prepared an update of the 1992 "Protective Action Guides" (PAG) governing radiation protection decisions for both short-term and long-term cleanup standards. Other divisions within EPA contend the ORIA plan geometrically raises allowable exposure to the public. For example, as **Charles Openchowski** of EPA's Office of General Counsel wrote in a January 23, 2009 e-mail to ORIA:

"[T]his guidance would allow cleanup levels that exceed MCLs [Maximum Contamination Limits under the Safe Drinking Water Act] by a factor of 100, 1000, and in two instances 7 million and there is nothing to prevent those levels from being the final cleanup achieved (i.e., it's not confined to immediate response of emergency phase)."

Another EPA official, **Stuart Walker** of the Office of Superfund Remediation and Technology Innovation, explains what the proposed new radiation limits in drinking water would mean:

"It also appears that drinking water at the PAG concentrations…may lead to subchronic (acute) effects following exposures of a day or a week. In a population, one should see some express acute effects…that is vomiting, fever, etc."

"This critical debate is taking place entirely behind closed doors because this plan is 'guidance' and does not require public notice as a regulation would," stated PEER Counsel Christine Erickson. Today, PEER sent EPA Administrator Lisa Jackson a letter calling for a more open and broader examination of the proposed radiation guidance. "We all deserve to know why some in the agency want to legitimize

exposing the public to radiation at levels vastly higher than what EPA officially considers dangerous."

The internal documents show that under the updated PAG a single glass of water could give a lifetime's permissible exposure. In addition, it would allow long-term cleanup limits thousands of times more lax than anything EPA has ever before accepted. These new limits would cause a cancer in as much as every fourth person exposed.

PEER obtained the internal e-mails after filing a lawsuit this past fall under the Freedom of Information Act (FOIA) but the EPA has yet to turn over thousands more communications. "EPA touts its new transparency but when it comes to matters of controversy the agency still puts up a wall," added Erickson, who filed the FOIA suit. "Besides the months of stonewalling, we are seeing them pull stunts such as ORIA giving us rebuttals to other EPA documents they have yet to release."

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Examine the Office of General Counsel e-mail

Look at the Office of Superfund Remediation and Technology Innovation concerns

Read the PEER letter to Administrator Jackson

See tables detailing how many times more radiation the PAG would allow

View the PEER lawsuit and additional background on the issue

To: Fitz-James, Schatzi[Fitz-James.Schatzi@epa.gov]
Cc: Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]
From: Walker, Stuart
Sent: Thur 1/5/2017 2:19:51 AM
Subject: Re: Water PAGs meeting Thurs jan 5 at 3 PM

ok, if you guys change your minds I can be reached at 202-262-9986. Pam knows the issue real well, Stiven I doubt it.

From: Fitz-James, Schatzi
Sent: Wednesday, January 4, 2017 6:53 PM
To: Walker, Stuart
Cc: Scozzafava, MichaelE
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> <image001.gif>
> <WATER PAGs 12-18-16 letter to Lisa Christ.pdf>
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PEER PROTECTING EMPLOYEES WHO PROTECT OUR ENVIRONMENT

PUBLIC EMPLOYEES FOR ENVIRONMENTAL RESPONSIBILITY

For Immediate Release: Apr 05, 2010

Contact: Kirsten Stade (202) 265-7337

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Posted on Apr 05, 2010 | Tags: EPA

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agency documents released today by Public Employees for Environmental Responsibility (PEER). At issue is the acceptable level of public health risk following a radiation release, whether an accidental spill or a "dirty bomb" attack.

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See tables detailing how many times more radiation the PAG would allow

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To: Barr, Pamela[Barr.Pamela@epa.gov]
Cc: Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]; Woolford, James[Woolford.James@epa.gov]; Fitz-James, Schatzi[Fitz-James.Schatzi@epa.gov]
From: Stalcup, Dana
Sent: Wed 1/4/2017 10:01:39 PM
Subject: Re: Water PAGs meeting Thurs jan 5 at 3 PM

I'll stop by your office in the morning and discuss if that's okay

Sent from my iPhone

On Jan 4, 2017, at 4:50 PM, Barr, Pamela <Barr.Pamela@epa.gov> wrote:

Are you comfortable having Stiven cover? Or do you think you should go or you and Stuart? I haven't met with these groups forseveral years but when I last did, they can get a little combative especially when they feel people aren't even listening.

Thanks

From: Scozzafava, MichaelE
Sent: Wednesday, January 04, 2017 4:22 PM
To: Woolford, James <Woolford.James@epa.gov>; Stalcup, Dana <Stalcup.Dana@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Barr, Pamela <Barr.Pamela@epa.gov>
Subject: RE: Water PAGs meeting Thurs jan 5 at 3 PM

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From: Woolford, James
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To: Stalcup, Dana <Stalcup.Dana@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>; Barr, Pamela <Barr.Pamela@epa.gov>
Subject: FW: Water PAGs meeting Thurs jan 5 at 3 PM

Sent from my Windows Phone

From: Diane D'Arrigo
Sent: 1/4/2017 1:03 PM
To: Woolford, James; Barr, Pamela
Cc: Openchowski, Charles; Walker, Stuart
Subject: FW: Water PAGs meeting Thurs jan 5 at 3 PM

Dear James Woolford and Pamela Barr

Cc: Walker Openchowski

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Sincerely,

Diane D'Arrigo

NIRS

dianed@nirs.org

202 841 8588

From: Diane D'Arrigo
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To: 'Gude.Karen@epa.gov'
Cc: Geoff Fettus; Emily Wurth; Paul Gallay; Damon Moglen; Catherine Thomasson; Dalal Aboulhosn; Cindy Folkers (cindy@beyondnuclear.org); Lynn Thorp CWA; Dan Hirsch 2; John Coequyt ; McKinzie, Matthew; Wenonah Hauter (whauter@fwwatch.org); Jeff Carter; Diane D'Arrigo
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Karen Gude

EPA Office of Water

Gude, Karen <Gude.Karen@epa.gov>

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dianed@nirs.org

mobile 202 841 8588

office 302 270-6477 x 15

<image002.jpg>

For Immediate Release: Apr 05, 2010

Contact: Kirsten Stade (202) 265-7337

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Plan to Radically Hike Post-Accident Radiation in Food & Water Sparks Hot Dissent

Posted on Apr 05, 2010 | Tags: EPA

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From: Barr, Pamela
Sent: Wed 1/4/2017 9:50:40 PM
Subject: RE: Water PAGs meeting Thurs jan 5 at 3 PM

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PUBLIC EMPLOYEES FOR ENVIRONMENTAL RESPONSIBILITY

For Immediate Release: Apr 05, 2010

Contact: Kirsten Stade (202) 265-7337

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From: Woolford, James
Sent: Wed 1/4/2017 9:13:04 PM
Subject: FW: Water PAGs meeting Thurs jan 5 at 3 PM
WATER PAGs 12-18-16 letter to Lisa Christ.pdf
attendees WATER PAGs jan 5 2017 meeting with Office of Water.pdf

Sent from my Windows Phone

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Cc: Stalcup, Dana[Stalcup.Dana@epa.gov]
From: Fitz-James, Schatzi
Sent: Wed 1/4/2017 6:34:48 PM
Subject: RE: Inside EPA - PAGs

Yes OW is the lead with OAR providing technical support (not OST as would typically be done).

From: Walker, Stuart
Sent: Wednesday, January 04, 2017 1:33 PM
To: Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>; Gartner, Lois <Gartner.Lois@epa.gov>; Reynolds, David <Reynolds.David@epa.gov>
Cc: Stalcup, Dana <Stalcup.Dana@epa.gov>
Subject: Re: Inside EPA - PAGs

Maybe OW is more likely. This is about the water PAG and I think they are the lead for that.

From: Fitz-James, Schatzi
Sent: Wednesday, January 4, 2017 7:36 AM
To: Scozzafava, MichaelE; Walker, Stuart; Gartner, Lois; Reynolds, David
Cc: Stalcup, Dana
Subject: RE: Inside EPA - PAGs

I doubt it. Playing devil's advocate, why would they?

From: Scozzafava, MichaelE
Sent: Wednesday, January 04, 2017 7:30 AM
To: Walker, Stuart <Walker.Stuart@epa.gov>; Gartner, Lois <Gartner.Lois@epa.gov>; Reynolds, David <Reynolds.David@epa.gov>
Cc: Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Stalcup, Dana <Stalcup.Dana@epa.gov>
Subject: RE: Inside EPA - PAGs

Is it possible that OAR released these documents?

From: Walker, Stuart
Sent: Tuesday, January 03, 2017 9:16 PM
To: Gartner, Lois <Gartner.Lois@epa.gov>; Reynolds, David <Reynolds.David@epa.gov>
Cc: Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>
Subject: Fw: Inside EPA - PAGs

I clicked on some of the links in this article on some FOIA release and I am EXTREMELY confused. Did you guys release some of my material in a FOIA recently that you did not clear by me?

If you click on the link entitled "graph" it looks sorta like one of the bar graphs I did that I sent to OSRTI management this fall, but not quite. I sent them two versions, one that included 2 horizontal lines about Flint Michigan and one without that Woolford sent over to OW. This looks some draft version I never sent to management. Not sure about the "analysis", when it was done, but it looks like mine. But I never use the "DRAFT" watermark that is on those pages, and I would not have sent a draft analysis up the management chain.

Note that the graph that was included in this FOIA release is not included in the FOIA package I put together for release since the analysis was not completed prior to the date of the FOIA

From: Anderson, RobinM
Sent: Tuesday, January 3, 2017 12:35 PM
To: Walker, Stuart
Subject: Inside EPA - PAGs

EPA Documents Reveal PAG Water Radiation Allowances Far Above SDWA

December 29, 2016

EPA has released documents that reveal the agency is recommending protective drinking water levels for scores of radionuclides after a radiological emergency

that significantly exceed Safe Drinking Water Act (SDWA) limits, and that the agency previously only released a few of these levels publicly in order to “avoid confusion.”

The release, in response to a Freedom of Information Act (FOIA) lawsuit by Public Employees for Environmental Responsibility (PEER), reveals new concentration levels under the agency's proposed water chapter for its Protective Action Guides (PAG) for radiological emergencies for dozens of radionuclides. In the draft version of the chapter available for public comment, EPA had only released limits for four of the 110 radionuclides covered, and declined to reveal how much they differed from SDWA limits, according to PEER, which represents local, state and federal environmental agency employees.

“To cover its embarrassment after being caught dissembling about Fukushima fallout on American soil, EPA is pursuing a justification for assuming a radioactive fetal position even in cases of ultra-high contamination,” PEER Executive Director Jeff Ruch said in a Dec. 22 press release. “The Safe Drinking Water Act is a federal law; it cannot be nullified or neutered by regulatory ‘guidance,’” he added. The PAGs are EPA guidance, rather than a regulation.

The highly controversial water chapter is currently undergoing review at the White House Office of Management & Budget (OMB). Once finalized, it is slated to be included in EPA’s PAG manual, which the agency issued in early December. The manual revises a 1992 version and sets radiological protection criteria for federal, state, local and tribal emergency response officials to use in a wide variety of incidents involving a radiological release.

The proposed water chapter would deem protective action dose levels of 500 millirems/year (mrem/yr) in the first year after an incident for the general population, and 100 mrem/yr in the first year for infants, children age 15 and under, and pregnant or nursing women, according to a notice of availability for the draft drinking water PAG.

PEER in October sued EPA to release data on the proposed water PAG that the group has argued would help justify a stricter guidance. The suit in part sought documents disclosing the allowable concentrations of radioactivity in drinking water that EPA is proposing for 110 radionuclides, after the group repeatedly raised concerns that the proposal would set new concentrations, or Derived Response Levels (DRLs), for 110 radionuclides, but disclosed only three of those concentrations. Even prior to the FOIA release, dozens of environmental groups and the New York's attorney general's office were severely critical of the draft drinking water chapter and urged EPA to scrap it.

Lifetime Dose

According to a graph included in the FOIA release, the proposed water PAGs for two radionuclides would be more than 10,000 times the SDWA limits, and others are shown to be hundreds or thousands of times in exceedance of the SDWA levels.

An internal EPA analysis accompanying the graph indicates that some of the concentrations permitted under the guide would be high enough to deliver the SDWA lifetime permissible dose in a single day, and in other cases DRLs for other radionuclides would reach that lifetime allowable dose within a week or month, PEER notes.

For instance, the graph indicates that the DRL for the radionuclide Calcium-45 (Ca-45) would be more than 10,000 times the SDWA limit. In the internal analysis, EPA says "drinking less than one day at the daily rate of 2 liters of Ca-45 at the DRL concentration would result in an exposure that corresponds to drinking liters of water per day for 70 years at the [SDWA maximum contaminant level]."

The graph also indicates the proposed DRLs exceed those proposed by the Bush EPA -- which were pulled back early on in the Obama administration.

The FOIA release shows development of the water PAGs mainly by EPA's Office of Radiation & Indoor Air and Office of Water. In one email exchange, in which a Superfund office official sought a table of concentrations regarding the water PAG from the other two offices as part of the Superfund office's review, a water office engineer eventually sends the table but indicates that the agency would include concentrations for just three radionuclides -- as it eventually did in the proposal released to the public -- and would only include a "more comprehensive list" once the guidance had been issued. "We did not want[] to overwhelm the readers of this chapter with a large table of derived concentrations," the engineer says.

PEER says in its release that this shows the agency hid the proposed high DRLs from the public to "avoid confusion" and that the documents "reveal that EPA's radiation division even hid the new concentrations from other divisions of EPA that were critical of the proposal, requiring repeated efforts to get them to even be disclosed internally."

Limited Application

In one of the briefing documents EPA provides in the FOIA release, the agency

argues environmentalists have been misleading when comparing the draft DRLs with the MCLs, but does not specify EPA's differences with environmentalists. Further, the agency points to the 2011 Fukushima, Japan, nuclear meltdown as a trigger for a need for water PAGs, noting the agency was pressed to develop a guide and failed to provide any guidance at the time.

But one environmentalist points out that EPA at the time stated no radioactivity from Fukushima was reaching the United States above levels of concern despite measurements indicating rainwater was exceeding the SDWA limits. This source argues the water PAG was pulled together because the agency "got caught," and now they are creating new, much higher allowances to say there is no safety concern at, for instance in the case of Iodine-131, thousands of times higher than an MCL.

Meanwhile, the environmental group Nuclear Information and Resource Service (NIRS) is pressing EPA to follow through on verbal commitments it says an agency water office official recently made to NIRS. In those, the official told NIRS that the water PAG DRLs would apply for no more than one year and that they would only apply to incidents of "national significance," and not lesser accidents or releases.

EPA has been criticized for defining the intermediate phase -- during which the DRLs would apply -- to be as long as up to several years after an incident occurs.

In a Dec. 18 letter to Lisa Christ, with EPA's Water Office, NIRS' Diane D'Arrigo seeks assurances that the agency will follow through on commitments made in a phone conversation that the water PAG will be limited to one year's application and that it will only be used for major incidents. D'Arrigo says such a commitment means the PAG manual also needs to be altered to avoid conflicting language, and lists an array of statements EPA would need to change.

In response to questions regarding NIRS' request, EPA does not respond to questions on whether the agency will make the changes NIRS is seeking but tells *Inside EPA* in a statement that the guidance "is intended for short term use only and is not intended for long-term (i.e. greater than one year) or everyday use." EPA also notes the guidance is "non-regulatory and non-binding," and that SDWA standards for radionuclides "would continue to apply even in the event of an emergency.

"EPA expects that the responsible party for any drinking water system adversely impacted during a radiation incident will take action to return to compliance with regulatory maximum contaminant levels." -- *Suzanne Yohannan*

(syohannan@iwpnews.com)

Related News | Waste | Water |

197665

To: Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]
Cc: Gartner, Lois[Gartner.Lois@epa.gov]; Fitz-James, Schatzi[Fitz-James.Schatzi@epa.gov]
From: Gude, Karen
Sent: Wed 1/4/2017 1:14:14 PM
Subject: RE: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

Hi Mike,

From OGC, we have invited Carrie Wehling and Paul Bangser from the Water Law Office. We did not include Charles, but would be happy to if OLEM/others feel this is useful.

I'm sure Eric will have additional information, but I believe that we would want to leave it up to OLEM to decide who best should attend for the office, understanding that we will likely get questions on the PEER article.

There is a pre-brief scheduled with Joel and the EPA folks attending Thursday's meeting with the NGOs, which is scheduled for 2:00 PM today. The actual meeting with the NGOs is scheduled for tomorrow at 3:00 PM. If there are people that OLEM would like to include, I would be happy to include them in both meetings. Hope this helps. If you have additional questions/concerns, let me know.

Thanks,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

From: Scozzafava, MichaelE
Sent: Wednesday, January 04, 2017 8:07 AM
To: Gude, Karen <Gude.Karen@epa.gov>

Cc: Gartner, Lois <Gartner.Lois@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>
Subject: RE: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

Hi Karen and happy New Year. Do you know if Charles O is planning to attend? Is OW trying to be responsive to the specific request for their attendance from PEER?

From: Gude, Karen
Sent: Wednesday, January 04, 2017 8:03 AM
To: Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>
Cc: Gartner, Lois <Gartner.Lois@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>
Subject: RE: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

Mike,

Thanks. As background when you talk to Eric – Diane D'Arrigo, who is organizing the meeting for the NGOs, has specifically asked for Stuart and Charles Openchowski (OGC) to attend, as noted in an email (below) that she sent to me yesterday afternoon, which I shared with Eric, Peter Grevatt, and Joel. (Obviously, it is up to OLEM to decide who would participate.) Attached also are the attendee list for Thursday's meeting, and a letter Diane sent to OGWDW in December outlining some of her concerns.

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

Karen Gude

EPA Office of Water

Gude, Karen <Gude.Karen@epa.gov>

Jan 3, 2017

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We believe it is essential to hear from them as well as our groups before the final decision.

Also I am attaching the letter I sent to Lisa Christ specifically outlining how the 2016 PAGs define Intermediate Phase and Incident important to the potential implementation of the Water PAGs.

THANK you so much,

Diane D'Arrigo

Nuclear Information and Resource Service

dianed@nirs.org

mobile 202 841 8588

office 302 270-6477 x 15

PEER PROTECTING EMPLOYEES WHO PROTECT OUR ENVIRONMENT

PUBLIC EMPLOYEES FOR ENVIRONMENTAL RESPONSIBILITY

For Immediate Release: Apr 05, 2010

Contact: Kirsten Stade (202) 265-7337

RADIATION EXPOSURE DEBATE RAGES INSIDE EPA

Plan to Radically Hike Post-Accident Radiation in Food & Water Sparks Hot Dissent

Posted on Apr 05, 2010 | Tags: EPA

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Another EPA official, **Stuart Walker** of the Office of Superfund Remediation and Technology Innovation, explains what the proposed new radiation limits in drinking water would mean:

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"This critical debate is taking place entirely behind closed doors because this plan is 'guidance' and does not require public notice as a regulation would," stated PEER Counsel Christine Erickson. Today, PEER sent EPA Administrator Lisa Jackson a letter calling for a more open and broader examination of the proposed radiation guidance. "We all deserve to know why some in the agency want to legitimize exposing the public to radiation at levels vastly higher than what EPA officially considers dangerous."

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PEER obtained the internal e-mails after filing a lawsuit this past fall under the Freedom of Information Act (FOIA) but the EPA has yet to turn over thousands more communications. "EPA touts its new transparency but when it comes to matters of controversy the agency still puts up a wall," added Erickson, who filed the FOIA suit. "Besides the months of stonewalling, we are seeing them pull stunts such as ORIA giving us rebuttals to other EPA documents they have yet to release."

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Examine the Office of General Counsel e-mail

Look at the Office of Superfund Remediation and Technology Innovation concerns

Read the PEER letter to Administrator Jackson

See tables detailing how many times more radiation the PAG would allow

View the PEER lawsuit and additional background on the issue

From: Scozzafava, MichaelE
Sent: Wednesday, January 04, 2017 7:56 AM
To: Gartner, Lois <Gartner.Lois@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>
Cc: Gude, Karen <Gude.Karen@epa.gov>
Subject: RE: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

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Subject: RE: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

Thanks, Lois. I'll reach out to Barbara regarding the meeting.

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

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Date: January 4, 2017 at 7:35:33 AM EST
To: "Gartner, Lois" <Gartner.Lois@epa.gov>
Subject: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs

I will be out of the office until Monday, January 9, and will not have acces to e-mail while I am out. If an immediate response is needed, please contact Stiven Foster (foster.stiven@epa.gov) or Gerain Cogliano (cogliano.gerain@epa.gov).

To: Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]
Cc: Gartner, Lois[Gartner.Lois@epa.gov]; Fitz-James, Schatzi[Fitz-James.Schatzi@epa.gov]
From: Gude, Karen
Sent: Wed 1/4/2017 1:02:34 PM
Subject: RE: Automatic reply: Request for meeting with EPA Administrator Gina McCarthy re PAGs
WATER PAGs 12-18-16 letter to Lisa Christ.pdf
attendees WATER PAGs jan 5 2017 meeting with Office of Water.pdf

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Karen Gude

EPA Office of Water

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THANK you so much,

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Nuclear Information and Resource Service

dianed@nirs.org

mobile 202 841 8588

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Cc: Gude, Karen <Gude.Karen@epa.gov>
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To: Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]; Walker, Stuart[Walker.Stuart@epa.gov]; Gartner, Lois[Gartner.Lois@epa.gov]; Reynolds, David[Reynolds.David@epa.gov]
Cc: Stalcup, Dana[Stalcup.Dana@epa.gov]
From: Fitz-James, Schatzi
Sent: Wed 1/4/2017 12:36:38 PM
Subject: RE: Inside EPA - PAGs

I doubt it. Playing devil's advocate, why would they?

From: Scozzafava, MichaelE
Sent: Wednesday, January 04, 2017 7:30 AM
To: Walker, Stuart <Walker.Stuart@epa.gov>; Gartner, Lois <Gartner.Lois@epa.gov>; Reynolds, David <Reynolds.David@epa.gov>
Cc: Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Stalcup, Dana <Stalcup.Dana@epa.gov>
Subject: RE: Inside EPA - PAGs

Is it possible that OAR released these documents?

From: Walker, Stuart
Sent: Tuesday, January 03, 2017 9:16 PM
To: Gartner, Lois <Gartner.Lois@epa.gov>; Reynolds, David <Reynolds.David@epa.gov>
Cc: Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>
Subject: Fw: Inside EPA - PAGs

I clicked on some of the links in this article on some FOIA release and I am EXTREMELY confused. Did you guys release some of my material in a FOIA recently that you did not clear by me?

If you click on the link entitled "graph" it looks sorta like one of the bar graphs I did that I sent to OSRTI management this fall, but not quite. I sent them two versions, one that included 2 horizontal lines about Flint Michigan and one without that Woolford sent over to OW. This looks some draft version I never sent to management. Not sure about the "analysis", when it was done, but it looks like mine. But I never use the "DRAFT" watermark that is on those pages, and I would not have sent a draft analysis up the management chain.

Note that the graph that was included in this FOIA release is not included in the FOIA package I put together for release since the analysis was not completed prior to the date of the FOIA

From: Anderson, RobinM
Sent: Tuesday, January 3, 2017 12:35 PM
To: Walker, Stuart
Subject: Inside EPA - PAGs

EPA Documents Reveal PAG Water Radiation Allowances Far Above SDWA

December 29, 2016

EPA has released documents that reveal the agency is recommending protective drinking water levels for scores of radionuclides after a radiological emergency that significantly exceed Safe Drinking Water Act (SDWA) limits, and that the agency previously only released a few of these levels publicly in order to "avoid confusion."

The release, in response to a Freedom of Information Act (FOIA) lawsuit by Public Employees for Environmental Responsibility (PEER), reveals new concentration levels under the agency's proposed water chapter for its Protective Action Guides (PAG) for radiological emergencies for dozens of radionuclides. In the draft version of the chapter available for public comment, EPA had only released limits for four of the 110 radionuclides covered, and declined to reveal how much they differed from SDWA limits, according to PEER, which represents local, state and federal environmental agency employees.

"To cover its embarrassment after being caught dissembling about Fukushima fallout on American soil, EPA is pursuing a justification for assuming a radioactive fetal position even in cases of ultra-high contamination," PEER Executive Director Jeff Ruch said in a Dec. 22 press release. "The Safe Drinking Water Act is a federal law; it cannot be nullified or neutered by regulatory 'guidance,'" he added. The PAGs are EPA guidance, rather than a regulation.

The highly controversial water chapter is currently undergoing review at the White House Office of Management & Budget (OMB). Once finalized, it is slated to be included in EPA's PAG manual, which the agency issued in early

December. The manual revises a 1992 version and sets radiological protection criteria for federal, state, local and tribal emergency response officials to use in a wide variety of incidents involving a radiological release.

The proposed water chapter would deem protective action dose levels of 500 millirems/year (mrem/yr) in the first year after an incident for the general population, and 100 mrem/yr in the first year for infants, children age 15 and under, and pregnant or nursing women, according to a notice of availability for the draft drinking water PAG.

PEER in October sued EPA to release data on the proposed water PAG that the group has argued would help justify a stricter guidance. The suit in part sought documents disclosing the allowable concentrations of radioactivity in drinking water that EPA is proposing for 110 radionuclides, after the group repeatedly raised concerns that the proposal would set new concentrations, or Derived Response Levels (DRLs), for 110 radionuclides, but disclosed only three of those concentrations. Even prior to the FOIA release, dozens of environmental groups and the New York's attorney general's office were severely critical of the draft drinking water chapter and urged EPA to scrap it.

Lifetime Dose

According to a graph included in the FOIA release, the proposed water PAGs for two radionuclides would be more than 10,000 times the SDWA limits, and others are shown to be hundreds or thousands of times in exceedance of the SDWA levels.

An internal EPA analysis accompanying the graph indicates that some of the concentrations permitted under the guide would be high enough to deliver the SDWA lifetime permissible dose in a single day, and in other cases DRLs for other radionuclides would reach that lifetime allowable dose within a week or month, PEER notes.

For instance, the graph indicates that the DRL for the radionuclide Calcium-45 (Ca-45) would be more than 10,000 times the SDWA limit. In the internal analysis, EPA says “drinking less than one day at the daily rate of 2 liters of Ca-45 at the DRL concentration would result in an exposure that corresponds to drinking liters of water per day for 70 years at the [SDWA maximum contaminant level].”

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In a Dec. 18 letter to Lisa Christ, with EPA's Water Office, NIRS' Diane D'Arrigo seeks assurances that the agency will follow through on commitments made in a phone conversation that the water PAG will be limited to one year's application and that it will only be used for major incidents. D'Arrigo says such a commitment means the PAG manual also needs to be altered to avoid conflicting language, and lists an array of statements EPA would need to change.

In response to questions regarding NIRS' request, EPA does not respond to questions on whether the agency will make the changes NIRS is seeking but tells *Inside EPA* in a statement that the guidance "is intended for short term use only and is not intended for long-term (i.e. greater than one year) or everyday use." EPA also notes the guidance is "non-regulatory and non-binding," and that SDWA standards for radionuclides "would continue to apply even in the event of an emergency.

"EPA expects that the responsible party for any drinking water system adversely impacted during a radiation incident will take action to return to compliance with regulatory maximum contaminant levels." -- *Suzanne Yohannan* (syohannan@iwpnews.com)

Related News | Waste | Water |

197665

To: Walker, Stuart[Walker.Stuart@epa.gov]; Gartner, Lois[Gartner.Lois@epa.gov]; Fitz-James, Schatzi[Fitz-James.Schatzi@epa.gov]; Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]
Cc: Meier, Kathleen[meier.kathleen@epa.gov]; Adler, Kevn[adler.kevin@epa.gov]; Novak, Dion[novak.dion@epa.gov]
From: Cibulskis, Karen
Sent: Wed 12/28/2016 4:09:01 PM
Subject: Re: 900 Methods & Application at SF Sites
2004 Ombudsman Report.pdf

Hi,

See pages 15-18 of the 2016 Five Year Review for the Industrial Excess Landfill (IEL) Site at the link below for a summary of Region 5's responses to comments concerning groundwater sampling, filtration and radiation results at IEL.

https://semspub.epa.gov/work/05/508650.pdf

A copy of the 2004 Office of Inspector General Report addressing this issue is also attached.

EPA also had the National Air and Radiation Environmental Laboratory (NAREL) review the data. NAREL's memos are in SEMS and should be dated around January 1999.

If anyone would like a copy of the NAREL's memos I will send them out when I return to the office and can access them on January 9th.

If you have any other questions or would like to discuss IEL further, just let me know.

Thanks, Karen.

From: Walker, Stuart
Sent: Thursday, December 22, 2016 9:20:11 AM
To: Cibulskis, Karen
Subject: FW: 900 Methods & Application at SF Sites

Per my voicemail

From: Gartner, Lois
Sent: Thursday, December 22, 2016 7:23 AM
To: Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Walker, Stuart <Walker.Stuart@epa.gov>
Cc: Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>
Subject: Re: 900 Methods & Application at SF Sites

thanks, stuart. seems to me we need to ascertain whether the email author's assertion abt IEL is correct...whom can we can contact in Reg 5 for that info? they don't have to craft a response--we should just know one way or the other. if they are using it incorrectly, seems like we need to do something about that...assuming stuart's hunch about what should be happening is correct, then maybe we need to send out a reminder to regions about 900 method. if writer is wrong, then we should say that and point to what epa's guidance is --again, assuming the lab SME is going to say it shouldn't be used. i'll let OGWDW contact know we're working on our piece of response. what do people think?

From: Fitz-James, Schatzi
Sent: Monday, December 19, 2016 8:47:38 PM
To: Walker, Stuart
Cc: Gartner, Lois; Scozzafava, MichaelE
Subject: Re: 900 Methods & Application at SF Sites

Region 5 has already punted so don't think we should go there again. Do we have a policy? I would think a general approach would suffice.

Sent from my iPhone

On Dec 19, 2016, at 7:38 PM, Walker, Stuart <Walker.Stuart@epa.gov> wrote:

> Are we supposed to answer what is Superfund's policy or general approach? Or what happened at IEL (which seems to be a R5 answer).

> **From:** Gartner, Lois
> **Sent:** Monday, December 19, 2016 4:27 PM
> **To:** Walker, Stuart
> **Cc:** Fitz-James, Schatzi
> **Subject:** 900 Methods & Application at SF Sites

Stuart: OW is pushing back on us regarding that PAGs control, which references IEL and application of 900 Methods on untreated water. They are going to address the PAGs part but can't speak to the 900 Methods application at SF sites. SOOOO, Schatzi told me we need your input in order to draft a response to the Methods comment in the email, which I've excerpted below.

Ms. McCarthy, I believe that those same US EPA experts **who had long ago shared their worries about the PAGs being implemented all too well**

understood the "gaming" of the rad testing that had already been going on for years. .... - i.e, so called "compliance monitoring" - using the US EPA

"Finished Drinking Water 900 Methods" - methods meant for finished, treated water systems and they said was never meant to be used on raw, untreated water

sources found like at IEL. Please see numerous letters documenting these serious deviations away from what is considered to be best available science in

letters to EPA found on our group's website: http://cclt.starksummit.org

Thus, the EPA scientists not simply expressed their fears of the PAGs being misused leaving Americans at risk to dangerous radiation, *but they likewise raised*

serious concerns to me about the US EPA's unscientific usage of the "EPA Finished Drinking Water 900 Methods" on raw, untreated water sources suspected of

containing radiation, which is what occurred at Uniontown IEL.

Lois Haas Gartner

Special Assistant

Office of Superfund Remediation

and Technology Innovation

U.S. Environmental Protection Agency

703.603.8711 (desk)

703.581.9794 (cell)

To: Woolford, James[Woolford.James@epa.gov]; Stalcup, Dana[Stalcup.Dana@epa.gov]
Cc: Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]; Fitz-James, Schatzi[Fitz-James.Schatzi@epa.gov]; Gartner, Lois[Gartner.Lois@epa.gov]
From: Walker, Stuart
Sent: Wed 12/7/2016 8:50:23 PM
Subject: RE: PAGS

This article and link to the NY AG letter also make for interesting reading

https://insideepa.com/sites/insideepa.com/files/documents/dec2016/epa2016_2535.pdf

Daily News

New York AG Office Urges White House To Reject Water Radiation Guide

December 05, 2016

The New York attorney general's (AG) office is urging the White House to reject a proposed EPA guidance that would set protective drinking water levels for radiological emergencies far in exceedance of Safe Drinking Water Act (SDWA) limits, even as EPA Administrator Gina McCarthy is defending the pending guide and arguing its reach is limited to temporary situations.

The White House Office of Management and Budget (OMB) is reviewing a drinking water chapter slated for inclusion in EPA's protective action guides (PAGs) for radiological emergencies. The agency plans to insert the chapter into an updated PAG manual that McCarthy signed Dec. 1.

EPA chose to finalize the manual now without the drinking water chapter, but says in a notice that it still plans to finalize the drinking water guidance and intends to add it into the "Intermediate Phase" chapter of the manual and reissue the manual once complete.

The pending drinking water amendments would largely weaken acceptable radiological concentrations allowed in drinking water months or years after a radiological emergency, and dozens of environmental groups have called for the amendments' withdrawal. In addition, several environmental groups in a Nov. 30 letter appealed to McCarthy to meet once again with them to reconsider the water amendments, arguing the draft version “would upend decades of clean water protections.”

An EPA Radiation and Indoor Air Office official, Sara DeCair, told EPA's Clean Air Act Advisory Committee (CAAAC) Dec. 1 that the drinking water amendments are in line to be finalized but gave the caveat that there are no guarantees that will occur under the current administration.

Echoing some of the criticisms levied by environmentalists, the New York AG's office is appealing to OMB to scrap the drinking water guide or alternatively, to send it back to EPA to be reworked, after the agency did not respond to concerns the state raised directly to EPA officials.

While the draft guidance purports to set acceptable radiation levels in public drinking water supplies following a radiological incident, it "advances a much less protective standard for drinking water interdiction than is set forth in existing EPA guidance and in EPA regulations promulgated under [SDWA]," a Nov. 21 letter from New York Assistant AGs Joshua M. Tallent and John J. Sipos says. The letter was sent to OMB Office of Information and Regulatory Affairs (OIRA) Administrator Howard Shelanski.

Potential Exposure

"Because it would substantially, indefinitely, and unjustifiably increase New Yorkers' exposure to radioactive contamination in drinking water in the aftermath of a potential radiological incident, the State of New York Office of the Attorney General strongly urges that OIRA either disapprove the draft guidance now under review or, in the alternative, return the guidance to the EPA for further consideration," the assistant AGs say.

A spokesman for New York Attorney General Eric Schneiderman says he cannot comment on whether the AG's office is considering the possibility of litigation over the PAGs, if EPA issues them without changes.

But McCarthy in response to a question asked during a Nov. 21 National Press Club speech she gave defended the draft water PAG, noting it is to be applied to temporary situations. She stressed that the agency is not altering its drinking water standards, and said the guide applies to a transitional period that would permit exposures temporarily that "would allow life to continue but not present a hazard to those individuals."

"[W]e are providing the best information we can in those transition days, not sending a signal that we think that those numbers should be the standard for drinking water. It clearly shouldn't be," she said at the Washington, D.C., event.

McCarthy said the guide grew out of the 2011 Fukushima, Japan, nuclear power

plant accident, where she said people were left not knowing what to do in the aftermath. The larger PAG manual in which the water amendments are slated to be inserted has long been needed by states, according to McCarthy. She said "states have been driven crazy because it's been years since anyone updated [the overall PAG manual] and because they know that we have more at issue now in terms of radiation."

DeCair in slides she presented to the CAAAC indicated that the agency in response to comments revised the draft PAGs to describe "how conservative PAGs levels are" and to further stress "how environmental standards are not changing because of this guidance."

Two-Tiered Approach

In the draft water amendments, EPA proposed a two-tiered approach that would provide more protective exposure levels for sensitive populations than the general population but would still allow radioactivity in drinking water at orders of magnitude beyond SDWA limits for radionuclides.

The amendments would deem protective action dose levels of 500 millirems/year (mrem/yr) in the first year after an incident for the general population, and 100 mrem/yr in the first year for infants, children age 15 and under, and pregnant or nursing women, according to a notice of availability for the draft drinking water PAG. The safety levels would be for emergency management officials to apply in the intermediate phase period after a radiological emergency -- which EPA has at times defined as up to one year but in other cases up to several years after an incident.

Among its criticisms of EPA's draft water PAG, the New York AG's office takes issue with the time period of exposure that citizens near a radiological incident could be subjected to.

The protective action thresholds in the water PAG are meant for use during what is called the intermediate phase of a radiological incident response, which means after the immediate release has been put under control but prior to a large-scale cleanup, the letter notes. In effect, the draft PAGs "create a variance of indeterminate duration from Safe Drinking Water Act standards," it says. This could allow emergency officials to permit citizens to be exposed to levels far exceeding SDWA limits for many months or even years after an incident, it says.

The state AG says what is especially troubling is the agency's "apparent abandonment of the organ dose-based radiation exposure measurement used in the [SDWA maximum contaminant levels (MCLs)] in favor of a measure of

exposure expressed as 'committed effective dose.'" EPA in the water PAG does not explain its rationale for the shift in methodology, but due to this change, the water PAG substantially understates "the increase in radionuclide concentrations allowable under the proposed PAGs over [SDWA] levels," it says. For example, EPA would allow a 3,450-fold rise in the maximum allowable concentration of iodine-131, it says.

'Effective Dose'

In the past, EPA has rejected "effective dose" as understating cancer risk, the state AG notes. "Inexplicably, the EPA seems to have adopted PAGs that could expose the public to levels of cancer risk far in excess of what the agency itself considers the maximum acceptable risk threshold," it says.

The state AG also questions EPA's release of "derived response levels" -- the allowable concentrations of each radionuclide in drinking water that correspond to EPA's PAG levels -- for just three of the 100 radionuclides that EPA believes may be found in drinking water systems following an incident.

The complaint echoes concerns voiced by environmentalists who have sued the agency under a Freedom of Information Act lawsuit to obtain the derived response levels for the other radionuclides. Without this data, the state and the public cannot "plausibly evaluate the protectiveness" of the agency's PAGs, the state AG says.

On the procedures side, the state AG also asks OIRA to reevaluate its apparent finding that the water PAG is not a "significant regulatory action," arguing against EPA's label that the PAGs are a nonbinding document.

"[T]he agency clearly intends and expects that federal, state, and local emergency planners will incorporate the draft PAGs into their planning protocols for use in the event of a radiological emergency," the letter says. Further, EPA's regulatory action could have significant adverse economic, agriculture, homeland security, healthcare and public health and safety impacts, it contends.

Therefore, OIRA should treat the water PAG as a significant regulatory action, subjecting it to the level of review required for such actions, it says. As part of that review, OIRA should scrutinize whether EPA has scientific justification for its claim that the water PAG is within the cancer risk range found in SDWA's MCLs, it says. -- *Suzanne Yohannan* (syohannan@iwpnews.com)

From: Woolford, James
Sent: Tuesday, December 06, 2016 8:24 AM
To: Stalcup, Dana <Stalcup.Dana@epa.gov>
Cc: Scozzafava, MichaelE <Scozzafava.MichaelE@epa.gov>; Walker, Stuart <Walker.Stuart@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Gartner, Lois <Gartner.Lois@epa.gov>
Subject: PAGS

EPA Finalizes Radiological Manual With 1992 Levels Despite Updated Science

December 05, 2016

EPA has quietly released a final guide for responding to radiological incidents, expanding the guide's reach while maintaining many of the protective action levels set in 1992, despite newer scientific findings EPA has adopted for other applications that one environmentalist radiation expert says should have led the agency to set stricter levels.

EPA Administrator Gina McCarthy Dec. 1 signed a notice making available the final Protective Action Guides (PAGs) and Planning Guidance for Radiological Incidents, commonly known as the PAG Manual. The manual revises a 1992 version and sets radiological protection criteria for federal, state, local and tribal emergency response officials to use in a wide variety of incidents involving a radiological release.

The agency chose to finalize the manual now without a highly controversial drinking water chapter that is still under interagency review at the White House Office of Management & Budget (OMB). EPA in the notice says it plans to eventually add the drinking water section to the "Intermediate Phase" chapter of the manual and then reissue the PAG manual. Environmentalists and the New York's attorney general's office have been severely critical of the draft drinking water chapter and have urged EPA to scrap it.

The guidance outlines three radiological incident phases for which it makes protective action recommendations. These are the early phase, the intermediate phase and the late phase. In the early phase, EPA calls for sheltering-in-place or evacuating the public if radioactive levels reach between 1 and 5 roentgen equivalent man (rem) -- a conventional unit used for equivalent dose -- over a four day period following the incident. It also calls for supplementary

administration of potassium iodide as a thyroid blocking agent per the latest guidance from the Food & Drug Administration if a child is subjected to 5 rem in the early phase of exposure -- hours to days.

In the intermediate phase, the PAG calls for relocating the public if the projected dose is equal to or greater than 2 rem in the first year, and 0.5 rem in the second and subsequent years. It also includes additional protective dose recommendations depending on food exposures or other circumstances.

For cleanup and waste disposal in the late phase, the manual includes brief guidance for planning the cleanup process and the disposal of radioactive waste, EPA says in a fact sheet issued with the guide.

EPA has expanded the breadth of the guidance from the 1992 version, saying the protective actions described in the manual now apply to a wide range of incidents, although generally to those involving significant radioactive releases. These incidents include nuclear weapons complex or nuclear power plant accidents, a fire in a nuclear fuel manufacturing plant, transportation accidents involving radioactive material or terrorist acts involving a radiological dispersal device.

Questionable Authority

The environmentalist questions the need for such a guidance when the Superfund law already contains authorities to respond to releases, including emergencies. “[D]espite their rote claims to the contrary,” the PAG manual undercuts the Superfund law, the source says.

The source says EPA seems “to admit the problem a bit” in a footnote, suggesting it may lack legal authority to issue the PAGs. The source points to a footnote not included in the draft PAG manual, and now repeated throughout the final that the source says effectively indicates the agency lacks the “legal basis to do any of this.” In the footnote to a section on cleanup under the late phase, EPA notes that “this cleanup process does not rely on and does not affect any authority, including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), . . . and the National Contingency Plan (NCP).”

It goes on to say: “This document expresses no view as to the availability of legal authority to implement this process in any particular situation.”

EPA is stressing that the PAG manual is non-binding, and does not set legal radiation limits or supersede environmental laws or regulations.

In the notice, which in part responds to comments critical of the draft, EPA says the levels established in the manual “are intended to be used only in an emergency when radiation levels have already exceeded environmental standards and could be high enough to cause health effects unless protective actions are taken.” The agency contends that PAGs are meant to prevent adverse health impacts by triggering public safety measures such as evacuation and to minimize “unnecessary exposures.”

The notice continues, “The PAGs are set at a level where the health risk from radiation exposure that could be avoided with protective action outweighs the risk associated with taking the safety measures, e.g., traffic accidents, trips and falls or anxiety associated with dislocation or the separation of family members.”

In response to criticism from environmental groups that the PAGs would not be stringent enough, EPA contends that “[t]here is an abundant conservatism built into the derivation of the PAGs, and into the assumptions used to generate derived response levels, to ensure that the PAGs are appropriate emergency guides for all members of the public, including sensitive subpopulations.”

Weaker Standards

But the environmentalist says EPA has effectively weakened the standards, and notes that the details in the manual contradict claims made in the notice and fact sheet.

EPA in the fact sheet says the manual “includes dose calculations based on the latest science.” But the source says, “What stunned me is it’s exactly the opposite.”

The manual says that most of the PAGs and related actions remain unchanged from the 1992 manual. For instance in its basis for early phase PAGs, EPA references Biological Effects of Ionizing Radiation (BEIR) III, which are now out-of-date cancer and non-cancer risk estimates from exposure to low-level ionizing radiation issued by the National Academy of Sciences (NAS). The source points out that EPA has since adopted more recent NAS findings -- BEIR V and VII -- that show risks are greater than previously estimated for the same level of radiation received. Therefore, the new science shows that levels should be more stringent, the source argues.

This new document contains essentially the same levels as the 1992 document, and is based on science from the 1970s, at the same time EPA is saying it is based on new science, the source says.

Further, EPA weakened the 1992 manual by eliminating certain evacuation requirements triggered when skin and thyroid doses exceed certain levels, the source says. Also, it eliminates a PAG for the intermediate phase that called for relocation if it was projected that the population would accumulate exposure at 5 rem over a 50-year period. EPA in the manual says this was removed for simplicity. The 50-year relocation PAG "is rarely, if ever, the driver for extending a relocation area beyond that prompted by the first or second year relocation PAGs in scenarios that have been analyzed."

In addition, the manual says that "dose projections over 50 years after a radiological incident for various age groups show no significant differences for individuals exposed at 3 months of age versus adult."

The fact sheet also contradicts the manual on the time interval for the intermediate phase, with the former saying it will last weeks to months, while the details included in the manual, including a table that specifies PAG levels, indicate this time period could last up to several years. -- *Suzanne Yohannan* (syohannan@iwpnews.com)

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Jim Woolford, Director

Office of Superfund Remediation and Technology Innovation

Office of Land and Emergency Management

US Environmental Protection Agency

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Washington, DC 20460

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2777 S. Crystal Dr.
Arlington, VA 22202

To: Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]
From: Walker, Stuart
Sent: Wed 11/16/2016 11:04:57 PM
Subject: Fw: New EPA Drinking Water PAGS [WARNING: DKIM validation failed]

fyi

From: Bain, Andrew W.
Sent: Wednesday, November 16, 2016 6:03 PM
To: Walker, Stuart
Subject: RE: New EPA Drinking Water PAGS [WARNING: DKIM validation failed]

Unclear. Probably his PIO.

From: Walker, Stuart
Sent: Wednesday, November 16, 2016 3:02 PM
To: Bain, Andrew W. <Bain.Andrew@epa.gov>
Subject: Re: New EPA Drinking Water PAGS [WARNING: DKIM validation failed]

How did Phil get it?

From: Bain, Andrew W.
Sent: Wednesday, November 16, 2016 11:52 AM
To: Walker, Stuart
Subject: FW: New EPA Drinking Water PAGS [WARNING: DKIM validation failed]

FYI

From: Wong, Phil [mailto:Phil.Wong@nnsa.doe.gov]
Sent: Tuesday, November 15, 2016 2:01 PM
To: Bain, Andrew W. <Bain.Andrew@epa.gov>
Subject: New EPA Drinking Water PAGS [WARNING: DKIM validation failed]

Hi Andy,

Here is that news story I mentioned.

http://www.nbcbayarea.com/investigations/E-P-AS-NEW-EMERGENCY-PLAN-FOR-DRINKING-WATER-CONCERNS-MANY-401206656.html

EPA's New Emergency Plan for Drinking Water Concerns Many

www.nbcbayarea.com

NBC Bay Area compares the proposed levels for radioactive elements in drinking water after a nuclear event or accident and found levels thousands of times higher than current federal law allows.

To: Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]; Bartenfelder, David[Bartenfelder.David@epa.gov]; Anderson, RobinM[Anderson.RobinM@epa.gov]; McEaddy, Monica[McEaddy.Monica@epa.gov]; Simes, Benjamin[Simes.Benjamin@epa.gov]
From: Walker, Stuart
Sent: Wed 11/16/2016 5:09:21 PM
Subject: Fw: New EPA Drinking Water PAGS [WARNING: DKIM validation failed]

fyi

From: Bain, Andrew W.
Sent: Wednesday, November 16, 2016 11:52 AM
To: Walker, Stuart
Subject: FW: New EPA Drinking Water PAGS [WARNING: DKIM validation failed]

FYI

From: Wong, Phil [mailto:Phil.Wong@nnsa.doe.gov]
Sent: Tuesday, November 15, 2016 2:01 PM
To: Bain, Andrew W. <Bain.Andrew@epa.gov>
Subject: New EPA Drinking Water PAGS [WARNING: DKIM validation failed]

Hi Andy,

Here is that news story I mentioned.

http://www.nbcbayarea.com/investigations/E-P-AS-NEW-EMERGENCY-PLAN-FOR-DRINKING-WATER-CONCERNS-MANY-401206656.html

EPA's New Emergency Plan for Drinking Water Concerns Many

To: Scozzafava, MichaelE[Scozzafava.MichaelE@epa.gov]; Nguyen, Lyndsey[Nguyen.Lyndsey@epa.gov]; Kappelman, David[Kappelman.David@epa.gov]
Cc: Bartenfelder, David[Bartenfelder.David@epa.gov]
From: Walker, Stuart
Sent: Thur 9/15/2016 9:26:20 PM
Subject: FW: my analysis of drinking water PAG
PAGs_vs_Risk_vs_MCL_123_Comparison.pdf

Pdf of the Lotus 123 files from the previous email if you can't read those

From: Stuart Walker [mailto:Walker.Stuart@epamail.epa.gov]
Sent: Thursday, September 15, 2016 4:08 PM
To: Walker, Stuart <Walker.Stuart@epa.gov>
Subject: Fw: my analysis of drinking water PAG

----- Forwarded by Stuart Walker/DC/USEPA/US on 09/15/2016 04:07 PM -----

From: Stuart Walker/DC/USEPA/US
To: David Huber/DC/USEPA/US@EPA,
Date: 03/04/2010 08:11 PM
Subject: Fw: my analysis of drinking water PAG

My 123 analysis scanned without all the extra pages.
(See attached file: PAGs_vs_Risk_vs_MCL_123_Comparison.pdf)
----- Forwarded by Stuart Walker/DC/USEPA/US on 03/04/2010 08:06 PM -----

Stuart Walker/DC/USEPA/US

From:

David Huber/DC/USEPA/US@EPA

To:

03/04/2010 06:57 PM

Date:

Fw: my analysis of drinking water PAG

Subject:

---

scanned in copy of my Lotus 123 files
[attachment "[Untitled].pdf" deleted by Stuart Walker/DC/USEPA/US]
----- Forwarded by Stuart Walker/DC/USEPA/US on 03/04/2010 06:55 PM -----

Stuart Walker/DC/USEPA/US

From:

David Huber/DC/USEPA/US@EPA

To:

03/04/2010 06:41 PM

Date:

my analysis of drinking water PAG

Subject:

----- Forwarded by Stuart Walker/DC/USEPA/US on 03/04/2010 06:40 PM -----

Stuart Walker/DC/USEPA/US

From:

Sara DeCair/DC/USEPA/US@EPA

To:

Cc: Doug Ammon/DC/USEPA/US@EPA, Colby Stanton/DC/USEPA/US@EPA, Elizabeth Southerland/DC/USEPA/US@EPA, Juan Reyes/DC/USEPA/US@EPA

05/15/2007 06:04 PM

Date:

Re: ACTION REQ'D: Five-week review of PAG Manual

Subject:

Hi Sara,

Thanks for providing us an opportunity to review the latest draft of the ORIA PAGs. OSRTI does not have any showstoppers. We request that you let us review a redline/~~strikeout~~ version of the next draft after you incorporate comments from the workgroup.

Ex. 5 - Deliberative Process

Below is further explanaition of the analysis discussed in the comments on the water and food PAGs.

Water PAGs

Ex. 5 - Deliberative Process

Here is an explanation of the comparison tables I put together on the food PAGs and the 3 tables themselves.
[attachment "2007ExplainCompareFOODTables.pdf" deleted by Stuart Walker/DC/USEPA/US]
[attachment "2007CompareFoodTable_convertPRG.123" deleted by Stuart Walker/DC/USEPA/US]
[attachment "2007CompareFoodTable.123" deleted by Stuart Walker/DC/USEPA/US] [attachment "2007CompareFoodTable_byRad.123" deleted by Stuart Walker/DC/USEPA/US]
Sara DeCair/DC/USEPA/US

Sara DeCair/DC/USEPA/US

04/10/2007 10:26 AM

To andrew.Wallo@eh.doe.gov, cmw6@cdc.gov, cym3@cdc.gov, Kenneth.Wierman@dhs.gov, man@cdrh.fda.gov, pxm@nrc.gov, paul.nelson@dtra.mil, pxs@cdrh.fda.gov, stanton.colby@epa.gov, Sara DeCair/DC/USEPA/US@EPA, stephen.domotor@eh.doe.gov, sam2@nrc.gov, Dan.Wilcox@dhs.gov, Vanessa.Quinn@dhs.gov, william.cunningham@nist.gov, walker.stuart@epa.gov, ammon.doug@epa.gov, schumann.jean@epa.gov, Ferris.John@dol.gov,

druedy@endyna.com, itasker@endyna.com, siddhanti@endyna.com, asa4@CDC.GOV, Jack.Patterson@rss.usda.gov, John Cardarelli/CI/USEPA/US@EPA, Scott Hudson/CI/USEPA/US@EPA, Colleen Petullo/LV/USEPA/US@EPA, Susan Stahle/DC/USEPA/US@EPA, ksteves@kdhe.state.ks.us, jim_hardeman@dnr.state.ga.us, debra.mcbaugh@doh.wa.gov, elzermam@michigan.gov, yalek@michigan.gov, Jessica Wieder/DC/USEPA/US@EPA, dschneider@scainc.com, Robert Dye/ARTD/R7/USEPA/US@EPA, CharlesA Hooper/ARTD/R7/USEPA/US@EPA, Roger Goodman/DC/USEPA/US@EPA, craig.conklin@dhs.gov, John Mackinney/DC/USEPA/US@EPA, tdkraus@sandia.gov, Mike Boyd/DC/USEPA/US@EPA, Neal Nelson/DC/USEPA/US@EPA, Lowell Ralston/DC/USEPA/US@EPA, Rick Poeton/R10/USEPA/US@EPA, boyd.wesley@epa.gov, Scott Telofski/MTG/USEPA/US@EPA, Roger Goodman/DC/USEPA/US@EPA

cc: Mike Boyd/DC/USEPA/US@EPA, Neal Nelson/DC/USEPA/US@EPA, Lowell Ralston/DC/USEPA/US@EPA, Rick Poeton/R10/USEPA/US@EPA, boyd.wesley@epa.gov

Subject: ACTION REQ'D: Five-week review of PAG Manual

PAGs Reviewers;

Ex. 5 - Deliberative Process

To: Stalcup, Dana[Stalcup.Dana@epa.gov]
From: BNA Highlights
Sent: Thur 1/19/2017 4:30:22 PM
Subject: Jan 19 -- BNA, Inc. EHS Federal Regulatory Alert (Daily)

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Email not displaying correctly? View publication in your browser.

January 19, 2017

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AIR

California Commercial Harbor Craft Engine Standards

Notice of the EPA announces the approval of a request from the California Air Resources Board (CARB) of amendments to its commercial harbor craft (CHC) regulations. The amendments extend the applicability of CHC provisions to in-use crew and supply, barge and dredge vessels that are equipped with federal Tier 0 and Tier 1 propulsion and auxiliary marine engines that operate within the regulated California waters. The amendments also eliminate exemptions for CHC engines registered in the Portable Equipment Registration Program or permitted by local air pollution districts, define “swing engines” as replacement engines maintained at dockside locations, require such engines to comply with CHC standards in-use engine requirements, and allow owners or operators to use a noncurrent year certified replacement engine under certain circumstances. In addition, the amendments allow use of existing engines in a fleet to replace an older engine, expand compliance extension options to fleets of three or more vessels and establish requirements applicable to new and in-use engines. Finally, the amendments allow owners and operators to use agency or CARB Tier 2 or higher tier certified off-road engines if the engine or vessel manufacturer complies with the provisions under 40 CFR 1042.605, which establishes requirements for marinized land-based engines. The notice also specifies that certain revisions are within the scope of the agency's previous authorization. Petitions for review are due March 20, 2017. Contact: David Dickinson; EPA, Office of Transportation and Air Quality; 202-343-9256; Dickinson.David@epa.gov

82 FR 6500 (01/19/2017)

Regulatory Update

AIR

California Off-Highway Recreational Vehicle Evaporative Emissions

Notice of the EPA announces the granting of a request from the California Air Resources Board for authorization of certain amendments to its off-highway recreational vehicle (OHRV) regulations under Section 209(e) of the Clean Air Act. The request concerns newly established evaporative emission standards and associated test procedures for OHRVs for 2018 and subsequent model years. Petitions for review are due March 20, 2017. Contact: David Dickinson; EPA, Office of Transportation and Air

Quality; 202-343-9256; Dickinson.David@epa.gov

82 FR 6540 (01/19/2017)

Regulatory Update

AIR

California Transport Refrigeration Units Regulations

Notice of the EPA announces a decision granting a request from the California Air Resources Board (80 FR 71791; 11/17/2015) for authorization of 2011 amendments to the state's regulations regarding in-use diesel-fueled transport refrigeration units (TRUs) and TRU generator sets and facilities where TRUs operate. The notice also confirms that the amendments are within the scope of a prior authorization issued by the EPA under Section 209(e) of the Clean Air Act. The amendments provide owners of TRU engines with certain flexibility; clarify recordkeeping requirements for certain types of TRU engines; and establish requirements for businesses that arrange, hire, contract or dispatch the transport of goods in TRU-equipped trucks, trailers or containers. Petitions for review are due March 20, 2017. Contact: David Dickinson; EPA, Office of Transportation and Air Quality; 202-343-9256; dickinson.david@epa.gov

82 FR 6525 (01/19/2017)

Regulatory Update

AIR

Ceiling Fan Efficiency Standards

Final rule of the Department of Energy, Office of Energy Efficiency and Renewable Energy, amends regulations under 10 CFR 430.32 to revise the energy conservation standards for ceiling fans. The rule establishes standards expressed as the minimum allowable airflow efficiency in terms of cubic feet per minute per watt for each product class as a function of ceiling fan diameter in inches. The rule also adds several related definitions and specifies a compliance date of Jan. 21, 2020. The rule is effective March 20, 2017. Contact: Lucy DeButts; DOE, Office of Energy Efficiency and Renewable Energy; 202-287-1604; ApplianceStandardsQuestions@ee.doe.gov

82 FR 6826 (01/19/2017)

Regulatory Update

AIR

Clean Air Act Ozone Transport Region Petition

Notice announces the intention of the EPA to deny a Clean Air Act Section 176A petition by the states of Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New York, Pennsylvania, Rhode Island and Vermont requesting that the EPA add the states of Illinois, Indiana, Kentucky, Michigan, North Carolina, Ohio, Tennessee, West Virginia and Virginia to the ozone transport region (OTR). The notice specifies that the denial would maintain the geographic scope and requirements of the OTR. Hearing requests are due Jan. 30, 2017. Comments are due Feb. 21, 2017. Contact: Gobeail McKinley; EPA, Office of Air Quality Planning and Standards; 919-541-5246; mckinley.gobeail@epa.gov

82 FR 6509 (01/19/2017)

Regulatory Update

AIR

Clean Air Act Settlement Agreement

Notice of the EPA announces a proposed settlement agreement in Sierra Club v. EPA (Civil Action No. 16-1158) with the U.S. District Court for the District of Columbia. The agreement resolves a petition for judicial review of a March 28, 2016, EPA final rule (81 FR 17248) regarding revisions to ambient monitoring quality assurance. The agreement requires the EPA to issue two nonbinding guidance documents regarding recommendations for public inspection of proposed monitoring plans and recommendations for stakeholder notification of submitted monitoring plan approvals and disapprovals. The agreement also requires the U.S. to pay Sierra Club's claim for fees and costs. Comments are due Feb. 21, 2017. Contact: Jonathan Skinner-Thompson; EPA, Office of General Counsel; 202-564-0291; skinner-thompson.jonathan@epa.gov

82 FR 6532 (01/19/2017)

Regulatory Update

AIR

General Service Lamp Efficiency Standards

Final rule of the Department of Energy, Office of Energy Efficiency and Renewable Energy, amends regulations under 10 CFR 430.2 to revise the definition of “general service lamp” (GSL) in connection with a March 17, 2016, proposed rule (81 FR 14528) to establish new and revised energy conservation standards for GSLs. The rule responds to comments on an Oct. 18, 2016, notice of proposed definition and data availability (81 FR 71794) with respect to the 22 lamps exempted from the definition of “general service incandescent lamp” (GSIL), except for comments specific to incandescent reflector lamps (IRLs), which are addressed in a concurrent final rule. The rule includes a revised definition of GSL that discontinues seven GSIL exemptions and maintains 15 GSIL exemptions due to low sales and potential for use. The rule also revises supporting definitions. The rule is effective Jan. 1, 2020. Contact: Lucy deButts; DOE, Office of Energy Efficiency and Renewable Energy; 202-287-1604; ApplianceStandardsQuestions@ee.doe.gov

82 FR 7276 (01/19/2017)

Regulatory Update

AIR

General Service Lamp Efficiency Standards

Final rule of the Department of Energy, Office of Energy Efficiency and Renewable Energy, amends regulations under 10 CFR 430.2 to revise the definition of “general service lamp” (GSL) in connection with a March 17, 2016, proposed rule (81 FR 14528) to establish new and revised energy conservation standards for GSLs. The rule responds to comments on an Oct. 18, 2016, notice of proposed definition and data availability (81 FR 71794) with respect to incandescent reflector lamps (IRLs). The rule includes a revised definition of GLS that discontinues the exemption for IRLs. In a concurrent final rule, the agency revises the definition of GSL to reflect the discontinuation of certain exemptions from the definition of “general service incandescent lamp” (GSIL) and the maintenance of other GSIL exemptions. The rule is effective Jan. 1, 2020. Contact: Lucy deButts; DOE, Office of Energy Efficiency and Renewable Energy; 202-287-1604; ApplianceStandardsQuestions@ee.doe.gov

82 FR 7322 (01/19/2017)

Regulatory Update

AIR

Washington SIP/Southwest Clean Air Agency

Proposed rule of the EPA amends regulations under 40 CFR 52 to approve revisions to the the Southwest Clean Air Agency (SWCAA) portion of the Washington SIP. The revisions replace or

supplement corresponding state Department of Ecology regulations for sources in SWCAA's jurisdiction and modify the visibility protection federal implementation plan regarding implementation of the major nonattainment new source review program. The revisions also approve a subset of Ecology regulations for which there are no corresponding SWCAA standards. Comments are due Feb. 21, 2017. Contact: Jeff Hunt; EPA Region 10; 206-553-0256; hunt.jeff@epa.gov

82 FR 6413 (01/19/2017)

Regulatory Update

ENDANGERED SPECIES

Blackchin Guitarfish and Common Guitarfish

Final rule of the National Oceanic and Atmospheric Administration, National Marine Fisheries Service, amends regulations under 50 CFR 223.102 to list the blackchin guitarfish and the common guitarfish as threatened. The rule designates no critical habitat for the foreign marine species. The rule is effective Feb. 21, 2017. Contact: Brendan Newell; NMFS, Office of Protected Resources; 301-427-8403

82 FR 6309 (01/19/2017)

Regulatory Update

FOOD SAFETY

Biological Select Agent and Toxin List

Final rule of the Animal and Plant Health Inspection Service amends regulations under 7 CFR 331.1 through 331.17 (nonconsecutive) and 9 CFR 121.1 through 121.17 (nonconsecutive) to revise and republish the list of select toxins and agents that have the potential to pose a severe threat to animal or plant health, or to animal or plant products, as required under the Agricultural Bioterrorism Protection Act. The rule clarifies that an entity must use a validated procedure to render a select agent nonviable or regulated nucleic acids noninfectious for future use. The rule also requires a responsible official to investigate any viability of material that was subjected to a validated inactivation protocol to determine the reason of the inactivation failure and, if unable to determine the reason for failure, to report the inactivation failure to the Centers for Disease Control and Prevention or APHIS. In addition, the rule clarifies review of site-specific standard operating inactivation procedures, allows the use of surrogate strains to validate inactivation procedures, clarifies waiver procedures, and adds definitions, The rule does not finalize proposals to remove three plant protection and quarantine select agents and toxins, to remove three overlap select agents and toxins, or to add definitions for “inactivation” and “kill curve.” A concurrent final rule of the CDC makes parallel regulatory changes. The rule is effective Feb. 21, 2017. Contact: Freeda Isaac; APHIS, Agriculture Select Agent Services; 301-851-3300

82 FR 6197 (01/19/2017)

Regulatory Update

FOOD SAFETY

Codex Alimentarius Commission Meeting/Food Additives

Notice of the Food Safety and Inspection Service announces a meeting to discuss agenda items and draft U.S. positions for the 49th session of the Codex Alimentarius Commission, Committee on Food Additives, to be held March 20-24, 2017, in Macao Special Administrative Region, China. The meeting is scheduled for Feb. 21, 2017, in College Park, Md. Comments are requested, but a due date is not specified. Contact: Daniel Folmer; FDA, Center for Food Safety and Applied Nutrition; 240-402-1269; daniel.folmer@fda.hhs.gov

82 FR 6485 (01/19/2017)

Regulatory Update

FOOD SAFETY

Genetically Modified Organisms That Present a Plant Pest Risk

Proposed rule of the of the Animal and Plant Health Inspection Service amends regulations under 7 CFR 340.0 through 340.7 and repeals regulations under 7 CFR 340.8 and 340.9 concerning evaluation, importation, interstate movement and environmental release of genetically engineered (GE) organisms that may present a plant pest risk to reflect advances in genetic engineering techniques. The rule replaces the noxious weed notification process with a permitting process and provides for evaluation of GE plants for noxious weed potential using a risk analysis process to determine which organisms would require a permit. The rule also sets forth requirements for GE organisms intended for use as a biological control that are determined to be a plant pest or noxious weed and addresses treatment of plants that produce plant-made industrials and pharmaceuticals. In addition, the rule sets forth permit requirements for plant-incorporated protectants planted on 10 acres or fewer if they present a plant pest or noxious weed risk or have not yet been evaluated by APHIS for such risk. Comments are due May 19, 2017. Contact: Sidney Abel; APHIS, Biotechnology Regulatory Services; 301-851-3896

82 FR 7008 (01/19/2017)

Regulatory Update

FOOD SAFETY

Genome Editing in New Plant Varieties Used For Foods

Notice of the Food and Drug Administration announces the establishment of a docket to receive comments on the use of genome editing techniques to produce new plant varieties for use in human or animal food. The notice requests comments on food safety risks associated with human and animal foods from genome edited plants and on possible steps to help small firms, including those considering using genome editing to produce new plant varieties, to engage with the FDA on questions related to food safety or the regulatory status of foods from their new plant varieties. Comments are due April 19, 2017. Contact: Jason Dietz; FDA, Center for Food Safety and Applied Nutrition; 240-402-2282

82 FR 6564 (01/19/2017)

Regulatory Update

FOOD SAFETY

Intentionally Altered Genomic DNA in Animals

Notice of the Food and Drug Administration announces the availability of a draft revised guidance for industry concerning requirements and recommendations for producers and developers of animals with intentionally altered genomic DNA. The revisions expand the scope of a 2009 guidance (GFI #187) on genetically engineered animals to address animals intentionally altered through the use of genome editing techniques. The revisions also clarify that unless otherwise excluded, the altered genomic DNA in an animal that is intended to affect the structure or function of the body of the animal or to diagnose, cure, mitigate treat or prevent disease in the animal meets the definition of a drug under Section 201(g) of the Food, Drug, and Cosmetic Act. In addition, the revisions clarify the definition of “altered genomic DNA” and specify that the guidance is primarily intended to address heritable alterations. Comments are due April 19, 2017. Contact: Laura Epstein; FDA, Center for Veterinary Medicine; 301-796-8558; laura.epstein@fda.hhs.gov

82 FR 6561 (01/19/2017)

Regulatory Update

FOOD SAFETY

Meat and Poultry Products/Nutrition Labeling

Proposed rule of the Food Safety and Inspection Service amends regulations under 9 CFR 301.2 through 412.2 (nonconsecutive) and adopts regulations under 9 CFR 413 to revise the nutrition labeling requirements for meat and poultry products. The rule updates the list of nutrients that are required or permitted to be declared and provides modified daily reference values and reference daily intake values based on current dietary recommendations from consensus reports. The rule also revises labeling requirements for foods represented or purported to be specifically for children under the age of 4, pregnant women and lactating women and establishes nutrient reference values specifically for such population subgroups. In addition, the rule modifies the format and appearance of the Nutrition Facts label, revises the definition of “single-serving container,” requires dual-column labeling for certain containers and revises several reference amounts customarily consumed. Finally, the rule consolidates the nutrition labeling regulations for meat and poultry products in a single CFR part. The rule is intended to provide consistency with May 27, 2016, FDA final rules (81 FR 33742 and 34000). Comments are due March 20, 2017. Contact: Jeff Canavan; FSIS, Office of Policy and Program Development; 301-504-0879

82 FR 6732 (01/19/2017)

Regulatory Update

FOOD SAFETY

Revised Advice About Eating Fish

Notice of the Food and Drug Administration announces the availability of a revised document regarding mercury in fish and shellfish, jointly released by the FDA and the EPA. The revised document adds to existing advice by encouraging pregnant and breastfeeding women to consume 8 to 12 ounces of a variety of fish per week. The revised document also adds a chart recommending how often fish should be eaten based on mercury concentrations and supplemental questions and answers to assist in understanding the advice in greater detail. Contact: William Jones; FDA, Center for Food Safety and Applied Nutrition; 240-402-1422; William.Jones@fda.hhs.gov

82 FR 6571 (01/19/2017)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

Adverse Event Program for Medical Devices

Notice announces the intention of the Food and Drug Administration to seek OMB approval for a continuing information collection request regarding the Adverse Event Program for Medical Devices. The collection addresses information included on form FDA 3500A related to medical devices and tissue products from the user facilities participating in the voluntary Medical Product Safety Network. The collection also address demographic profiles of facilities and additional questions to allow the FDA to better understand the cause of reported adverse events. Comments are due March 20, 2017. Contact: FDA, Office of Operations; 301-796-3793; PRAStaff@fda.hhs.gov

82 FR 6566 (01/19/2017)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

Alaska/Eastern Interior Resource Management Plans

Notice of the Bureau of Land Management announces the denial of the Alaska governor's appeal of the Alaska state director's decision regarding the governor's consistency review letter concerning the Eastern Interior proposed resource management plan and associated final environmental impact statement (81 FR 50009; 07/29/2016). The plan covers approximately 6.5 million acres of BLM-administered lands, designates three areas of critical environmental concern, maintains four research natural areas, and provides direction for management of three wild and scenic river planning areas. The notice affirms the state director's determination that the governor's consistency review letter does not identify inconsistencies with state plans, policies or programs. Contact: Leah Baker; BLM, Decision Support, Planning and NEPA; 202-912-7282

82 FR 6634 (01/19/2017)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

American Burying Beetle Incidental Take Permit

Notice announces the intention of the U.S. Fish and Wildlife Service to prepare a draft environmental impact statement concerning the proposed issuance of an incidental take permit of the endangered American burying beetle in response to the habitat conservation plan proposed by American Electric Power of Columbus, Ohio. The notice specifies the proposed action to issue a permit for activities associated with construction, operation and maintenance of electric transmission and distribution lines or other associated infrastructure in 62 counties in Arkansas, Oklahoma and Texas for a period of 30 years. The notice also specifies that the agency will evaluate whether the covered activities will impact 24 other species and whether those species should be included on the permit and provides a no-action alternative. Meetings will held in Fort Smith, Ark.; McAlester and Tulsa, Okla.; and Texarkana, Texas, and times and specific locations will be announced. Comments are due Feb. 17, 2017. Contact: Jonna Polk; FWS, Oklahoma Ecological Services Field Office; 918-581-7458; OKES_HCP_EIS@fws.gov

82 FR 6625 (01/19/2017)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

Arizona/Fossil Creek Wild and Scenic River

Notice of the U.S. Forest Service announces the extension of the comment period for a Nov. 29, 2016, notice of intent (81 FR 85923) to prepare a comprehensive river management plan and associated environmental impact statement for the Fossil Creek Wild and Scenic River in Arizona. The plan establishes river corridor boundaries and recreation and wild segment classifications to protect water quality and outstandingly remarkable values following the designation of Fossil Creek as a wild and scenic river corridor. The plan also addresses increased river flow following the decommissioning of a historic hydropower dam in 2005 and increased public use of the river. The notice specifies that the issuance of a draft EIS is scheduled for summer 2017, and the issuance of a final EIS is scheduled for spring 2018. Comments now are due Jan. 27, 2017. Contact: Marcos Roybal; USFS; 928-203-2915; maroybal@fs.fed.us

82 FR 6487 (01/19/2017)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

Drug and Device Manufacturer Communications With Payors, Formulary Committees, Similar Entities

Notice of the Food and Drug Administration announces the availability of a draft guidance for industry concerning drug and device manufacturer communications with payors, formulary committees and

similar entities. The draft guidance provides answers to common questions concerning the communication of health care economic information about approved prescription drugs by medical product manufacturers, packers and distributors and their representatives. The draft guidance also provides answers to common questions regarding communication concerning investigational drugs and devices before the FDA approval or clearance of such products. Comments are due April 19, 2017. Contact: Elaine Hu Cunningham; FDA, Center for Drug Evaluation and Research; 301-796-0418

82 FR 6568 (01/19/2017)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

Maine/Hydro Kennebec Project

Notice of the Federal Energy Regulatory Commission announces the filing of a hydroelectric application by Hydro Kennebec LLC to amend the license for the Hydro Kennebec Project on the Kennebec River, in Kennebec and Somerset counties in Maine. The revisions would extend the expiration date of the approved interim species passage plan for the project to Dec. 31, 2019. Comments, motions to intervene and protests are due Feb. 13, 2017. Contact: Mark Pawlowski; FERC; 202-502-6052; mark.pawlowski@ferc.gov

82 FR 6497 (01/19/2017)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

Manufacturer Communications/Unapproved Uses of Medical Products

Notice of the Food and Drug Administration announces the reopening of the comment period for a Sept. 1, 2016, notice (81 FR 60299) regarding a hearing on manufacturer, packer and distributor communications regarding regulated human drugs and medical devices and animal drugs, including unapproved uses of approved or cleared medical products. The hearing, held Nov. 9-10, 2016, addressed proposed limitations on or requirements for unapproved use information necessary to protect patients from harm. The hearing also included discussion of the extent to which health care professionals currently face impediments to accessing unapproved use information and the impacts of health care system quality and appropriate use measurements on medical decisionmaking and prescribing. The current action also announces the availability of a memorandum on public health interests and first amendment considerations related to manufacturer communications regarding unapproved uses of approved or cleared medical products. Two concurrent notices announce the availability of draft guidance documents concerning drug and device manufacturer communications with payors, formulary committees and similar entities and medical product communications that are consistent with FDA-required labeling. Comments now are due April 19, 2017. Contact: Kristin Davis; FDA, Office of Policy; 301-796-0418

82 FR 6367 (01/19/2017)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

Medical Product Communications Consistent with Labeling Requirements

Notice of the Food and Drug Administration announces the availability of a draft guidance for industry concerning medical product communications by manufacturers, packers and distributors and their representatives concerning drugs and medical devices for humans, including those that are licensed as biological products, and animal drugs. The draft guidance addresses the evaluation of medical product communications, including promotional materials, that present information that is not contained in FDA-

required labeling for the product but that may be consistent with FDA-required labeling for the product. Comments are due April 19, 2017. Contact: Kristin Davis; FDA, Office of Policy; 301-796-0418

82 FR 6575 (01/19/2017)

GENERAL ENVIRONMENT AND SAFETY

Minnesota/Superior National Forest and Rainy River Watershed

Notice of the Bureau of Land Management announces the filing of an application by the U.S. Forest Service requesting that the secretary of the Interior withdraw, for a period of 20 years, approximately 234,328 acres of National Forest System Lands located within the Rainy River Watershed in the Superior National Forest, in Cook, Lake and Saint Louis counties in Minnesota. The notice specifies that the purpose of the withdrawal is to protect and preserve natural resources and waters of the watershed that flow into the Boundary Waters Canoe Area Wilderness and the Boundary Waters Canoe Area Wilderness Mining Protection Area. The notice also specifies that the lands will remain open for other forms of use and disposition, including disposition of mineral materials. A meeting is scheduled for March 16, 2017, in Duluth. Comments are due April 19, 2017. Contact: Dominica VanKoten; BLM, Eastern States Office; 202-912-7756

82 FR 6639 (01/19/2017)

GENERAL ENVIRONMENT AND SAFETY

OCS Oil and Gas Leasing Program 2017-2022 Assessment

Notice of the Bureau of Ocean Energy Management announces the availability of the record of decision for the 2017-2022 Outer Continental Shelf Oil and Gas Leasing Program final programmatic environmental impact statement. The decision approves the program and two mitigation measures, the protection of biologically sensitive underwater features in the Gulf of Mexico and the Alaska Conflict Management Plan. The decision also directs the bureau to analyze a seasonal restriction on seismic surveys and exploration of drilling for Cook Inlet Lease Sale 258. Contact: Jill Lewandowski; BOEM; 703-787-1703

82 FR 6643 (01/19/2017)

GENERAL ENVIRONMENT AND SAFETY

Protection of Human Research Subjects

Final rule of the Department of Health and Human services, in conjunction with 15 additional federal agencies, amends regulations under 7 CFR 1c, 10 CFR 745, 14 CFR 1230, 15 CFR 27, 22 CFR 225, 24 CFR 60, 32 CFR 219, 34 CFR 97, 38 CFR 16, 40 CFR 26, 45 CFR 46, 45 CFR 690 and 49 CFR 11 and adopts regulations under 6 CFR 46, 20 CFR 431 and 29 CFR 21 regarding federal policy for the protection of human research subjects. The rule sets forth new requirements regarding the information that must be given to prospective research subjects as part of the informed consent process and allows the use of broad consent from a subject for the storage, maintenance and secondary research use of identifiable private information and biospecimens. The rule also establishes new exempt categories of research based on risk profile and requires U.S.-based institutions that engage in cooperative research to use a single institutional review board for the portion of the research that takes place within the U.S. In addition, the rule removes the requirement to conduct continuing review of ongoing research for studies that undergo expedited review and for certain studies that have completed study interventions. The rule does not finalize proposals concerning applicability of the requirements to nonidentified

biospecimens and nonfederally funded clinical trials, “excluded” activities, standardized privacy safeguards and certain restrictive criteria for obtaining a waiver of consent requirements. The rule is effective Jan. 19, 2018. The rule establishes a compliance date of Jan. 19, 2018, except for the cooperative research provisions, which have a compliance date of Jan. 20, 2020. Contact: Jerry Menikoff; HHS, Office for Human Research Protections; 240-453-6900; jerry.menikoff@hhs.gov

82 FR 7149 (01/19/2017)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

Psychopharmacologic Drugs Advisory Committee Meeting

Notice of the Food and Drug Administration announces the cancellation of a Feb. 16, 2017, meeting (81 FR 95147; 12/27/2016) of the Psychopharmacologic Drugs Advisory Committee to discuss new drug application 209241, submitted by Neurocrine Biosciences Inc., of San Diego, for valbenazine 40 milligram capsules for the proposed treatment of tardive dyskinesia. The notice specifies that the meeting is no longer needed. Contact: Kalyani Bhatt; FDA, Center for Drug Evaluation and Research; 301-796-9001; PDAC@fda.hhs.gov

82 FR 6564 (01/19/2017)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

Texas/Aerojet General Nucleonics Reactor Facility

Notice of the Nuclear Regulatory Commission announces the availability of a draft environmental assessment and finding of no significant impact regarding issuance of a license amendment for the Aerojet General Nucleonics Model 201-Modified (AGN-201M) reactor facility, located in Brazos County, Texas. The amendment, requested by Texas A&M University, would delete from the technical specifications the Zachry Engineering Center location that constituted the reactor facility for the AGN-201M reactor and associated components. The amendment also would delete license conditions requiring a physical security plan and technical specifications requiring procedures that implement the security plan and plan audits and implementing procedures regarding the license's special nuclear material possession limit. The notice specifies that the agency has completed its environmental review of the proposed action and concludes that the proposed action will not present any undue risk to public health and safety and the environment. Contact: Patrick Boyle; NRC, Office of Nuclear Reactor Regulation; 301-415-3936; Patrick.Boyle@nrc.gov

82 FR 6660 (01/19/2017)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

Texas/South Texas Expansion Project

Notice of the Federal Energy Regulatory Commission announces the filing of an amendment by Texas Eastern Transmission LP, of Houston, to its application for the proposed South Texas Expansion Project. The project involves the construction, modification and operation of pipeline and compression facilities in Brazoria, Chambers, Matagorda, Nueces and Orange counties in Texas. The amendment addresses construction of new gas release measurement equipment and associated enclosures at the existing Vidor and Mont Belvieu compressor stations and at the proposed Petronila Compressor Station. The amendment also addresses the addition of gas coolers at the Blessing Compressor Station, a tie-in to the Pomelo Connector at the proposed Petronila Compressor Station, and the lease of additional capacity on Pomelo Connector LLC's proposed pipeline. In addition, the amendment changes the

project's targeted in-service date to Oct. 1, 2018; changes the project's capacity; removes the meter and regulating station at the Petronila Compressor Station; and modifies Exhibit K of the application. The notice specifies that the commission will complete an environmental analysis or issue a schedule for environmental review by April 12, 2017. Comments are due Feb. 2, 2017. Contact: FERC; 886-208-3676; FERCOnlineSupport@ferc.gov

82 FR 6495 (01/19/2017)

Regulatory Update

HAZARDOUS MATERIALS TRANSPORTATION

Carriage By Rail

Advance notice of proposed rulemaking of the Pipeline and Hazardous Materials Safety Administration would amend regulations under 49 CFR 174 regarding carriage by rail requirements under the Fixing America's Surface Transportation (FAST) Act. The amendments address requirements that prohibit Class I railroads, employees or agents from withholding the train consist information from first responders, officials, and law enforcement personnel during an incident, accident or public health or safety emergency. The amendments also address requirements for fusion centers and emergency security; confidentiality protections for real-time train consist information; and memorandums of understanding between Class I, Class II and Class III railroads that operate trains over the Class I railroad's line to incorporate train consist information. The notice specifies that the agency will address state emergency response commission notification requirements under the FAST Act in a separate rulemaking. Comments are due April 19, 2017. Contact: Dirk Der Kinderen; PHMSA, Standards and Rulemaking Division; 202-366-4460

82 FR 6451 (01/19/2017)

Regulatory Update

HAZARDOUS WASTE CLEANUP

Brownfields Cleanup Revolving Loan Fund Grants

Notice of the EPA announces the availability of approximately $13 million in fiscal year 2017 supplemental funding for Brownfields Cleanup Revolving Loan Fund capitalization grants previously awarded under CERCLA Section 104(k)(3). The notice specifies that pilots awarded under CERCLA Section 104(d)(1) that have not transitioned to Section 104(k)(3) grants are not eligible to apply. Requests for funding, including requests for hazardous substances and/or petroleum funding, are due March 1, 2017. The action is effective Jan. 19, 2017. Contact: Pankaj Arora; EPA; 202-566-1388; arora.pankaj@epa.gov

82 FR 6548 (01/19/2017)

Regulatory Update

HAZARDOUS WASTE MANAGEMENT

Waste Import and Export/Business Confidentiality Claims

Notice of the EPA announces a request for comments from affected businesses concerning documents or data sought by certain requests under the Freedom of Information Act in order to provide the businesses with the opportunity to assert claims that any of the information sought that pertains to them is entitled to treatment as confidential business information. The requests concern the export and import of RCRA hazardous waste, the export of cathode ray tubes and spent lead acid batteries, and the export and import of RCRA universal waste. Comments are due Feb. 21, 2017. Contact: Eva Kreisler; EPA, Office of Enforcement and Compliance Assurance; 202-564-8186; kreisler.eva@epa.gov

82 FR 6506 (01/19/2017)

Regulatory Update

OCCUPATIONAL SAFETY AND HEALTH

Special Exposure Cohort Petition/Pantex Plant

Notice announces the intention of the Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, to evaluate a petition to designate a class of employees of the Department of Energy who worked at the Pantex Plant facility in Amarillo, Texas, for inclusion in the Special Exposure Cohort under the Energy Employees Occupational Illness Compensation Program Act. The petition concerns all employees who worked in the facility from Jan. 1, 1951, through Dec. 31, 1957, for at least 250 work days. Contact: Stuart Hinnefeld; NIOSH, Division of Compensation Analysis and Support; 877-222-7570; DCAS@CDC.GOV

82 FR 6556 (01/19/2017)

Regulatory Update

OCCUPATIONAL SAFETY AND HEALTH

Special Exposure Cohort Petition/Santa Susana Field Laboratory

Notice announces the intention of the Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, to evaluate a petition to designate a class of employees of the Santa Susana Field Laboratory in Ventura County, Calif., for inclusion in the Special Exposure Cohort under the Energy Employees Occupational Illness Compensation Program Act. The petition concerns all employees who worked at least 250 work days in the facility from Jan. 1, 1965, through Dec. 31, 1988. Contact: Stuart Hinnefeld; NIOSH, Division of Compensation Analysis and Support; 877-222-7570; DCAS@CDC.GOV

82 FR 6558 (01/19/2017)

Regulatory Update

OIL AND GAS INDUSTRY

Onshore Oil and Gas Operations/Civil Penalties Inflation Adjustments

Final rule of the Bureau of Land Management amends regulations under 43 CFR 3160 and 3163.2 to adjust the civil penalties assessed for violations of the agency's onshore oil and gas operations authorities. The rule is effective Jan. 19, 2017. Contact: Steven Wells; BLM, Fluid Minerals Division; 202-912-7143

82 FR 6305 (01/19/2017)

Regulatory Update

PESTICIDES

Mosquito-Related Products

Notice of the Food and Drug Administration announces the availability of draft guidance for industry regarding regulatory oversight of mosquito-related products for use in or on mosquitoes, including those produced through biotechnology. The guidance clarifies that articles intended to affect the structure or any function of the body of man or other animals do not include articles that function as pesticides by preventing, destroying, repelling or mitigating mosquitoes for population control purposes. Comments are due Feb. 21, 2017. Contact: Laura Epstein; FDA, Center for Veterinary Medicine; 301-796-8558; Laura.Epstein@fda.hhs.gov

82 FR 6574 (01/19/2017)

Accuracy Update

RADIATION

Protective Action Guides/Drinking Water After Radiological Incidents

Notice of the EPA announces revisions to the 2016 Protective Action Guide (81 FR 88679; 12/08/2016) for use by federal, state, local and tribal emergency response officials making radiation protection decisions during emergencies to incorporate guidance for radiation protection decisions concerning drinking water. The revisions provide projected radiation dose levels at which specific actions are recommended in order to reduce or avoid that dose. The revisions also set forth a two-tiered drinking water PAG for short-term incidents of 100 millirem (mrem) for infants, children and pregnant or nursing women and 500 mrem projected dose for the general population. The guide also specifies that recommendations are only intended to apply to nationally significant radiological contamination incidents for a duration of no longer than one year. Contact: Samuel Hernandez; EPA, Standards and Risk Management Division; 202-564-1735; hernandez.samuel@epa.gov

82 FR 6498 (01/19/2017)

Accuracy Update

RADIATION

Uranium and Thorium Mill Tailing Standards

Proposed rule of the EPA amends regulations under 40 CFR 192.20, 192.31 and 192.32 and adopts regulations under 40 CFR 192.50 through 192.56 (Subpart F) concerning health and environmental protection standards for uranium and thorium mill tailings. The rule establishes standards for byproduct materials produced by uranium in-situ recovery for implementation by the Nuclear Regulatory Commission and NRC agreement states, including both surface and subsurface standards for groundwater protection, monitoring, restoration and stability. The rule also provides for a corrective action approach to meeting constituent concentration standards, adds specific criteria and procedures for approving termination of long-term stability monitoring, and provides for the NRC and agreement states to determine on a site-specific basis the constituents for which concentration based standards are set. In addition, the rule removes a requirement that the NRC obtain EPA concurrence prior to making site-specific alternate concentration limit determinations. The rule supersedes a Jan. 26, 2015, proposed rule (80 FR 4155). Comments are due July 18, 2017. Contact: Ingrid Rosencrantz; EPA, Office of Radiation and Indoor Air; 202-343-9286; Rosencrantz.ingrid@epa.gov

82 FR 7400 (01/19/2017)

Accuracy Update

TOXIC SUBSTANCES

Chemical Risk Evaluation Procedures

Proposed rule of the EPA adopts regulations under 40 CFR 702.31 through 702.47 (Subpart B) regarding procedures for chemical risk evaluation under TSCA Section 6(b). The rule establishes a process for conducting risk evaluations to determine whether a chemical substance presents an unreasonable risk of injury to health or the environment, without consideration of costs or other nonrisk factors under the conditions of use. The rule also details the steps of a risk evaluation process, including scope, hazard assessment, exposure assessment, risk characterization and a risk determination. In addition, the rule specifies that the process will be used for the first 10 chemical substances evaluated from the 2014 update to the TSCA Work Plan for Chemical Assessments, chemical substances designated as high-priority substances during the prioritization process, and chemical substances for

which the EPA has initiated a risk evaluation in response to manufacturer requests. Finally, the rule specifies the required form and criteria for such manufacturer requests. Comments are due March 20, 2017. Contact: Susanna Blair; EPA, Office of Pollution Prevention and Toxics; 202-564-4371; blair.susanna@epa.gov

82 FR 7562 (01/19/2017)

Regulatory Update

TOXIC SUBSTANCES

Chemical Substance Risk Evaluations

Notice of the EPA announces a meeting relating to a Dec. 19, 2016, notice (81 FR 91927) regarding the designation of 10 chemical substances for initial risk evaluations under TSCA. The listed chemicals include 1,4-dioxane; 1-bromopropane; asbestos; carbon tetrachloride and cyclic aliphatic bromide cluster. The listed chemicals also include methylene chloride, N-methylpyrrolidone, Pigment Violet 29, trichloroethylene and tetrachloroethylene. The notice specified that it is seeking information regarding the conditions of use for the 10 chemical substances, which the EPA will use as it develops the scoping documents for the TSCA risk evaluations for the substances. The notice also clarified that the scoping documents must be issued by June 19, 2017. The meeting is scheduled for Feb. 14, 2017, in Washington, D.C. Comments are due March 1, 2017. Contact: Sheila Canavan; EPA, Office of Pollution Prevention and Toxics; 202-566-1978; canavan.sheila@epa.gov

82 FR 6545 (01/19/2017)

Regulatory Update

TOXIC SUBSTANCES

Methylene Chloride, N-methylpyrrolidone/Paint and Coating Removal Prohibition

Proposed rule of the EPA adopts regulations under 40 CFR 751.101 through 751.111 (Subpart B) and 751.201 through 751.211 (Subpart C) to prohibit the manufacture, processing and distribution of methylene chloride and N-methylpyrrolidone (NMP) for consumer and most types of commercial paint and coating removal. The rule, which is issued under TSCA Section 6(a), prohibits the use of methylene chloride in consumer uses and of NMP in consumer and commercial paint and coating removal, and requires downstream notification of such prohibitions throughout the supply chain and recordkeeping. The rule provides an initial 10-year time-limited exemption for methylene chloride and a time-limited exemption for NMP for coating removal uses critical for national security. In addition, the rule sets forth an alternate proposal that would require commercial users of NMP for paint and coating removal to establish a worker protection program for dermal and respiratory protection, to not use paint and coating removal products that contain greater than 35 percent NMP by weight, to reformulate products to not exceed 35 percent NMP by weight, to identify gloves that provide effective protection for the formulation, and to provide warning and instruction labels on the products. The current action specifies that the EPA intends to issue a separate proposal on methylene chloride in paint and coating removal in commercial furniture refinishing but will issue a single final rule for both proposals. Comments are due April 19, 2017. Contact: Ana Corado; EPA, Office of Pollution Prevention and Toxics; 202-564-0140; corado.ana@epa.gov

82 FR 7464 (01/19/2017)

Regulatory Update

TOXIC SUBSTANCES

Significant New Use Rules for Chemical Substances

Notice of the EPA announces the partial withdrawal of a Nov. 17, 2016, direct final rule (81 FR 81250)

that amended regulations under 40 CFR 9.1 and adopted regulations under 40 CFR 721.10927 through 721.10960 to establish significant new use rules for 57 chemical substances that were the subject of premanufacture notices, including 34 substances that are subject to TSCA consent orders. The withdrawal, which is due to the receipt of adverse comments, affects the SNURs for the chemical substances bimodal mixture consisting of multiwalled carbon nanotubes and other classes of carbon nanotubes (generic) (PMN P-11-482) and carbon nanotubes (generic) (PMN No. P-15-54). The EPA intends to publish proposed SNURs for the chemical substances under a separate notice. The withdrawal is effective Jan. 19, 2017. Contact: Kenneth Moss; EPA, Office of Pollution Prevention and Toxics; 202-564-9232; moss.kenneth@epa.gov

82 FR 6277 (01/19/2017)

Regulatory Update

TOXIC SUBSTANCES

TSCA Confidential Business Information Claims

Notice of the EPA announces the availability of an interpretation of TSCA Section 14 regarding confidential business information claims for information submitted to the agency as mandated by recent amendments to the act. The agency interprets Section 14 as requiring substantiation nonexempt CBI claims at the time the information claimed as CBI is submitted to the EPA. The action is effective March 20, 2017. Substantiations for claims are due Sept. 18, 2017. Contact: Scott Sherlock; EPA, Office of Pollution Prevention and Toxics; 202-564-8257; sherlock.scott@epa.gov

82 FR 6522 (01/19/2017)

Regulatory Update

TOXIC SUBSTANCES

Trichloroethylene/Prohibition on Aerosol Degreasing

Proposed rule of the EPA amends regulations under 40 CFR 751.303 and adopts regulations under 40 CFR 751.309 to prohibit commercial use of trichloroethylene (TCE) (CAS No. 79-01-6) in vapor degreasing. The rule also prohibits the manufacture, import, processing and distribution in commerce of TCE for use in vapor degreasing. In addition, the rule requires manufacturers, processors and distributors, except for retailers, to provide downstream notification of the prohibitions throughout the supply chain and to keep records. The rule, which is issued under TSCA Section 6(a), is based on a 2014 risk assessment. The rule specifies that the EPA has issued a separate proposed rule regarding TCE use in dry cleaning spot removal (81 FR 91592; 12/16/2016) but will issue a single final rule for both proposals. Comments are due March 20, 2017. Contact: Cindy Wheeler; EPA, Office of Pollution Preventionand Toxics; 202-566-0484; wheeler.cindy@epa.gov

82 FR 7432 (01/19/2017)

Regulatory Update

TOXIC SUBSTANCES AND HAZARDOUS MATERIALS

Select Agents and Toxins List

Final rule of the Centers for Disease Control and Prevention amends regulations under 42 CFR 73.1 through 73.17 (nonconsecutive) to update the list of select agents and toxins that have the potential to pose a severe threat to public health and safety, as required under the Bioterrorism Response Act. The rule addresses toxin permissible limits and the inactivation of select agents and modifies biosafety requirements. The rule also clarifies security, training, incident response and recordkeeping requirements. In addition, the rule corrects a Sept. 14, 2016, interim final rule (81 FR 63138) by adding Bacillus cereus Biovar anthracis to the immediate notification list for tier 1 agents. The rule does not

finalize a proposal to remove six biological agents and two toxins from the list. A concurrent final rule of the Animal and Plant Health Inspection Service makes parallel regulatory changes. The rule is effective Feb. 21, 2017. Contact: Samuel Edwin; CDC, Division of Select Agents and Toxins; 404-718-2000

82 FR 6278 (01/19/2017)

WATER

NPDES General Permit/Stormwater from Construction Activities

Notice of EPA announces the issuance of the final 2017 NPDES general permit for stormwater discharges from construction activities, also known as the construction general permit (CGP). The permit includes effluent limitations; requirements for self-inspections, corrective actions, staff training and development of stormwater pollution prevention plans; and permit conditions applicable to construction sites. The permit will replace the existing CGP that expires Feb. 16, 2017. The permit will be effective for five years and will provide coverage for facilities in areas where the EPA is the NPDES permitting authority, including Idaho; Massachusetts; New Hampshire; New Mexico; Puerto Rico; Washington, D.C; Indian country lands; and most U.S. territories and protectorates. The permit is effective Feb. 16, 2017. Contact: Emily Halter; EPA, Office of Water; 202-564-3324; halter.emily@epa.gov.

82 FR 6534 (01/19/2017)

WATER

Susquehanna River Basin Commission/Projects Approved for Consumptive Water Uses

Notice of the Susquehanna River Basin Commission announces the availability of a list of projects approved for consumptive uses of water during the period Dec. 1-30, 2016. The notice addresses projects approved under 18 CFR 806.22(f) for consumptive use, including uses related to unconventional natural gas and other hydrocarbon development. Contact: Jason Oyler; SRBC; 717-238-0423; joyler@srbc.net

82 FR 6687 (01/19/2017)

WATER

Texas/NPDES Permit for Oil and Gas Extraction in Territorial Seas

Notice of the EPA announces the proposed reissuance of National Pollutant Discharge Elimination System general permit (No. TXG260000) for discharges from oil and gas exploration, development and production facilities located and discharging to the territorial seas of Texas. The permit will prohibit the discharge of drilling fluids, drill cuttings and produced sand and limit produced water discharges for oil and grease, seven-day chronic toxicity and 48-hour acute toxicity. The permit also will prohibit the discharge of priority pollutants except in trace amounts in well treatment, completion and workover fluids and include a limit of no free oil for miscellaneous discharges. In addition, the permit will specify that new facilities withdrawing cooling water greater than 2 million gallons per day are required to have the best technology available for minimizing fish/shellfish impingement mortality and entrainment caused by cooling water intake structures. Finally, the permit will require permittees and regulators to use existing, available technology to electronically report permit information and data instead of filing written reports. The notice specifies that the permit supersedes the Feb. 15, 2012, general permit (77 FR 8855). Comments are due March 6, 2017. Contact: Evelyn Rosborough; EPA Region 6; 214-665-7515; rosborough.evelyn@epa.gov

82 FR 6533 (01/19/2017)

Regulatory Update

WATER

Water Concentration Value for Lead in Drinking Water

Notice of the EPA announces the availability of materials to support the assessment of lead in drinking water under the Safe Drinking Water Act and a draft report concerning modeling approaches to define the relationship between lead levels in drinking water and blood lead levels, particularly for sensitive life stages such as formula-fed infants and children up to age seven. The notice also requests nominations for scientific experts to serve on the expert peer review panel. In addition, the notice requests comments on draft charge questions for the peer review panel. Nominations are due Feb. 21, 2017. Comments are due March 6, 2017. Contact: Erik Helm; EPA, Office of Ground Water and Drinking Water; 202-566-1049; helm.erik@epa.gov

82 FR 6546 (01/19/2017)

Regulatory Update

WATER

West Virginia/Clean Water Act Consent Decree

Notice of the Department of Justice announces a proposed consent decree in United States v. Greer Industries Inc. (Case No. 1:17-cv-00004-IMK), lodged on Jan. 9, 2017, with the U.S. District Court for the Northern District of West Virginia. The consent decree resolves claims under the Clean Water Act for alleged discharges of pollutants into U.S. and West Virginia waters without a permit. The consent decree requires the defendants to restore the impacted areas and/or perform mitigation and to pay a civil penalty. Comments are due Feb. 21, 2017. Contact: DOJ, Environment and Natural Resources Division; 202-514-2701

82 FR 6646 (01/19/2017)

Regulatory Update

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December 8, 2016

Latest Developments

AIR

Texas/Interstate Transport of Fine Particulate Matter

Notice of the EPA announces an extension of the comment period for a Nov. 10, 2016, proposed rule (81 FR 78954) to amend regulations under 40 CFR 52.38, 52.39, 52.2283 and 52.2284 to withdraw the federal implementation plan (FIP) provisions that require affected electricity generating units in Texas to participate in trading programs for annual emissions of sulfur dioxide and nitrogen oxides under the Cross-State Air Pollution Rule (CASPR). The rule also determines that such sources will not contribute significantly to nonattainment in or interfere with maintenance by any other state of the 1997 national ambient air quality standard for fine particulate matter (PM-2.5) and that the EPA has no obligation to issue new FIP requirements to address transported PM-2.5 pollution. The rule is issued in response to a July 2015 D.C. Circuit court decision that remanded several CSAPR emissions budgets to the EPA for reconsideration, and includes a sensitivity analysis demonstrating that the current action and a similar action in Florida would not adversely impact the analytic demonstration for the agency's 2012 determination that CSAPR participation qualifies as an alternative to the application of best available retrofit technology under the regional haze rule. Comments now are due Jan. 9, 2017. Contact: Robert Miller; EPA, Clean Air Markets Division; 202-343-9077; miller.robertl@epa.gov

81 FR 88636 (12/08/2016)

Regulatory Update

ENDANGERED SPECIES

Gulf of Mexico Bryde's Whale Endangered Listing

Proposed rule of the National Oceanic and Atmospheric Administration, National Marine Fisheries Service, amends regulations under 50 CFR 224.101 to add the Gulf of Mexico Bryde's whale to the list of endangered marine and anadromous species. The agency also announces the availability of a 12-month finding on a petition to list the species and its determination that the species is in danger of extinction throughout all of its range and meets the definition of an endangered species. In addition, the agency requests comments on its classification of the Gulf of Mexico Bryde's whale as a subspecies, life history information, threats to the species and protection efforts, and information to support the designation of critical habitat. A hearing is scheduled for Jan. 19, 2017, in St. Petersburg, Fla.

Comments are due Jan. 30, 2017. Contact: Laura Engleby; NMFS, Southeast Regional Office; 727-824-5312

81 FR 88639 (12/08/2016)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

Alaska/Tongass National Forest Land and Resource Management Plan Amendment

Notice of the U.S. Forest Service, announces the final record of decision and approval of an amendment to the 2008 Land and Resource Management Plan for the Tongass National Forest in Alaska. The amendment provides for transition to young growth management over the next 10 to 15 years while retaining the expertise and infrastructure for the timber industry. The amendment explains resource management practices, levels of resource production and management, and the availability and suitability of lands for different kinds of resource management. The amendment is effective 30 days after publication in the newspapers of record. Contact: Earl Stewart; USFS, Tongass National Forest; 907-228-6200

81 FR 88657 (12/08/2016)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

Executive Order/Invasive Species

Notice of the Executive Office of the President announces the issuance of Executive Order 13751 regarding U.S. protection from the impacts of invasive species. The order amends Executive Order 13112 (64 FR 6183; 02/08/1999) concerning invasive species. The current order maintains the Invasive Species Advisory Committee, expands the National Invasive Species Council membership, and clarifies the council's operations and duties. The order also revises federal agency duties to incorporate considerations related to human environmental health, climate change, technological innovation and other emerging priorities. The order is dated Dec. 5, 2016.

81 FR 88609 (12/08/2016)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

New Hampshire/I-93 Exit 4A Project

Notice announces the intention of the Federal Highway Administration to prepare a supplemental environmental impact statement regarding the I-93 Exit 4A Project in Derry and Londonderry, N.H. The SEIS will update a 2007 draft environmental impact statement for the project to address updated information regarding traffic, socioeconomic projections, land development proposals in the project area, and changes in environmental resources and regulatory requirements. Comments are requested, but a due date is not specified. Contact: Jamie Sikora; FHWA, New Hampshire Division; 603-410-4870

81 FR 88725 (12/08/2016)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

North Carolina/Cape Lookout National Seashore ORV Management Plan

Notice of the National Park Service announces the availability of the final environmental impact

statement for the Off-Road Vehicle (ORV) Management Plan at the Cape Lookout National Seashore in North Carolina. The final EIS identifies four alternatives for designation of ORV routes and resource management and specifies that Alternative C is the agency preferred alternative. The final EIS also addresses an additional alternative, Alternative E, which prohibits ORV use and is the environmentally preferable alternative. A record of decision will be issued no sooner than 30 days following publication by the EPA of a notice of availability of the final EIS. Contact: Patrick Kenney; NPS, Cape Lookout National Seashore; 252-728-2250

81 FR 88702 (12/08/2016)

Regulatory Update

GENERAL ENVIRONMENT AND SAFETY

Texas/Border Crossing Project

Notice of the Federal Energy Regulatory Commission announces the receipt of an application by Valley Crossing Pipeline LLC, of Houston, regarding the Border Crossing Project. The project involves the siting, construction and operation of 1,000 feet of natural gas pipeline that extends into the Gulf of Mexico in Texas state waters to the international boundary between the U.S. and Mexico. The notice specifies that the agency will complete an environmental assessment or issue a notice of schedule for environmental review by March 2, 2017. Comments are due Dec. 23, 2016. Contact: FERC, Office of External Affairs; 866-208-3676; FERCOnlineSupport@ferc.gov

81 FR 88675 (12/08/2016)

Regulatory Update

HAZARDOUS MATERIALS TRANSPORTATION

Entry-Level Commercial Motor Vehicle Operators Training

Final rule of the Federal Motor Carrier Safety Administration amends regulations under 49 CFR 383.51, 383.71, 383.73 and 384.301 and adopts regulations under 49 CFR 380.600 through 380.609 (Subpart F), 380.700 through 380.725 (Subpart G), 384.230 and 384.235 to revise training requirements for entry-level operators of commercial motor vehicles in interstate and intrastate operations who are required to possess a commercial driver's license (CDL). The rule establishes minimum training requirements for certain individuals applying for a CDL or an upgrade of their CDL and individuals applying for a hazardous materials, passenger or school bus endorsement for their license. The rule also sets forth a Class A and Class B CDL core curriculum, training curricula for license endorsements and a “refresher” training curriculum. In addition, the rule requires individuals to complete a course of instruction provided by an entity that meets the minimum qualifications for training providers, covers the curriculum, is listed on the FMCSA's proposed Training Provider Registry, and submits electronically to the FMCSA the training certificate for each individual who completes the training. The rule implements requirements under the Moving Ahead for Progress in the 21st Century Act. The rule is effective Feb. 6, 2017. Comments on the information collection requirements are due Jan. 9, 2017. Contact: Richard Clemente; FMCSA, Driver and Carrier Operations Division; 202-366-4325; MCPSD@dot.gov

81 FR 88732 (12/08/2016)

Regulatory Update

HAZARDOUS WASTE MANAGEMENT

Wyoming/RCRA Consent Decree

Notice of the Department of Justice announces a proposed consent decree in United States v. Jim's Water Service Inc. (Civil Action No. 16-cv-296-S), lodged on Dec. 2, 2016, with the U.S. District Court for the District of Wyoming. The consent decree resolves claims under RCRA for alleged failure to

comply with a 2008 EPA administrative order concerning conditions endangering wildlife at the defendant's Werner oilfield waste disposal facility in Converse County, Wyo. The consent decree requires the defendant to pay a civil penalty of $90,000 and to take mitigating measures at the facility. The consent decree also requires the defendant to implement a mitigation project at Burlington Lake in Gillette, Wyo., consisting of the construction of an artificial island to enhance nesting and bird habitat. Comments are due Jan. 9, 2017. Contact: DOJ, Environment and Natural Resources Division; 202-514-2701

81 FR 88705 (12/08/2016)

Regulatory Update

OCCUPATIONAL SAFETY AND HEALTH

Nationally Recognized Testing Laboratories/UL

Notice of OSHA announces a final decision to grant an application from Underwriters Laboratories Inc. (UL), of Northbrook, Ill., for expansion of its recognition as a nationally recognized testing laboratory under 29 CFR 1910.7. The expansion involves the addition of 25 test standards to the scope of recognition. The decision is effective Dec. 8, 2016. Contact: Kevin Robinson; OSHA, Office of Technical Programs and Coordination Activities; 202-693-2110; robinson.kevin@dol.gov

81 FR 88705 (12/08/2016)

Regulatory Update

OCCUPATIONAL SAFETY AND HEALTH

Pharmacy Compounding/Test Protocol for Closed System Transfer Devices

Notice of the Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, announces an extension of the comment period for a Sept. 15, 2016, notice (81 FR 63482) regarding a draft universal performance test protocol for closed system drug-transfer devices (CSTDs) used during pharmacy compounding and administration of hazardous drugs. The notice specifies that the longer time frame will allow companies to acquire the proposed challenge agents and test their CSTDs with the proposed universal CSTD performance test protocol. Comments now are due June 7, 2017. Contact: Deborah Hirst; NIOSH, Division of Applied Research and Technology; 513-841-4141; DHirst@cdc.gov

81 FR 88687 (12/08/2016)

Regulatory Update

OIL AND GAS INDUSTRY

Gulf of Mexico OCS Marine Mammals Incidental Take

Notice of the National Oceanic and Atmospheric Administration, National Marine Fisheries Service, announces the receipt of a revised application for marine mammal incidental take regulations from the Bureau of Ocean Energy Management to conduct geophysical survey activity in the Gulf of Mexico over a five-year period. The application describes survey activities to be conducted by industry operators in Outer Continental Shelf (OCS) waters within the bureau's Gulf of Mexico planning areas to obtain data for hydrocarbon exploration and production, to aid in siting oil and gas structures and facilities, to identify possible geologic hazards, and to locate potential archaeological resources and benthic habitats that should be avoided. Comments are due Jan. 9, 2017. Contact: Ben Law; NMFS, Office of Protected Resources; 301-427-8401

81 FR 88664 (12/08/2016)

OIL AND GAS INDUSTRY

Onshore Oil and Gas Leases/Venting and Flaring of Waste Gases

Notice of the Department of the Interior, Bureau of Land Management, announces corrections to a Nov. 18, 2016, final rule (81 FR 83008) that amended regulations under 43 CFR 3103.3-1, 3160.0-5 and 3162.3-1 and adopted regulations under 43 CFR 3178.1 through 3179.401 to set forth requirements to reduce waste of natural gas from venting, flaring and leaks during oil and natural gas production activities on onshore federal and Indian leases. The rule establishes criteria for when flared gas would qualify as waste subject to royalties, clarifies on-site uses of gas that are exempt from royalties, prohibits venting except in limited circumstances, and requires operations to reduce wasteful flaring by capturing for sale or using on the lease a percentage of gas production. The rule also adds requirements for operators to detect and repair leaks and to reduce venting from pneumatic controllers and pumps that operate by releasing natural gas; storage vessels; activities to unload liquids from a well; and well drilling, completion and related operations. In addition, the rule requires operators to submit a waste minimization plan when they apply for a permit to drill a new development oil well. The rule replaces 1979 requirements for flaring, venting and royalty-free use of gas (NTL-4A). The corrections, which make technical and editorial revisions, are effective Jan. 17, 2017. Contact: Timothy Spisak; BLM; 202-912-7311

81 FR 88634 (12/08/2016)

PESTICIDES

Pesticide Tolerances/Dicamba

Final rule of the EPA amends regulations under 40 CFR 180.227 to establish tolerances for residues of the herbicide dicamba in or on cotton gin byproducts at 70 parts per million, cotton undelinted seed at 3.0 ppm, soybean forage at 60 ppm, and soybean hay at 100 ppm. The rule is in response to petitions filed by Monsanto Co., of Washington, D.C. The notice specifies that the agency is establishing tolerances for soybean forage and soybean hay that are higher than requested. The rule is effective Dec. 8, 2016. Objections and hearing requests are due Feb. 6, 2017. Contact: Michael Goodis; EPA, Office of Pesticide Programs; 703-305-7090; RDFRNotices@epa.gov

81 FR 88627 (12/08/2016)

RADIATION

Accidents for Boiling Water Reactors and Pressurized Water Reactors

Notice of the Nuclear Regulatory Commission announces the withdrawal of three Regulatory Guides (RGs) regarding assumptions used for evaluating the potential radiological consequences of a loss of coolant accident for boiling water reactors (RG 1.3), loss of coolant accident for pressurized water reactors (RG 1.4), and a steam line break accident for boiling water reactors (RG 1.5). The notice specifies that the guides are obsolete because the guidance contained in them has been incorporated into RG 1.183 concerning alternative radiological source terms for evaluating design basis accidents at nuclear power reactors, and into RG 1.195 concerning methods and assumptions for evaluating radiological consequences of design basis accidents at light-water nuclear power reactors. The withdrawal is effective Dec. 8, 2016. Contact: John Parillo; NRC, Office of Nuclear Reactor Regulation; 301-415-1344; John.Parillo@nrc.gov

81 FR 88710 (12/08/2016)

Regulatory Update

RADIATION

Plant-Specific Applicability of Transition Break Size

Notice of the Nuclear Regulatory Commission announces the withdrawal of a June 28, 2010, draft regulatory guidance (DG-1216; 75 FR 36698) regarding plant-specific applicability of transition break size under 10 CFR 50.46. The guidance would have addressed a Nov. 7, 2005, proposed rule (70 FR 67597) concerning acceptance criteria for emergency core cooling systems (ECCS) for light-water nuclear power reactors. The guidance would have provided a voluntary, risk-informed alternative to the existing, deterministic requirements for evaluating ECCS performance. The notice specifies that the proposed rule was withdrawn Oct. 6, 2016 (81 FR 69446). Contact: Robert Tregoning; NRC; 301-415-2324; Robert.Tregoning@nrc.gov

81 FR 88615 (12/08/2016)

Regulatory Update

RADIATION

Protective Action Guides/Radiological Incidents

Notice of the EPA announces the availability of a final revision to the Manual of Protection Action Guides (PAGs) and Protective Actions for Nuclear Incidents, which provides guidance to federal, state and local emergency management officials on radiological emergency response. The revised manual, originally issued in May 1992, applies PAGs to radiological emergencies other than nuclear power plan accidents, updates the radiation dosimetry and dose calculations, and incorporates late phase guidance. The notice specifies that a June 10, 2016, draft PAG (81 FR 37589) regarding drinking water after a radiological incident will be added to the manual once the draft PAG has been finalized. Contact: Sara DeCair; EPA, Center for Radiological Emergency Management; 202-343-9108; decair.sara@epa.gov

81 FR 88679 (12/08/2016)

Regulatory Update

RADIATION

Recording and Reporting Occupational Radiation Dose Data

Notice of the Nuclear Regulatory Commission announces the issuance of Revision 3 to Regulatory Guide 8.7 regarding instructions for recording and reporting occupational radiation dose data. The guide describes methods that the NRC considers acceptable for licensees to use for the preparation, retention and reporting of records of occupational radiation doses. The guide also includes revised procedures to determine monitoring for occupational exposure, determine prior doses, record monitoring results and report the results. In addition, the guide includes updated forms concerning occupational dose history (NRC Form 4) and occupation dose record for a monitoring period (NRC Form 5). Contact: Terry Brock; NRC, Office of Nuclear Regulatory Research; 301-415-1793; Terry.Brock@nrc.gov

81 FR 88710 (12/08/2016)

Regulatory Update

TOXIC SUBSTANCES

American Healthy Homes Survey II

Notice announces the intention of the Department of Housing and Urban Development to seek OMB approval for a new information collection request regarding the American Healthy Homes Survey II. The collection will update information on lead-based paint hazards in homes to identify progress towards the

goal of eliminating lead paint hazards in housing where children under the age of six live, as set forth by the President's Task Force on Environmental Health Risks and Safety Risks to Children. The collection also will identify airborne chemicals that affect asthma, including carbon monoxide, airborne particulate matter, formaldehyde and pesticides, and will collect allergy-related samples for pesticide and mold analyses. Comments are due Feb. 6, 2017. Contact: Peter Ashley; HUD; 202-402-7595; peter.j.ashley@hud.gov

81 FR 88700 (12/08/2016)

Regulatory Update

WATER

National Lakes Assessment 2012

Notice of the EPA announces the availability of the final report on the National Lakes Assessment (NLA) 2012. The NLA describes the results of the nationwide probabilistic survey of 1,038 sites conducted in the summer of 2012 as part of a series of National Aquatic Resource Surveys. The NLA finds that 40 percent of the nation's lakes have excessive levels of phosphorus and that 31 percent of lakes have degraded benthic macroinvertebrate communities. Contact: Amina Pollard; EPA, Office of Water; 202-566-2360; pollard.amina@epa.gov

81 FR 88681 (12/08/2016)

Regulatory Update

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From: DeCair, Sara
Sent: Mon 11/28/2016 3:48:33 PM
Subject: Latest version attached: PAGs Rollout Materials
PAGs Finalization Comm Plan 11-15-2016.docx

All, here is the more up to date Comms Plan. All of the ORIA staff & mgrs associated with the project have access to the OneDrive folder with the latest versions, too, in case you can't reach me. Plz let me know if there are any questions.

PS, the FR pkg is still in OP with Glynis as of Friday. Thanks, and I hope everyone has a good day,

S.

From: Perrin, Alan
Sent: Monday, November 28, 2016 9:58 AM
To: DeCair, Sara; Veal, Lee
Subject: FW: PAGs Rollout Materials

FYI

Alan Perrin, Acting Director
Radiation Protection Division, USEPA
ofc (202) 343-9775 | mbl (202) 279-0376

From: McMichael, Nate
Sent: Monday, November 28, 2016 9:40 AM
To: Nesky, Anthony <Nesky.Tony@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; White, Rick <White.Rick@epa.gov>
Cc: Wieder, Jessica <Wieder.Jessica@epa.gov>; Millett, John <Millett.John@epa.gov>
Subject: RE: PAGs Rollout Materials

Hi Everyone -

Digging this back up to send downstairs – I added the updated statement to the rollout plan. Before I send it, please let me know if you have any other changes and if we have an estimate on timing.

Thanks!

-Nate

From: Nesky, Anthony
Sent: Tuesday, November 15, 2016 1:02 PM
To: McMichael, Nate <McMichael.Nate@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; White, Rick <White.Rick@epa.gov>
Cc: Wieder, Jessica <Wieder.Jessica@epa.gov>; Millett, John <Millett.John@epa.gov>
Subject: RE: PAGs Rollout Materials

Dear Nate:

Wow—thanks for sending this! Your edits are very helpful Drinking water guidance will not be part of this manual, so I deleted all references to it.

On _____, 2016, EPA published Protective Action Guides and Planning Guidance for Radiological Incidents, also known as the PAG Manual. Last revised in 1992, this action brings the PAG Manual up to date with the best available radiation science, giving emergency response officials the tools they need to base critical decisions on current health and safety data.

~~This document~~ The PAG Manual is a federally coordinated radiation emergency planning ~~guidance~~ guide for state and local emergency response organizations. The PAG Manual contains science-based radiation dose guidelines that would trigger public

safety measures, such as evacuation or staying indoors, to minimize or prevent radiation exposure during an emergency.

The PAG Manual is a planning guide for emergency situations only, it ~~that~~ does not replace or affect the agency's Superfund authorities, existing clean up regulations or current health and safety standards.

Tony Nesky

Center for Radiation Information and Outreach

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From: McMichael, Nate
Sent: Tuesday, November 15, 2016 12:48 PM
To: Nesky, Anthony <Nesky.Tony@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; White, Rick <White.Rick@epa.gov>
Cc: Wieder, Jessica <Wieder.Jessica@epa.gov>; Millett, John <Millett.John@epa.gov>
Subject: PAGs Rollout Materials

Hi - I see the Jess is out of the office but I wanted to check in on the latest PAGs materials. I have a draft comm plan that she sent a few weeks ago, but I don't know if I've seen a final. I think that the draft looks good, but one suggestion is beef up the topline statement to enforce the message that we are using the best available science to protect health and safety; a much needed updated to the 1992 version. Please see my suggestion below and let me know if there have been any other updates to the draft that I have. Thanks!

On _____, 2016, EPA published Protective Action Guides and Planning Guidance for Radiological Incidents, also known as the PAG Manual. Last revised in 1992, this action brings the PAG Manual up to date with the best available radiation science, giving emergency response officials the tools they need to base critical decisions on current health and safety data.

~~This document~~ The PAG Manual is a federally coordinated radiation emergency planning ~~guidance~~ guide for state and local emergency response organizations. The PAG Manual contains science-based radiation dose guidelines that would trigger public safety measures, such as evacuation or staying indoors, to minimize or prevent radiation exposure during an emergency.

This ~~manual updates the previous version issued in 1992,~~ update also incorporates non-regulatory drinking water guidance ~~guides~~, and reflects input from public comments ~~received on a 2013 Interim Final version and on the 2016 drinking water guidance~~. The PAG Manual is a planning guide for emergency situations only, it ~~that~~ does not replace or affect the agency's Superfund authorities, existing clean up regulations, National Primary Drinking Water Regulations for Radionuclides, or current health and safety standards.

_____

Nate McMichael

Office of Air and Radiation

202-564-0382 (o)

202-236-4176 (c)

To: Veal, Lee[Veal.Lee@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]; Cherepy, Andrea[Cherepy.Andrea@epa.gov]
From: DeCair, Sara
Sent: Wed 5/11/2016 5:52:01 PM
Subject: PAGs update, docs on G drive
Finalize PAG Manual 5-11-2016.docx
PAG Manual draft Final 05-06-2016.docx

Lee, Alan and Andrea,

We talked briefly today about PAGs and here are the high points:

OW is finishing incorporating the second round of input from OMB. Margo said that if we insisted this is such a rush, that we'd better get back to them pretty quickly. I left a message for Lisa Christ to ask when they anticipate getting back to OMB and offer more of our help on process or wordsmithing. Alan is going to call Eric tomorrow, too. The one big issue for us was a statement about where the Water PAG falls near the risk range, and I provided a more general, non-numeric statement that I think we'd be much more comfortable with. That is in the FR Notice.

Janet said she wanted to know if OMB didn't accept the full PAG Manual in ROCIS by the end of this week. Margo was clear that it was not being accepted since the water proposal isn't yet finished. My updated Project Plan, attached, shows that we'd be publishing a final Manual in October 2016, but Andrea and Alan said the internal Agency steps can be sped up since the Manual has been seen already so not a long review. Andrea has heard that as long as things go in to OMB by August, they should be able to get through the process and published.

I've attached a clean version of the new, improved full PAG Manual if you'd like to take a look. Also, all the FR package materials that accompany it are on the share drive at G/CREM/PAGs/FR Pkg Full Manual Final 2016.

Sara D. DeCair

http://www.epa.gov/radiation/rert/pags.html

202-343-9108

Room 1416 B in WJC West

Revision Date: 5/11/2016

EPA PAG Manual – Major Milestones

	Action Step	Starting Date	Completion Date	Notes
1.	Internal review of full PAG Manual w/ water placeholder	12/15/2015	1/29/16	done
2.	Incorporate feedback, ODs meeting	2/1/2016	2/5/2015	done
3.	**FRPCC Review** & brief OP on content of PAG Manual	2/8/2015	2/19/2016	done
4.	**OP Process**	3/14/2016	3/29/2016	done
5.	**OMB review & clearance**	5/16/2016		12 weeks
6.	Finalize PAG Manual & FR Package materials, share copies with Internal Review Team	8/15/2016		2 weeks
7.	Final OAR approval of Internal Q&A, Key Messages, Desk Statement, FR notice	9/6/2016		1 week
8.	**OP process, FR signature, then to FR office**	10/2016		2 weeks

Steps in bold involve ODs and/or external partners

Publication XXXX.X-XXX
Month YYYY

PAG Manual

Protective Action Guides and Planning Guidance for Radiological Incidents

MAY 2016 DRAFT FOR INTERNAL REVIEW
[DO NOT CITE OR DISTRIBUTE]

Office of Radiation and Indoor Air
Radiation Protection Division
U.S. Environmental Protection Agency
Washington, DC 20460

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LIMITS ON SCOPE

This guidance does not address or impact site cleanups occurring under other statutory authorities such as the United States Environmental Protection Agency's (EPA) Superfund program, the Nuclear Regulatory Commission's (NRC) decommissioning program, or other federal or state cleanup programs.

As indicated by the use of non-mandatory language such as "may," "should" and "can," this Manual only provides recommendations and does not confer any legal rights or impose any legally binding requirements upon any member of the public, state, tribe, locality, or any federal agency.

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CHAPTER 1. OVERVIEW

1.1 PLANNING GUIDANCE AND PROTECTIVE ACTION GUIDES

The U.S. Environmental Protection Agency (EPA) has developed this Manual to assist public officials in planning for emergency response to radiological incidents. For purposes of this document, a radiological incident is an event or a series of events, deliberate or accidental, leading to the release or potential release into the environment of radioactive materials in sufficient quantity to warrant consideration of protective actions. This Manual provides radiological protection criteria for application to all incidents that would require consideration of protective actions, with the exception of nuclear war.

During an incident with an uncontrolled source of radiation, protection of the public from unnecessary exposure to radiation may require some form of intervention that will disrupt normal living. Such intervention is termed a protective action. Examples of protective actions include:

- Evacuating an area;
- Sheltering-in-place within a building or protective structure;
- Administering potassium iodide (KI) as a supplemental action;
- Relocation;
- Acquiring an alternate source of drinking water; and
- Interdiction of food/milk.

This Manual provides recommended numerical protective action guides (PAGs) for the principal protective actions available to public officials during a radiological incident. A PAG is defined for purposes of this document as the projected dose to an individual from a release of radioactive material at which a specific protective action to reduce or avoid that dose is recommended. PAGs are guides to help officials select protective actions under emergency conditions during which exposures would occur for relatively short time periods. They are not meant to be applied as strict numeric criteria, but rather as guidelines to be considered in the context of incident-specific factors. PAGs do not establish an acceptable level of risk for normal, nonemergency conditions, nor do they represent the boundary between safe and unsafe conditions. The PAGs are not legally binding regulations or standards and do not supersede any environmental laws. For information on roles, responsibilities and authorities during emergency response and recovery, please refer to the National Response Framework: http://www.fema.gov/national-response-framework and specifically for radiological incidents, the Nuclear Radiological Incident Annex: http://www.fema.gov/pdf/about/divisions/thd/IncidentNucRad.pdf (FEMA 2008a,b).

Some protective actions are not associated with a numerical PAG. For example, the control of access to areas is a protective action implemented in concert with other protective actions; it does not have its own PAG. Any reasonable action to reduce radiation dose is encouraged even if it is not associated with a PAG, such as recommending that individuals use ad hoc respiratory protection with a handkerchief or piece of folded cloth. In areas where PAGs are not exceeded, but airborne radioactivity is present, people might be asked to stay indoors to the extent practicable to reduce their exposures. To further develop radiological emergency plans, brief planning guides have been provided for reentry to relocation areas, the cleanup planning process and considerations for radioactive waste disposal.

1.2 APPLICABILITY

Protective actions may be recommended for a wide range of incidents, but generally apply to incidents involving relatively significant releases of radionuclides. Radiological incidents with potential for significant releases include:

- A fire in a major facility such as a nuclear fuel manufacturing plant;
- An accident at a federal nuclear weapons complex facility;
- An accident at a commercial nuclear power plant (NPP);
- A transportation accident involving radioactive material; and
- A terrorist act involving a radiological dispersal device (RDD) or yield-producing improvised nuclear device (IND).

Each type of incident would pose a unique threat to public health and should be planned for and managed accordingly. Emergency response planning for a given facility or scenario should consider:

- The radionuclides involved;
- The dynamics of the release including size and magnitude;
- The feasibility of specific protective actions; and
- The timing of notification, response and protective action implementation.

The decision to advise members of the public to take a protective action during a radiological incident involves a complex judgment in which the radiological risk must be weighed against the action's inherent risks. This decision may have to be made under emergency conditions, with limited information and little time to analyze options. Advance planning reduces the complexity of the decision-making process during an incident. The planning process can identify the viability of responses to various incidents, the courses of action that can be set in motion in advance and the decisions that can only be made during an actual emergency. While many aspects of protective actions can be considered well in advance of an emergency, the situations and conditions that exist at the time of emergency must be considered if the most effective action is to be selected.

The unpredictable locations of certain radiological incidents make advance planning challenging. For example, an RDD could detonate anywhere and spread radiological contaminants over a wide variety of surfaces and terrain. Emergency planners should be prepared to apply PAGs to a wide scope of facilities and circumstances.

1.3 BACKGROUND ON THE UPDATED PAGS

This Manual updates the "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (EPA-400-R-92-001, May 1992), published by EPA (EPA 1992b) (hereinafter referred to as the "1992 PAG Manual"). The guidance in this Manual was developed cooperatively with the Federal Radiological Preparedness Coordination Committee (FRPCC), with representation from the EPA; the Department of Energy (DOE); the Department of Defense (DoD); the Department of Homeland Security (DHS) Federal Emergency Management Agency (FEMA); the Nuclear Regulatory Commission (NRC); the Department of Health and Human Services (HHS), including the Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA); the U.S. Department of Agriculture (USDA); and the Department of Labor (DOL).

1.3.1 Legal Basis

The historical and legal basis of EPA's role in developing this guidance begins with Reorganization Plan No. 3 of 1970, in which the Administrator of EPA assumed all the functions of the Federal Radiation Council (FRC), including the charge to "…advise the President with respect to radiation matters, directly or indirectly affecting health, including guidance for all federal agencies in the formulation of radiation standards and in the establishment and execution of programs of cooperation with states" (Reorg. Plan No. 3 of 1970, sec. 2(a) (7), 6(a) (2); § 274.h of the Atomic Energy Act of 1954, as amended (AEA), codified at 42 U.S.C. § 2021(h)). Recognizing this role, FEMA, in its Radiological Emergency Planning and Preparedness Regulations, directed EPA to "establish Protective Action Guides (PAGs) for all

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aspects of radiological emergency planning in coordination with appropriate federal agencies" (44 Code of Federal Regulations (CFR) §351.22(a)). FEMA also tasked EPA with preparing "guidance for state and local governments on implementing PAGs, including recommendations on protective actions which can be taken to mitigate the potential radiation dose to the population" (44 CFR §351.22(b)). All of this information was to "be presented in the EPA Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (44 CFR §351.22(b)).

Additionally, section 2021(h) charged the Administrator with performing "such other functions as the President may assign to him [or her] by Executive Order." Executive Order 12656 states that the Administrator shall "develop, for national security emergencies, guidance on acceptable emergency levels of nuclear radiation…." (Executive Order No. 12656, sec. 1601(2)). EPA's role in the development of PAGs was also recognized in the "Nuclear/Radiological Incident Annex of the National Response Framework" of June 2008.

1.3.2 Interaction with Federal Radiation Council (FRC) Reports No. 5 and 7

In the 1960s, the Federal Radiation Council (FRC) defined PAGs and established limiting guides for ingestion of strontium-89, strontium-90, cesium-137, and iodine-131 (FRC 1964; FRC 1965). That guidance applied to restricting the use of food products that had become contaminated as the result of release of radioactivity to the stratosphere from weapons testing. Since the 1960s, experience with other exposure scenarios such as accidents and terrorism made more guidance necessary. During the period immediately following an incident at any domestic nuclear facility, when the critical source of exposure is expected to be a nearby airborne plume, the principal protective actions are evacuation or sheltering. The PAGs developed here thus do not supersede previous guidance, but provide additional guidance for promptly addressing exposure pathways specific to a domestic nuclear incident.

1.3.3 Technical Basis

The FRC introduced the concept of a PAG in a series of recommendations issued in the 1960s. A key concept about PAGs is that the decision to implement protective actions should be based on the projected dose that would be avoided if the protective actions were implemented. Developers of the EPA PAGs considered the following three principles in establishing exposure levels for the PAGs—

1. Prevent acute effects.
2. Balance protection with other important factors and ensure that actions result in more benefit than harm.
3. Reduce risk of chronic effects.

These principles apply to the determination of any PAG. Principles 1 and 2 have been proposed for use by the international community as essential bases for decisions to intervene during an incident. Principle 3 has been recognized as an appropriate additional consideration (IAEA 2002). Although it is important during emergency planning to consider a range of source terms to assess the costs associated with their implementation, the PAGs are pre-determined for use in emergencies without regard to the magnitude or type of radiological release.

1.3.4 Changes in Scenarios since the Issuance of the 1992 PAG Manual

EPA's 1992 PAG Manual provided emergency management officials at the federal, state, tribal and local levels with the technical basis to plan responses to radiological emergencies. The 1992 PAG Manual was written to accommodate the worst release scenario deemed likely at the time – a major accident at a commercial NPP that would result in a significant off-site release of radioactive material. ("Site" and "off-site" in this Manual refer to locations where the radiological incident occurs and are not limited to facility-

type incidents.) Certain characteristics typify NPPs, including: fixed locations at which an accident might occur; a known suite of radionuclides on site, the dose from which is dominated by short-lived radioisotopes; tight regulatory controls and requirements; skilled operational personnel who plan for and exercise emergency responses; state and local involvement in emergency planning; well-developed and zoned emergency evacuation plans and routes; and advance notice (generally hours to days) from deteriorating plant conditions prior to accidental release of radioactive material into the environment. Therefore, the 1992 PAG Manual provided decision-makers with radiation dose-based PAG values for various exposure pathways (such as whole body, skin dose and food ingestion) and associated protective actions that were adapted to the mix of radionuclides and operational environments associated with commercial NPPs.

In late 1991, EPA conducted a symposium titled "Implementing Protective Actions for Radiological Incidents at Other Than Nuclear Power Reactors," to evaluate PAGs for incidents other than accidents at NPPs and concluded that the PAGs could be applied to all radiological incidents (EPA 1992a). Since then, new radiological and nuclear scenarios involving terrorist use of radioactive materials have gained status in radiological emergency response planning.

In 2008, DHS published "Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents" (DHS 2008). An RDD is a device or mechanism that is intended to spread radioactive material from the detonation of conventional explosives or other means. An IND is a crude, yield-producing nuclear weapon fabricated from diverted fissile material. Incidents like these may occur anywhere with little or no warning. The DHS guidance, developed cooperatively with EPA, DOE, DoD, DOL, HHS, Department of Commerce, and the NRC, affirms the applicability of existing 1992 EPA PAGs to terrorist acts, while acknowledging that the PAGs were inadequate for early response planning needs specific to an IND. To address this gap, "Planning Guidance for Response to a Nuclear Detonation" (NSS 2010) was subsequently published.

This Manual substantively incorporates late phase cleanup guidance provided in the 2008 DHS document and refers readers to additional planning resources.

1.3.5 Key Changes to PAGs in this Updated Manual

This updated Manual applies PAGs and protective actions to an expanded range of sources of potential radiological releases, including commercial nuclear power facilities, uranium fuel cycle facilities, nuclear weapons facilities, transportation accidents, radiopharmaceutical manufacturers and users, space vehicle launch and reentry, RDDs and INDs.

Dosimetry for all the PAGs was updated using the International Commission on Radiological Protection (ICRP) Publication 60 series (ICRP 1991). The PAGs in this Manual may be implemented using calculated, measurable values contained in the Federal Radiological Monitoring and Assessment Center (FRMAC) Assessment Manuals,[1] though using other incident-specific dose assessment methodologies is encouraged, where appropriate. EPA anticipates that radiological assessment methods will be periodically updated as improved models and methods become available. Therefore, readers are encouraged to review the FRMAC Assessment Manual to understand the most current, default radiological assessment methods. For simplicity, specific organ dose thresholds for evacuation and sheltering were removed from the Manual.

This Manual incorporates several related guidance documents published subsequent to the 1992 guidance, including FDA's 1998 update of the PAGs for interdiction of food. This Manual also incorporates FDA's 2001 decision to lower the PAG for administration of potassium iodine (KI) to 5 rem (50 millisieverts (mSv)) projected child thyroid dose. This update removes the intermediate phase relocation PAG of 5

[1] See FRMAC Assessment Manuals at http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.

rem (50 mSv) over 50 years to avoid confusion with long-term cleanup. Most of the PAGs and corresponding protective actions from the 1992 PAG Manual remain unchanged.

Recommended limits of exposure for emergency workers also remain unchanged from the 1992 PAG Manual. The emergency worker guidelines in this manual are consistent with federal and state regulations. Responsible officials should use judgment when doses may exceed regulatory limits and must advise workers of the risks. Table 1-1 (see below) presents PAGs with their principal associated protective actions and also presents related guidelines, and planning guidance.

To further develop radiological emergency plans, brief planning guides have been provided for reentry to relocation areas, a cleanup planning process and considerations for radioactive waste disposal. In this Manual, the term reentry is used for emergency workers and members of the public going into relocation areas temporarily, under controlled conditions.

1.4 RADIOLOGICAL INCIDENT PHASES AND APPLICABILITY OF PROTECTIVE ACTIONS

Emergency planners divide responses to radiological incidents into three phases of activity—

- **Early Phase** — The beginning of a radiological incident for which immediate decisions for effective use of protective actions are required and must therefore be based primarily on the status of the radiological incident and the prognosis for worsening conditions. When available, predictions of radiological conditions in the environment based on the condition of the source or actual environmental measurements may be used. Protective actions based on the PAGs may be preceded by precautionary actions during the period. This phase may last from hours to days.
- **Intermediate Phase** — The period beginning after the source and releases have been brought under control (has not necessarily stopped but is no longer growing) and reliable environmental measurements are available for use as a basis for decisions on protective actions and extending until these additional protective actions are no longer needed. This phase may overlap the early phase and late phase and may last from weeks to months.
- **Late Phase** — The period beginning when recovery actions designed to reduce radiation levels in the environment to acceptable levels are commenced and ending when all recovery actions have been completed. This phase may extend from months to years. A PAG level, or dose to avoid, is not appropriate for long-term cleanup.

The phases cannot be represented by precise periods of time—and may even overlap—but to view them in terms of activities, rather than time spans, can provide a useful framework for emergency response planning.

In the early phase, sheltering-in-place and evacuation are the principal protective actions. These actions are meant to avoid inhalation of gases or particulates in an atmospheric plume and to minimize external radiation exposures. Administration of prophylactic drugs may be employed depending on the specific radionuclides released; in particular, KI, also called “stable iodine,” may be administered as a supplementary protective action in incidents involving the release of significant quantities of radioactive iodine, such as NPP incidents. Some protective actions may begin prior to the release of radioactive material when there is advance notice.

Planning considerations for reentry and relocation are suggested and basic planning guidance for late phase cleanup is provided in Chapters 4 and 5.

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Table 1-1. Summary Table for PAGs, Guidelines, and Planning Guidance for Radiological Incidents[a]

Phase	Protective Action Recommendation	PAG, Guideline, or Planning Guidance
Early Phase	Sheltering-in-place or evacuation of the public[b]	**PAG**: 1 to 5 rem (10 to 50 mSv) projected dose over four days[c]
	Supplementary administration of prophylactic drugs – KI[d]	**PAG**: 5 rem (50 mSv) projected child thyroid dose[e] from exposure to radioactive iodine
	Limit emergency worker exposure (total dose incurred over entire response)	**Guideline**: 5 rem (50 mSv)/year (or greater under exceptional circumstances)[f]
Intermediate Phase	Relocation of the public	**PAG**: ≥ 2 rem (20 mSv) projected dose[c] in the first year, 0.5 rem (5 mSv)/year projected dose in the second and subsequent years
	Apply simple dose reduction techniques	**Guideline**: < 2 rem (20 mSv) projected dose[c] in the first year
	Food interdiction[g]	**PAG**: 0.5 rem (5 mSv)/year projected whole body dose, or 5 rem (50 mSv)/year to any individual organ or tissue, whichever is limiting
	Limit emergency worker exposure (total dose incurred over entire response)	**Guideline**: 5 rem (50 mSv)/year
	Reentry	**Guideline**: Operational Guidelines[h] (stay times and concentrations) for specific reentry activities (see Section 4.6)
Late Phase	Cleanup	**Planning Guidance**: Brief description of planning process (see Section 5.1)
	Waste Disposal	**Planning Guidance**: Brief description of planning process (see Section 5.2)

a This guidance does not address or impact site cleanups occurring under other statutory authorities such as the United States Environmental Protection Agency's (EPA) Superfund program, the Nuclear Regulatory Commission's (NRC) decommissioning program, or other federal or state cleanup programs.

b Should begin at 1 rem (10 mSv); take whichever action (or combination of actions) that results in the lowest exposure for the majority of the population. Sheltering may begin at lower levels if advantageous.

c Projected dose is the sum of the effective dose from external radiation exposure (e.g., groundshine and plume submersion) and the committed effective dose from inhaled radioactive material.

d Provides thyroid protection from radioactive iodines only. The complete FDA guidance may be found at http://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/ucm080542.pdf. Further information is also available: http://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/ucm080546.pdf and http://www.fda.gov/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness/ucm072265.htm.

e Thyroid dose. For information on other radiological prophylactics and treatment, refer to http://www.fda.gov/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness/ucm063807.htm, http://www.bt.cdc.gov/radiation and www.orau.gov/reacts.

f When radiation control options are not available, or, due to the magnitude of the incident, are not sufficient, doses to emergency workers above 5 rem (50 mSv) may be unavoidable and are generally approved by competent authority. For further discussion see Chapter 3, Section 3.1.2.

g For more information on food and animal feeds guidance, the complete FDA guidance may be found at http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM094513.pdf.

h For extensive technical and practical implementation information please see "Preliminary Report on Operational Guidelines Developed for Use in Emergency Preparedness and Response to a Radiological Dispersal Device Incident" (DOE 2009).

i This cleanup process does not rely on and does not affect any authority, including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq. and the National Contingency Plan (NCP), 40 CFR Part 300. This document expresses no view as to the availability of legal authority to implement this process in any particular situation.

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1.4.1 Implementation of Protective Action Guides and Protective Actions

Immediately upon becoming aware that an incident is about to occur or has occurred that may result in exposure of the population, responsible authorities should make a preliminary evaluation to determine the nature and potential magnitude of the incident. This evaluation should determine whether conditions indicate a significant possibility of a major release and, to the extent feasible, determine potential exposure pathways, populations at risk and projected doses. The incident evaluation and recommendations should then be presented to emergency response authorities for consideration and implementation.

During the early phase, the sequence of events includes—evaluation of conditions at the location of the incident, notification of responsible authorities, prediction or evaluation of potential consequences to the general public, recommendations for action and implementation of actions for the protection of the public.

In the intermediate phase, dose projections used to support decisions about protective actions may be based on measurements of environmental radioactivity and dose models. When conditions warrant relocation of populations, the collection of extensive radiological and cost-of-cleanup data will be necessary to form the decision basis for cleanup and recovery of the affected areas.

Protective actions may already be designated in existing emergency response plans. Under NRC regulations, large commercial NPPs must maintain detailed radiological response plans for an emergency planning zone (EPZ) within a 10 mile (16.1 km) radius of the plant and for a separate ingestion pathway EPZ within a 50 mile (80.5 km) radius. Emergency workers should be prepared to select and implement appropriate protective actions when standing response plans are not available or applicable.

1.4.2 Early Phase Protective Action Guides and Protective Actions

In the early phase, there may be little or no data on actual releases to the environment and responders may have to rely on crude estimates of airborne releases. Decision time frames are short and preparation is critical to make prudent decisions when data are lacking or insufficient.

The principal protective actions for the early phase are evacuation and sheltering-in-place. These protective actions would be taken if whole body doses are projected to exceed 1 to 5 rem (10 to 50 mSv) over four days. The decision to evacuate must weigh the anticipated radiation dose to individuals in the affected population against the feasibility of evacuating within a determined time frame and the risks associated with the evacuation itself. For example, evacuating a population of 50,000 carries with it a statistical risk of injury or death from transportation hazards or increased exposure. Evacuation also takes time. In the case of an accident at an NPP, there will likely be time for an orderly and relatively safe evacuation. In the case of a fire or explosion of an RDD in an urban area, evacuating a large group of people could leave them exposed to the plume and actually increase radiation dose. Sheltering-in-place may be warranted in situations where evacuation poses a greater risk of exposure or physical harm.

In addition, there are actions that are advisable, but not associated with a numerical PAG. For example, individuals should be instructed to cover airways (nose and mouth) with available filtering material when airborne radionuclides may be present. Decontamination is another protective action that may be utilized in the early phase and may include washing of contaminated individuals, removing contaminated clothing, and decontaminating surfaces of critical areas and objects. Further, in areas where airborne radioactivity is present but PAGs are not exceeded, officials can consider asking people to stay indoors to the extent practicable. In such cases, individuals are not prevented from carrying out necessary tasks (e.g., seeking medical care, purchasing food). Similar to actions used in major cities on high pollution days, these measures can be effective to reduce radiation doses when prolonged releases occur, as was the case for the Fukushima accident in Japan.

In cases where significant quantities of radioiodine may have been released, administration of the radioprotectant KI should be considered as a supplementary protective action if the projected child thyroid dose exceeds 5 rem (50 mSv). This PAG is lower than the 1992 guidance. The lower dose, which FDA adopted in 2001, is for protection of children based on early studies of Chernobyl exposure data.

The choice of protective action will be based on the status of the incident site and the prognosis for worsening conditions. In the early phase, precautionary actions based on worst-case scenarios may be used before implementation of protective actions based on PAGs. For example, in the case of RDD detonation, governments may instruct affected populations to shelter-in-place as a precautionary action while radiation levels are being measured to determine appropriate PAG-based protective actions. Officials should plan for rapid broadcast and dissemination of protective action orders to the public.

When available, predictions of radiological conditions in the environment based on an estimate of the source or actual environmental measurements may be used. Nuclear facilities, for example, have continuous, real-time radioactive effluent monitoring capabilities to monitor radioactive material released to the environment and may have a network of off-site measurement stations.

1.4.3 Intermediate Phase Protective Action Guides and Protective Actions

Intermediate phase activities are intended to reduce or avoid dose to the public, to control worker exposures, to control the spread of radioactive contamination and to prepare for late phase cleanup operations. During the intermediate phase, relocation is the principal protective action against whole body external exposure from deposited radioactive material and internal exposure from inhalation of radioactive particulates. People may need to be relocated for weeks or months.

It is necessary to distinguish between evacuation and relocation. Evacuation is the urgent removal of people from an area to avoid or reduce high-level, short-term exposure from the plume or deposited radioactivity. Relocation is the removal or continued exclusion of people (households) from contaminated areas to avoid chronic radiation exposure. Site-specific conditions may allow some groups evacuated in an emergency to return, while others may have to relocate. In other cases, some groups that were not previously evacuated may have to relocate (see Section 4.2.2 for more details).

Intermediate phase PAGs are based on doses projected in the first several years. The PAG for relocation of the public is 2 rem (20 mSv) in the first year and 0.5 rem (5 mSv) in any subsequent year. (Note: Relocation PAGs are treated separately from food and water ingestion. That is, projection of intermediate phase doses should not include these ingestion pathways. In some instances, however, where withdrawal of food and/or water from use would, in itself, create a health risk, relocation may be an appropriate alternative protective action. In this case, the ingestion dose should be considered along with the projected dose from deposited radionuclides via other pathways, for decisions on relocation.) When projected doses are less than the relocation PAG of 2 rem (20 mSv) in the first year, focused environmental decontamination and cleanup may be able to reduce doses to populations that are not relocated. Decontamination and focused cleanup techniques can range from simple actions such as the scrubbing and flushing of surfaces with uncontaminated water to the removal and disposal of soil and contaminated debris.

Keeping projected doses below the 0.5 rem (5 mSv) PAG – in the second and subsequent years – may be achieved through the decay of shorter half-life radioisotopes (as in the case of an accident at an NPP), through environmental decontamination and cleanup efforts or through other means of controlling public exposures, such as limiting access to certain areas. Information on food and animal feeds protective action guidance is contained in FDA's "Accidental Radioactive Contamination of Human Food and Animal Feeds: Recommendations for State and Local Agencies" (FDA 1998). Workers and members of the public may be allowed to re-enter a relocation area for tasks related to critical infrastructure and key

resources, to care for animals and to assess the condition of closed zones. Reoccupancy may be allowed under dose constraints acceptable to the community. In this Manual, the term reoccupancy refers to households and communities moving back into relocation areas where the cleanup process is still ongoing, based on radiation levels acceptable to those communities.

During the intermediate phase, government officials may convene to discuss late phase cleanup and site restoration strategies. All actions taken during the early and intermediate phases should be considered with respect to the impact they may have on late phase remediation, such as avoiding the use of fixatives that could hinder surface decontamination at a later date.

1.4.4 Late Phase

The late phase, as used in this Manual, is the period beginning when cleanup and recovery actions have begun and ending when all recovery actions have been completed. This phase may extend from months to years.

The late phase cleanup process, as described in this guidance, begins sometime after the commencement of the intermediate phase and proceeds independently of intermediate phase protective action activities. The transition is characterized by a change in approach, from strategies predominantly driven by urgency, to strategies aimed at both reducing longer-term exposures and improving living conditions. The late phase involves the final cleanup of areas and property at which contamination directly attributable to the incident is present. It is in the late phase that final cleanup decisions are made and final recovery efforts following a radiological incident are implemented.

Unlike the early and intermediate phases of a radiological incident, decision-makers will have more time and information during the late phase to allow for better data collection, stakeholder involvement and options analysis. Community members will influence decisions such as if and when to allow people to return home to contaminated areas. There will be populations, who were not relocated or evacuated, living in contaminated areas where efforts to reduce exposures will be ongoing. Implicit in these decisions is the ability to balance health protection with the desire of the community to resume normal life.

Radiation protection considerations must be addressed in concert with health, environmental, economic, social, psychological, cultural, ethical, political and other considerations. Many federal, state, and local agencies have important roles to play. It is recognized that experience from existing programs, such as the U.S. EPA's Superfund program, the U.S. NRC's process for decommissioning and decontamination to terminate a nuclear facility license and other national recommendations may be useful for designing cleanup and recovery efforts that could apply to a radiological incident. The cleanup process described in Chapter 5, however, does not rely on and does not affect any authority, including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq., and the National Contingency Plan (NCP), 40 CFR Part 300. For information on roles, responsibilities and authorities during emergency response and recovery please refer to the National Response Framework: http://www.fema.gov/national-response-framework and specifically for radiological incidents, the Nuclear Radiological Incident Annex: http://www.fema.gov/pdf/about/divisions/thd/IncidentNucRad.pdf (FEMA 2008a, b).

The late phase or cleanup process described in Chapter 5 consists of multiple steps, namely 1) characterization and stabilization, 2) development of goals and strategies, and 3) implementation and reoccupancy. Meaningful stakeholder involvement should be integrated *throughout* the process.

While radioactive waste handling and disposal will be an ongoing endeavor during the entire emergency response, brief planning guidance is provided in Chapter 5, the late phase. This guidance addresses both locations that may be identified by state and local officials and locations owned by the federal

government, and lists criteria for evaluating their suitability for disposal, as well as actions that can be taken to facilitate their use. Legal and other considerations are also discussed. This guidance assumes that on-site disposal at a location affected by the incident, where appropriate, will be one of the locations of choice. Though recommended as the first consideration for discussion post-accident or attack, this guidance assumes that existing non-federal radioactive waste disposal capacity that is available to impacted states and their regions is overwhelmed or otherwise eliminated from consideration, which drives the need to identify other disposal options or develop new disposal capacity.

1.4.5 Conservatism built into the PAGs

Conservatism is built into the PAG levels themselves, as described in Sections 2.5 and 4.7, about the risk-benefit balancing process used to derive the PAGs. Additionally, assumptions made to generate default parameters and derived response levels in the FRMAC Assessment Manual, Volume 1, Appendix C,[2] include some conservative assumptions to ensure PAGs are appropriate emergency guides for all members of the public, including sensitive subpopulations such as young children. For example, early phase derived levels are based on the assumption that a person is outdoors 24 hours a day for four days being exposed to the plume. Intermediate phase derived levels also conservatively do not account for shielding provided by being indoors part of each day of the projection year. People are assumed to remain in the contaminated area during the entire time (not going to work or school in an uncontaminated area, for instance.) Another example of conservatism is assuming that radionuclides are in the chemical and physical form that yields the highest dose, (e.g., the particle size is one micrometer mean aerodynamic diameter). These conservatisms allow dose assessors to project whole body doses (or total effective dose – TED) to a reference person, for simplicity, and then decision-makers can make protective action decisions that apply to entire communities including children, adults and the elderly.

Radiological assessors are encouraged to utilize realistic inputs when site- or source-specific information is available to limit the amount of conservatism built into the calculations. For example, if the radionuclide does not exist in a chemical or physical form or particle size that yields the highest dose, then assessors should use appropriate inputs to avoid overly conservative dose estimates that may lead to unnecessary protective actions.

Certain guidelines that lend themselves to different PAGs for different subpopulations are the PAGs for KI (potassium iodide), food and water. These guidelines provide age-specific recommendations because of the radiosensitivity of the thyroid and young children with respect to ingestion and inhalation doses in particular. Taking protective actions like use of KI, avoiding certain foods or using alternative sources of drinking water can be relatively simple to implement by the parents of younger children. Clear public messages can convey which age groups should take which action, unlike how an evacuation or relocation order should apply to entire households or neighborhoods.

EPA evaluated the dose consequences to several age groups across many radiological scenarios and, for the early phase including the plume, child whole body doses are typically no more than 15% higher than adult whole body doses. That margin is well within the conservatism discussed above, so that separate PAGs or projections need not be required. Therefore, basing evacuation, shelter-in-place, and relocation dose projections on an adult is appropriate for all age groups. Sensitive age groups should be evaluated separately for KI, food and water decisions. Keeping calculations and decision-making simple in the face of a disaster can enable timely actions to protect communities.

[2] See FRMAC Assessment Manuals at http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.

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KEY POINTS IN CHAPTER 1 – OVERVIEW

- A PAG is the projected dose to an individual from a release of radioactive material at which a specific protective action to reduce or avoid that dose is recommended. PAGs are guides to help officials select protective actions under emergency conditions when exposures would occur over relatively short time periods.
- EPA provides the PAG Manual to assist public officials with their radiological emergency response planning activities. The PAG Manual is a guidance document, not a legally binding regulation and does not affect or supersede any environmental laws. The PAG recommendations do not represent the boundary between safe and unsafe conditions.
- PAGs may be implemented to protect the public in a wide variety of radiological emergencies, including terrorist incidents and accidents involving nuclear power plants, transportation and the space program.
- PAGs are appropriate for implementation in the early and intermediate phases of radiological incidents. The early phase—lasting hours to days—is the period beginning at the projected (or actual) initiation of a release when immediate decisions for effective use of protective actions are required and must therefore be based primarily on the status of the release and the prognosis for worsening conditions. Little environmental data may be available in the early phase. The intermediate phase—lasting weeks to months—is the period beginning after the source and releases have been brought under control and environmental measurements are available for use as a basis for decisions on protective actions.
- Reentry and reoccupancy decisions will be made using incident-specific circumstances and the Operational Guidelines (DOE 2009).
- Cleanup and waste disposal decisions may be informed by planning guidance provided in Chapter 5.
- What's new in this updated Manual—
  - The PAGs in this Manual are implemented using the calculations and methods in the FRMAC Assessment Manual. Dosimetry in that Manual has been updated using the ICRP Publication 60 series (ICRP 1991).
  - EPA adopts the FDA guidance issued in 2001 that recommended lowering the projected thyroid dose at which the administration of KI is warranted as a supplementary protective action.
  - EPA adopts the 1998 FDA Food PAGs.
  - Planning guidance has been provided for reentry, late phase cleanup and waste disposal.

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CHAPTER 2. EARLY PHASE PROTECTIVE ACTION GUIDES

Decisions regarding protective actions for workers and the public during radiological incidents are risk management decisions and the recommendations in this Manual are provided in that context. Rapid action may be required to protect members of the public in the event of an incident involving a large release of radioactive materials into the environment. In all cases, all practical and reasonable means should be used to reduce or eliminate exposures.

This chapter presents PAGs for use in the early phase of a radiological incident. A PAG is the projected dose to an individual from a release of radioactive material at which a specific protective action should be taken to reduce or avoid that dose. The early phase begins at the actual or projected start of a release—most likely before ambient environmental and radiological data become available for quantitative risk-based actions. The exact duration of the early phase depends upon site conditions, but one should plan to project doses for four days.

Many radiological emergency scenarios would involve airborne releases, so this chapter provides guidance for estimating projected doses from exposure to an airborne plume of radioactive material and for implementing protective actions. Dose calculations for implementing the PAGs are made using the dose parameter (DP) and derived response level (DRL) methods referenced in the FRMAC Assessment Manuals.[3] Note that FRMAC refers to dose parameters in emergency response dose assessment methods to avoid confusion with dose coefficients and dose conversion factors published for radiation protection in general. Other calculation methods to implement PAGs may be appropriate.

1.5 EXPOSURE PATHWAYS DURING THE EARLY PHASE

To make decisions about rapid actions to protect the public in a radiological emergency, it is important to understand exposure pathways from airborne releases. It may also be necessary to make estimates about exposure patterns to make initial dose projections and determine whether protective actions are needed, before environmental monitoring is complete.

1.5.1 Exposure Pathways from Airborne Releases

During the early phase of an incident, there are three main exposure pathways from airborne releases—

- **Direct exposure** to radioactive materials in an atmospheric plume. The contents of such a plume will depend on the source of radiation involved and conditions of the incident. For example, in the case of an incident at an NPP, the plume may contain radioactive noble gases, radioiodines and radioactive particulate materials. Many of these materials emit gamma radiation that can expose people in the vicinity of the passing plume.
- **Inhalation** of radionuclides from immersion in a radioactive atmospheric plume and inhalation of ground-deposited radionuclides that are resuspended into a breathing zone. Inhaled radioactive particulates, depending on their solubility in body fluids, may remain in the lungs or move via the bloodstream to other organs, prior to elimination from the body. Some radionuclides become concentrated in a single body organ, with only small amounts going to other organs. For example, a significant fraction of inhaled radioiodines will move through the bloodstream to the thyroid gland.
- **Deposition** of radioiodine and particulates from a radioactive plume. Deposited materials can continue to emit "groundshine" (e.g., beta and gamma radiation) after the plume has passed causing continued exposure to skin and internal body organs.

[3] See FRMAC Assessment Manuals at http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.

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A plume may deposit materials on surfaces, posing a risk of longer-term exposures via ingestion, direct external exposure and inhalation pathways. If the release contains large quantities of radioactive iodines or particulates, the resulting long-term exposure to this "groundshine" can be more significant than external exposure from the passing plume if the exposure time to the ground contamination is long in comparison to the plume passage time. The early phase PAGs assume four days of exposure to ground contamination to address this possibility. Doses from groundshine can be readily measured by field monitoring teams dispatched at the onset of a significant radioactive release. Holding a detector probe horizontal and three feet (approximately one meter) above the contaminated surface provides a direct measurement of groundshine dose. Such assessments can confirm dose projections based upon effluent release data and the adequacy of protective actions in the early phase. More detailed analyses (e.g., isotopic) would be needed to support long-term dose projections in the intermediate phase. Doses for groundshine can be calculated during the intermediate phase (see Chapter 4). Exposure pathways that contribute less than 10 percent to the total dose incurred need not be considered during the early phase.

1.5.2 Establishment of Exposure Patterns

It is unlikely that sufficient environmental data will be available for accurate dose projections during and immediately following the early response to a radiological incident. Dose projections are needed to determine whether protective actions should be implemented in additional areas during the early phase.

For dose projections in the early phase there are two sources of data: current data from initial environmental measurements or estimates of the source term and estimated data using modeled or historical atmospheric transport data. Source term measurements, or exposure rates or concentrations measured in the plume at a few selected locations, may be used to estimate the extent of the exposed area in a variety of ways, depending on the types of data and computation methods available. The most accurate method of projecting doses is through the use of an atmospheric diffusion and transport model that has been verified for use at the site in question or for similar site conditions. A variety of computer software packages can be used to estimate dose in real time, or to extrapolate a series of previously-prepared isopleths for unit releases under various meteorological conditions. The latter can be adjusted for the estimated source magnitude or environmental measurements at a few locations during the incident. If the model projections have some semblance of consistency with environmental measurements, extrapolation to other distances and areas can be made with greater confidence. If projections using a sophisticated site-specific model are not available, a simple but crude method is to measure the plume centerline exposure rate[4] at ground level (measured at approximately 1 meter height) at a known distance downwind from the release point and then to calculate exposure rates at other downwind locations by assuming that the plume centerline exposure rate is a known function of the distance from the release point.

The following relationship can be used for this calculation:

$$D_2 = D_1 (R_1/R_2)_y$$

where D_1 and D_2 are exposure rates at the centerline of the plume at distances R_1 and R_2 from the release, respectively and y is a constant that depends on atmospheric stability. For stability classes[5] A and B, y = 2; for stability classes C and D, y = 1.5; and for stability classes E and F, y = 1. Classes A and B (unstable) occur with light winds and strong sunlight and classes E and F (stable) with light winds at night. Classes C and D generally occur with winds stronger than about 10 mph. This method of

[4] The centerline exposure rate can be determined by traversing the plume at a point sufficiently far downwind that it has stabilized (usually more than one mile from the release point) while taking continuous exposure rate measurements.
[5] Pasquill stability classes categorize atmospheric turbulence into six stability classes named A, B, C, D, E and F, class A being the most unstable or most turbulence and class F the most stable or least turbulence. Pasquill, F. 1961. The Estimation of the Dispersion of Windborne Material. The Meteorological Magazine 90, No. 1063, 33-49.

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extrapolation is risky because the measurements available at the reference distance may be unrepresentative, especially if the plume is aloft and has a looping behavior. In the case of an elevated plume, the ground level concentration increases with distance from the source and then decreases, whereas any high-energy gamma radiation from the overhead cloud continuously decreases with distance. For these reasons, this method of extrapolation will perform best for surface releases or if the point of measurement for an elevated release is sufficiently distant (usually more than 1 mile) from the point of release for the plume to have expanded to ground level. The accuracy of this method will be improved by the use of measurements from many locations averaged over time.

1.6 THE PROTECTIVE ACTION GUIDES AND PROTECTIVE ACTIONS FOR THE EARLY PHASE: EVACUATION, SHELTERING-IN-PLACE AND ADMINISTRATION OF POTASSIUM IODIDE

The principal protective actions for the early phase are evacuation or sheltering-in-place. Evacuation is the urgent removal of people from an area to avoid or reduce high-level, short-term exposure from the plume or deposited radioactivity. Sheltering-in-place is the action of staying or going indoors immediately. The administration of KI (potassium iodine) to partially block the uptake of radioiodines by the thyroid is a supplemental protective action.

In addition, washing the body and changing clothing as soon as possible after significant exposure to a radioactive plume of any composition may be recommended protective actions. Changing of clothing is recommended primarily to provide protection from beta radiation from radioiodines and particulate materials deposited on the clothing.

The PAGs and corresponding protective actions for response during the early phase of an incident are summarized in Table 2-1. Evacuation or sheltering-in-place will be justified when the projected dose to an individual is 1 rem (10 mSv) projected over four days. This conclusion is based primarily on EPA's determination concerning acceptable levels of risk of health effects from radiation exposure in an emergency situation, while weighing costs and risks associated with any protective action.

1.6.1 Thyroid Based Evacuation

This revised PAG Manual does not include a footnote from the 1992 PAG Manual early phase PAG table, which noted that "thyroid and skin may be 5 and 50 times larger, respectively." That footnote effectively provided organ dose-based evacuation thresholds in addition to the whole body dose PAG range of 1 to 5 rem (10 to 50 mSv). Because of the factors described above, these organ dose-based early phase PAGs are not necessary.

Regarding sensitive subpopulations, child thyroid doses typically are about twice as high as adult thyroid doses. The former range recommended for thyroid dose-based evacuation (5 to 25 rem adult thyroid dose) is well covered by projections of whole body dose, with evacuation recommended at 1 to 5 rem (10 to 50 mSv) adult TED. The conservatism built into the PAG levels when they were set results in an appropriate level of dose avoidance for the whole community, including all age groups, for an emergency. Planners should consider instituting public messaging templates in advance to address concerns the public may have about how protective the PAG recommendations are for all members of an impacted community.

The PAG Manual is guidance, and intentionally not prescriptive. This set of recommendations does not preclude an emergency manager from setting local or state protective action guidelines for actions based on specific organ or age group dose levels, as warranted by specific needs of that community.

Table 2-1. PAGs and Protective Actions for the Early Phase of a Radiological Incident[a]

Protective Action Recommendation	PAG	Comments
Sheltering-in-place or evacuation of the public[b]	**PAG**: 1 to 5 rem (10 to 50 mSv) projected dose over four days[c]	Evacuation (or, for some situations, sheltering-in-place) should be initiated when projected dose is 1 rem (10 mSv).
Supplementary administration of prophylactic drugs – KI[d]	**PAG**: 5 rem (50 mSv) projected child thyroid dose from exposure to radioactive iodine[e]	KI is most effective if taken prior to exposure. May require approval of state medical officials (or in accordance with established emergency plans).

a This guidance does not address or impact site cleanups occurring under other statutory authorities such as the United States Environmental Protection Agency's (EPA) Superfund program, the Nuclear Regulatory Commission's (NRC) decommissioning program, or other federal or state cleanup programs.

b Should begin at 1 rem (10 mSv) if advantageous except when practical or safety considerations warrant using 5 rem (50 mSv); take whichever action (or combination of actions) that results in the lowest exposure for the majority of the population. Sheltering may begin at lower levels if advantageous.

c Projected dose is the sum of the effective dose from external radiation exposure (i.e., groundshine and plume submersion) and the committed effective dose from inhaled radioactive material.

d Provides thyroid protection from radioactive iodines only. The complete FDA guidance may be found at http://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/ucm080542.pdf. Further information is also available: http://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/ucm080546.pdf and http://www.fda.gov/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness/ucm072265.htm.

e Thyroid dose. For information on other radiological prophylactics and treatment, refer to http://www.fda.gov/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness/ucm063807.htm, http://www.bt.cdc.gov/radiation and www.orau.gov/reacts.

1.6.2 Evacuation vs. Sheltering-in-Place

Evacuation and sheltering-in-place provide different levels of dose reduction from the principal exposure pathways: direct gamma exposure and inhalation. Both sheltering-in-place and evacuation may be implemented during the same response in different areas or timeframes. Evacuation, if completed before plume arrival, can be 100 percent effective in avoiding radiation exposure. A decontamination station, with simple decontamination actions, may need to be collocated at shelters during the pre-evacuation period. This may reduce the spread of contamination and provide for greater protection during evacuation. Medical stations should also be collocated at shelters during the pre-evacuation period to ensure simple triage capabilities are met and to manage the distribution of prophylactic drugs. The effectiveness of evacuation will depend on many factors, such as how rapidly it can be implemented and the nature of the incident. For incidents where the principal source of dose is inhalation, evacuation could increase exposure if it is implemented during the passage of a short-term plume, because the air inside a vehicle rapidly equalizes with the outside air even when all of the windows and vents are closed (DOE 1990). When dose projections are at levels less than 1 rem (10mSv) over the first four days, evacuation is not recommended due to the associated risks of moving large numbers of people.

Sheltering-in-place is a low-cost, low-risk protective action that can provide protection with an efficiency ranging from zero to almost 100 percent, depending on the type of release, the type of shelter available, the duration of the plume passage and climatic conditions. Because of these advantages, planners and

decision-makers may consider implementing sheltering-in-place when projected doses are below 1 rem (10 mSv) over the first four days. More guidance on the unique challenges posed by an IND can be found in the "Planning Guidance for Response to a Nuclear Detonation" (NSS 2010).[6]

Sheltering-in-place may be preferred for special populations (e.g., those who are not readily mobile) as a protective action at projected doses of up to 5 rem (50 mSv) over four days. When environmental, physical, or weather hazards impede evacuation, sheltering-in-place may be justified at projected doses up to 5 rem (50 mSv) for the general population (and up to 10 rem (100 mSv) for special populations). It is also comparatively easy to communicate with populations that have sheltered-in-place. Dose projections use a four-day exposure duration, but sheltering-in-place duration is intentionally not specified. Incident-specific decisions must be made to determine how long people should shelter-in-place.

Selection of evacuation or sheltering-in-place is far from an exact science, particularly in light of time constraints that may prevent thorough analysis at the time of an incident. The selection process should be based on realistic or "best estimate" dose models and should take into account the unavoidable dose incurred during evacuation and potential failure scenarios for sheltering-in-place (e.g., leaking ventilation system).

Advance planning and exercises can facilitate the decision process. In a commercial NPP incident, early decisions should be based on information from the response plans for the EPZ and on actual conditions at the nuclear facility. For transportation accidents, RDDs, INDs and other incident scenarios for which EPZs are not practicable, best estimates of dose projections should be used for deciding on evacuation, sheltering-in-place or a combination thereof.

Sheltering-in-place should be preferred to evacuation whenever it provides equal or greater protection.

Sheltering-in-place followed by informed evacuation may be most protective.

The following is a summary of planning guidance for evacuation and sheltering-in-place—

- Evacuation may be the only effective protective action close to the plume source.
- Evacuation will be most effective if it is completed before arrival of the plume.
- Evacuation may increase exposure if carried out during the plume passage.
- Evacuation is appropriate for protection from groundshine in areas with high exposure rates from deposited radioactive materials when suitable shelter is not available.
- Sheltering-in-place may be appropriate for areas not designated for immediate evacuation—
  - It may provide protection equal to or greater than evacuation for rapidly developing releases (e.g., RDDs) if followed by evacuation.
  - It positions the public to receive additional instructions.
  - Since it may be implemented rapidly, sheltering-in-place may be the protective action of choice (followed with evacuation when feasible) if rapid evacuation is impeded by:
    - severe environmental conditions (e.g., severe weather or floods);
    - uncertainty about contamination levels along routes;
    - health constraints (e.g., patients and workers in hospitals and nursing homes);
    - long mobilization times that may be associated with certain individuals, such as industrial and farm workers, or prisoners and guards;
    - physical constraints to evacuation (e.g., inadequate roads or blockage due to debris).
- If a major release of radioiodine or particulate materials occurs, inhalation dose may be a controlling criterion for protective actions—

[6] See http://www.epa.gov/rpdweb00/docs/er/planning-guidance-for-response-to-nuclear-detonation-2-edition-final.pdf.

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- Breathing air filtered through common household items (e.g., folded handkerchiefs or towels) may help reduce exposures.
- After confirmation that the plume has passed, continued sheltering-in-place should be re-evaluated. People should remain sheltered until receiving official notice about leaving high exposure areas to avoid exposure to deposited radioactive material. Shelters may be opened to vent any airborne radioactivity trapped inside.

Advance planning is essential to identify potential problems that may occur in an evacuation. An NRC case study cites the following aspects of planning as contributing to efficiency and effectiveness of evacuation (NRC 2005)—

- High level of cooperation among agencies.
- Use of multiple forms of emergency communications.
- Community familiarity with alerting methods, the nature of the hazard and evacuation procedures.
- Community communication.
- Well-trained emergency workers.

The NRC 2005 study included an evaluation of 50 incidents of public evacuation involving 1,000 or more people. The evacuations studied were initiated in response to natural disasters, technological hazards and malevolent acts occurring between January 1, 1990 and June 30, 2003. The report indicated that public familiarity with alerting methods and door-to-door notification were statistically significant factors for the efficiency of evacuation. The report also indicated that many communities are making improvements to response capabilities by modernizing communication systems, improving traffic flow, local education awareness and developing interagency and cross-boundary coordination plans.

Large or small population groups can be evacuated effectively with minimal risk of injury or death. In the NRC report, only six of the 50 cases studied involved deaths from the hazard and of those six, only one involved death from the evacuation itself (NRC 2005).

However, in 2005, not long after this report was published, the gulf coast of the United States was hit by a series of hurricanes that resulted in the evacuation of approximately 5 million people. During the evacuation that accompanied Hurricane Rita in Houston, Texas, at least 106 people were reported to have died as a direct result of the evacuation. It is estimated that at least two-thirds of the evacuees did not need to evacuate but did so because of poor communication, fear and poor traffic management (NRC 2008).

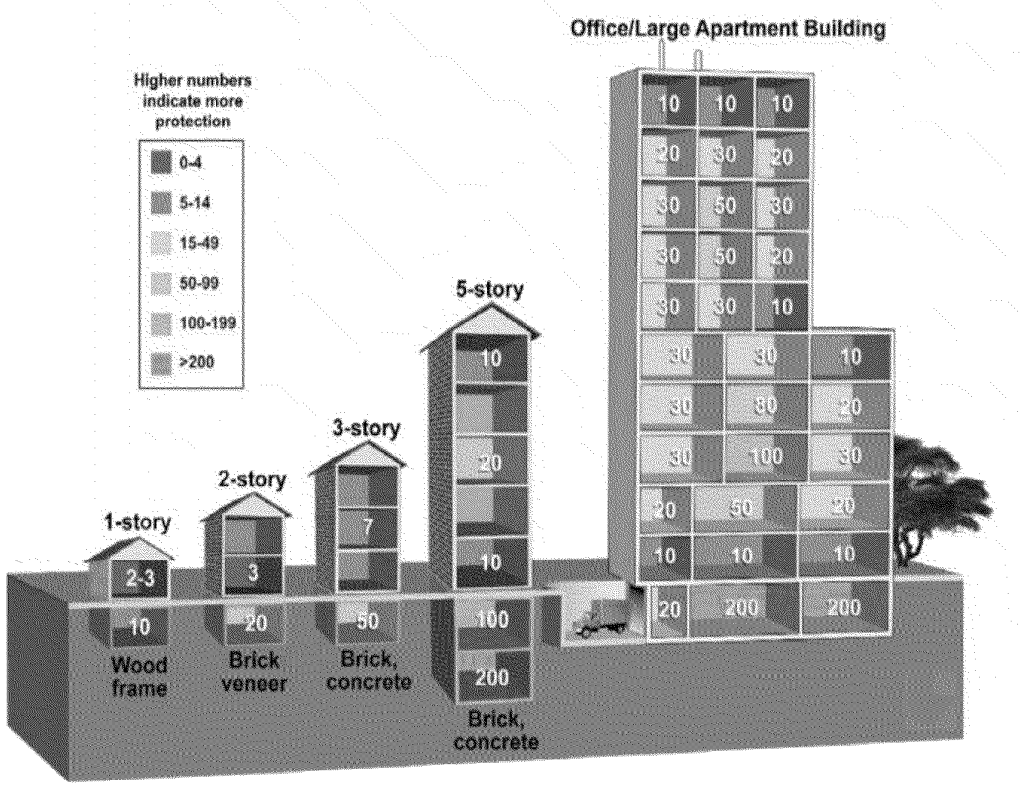
In a study of 230 mass evacuations in the U.S. ("Identification and Analysis of Factors Affecting Emergency Evacuations" NUREG/CR-6484, 2004) only six cases involved deaths from the hazard itself, and of these six, only one case involved deaths during the evacuation itself. Only two cases involved injuries during the evacuation. Traffic issues, such as traffic congestion, were reported in 28% of the evacuation cases studied. However, traffic accidents occurred in only 8% of the cases.

During the tsunami and nuclear disaster response in Japan in 2011, over 1,000 deaths occurred during evacuations, primarily among elderly hospital patients being moved from areas without power. Compounded disaster conditions including aftershocks, widespread power outages and radiation releases led to prolonged transit along routes extended to avoid hazards.

The emergency planning process for radiological incidents should include effective traffic management plans and communications plans, including pre-scripted messages, provisions for evacuation of special needs populations, such as children in schools and child care facilities, people in institutions and people who have impaired mobility or lack personal transportation.

The degree of protection provided by structures is affected by factors such as attenuation of gamma radiation (shielding) by structural components (the mass of walls, ceilings, etc.) and outside/inside air exchange rates (see Figure 2-1). The use of large structures, such as shopping centers, schools, churches and commercial buildings, as collection points during evacuation mobilization will generally provide greater protection against gamma radiation than use of small structures. As with evacuation, delay in taking shelter during plume passage will result in higher exposure to radiation.

Figure 2-1. Exposure Reduction from External Radiation from Nuclear Fallout as a function of Building Type and Location



The numbers represent dose reduction factors. A dose reduction factor of 10 indicates that a person in that area would receive 1/10th of the dose of a person in the open. A dose reduction factor of 200 indicates that a person in that area would receive 1/200th of the dose of a person out in the open.

Figure taken from "Planning Guidance for Response to a Nuclear Detonation," Second Edition, National Security Staff, Interagency Policy Coordination Subcommittee for Preparedness and Response to Radiological and Nuclear Threats, June 2010, courtesy of Lawrence Livermore National Laboratory. The protection factors in this figure are specific to nuclear detonation fallout, but the variations in factors throughout typical buildings may be informative for other airborne radiological releases.

1.6.3 Considerations for Potassium Iodide (KI)

FDA updated its guidance on the use of KI, also called "stable iodine," as a thyroid blocking agent during radiological emergencies in 2001 (FDA 2001[7] and FDA 2002[8]). FDA based these dose recommendations on a review of the thyroid cancer data from the Chernobyl reactor accident of April 1986 and the experience of Poland in administering KI following the Chernobyl release (FDA 2001).

However, FDA understands that a KI administration program that sets different projected thyroid radioactive exposure thresholds for treatment of different population groups may be logistically impractical to implement during a radiological emergency. In such cases, FDA recommends that KI be administered to both children and adults at the lowest intervention threshold (i.e., >5 rem (50 mSv) predicted internal thyroid exposure in children (FDA 2002). See Table 2-2 for a summary of recommended doses of KI for different risk groups.

Regarding dosage of KI, FDA's guidance adheres to principles of minimum effective dose and therefore recommends graded dosing according to age (and thus, in effect, body size). There is ample evidence that the recommended doses, as well as higher doses (e.g., up to 130 mg), will effectively block thyroidal uptake of radioactive iodine if taken in advance of exposure. Furthermore, particularly among school-age children, higher milligram doses are extremely safe. However, FDA continues to emphasize attention to KI dosing in infants. Excess iodine intake can lead to transient iodine-induced hypothyroidism. Individuals who are intolerant of KI at protective doses, as well as neonates (i.e., a newborn infant, especially an infant less than one month old) and pregnant or lactating women, should be given priority with regard to other protective measures (i.e., sheltering, evacuation, and control of the food supply). In summary, if local emergency planners conclude that graded dosing is logistically impractical, FDA believes that for populations at risk for radioiodine exposure, the overall benefits of taking up to 130 mg of KI instead of the lower doses recommended for certain age groups far exceed the small risks of overdosing. However, where feasible, adherence to FDA guidance should be attempted when dosing infants (FDA 2002).

Note that KI is effective only against uptake of radioiodine, and is best taken prior to or just after exposure. The protective effect of a single dose of KI lasts approximately 24 hours. It should be administered as directed by state/local health officials until the risk of significant exposure to radioiodine (either by inhalation or ingestion) no longer exists (i.e., once the plume has passed). KI is a supplemental action, secondary to evacuation or sheltering. It should not be used as a substitute for evacuation or sheltering. Many communities do not use KI.

It should be noted that adults over 40 need to take KI only in the case of a projected large internal radiation dose to the thyroid (>500 rem (5 Sv)) to prevent hypothyroidism which could lead to lifelong dependence on thyroid hormone replacement therapy. Thyroid irradiation in adults over 40 years of age is associated with an extremely low incidence of cancer (FDA 2001).

Some people should not take KI. As a rule, individuals with known allergy to iodine or with pre-existing thyroid disease (e.g., Graves' disease, thyroid nodules, Hashimoto's thyroiditis) that might predispose them to adverse reactions should avoid KI. Allergies to iodine and to shellfish are not related. People allergic to shellfish need not worry about cross reactions with KI.[9]

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[7] Food and Drug Administration [FDA]. Notice: Guidance on Use of Potassium Iodide as a Thyroid Blocking Agent in Radiation Emergencies. Federal Register, 66, 64046: 2001. Published as "Guidance: Potassium Iodide as a Thyroid Blocking Agent in Radiation Emergencies," FDA, Center for Drug Evaluation and Research. Procedural, December 2001.

[8] Food and Drug Administration [FDA]. "Guidance for Industry: KI in Radiation Emergencies — Questions and Answers," FDA, Center for Drug Evaluation and Research, Procedural, Revision 1, December 2002.

[9] More information is available at: http://www.foodallergy.org/allergens/shellfish-allergy and http://www.acaai.org/allergist/Resources/ask-allergist/Pages/Is_Shellfish_Allergy_Related_to_Iodine.aspx.

Pregnant women should be given KI for their own protection and for that of the fetus, as iodine (whether stable or radioactive) readily crosses the placenta. However, because of the risk of blocking fetal thyroid function with excess KI, repeat dosing with KI of pregnant women should be avoided.

Lactating females should be administered KI for their own protection, as for other young adults, and potentially to reduce the radioiodine content of the breast milk, but not as a means to deliver KI to infants, who should get their KI directly. As for direct administration of KI, stable iodine as a component of breast milk may also pose a risk of hypothyroidism in nursing neonates. Therefore, repeat dosing with KI should be avoided in the lactating mother, except during continuing severe contamination. If repeat dosing of the mother is necessary, the nursing neonate should be monitored.

Table 2-2. Threshold Thyroid Radioactive Exposures and Recommended Doses of KI for Different Risk Groups

	Predicted Thyroid gland exposure (cGy)	KI dose (mg)	Number or fraction of 130 mg tablets	Number or fraction of 65 mg tablets
Adults over 40 years	≥ 500	130	1	2
Adults over 18 through 40 years	≥ 10			
Pregnant or lactating women	≥ 5			
Adolescents, 12 through 18 years[a]		65	1/2	1
Children over 3 years through 12 years				
Children over 1 month through 3 years		32	Use KI oral solution[b]	1/2
Infants birth through 1 month		16	Use KI oral solution[b]	Use KI oral solution[b]

a Adolescents approaching adult size (≥ 150 lbs) should receive the full adult dose (130 mg).
b Potassium iodide oral solution is supplied in 1 oz (30 mL) bottles with a dropper marked for 1, 0.5, and 0.25 mL dosing. Each mL contains 65 mg potassium iodide.

Source: FDA, "Guidance: Potassium Iodide as a Thyroid Blocking Agent in Radiation Emergencies" (December 2001): http://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/UCM080542.pdf; and FDA, Frequently Asked Questions on Potassium Iodide (KI): http://www.fda.gov/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness/ucm072265.htm (Last Updated: 10/27/2014).

Once the plume has passed, protective actions such as evacuation and/or sheltering-in-place and food control measures to limit exposure to radioiodine should be implemented and the administration of KI should be suspended. Food control measures include providing the public with non-contaminated food supplies while awaiting the eventual radioactive decay of contaminated food. Consumption of contaminated food may be permitted on a case-by-case basis after surveying the foodstuffs and determining the level of contamination consistent with FDA food and animal feeds guidance. As a result of radioactive decay, grain products and canned milk and vegetables from sources affected by radioactive fallout will not present a risk from radioiodine if they have been stored for weeks to months after production.

An RDD is not likely to contain radioiodine, so administration of KI would not be necessary in such incidents. The administration of other prophylactic drugs should be evaluated on a case-by-case basis

depending on the nature of the event and the radioisotopes involved. For more information on radiological prophylactics and treatments, see: http://www.fda.gov/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness.

1.6.4 PAGs and Nuclear Facilities Emergency Planning Zones (EPZ)

Under NRC regulations, before a nuclear power reactor may be issued a license, the NRC must find that licensee, state and local emergency plans are adequate and that they can be implemented. For nuclear power reactors, there is a plume exposure EPZ within a 10 mile (16.1 km) radius of the plant and for a separate ingestion pathway EPZ within a 50 mile (80.5 km) radius. The sizes of these EPZs were developed by the NRC/EPA Task Force Report on Emergency Planning, NUREG-0396/EPA 520/1-7-016 and are based, in part, on the numerical values of the PAGs for the plume exposure and ingestion pathway EPZ. The licensee develops and maintains a detailed emergency plan for its facility while state and local authorities within the EPZ develop and maintain detailed emergency response plans for their respective jurisdictions. Guidance to these licensees, states and local agencies for developing these emergency response plans, including guidance on arrangements for implementing immediate protective actions is primarily contained in NUREG-0654/FEMA-REP-1 (NRC 1980)[10] and supplemented with other guidance issued by NRC (for licensees) and FEMA (for off-site response organizations).

Planning for incidents at other types of nuclear facilities should be developed using similar considerations. Emergency preparedness requirements for non-power reactors (e.g., test and research facilities) are provided in 10 CFR Part 50 Appendix E with supporting guidance in NRC Regulatory Guide 2.6, "Emergency Planning for Research and Test Reactors." Emergency preparedness requirements for fuel cycle and materials facilities are provided in 10 CFR Parts 30, 40, and 70 with supporting guidance in NRC Regulatory Guide 3.67, "Standard Format and Content for Emergency Plans for Fuel Cycle and Materials Facilities." Because of the relatively limited number and diverse nature of these facilities, the size of the EPZ is determined, if needed, on a case-by-case basis for reactors with an authorized power level less than 250 MW thermal.

Within an EPZ, an area should be pre-designated for immediate response based on specified plant conditions prior to a release, or, given a release, prior to the availability of information on quantities of radioactive materials released. The shape of this area will depend on local topography, as well as political and other boundaries. Additional areas of the EPZ, particularly in the downwind direction, may require evacuation or sheltering-in-place, as determined by dose projections. The size of these areas will be based on the potential magnitude of the release and on an angular spread determined by meteorological conditions and any other relevant factors.

The pre-designated areas for immediate protective action may be reserved for use only in the most severe incidents and in cases when the facility operator cannot provide a quick estimate of projected dose based on actual releases. For lesser incidents, or if the facility operator is able to provide prompt off-site dose projections, the area for immediate protective action may be specified at the time of the incident instead

[10] Immediate protective actions based on in-plant conditions and EPZs established by NUREG-0654/FEMA-REP-1 are not applicable to naval nuclear propulsion plants. The largest naval reactors are rated at less than one-fifth of a large U.S. commercial NPP. In addition, since reactor power is directly linked to propulsion requirements, naval nuclear propulsion plants typically operate at low power when the ship is close to shore where high speeds are not required and are normally shut down when in port. Prototype reactor plants are typically operated at low power because of their training mission. Therefore, less than about 1% of the radioactivity contained in a typical commercial NPP could be released from a naval nuclear propulsion plant, limiting the possible dose to the general public and the size of the area of potential concern. Therefore, there is no need for towns and cities to have special emergency response plans such as those required for cities near commercial NPPs. Instead, existing all-hazards emergency response plans for responding to natural and industrial disasters are adequate to protect the public in areas around facilities where naval nuclear propulsion plants are located. However, the Naval Nuclear Propulsion Program (NNPP) maintains close relationships with civil authorities to ensure that communications and emergency responses are coordinated, if required. Periodic exercises are conducted with all States and Guam where U.S. nuclear-powered warships are homeported and NNPP facilities are located.

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of using a pre-designated area. Regardless of the basis for the initial protective action, radiological assessments need to continue through the duration of the event and if warranted, the initial protective actions extended into additional geographical areas.

Such prompt off-site dose projections may be possible when the facility operator can estimate the potential off-site dose based on information at the facility, using relationships developed during planning that relate abnormal plant conditions and meteorological conditions to potential off-site doses. After the release starts and the release rate is measurable, or when plant conditions or measurements can be used to estimate the characteristics and rate of the release, then these factors, along with atmospheric stability, wind speed and wind direction, can be used to estimate integrated concentrations of radioactive materials as a function of location downwind. Although such projections are useful for initiating protective action, the accuracy of these methods for estimating projected dose will be uncertain prior to confirmatory field measurements because of unknown or uncertain factors affecting environmental pathways, inadequacies of computer modeling and uncertainty in the data for release terms.

The EPZs should be large enough to cover affected urban and rural areas and accommodate the various organizations needed for emergency response.[11]Although the size of the EPZ is based on the maximum distance at which a PAG might be exceeded, the actual boundary of an EPZ should be demarcated by features readily identifiable by people within that area. Such boundaries generally include major topographical features (e.g., rivers, roads, transmission line corridors, rail rights of way) and political boundaries. The EPZ should be further subdivided, using similarly identifiable features, to facilitate implementing protective actions when the entire EPZ is not affected. Maps, showing the boundaries of the EPZ and the sub-areas and evacuation routes should be provided to the public within the EPZ on a periodic basis in a format that will likely be available if the emergency occurs (e.g., inserted sections in local phone directories, wall calendars, etc.). EPZs are not necessary at those facilities where it is not possible for PAGs to be exceeded off-site.

1.7 DOSE PROJECTIONS

The PAGs in this chapter are specified in terms of the projected whole body dose. This projected dose is the sum of the effective dose from external exposure to the plume and the committed effective dose from inhaled radionuclides. Guidance is also provided on the thyroid equivalent dose. Further references to effective or organ dose equivalent refer to these two quantities, respectively. The FRMAC Assessment Manuals[12] provide detailed methods for estimating projected dose. These methods require knowledge of, or assumptions for, the intensity and duration of exposure and make use of standard assumptions on the relation, for each radioisotope, between exposure and dose. Exposure and dose projections should be based on the best estimates available. The FRMAC methods and models may be modified as necessary for specific sites for improved accuracy. Emergency response organizations are encouraged to use the most current, applicable tools and methods for implementing PAGs, understanding that differing approaches and assumptions will produce results with minor differences.

1.7.1 Dose Projection during the Early Phase

PAGs are expressed in terms of projected dose. The calculation of projected doses should be based on realistic dose models, to the extent practicable. Public protection decisions should be based upon the dose that can be avoided (i.e., avoidable dose) by taking some protective action (e.g., evacuation, sheltering-in-place). Unavoidable dose or doses incurred before the start of the protective action being considered generally should not be included in evaluating the need for protective action. Similarly, doses that may be incurred at later times than those affected by the specific protective action should not be

[11] The development of EPZs for nuclear power facilities is discussed in the NUREG 0396 (NRC 1978).
[12] See FRMAC Assessment Manuals at http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.

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included. As noted earlier, the projection of doses in the early phase needs to include only those exposure pathways that contribute a significant fraction (i.e., more than 10 percent) of the dose to an individual.

In the early phase of an incident, parameters other than projected dose may provide a more appropriate basis for decisions to implement protective actions. When a facility is operating outside its design basis and a substantial release to the environment has started, or is imminent but has not yet occurred, data adequate to directly estimate the projected dose may not be available. Emergency response plans should anticipate specific conditions at the source of a potential release and the possible consequences off-site. Emergency response plans for NPPs and facilities should make use of emergency action levels (EALs), based on in-plant conditions, to trigger notification and initial protective action recommendations to off-site officials.[13] Once the initial protective actions have been implemented, accident assessment should continue. Although initial assessments may be uncertain, the subsequent assessments will be less uncertain as additional information on facility condition and prognosis, effluent radiation monitoring data and environmental data become available. The results of these continuing radiological assessments, including dose projections, should be used as the basis for refining the initial protective actions. In the case of transportation accidents, an RDD or IND, or other incidents that are not related to a facility, it may not be practicable to establish EALs.

Doses that may be incurred from ingestion of food and water, long-term radiation exposure (i.e., longer than four days), radiation exposure to deposited radioactive materials, or long-term inhalation of resuspended materials are chronic exposures for which neither emergency evacuation nor sheltering-in-place are appropriate protective actions. PAGs for the intermediate phase cover these exposure pathways (see Chapter 4).

1.7.2 Duration of Exposure

The projected dose for comparison to the early phase PAGs is calculated for exposure during the first four days following the anticipated (or actual) start of a release. The objective is to encompass the entire period of exposure to the radioactive plume and deposited material prior to implementation of any further, longer-term protective action such as relocation. For planning purposes, the four-day period is chosen as the duration of exposure during the early phase because it is a reasonable estimate of the time necessary to make measurements, reach decisions and prepare to implement further protective actions (such as relocation) if necessary. However, officials at the site at the time of the emergency may decide that a different time frame is more appropriate.

For example, doses incurred through ingestion pathways or long-term exposure to deposited radioactive materials take place over a longer time period. Protective actions for such exposures should be based on guidance addressed in Chapter 4.

The projected dose from each radionuclide in a plume is proportional to the time-integrated concentration of the radionuclide in the plume at each location. This concentration will depend on the rate and the duration of the release and meteorological conditions. Release rates will vary with time and this time-dependence cannot usually be predicted accurately. In the absence of more specific information, the release rate may be assumed to be constant.

Another factor affecting the estimation of projected dose is the duration of the plume at a particular location. For purposes of calculating projected dose from most pathways, exposure will start at a particular location when the plume arrives and will end when the plume is no longer present. Exposure from deposited materials will continue for an extended period as long as people are present. Other factors

[13] Immediate protective actions based on in-plant conditions are not applicable to naval nuclear propulsion plants. See Footnote 10 for additional information. In addition, because of differences in design and operation, EALs based on in-plant conditions are not applicable to naval nuclear propulsion plants.

such as the aerodynamic diameter and solubility of particles, shape of the plume and terrain may also affect estimated dose and may be considered on a site- or source-specific basis.

Prediction of time frames for releases is difficult because of the wide range associated with the spectrum of potential incidents. Therefore, planners should consider the possible time periods between an initiating event and arrival of a plume and the duration of releases in relation to the time needed to implement competing protective actions (i.e., evacuation and sheltering-in-place). Analyses of commercial nuclear power reactors (NRC 1975) have shown that some incidents may take several days to develop to the point of a release while others may begin as early as a half hour after an initiating event. Furthermore, the duration of a release may range from less than one hour to several days, with the major portion of the release likely occurring within the first day.

Wind speed also influences radiological exposure rates from a plume. As a general rule, air concentration is inversely related to the wind speed at the point of release. Concentrations are also affected by the turbulence of the air, which tends to increase with wind speed and sunlight and by wandering of the plume, which is greater at the lower wind speeds. This results in higher concentrations generally being associated with low winds near the source and with moderate winds at larger distances. Higher wind speed also shortens the travel time of the plume. Planning information on time frames for releases from nuclear power facilities may be found in references NRC 1978 and EPA 1978(a, b). Time frames for releases from other facilities will depend on the characteristics of the facility.

1.7.3 Derived Response Levels and Dose Parameters

A Derived Response Level (DRL) is a level of radioactivity in an environmental medium that would be expected to produce a dose equal to its corresponding PAG. Depending on the exposure pathway, many factors such as ground roughness, weathering and resuspension may be required to calculate the Dose Parameter (DP) that converts an environmental measurement into a projected dose over a given time period (e.g., early phase).

The FRMAC Assessment Manuals[14] provide guidance in calculating DRLs and DPs based on the ICRP dosimetry models (ICRP 60 series). In addition, the FRPCC encourages the use of computational tools such as DOE's Turbo FRMAC and NRC's Radiological Assessment System for Consequence Analysis (RASCAL) as well as other appropriate or more current tools to implement the PAGs.

1.7.4 Higher PAGs for Special Circumstances

Hazardous environmental conditions (e.g., severe weather or a competing disaster) could create transportation risks from evacuation that would be higher than normal. It is therefore appropriate to allow higher projected doses for evacuation decisions under these circumstances. In the absence of any definitive information on such higher risks from evacuation, one should assume that it would be appropriate to increase the recommended projected dose for evacuation of the general population under hazardous environmental conditions up to a factor of five higher than that used under normal environmental conditions.

It is also recognized that people who are not readily mobile are at higher risk from evacuation than are average members of the population. It would be appropriate to adopt higher PAGs for evacuation of individuals who would be at greater risk from evacuation itself than for the typically healthy members of the population, who are at low risk from evacuation. In the absence of definitive information on the higher risk associated with the evacuation of this group, one should assume that it is appropriate to adopt PAGs a factor of five higher for evacuation of high risk groups under normal environmental conditions. If both conditions (high risk groups and hazardous environmental conditions) exist, projected doses up to

[14] See FRMAC Assessment Manuals at http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.

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ten times higher than the PAGs for evacuation of the general population under normal conditions may be justified.[15]

1.8 CONTAMINATION LEVELS AND MONITORING OF THE ENVIRONMENT AND POPULATIONS

Areas under the plume can be expected to contain deposited radioactive materials if aerosols or particulate materials were released during the incident. In extreme cases, individuals and equipment may be highly contaminated and monitoring stations will be required for emergency monitoring, decontamination of individuals and medical evaluations. Equipment should be checked and decontaminated as necessary to avoid the spread of contamination to other locations. This monitoring service would be required for only a few days following plume passage until all have been evacuated. Guidance on surface contamination levels for use at such monitoring stations is provided below.

Adults may reenter restricted areas under controlled conditions in accordance with occupational exposure standards. The need for monitoring stations should be evaluated along highways, which serve as the major evacuation or transportation routes, to control surface contamination at exits from the more highly contaminated areas. Decontamination and other measures should be implemented to maintain low exposure rates at monitoring stations.

A contaminated item should not be released to an unrestricted area. Based on incident and locality specific considerations, it may be acceptable to release contaminated materials if the level of surface contamination is below acceptable release criteria. As an alternative to decontamination, contaminated items (i.e., not people or animals) may be retained in the restricted area while the radiological contamination decays.

In some extreme cases, decontamination may be impractical. Evacuating a large area requires resources, and decontamination may conflict with priority use of those resources. Screening and decontamination can slow egress, which could result in increased dose to the evacuees. Emergency managers should consult with their state radiation control authority to establish proposed radiation screening criteria. Refer to CDC's "Population Monitoring in Radiation Emergencies: A Guide for State and Local Public Health Planners" (CDC 2014)[16] for additional in-depth discussion in Appendix D on radiological screening criteria for external contamination. These simple initial screening guides from CDC are more general than FEMA REP-21 and REP-22 on use of handheld instruments and portal monitors for screening the public.

1.8.1 Surface Contamination Control

Surface contamination must be controlled both before and after evacuation protective actions are implemented. The contamination level for screening people, animals and objects for surface contamination at monitoring stations should be influenced by the potential for the contamination to be ingested, inhaled or transferred to other locations. The principal exposure pathways for loose surface contamination on people, clothing and equipment are:

- Internal doses from ingestion by direct transfer;
- Internal doses from inhalation of resuspended materials;
- Beta dose to skin from contaminated skin or clothing or from nearby surfaces;
- Dose to the whole body from external gamma radiation; and
- Internal doses from absorption of contamination into wounds.

[15] These doses are expected to satisfy Principle 4 without violating Principles 1 and 3. Although they violate Principle 2, Principle 4 becomes, for such cases, the overriding consideration. See Section 2.5 for more information about these principles.
[16] See: http://emergency.cdc.gov/radiation/pdf/population-monitoring-guide.pdf. (CDC 2014)

It is not practical to set surface contamination screening levels significantly lower than residual contamination levels in uncontrolled areas. Although the contamination levels recommended in this Manual are accordingly set high, consideration should be given as the incident progresses to using lower contamination screening levels (and more sensitive monitoring instruments) once people are removed from areas causing high external doses. Such efforts will minimize cross-contamination of people located outside of the affected areas. For incidents involving fixed nuclear facilities, some evacuation reception centers or shelters will have walk-through portal monitors.

The recommended "2x existing background" level for screening for surface contamination at monitoring stations is merely a simplified basis for responders to set their own instrument trigger levels based on practical circumstances at the time and location of each screening center. Local and state officials may choose to establish a screening level expressed in measurement units (e.g., cpm, μR/h) that are compatible with radiation detection instruments being used and appropriate for local conditions, taking into account the number of people in need of screening and available resources.[17] The following guidance documents from the National Council on Radiation Protection and Measurements (NCRP) provide more detailed information about initial screening levels:

- "Population Monitoring and Radionuclide Decorporation Following a Radiological or Nuclear Incident," (NCRP Report No. 166), Bethesda, MD, 2011.
- "Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers," (NCRP Report No. 165), Bethesda, MD, 2010.
- "Management of Persons Contaminated with Radionuclides: Scientific and Technical Bases," (NCRP Report No. 161, Vol. II), Bethesda, MD, 2010. Chapter 5: Performing Surveys and Controlling Personnel and Area Contamination.
- "Management of Persons Contaminated with Radionuclides: Handbook" (NCRP Report No. 161, Vol. I), Bethesda, MD, 2008.

1.8.2 Priorities for Control of Contaminated Areas

The following priorities are recommended—

- Do not delay urgent medical care for decontamination efforts or for time-consuming protection of attendants, such as donning of additional anti-contamination clothing.
- In early phase scenarios where it might not be practical or would interfere with other lifesaving and public health protection priorities, do not waste effort trying to contain contaminated wash water but be sure to notify sewage treatment plants.
- Do not allow monitoring and decontamination to delay an ordered evacuation.
- *When early screening is needed after a major incident* — After plume passage, it may be necessary to establish emergency contamination monitoring stations in areas not qualifying as low background areas. These monitoring stations should be used only during the early phase after major atmospheric releases to monitor people emerging from possible high exposure areas. The stations should be set up to provide simple (rapid) decontamination if needed and to evaluate whether affected people should undergo more extensive decontamination or other special care. Section 2.4.3 provides guidance on surface contamination levels for use, if such emergency contamination monitoring stations centers are needed.
- *Establish screening to control surface contamination* — Establish monitoring and decontamination (e.g., bathing) facilities at evacuation centers or other locations in low background areas (less than 0.1 millirem (1 μSv) per hour gamma exposure rate). Section 2.4.4 provides surface contamination guidance for monitoring stations in low background areas. These surface contamination screening

[17] See: http://emergency.cdc.gov/radiation/pdf/population-monitoring-guide.pdf. (CDC 2014)

levels are examples derived primarily on the basis of easily measurable radiation levels using portable instruments. The background may be elevated because of the incident, so these screening levels refer to a "2x existing background" level in a low radiation area.

- *Encourage self-decontamination* — Encourage evacuated people who were exposed in areas where release of particulate materials would have warranted evacuation to change and bag the clothes they were wearing and store them in an area away from people and pets until authorities provide further instructions on their disposition, to wash other exposed surfaces such as cars and trucks and their contents, and then report to evacuation centers or other established locations for monitoring.
- After the evacuation area has been established, consider the need to set up monitoring and decontamination stations at exits from the more highly contaminated parts of the area. Low levels of contamination may be undetectable because of high background radiation levels at these locations. Monitoring should be done at lowest practical background levels. Nevertheless, these individuals should be advised to bathe and change clothes at their first opportunity—no later than within the next 24 hours. If, after decontamination, people still exceed the surface contamination screening levels for the station, they should be sent for further decontamination or for medical or other special attention.

1.8.3 Recommendations for Emergency Screening in Areas Not Qualifying as Low Background Areas

This section provides the recommended surface contamination screening levels for emergency screening of people and objects at monitoring stations in areas with elevated background radiation (exceeding 0.1 mR/h or 1 μSv/h gamma exposure rate). Monitoring stations in such high exposure rate areas are for use only during the early phase of an incident involving major atmospheric releases of particulates (otherwise see Section 2.4.4). For such emergency screening at monitoring stations, recommended actions for a detection instrument reading at either less than or greater than 2x existing background are outlined below.

- **Before Decontamination**:
  - If <2x existing background — *Recommended action:* Release for further screening outside affected area.
  - If >2x existing background — *Recommended action:* Perform gross decontamination (carefully remove outer layer of clothing) and/or simple decontamination (examples include washing hands and face, wiping of exposed skin, washing feet or soles of shoes). Equipment may be stored for decay, reuse or disposal in the same area, as appropriate.

- **After Decontamination**:
  - If <2x existing background — *Recommended action:* Release for further screening outside affected area.
  - If >2x existing background — *Recommended action:* Continue to decontaminate or refer to low background monitoring and decontamination station. Equipment may be stored for decay, reuse or disposal in the same area, as appropriate.

1.8.4 Recommendations for Screening in Low Background Areas

This section provides the recommended surface contamination screening levels for people and objects at monitoring stations in low background radiation areas (<0.1 mR/h or 1 μSv/h gamma exposure rate). People reporting to monitoring stations in low background radiation areas have been previously instructed to change and bag clothes, wash other exposed surfaces such as cars and their contents, and then report to these centers for monitoring. Levels higher than 2x existing background (not to exceed the meter reading corresponding to 0.1 mR/h) may be used to speed the monitoring of evacuees in very low background areas. For screening at monitoring stations in low background areas, recommended actions for a detection instrument reading at either less than or greater than 2x existing background are outlined below.

- **Before Decontamination**:
  - If <2x existing background — *Recommended action:* Unconditional release.
  - If >2x existing background — *Recommended action:* Perform gross decontamination (carefully remove outer layer of clothing) and/or simple decontamination (examples include washing hands and face, wiping of exposed skin, washing feet or soles of shoes).

- **After Simple Decontamination Effort**:
  - If <2x existing background — *Recommended action:* Unconditional release.
  - If >2x existing background — *Recommended action:* Full decontamination.

- **After Full Decontamination Effort** (Changing clothes and/or showering are examples of a full decontamination effort. Washing or gentle scrubbing with soap or other mild detergent followed by flushing is another example of a full decontamination effort.):
  - If <2x existing background — *Recommended action:* Unconditional release.
  - If >2x existing background — *Recommended action:* Continue to decontaminate people.

- **After Additional Full Decontamination Effort**:
  - If <2x existing background — *Recommended action:* Unconditional full release.
  - If >2x existing background — *Recommended action:* Send people for further evaluation.

The recommended "2x existing background" level for screening for surface contamination at monitoring stations is merely a simplified basis for responders to set their own instrument trigger levels based on practical circumstances at the time and location of each screening center. Local and state officials may choose to establish a screening level expressed in measurement units (e.g., cpm, μR/h) that are compatible with radiation detection instruments being used and appropriate for local conditions, taking into account the number of people in need of screening and available resources.[18]

1.9 BASIS FOR EARLY PHASE PAGS

For a full description of the risk-benefit analysis used to set the PAG levels, refer to the 1992 PAG Manual, Appendices B, C and E. The 1992 PAG Manual is available online in a searchable format. Below is a short summary of the basis for the early phase evacuation/sheltering PAG of 1 to 5 rem (10 to 50 mSv) projected over four days.

PAGs are intended to apply to all individuals in a population other than workers performing emergency services. However, there may be identifiable groups that have different average sensitivity to radiation or, because of their living situation, will receive higher or lower doses. In addition, some groups may be at greater risk from taking a given protective action. Special circumstances and age groups (e.g., fetal dose) were considered, when appropriate, in establishing values for the PAGs.

The following four principles provided the basis for establishing values for Protective Action Guides:

1. Acute effects on health (those that would be observable within a short period of time and which have a dose threshold below which they are not likely to occur) should be avoided.

2. The risk of delayed effects on health (primarily cancer and genetic effects, for which linear non-threshold relationships to dose are assumed) should not exceed upper bounds that are judged to be adequately protective of public health, under emergency conditions, and are reasonably achievable.

[18] See: http://emergency.cdc.gov/radiation/pdf/population-monitoring-guide.pdf. (CDC 2014)

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3. PAGs should not be higher than justified on the basis of optimization of cost and the collective risk of effects on health. That is, any reduction of risk to public health achievable at acceptable cost should be carried out.

4. Regardless of the above principles, the risk to health from a protective action should not itself exceed the risk to health from the dose that would be avoided.

EPA considered the acceptable range of costs for avoiding a statistical death from pollutants other than radiation and using a rounded value from the BEIR III risk of 0.0003 cancer deaths per person-rem.[19] Further evaluation of thyroid, skin and fetal dose consequences was conducted as well.

Costs of evacuation:

Based on a prior published study ("An Analysis of Evacuation Options for Nuclear Accidents," EPA 520/1-87-023, 1987) evaluating evacuation options for several accident types, an analysis focused on the smallest category of fuel melt accident yielding effective dose equivalents during the first four days of exposure that are greater than 0.5 rem outside the assumed 2-mile evacuation circle for all stability classes. For that scenario, total and incremental costs were calculated for several different sized evacuation areas. Data on costs versus dose avoided for several meteorological stability classes and evacuation options (sizes) were summarized in tables in the 1992 PAG Manual, Appendix C.

For a risk of 0.0003 cancer deaths per person-rem, the range of evacuation costs can be compared to the marginal cost-effectiveness (dollars per person-rem) of evacuation over an angle of 90 degrees. The resulting ranges of upper bounds on dose are found in tables in the 1992 PAG Manual, Appendix C, for three different accident scenarios. The maximum upper bounds (based on minimum costs for avoiding risk) range from 1 to 10 rem, with most values being approximately 5 rem. The minimum upper bounds (based on maximum costs for avoiding risk) range from 0.15 to 0.8 rem, with 0.5 rem dose incurred being representative of most situations.

From these data we conclude that, based on the cost of evacuation, a PAG larger than the range of values 0.5 to 5 rem would be incompatible with Principle 3.

Based on comparison of exposures from evacuation versus the presumed alternative of sheltering in various building types for several timeframes, the dose actually avoided by evacuation is one half of the projected dose.

Risk from evacuation:

Principle 4 requires that the risk of the protective action not exceed the risk associated with the dose that will be avoided. Risk from evacuation can come from several sources, including 1) transportation incidents for both pedestrians and vehicle passengers, 2) exposure to severe weather conditions or a competing disaster, and 3) in the case of immobile persons, anxiety, unusual activity, and separation from medical care or services. While all these factors must be considered, transportation incidents is the only category for which the risk has been quantified.

Conformance to Principle 1 (avoidance of acute health effects) is assured by the low risk required to satisfy Principle 2 (acceptable risk of delayed health effects), and thus requires no additional consideration. Based on Principle 2, evacuation of the general population is not justified below 0.5 rem. This represents a risk of about 0.0002 of fatal cancer. Maximum lifetime risk levels considered acceptable

[19] For more information on BEIR III risk, see the 1992 PAG Manual. BEIR III refers to the 1980 report from the Committee on the Biological Effects of Ionizing Radiation (BEIR) of the National Academy of Sciences, National Research Council, *The Effects on Populations of Exposure to Low Levels of Ionizing Radiation: BEIR III.*

by EPA from routine operations of individual sources range from 0.000001 to 0.0001. Risk levels that are higher than this must be justified on the basis of the emergency nature of a situation. In this case, we judge that up to an order of magnitude higher combined risk from all phases of an incident may be justifiable. The choice of 0.5 rem avoided dose as an appropriate criterion for an acceptable level of risk during the early phase is a subjective judgment that includes consideration of possible contributions from exposure during other phases of the incident.

Principle 4 (risk from the protective action must be less than that from the radiation risk avoided) supplies a lower bound of 0.03 rem on the dose at which evacuation of most members of the public is justified. The lower bound was derived from the risk of death from traffic accidents in emergency evacuations, using the factor of 0.0003 cancer deaths per person-rem. Finally, under Principle 3 (cost/risk considerations) evacuation is justified only at values equal to or greater than 0.5 rem. This will be limiting unless lower values are required for purely health-based reasons (Principle 2). But this is not the case.

In summary, we have selected the value 0.5 rem as the avoided dose which justifies evacuation, because 1) it limits the risk of delayed effects on health to levels adequately protective of public health under emergency conditions, 2) the cost of implementation is justified, and 3) it satisfies the two bounding requirements to avoid acute radiation effects and to avoid increasing risk through the protective action itself.

The value of the PAG for evacuation of the general public is therefore chosen as one rem projected total effective dose from inhalation of radionuclides and exposure to external radiation.

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KEY POINTS IN CHAPTER 2 – EARLY PHASE

- The principal protective actions for the early phase are evacuation or sheltering-in-place. Evacuation is the urgent removal of people from an area to avoid or reduce high-level, short-term exposure from the plume or deposited radioactivity. Sheltering-in-place refers to the use of a readily available structure that will provide protection from exposure to the plume.
- The PAG for evacuation or sheltering-in-place is a projected whole body dose of 1 to 5 rem (10 – 50 mSv) total effective dose (TED) over four days.
- Evacuation is appropriate when its risks and secondary effects are less severe than the risk of the projected radiation dose. Evacuation will be most effective in avoiding dose if completed before plume arrival.
- In general, sheltering-in-place should be preferred to evacuation whenever it provides equal or greater protection. After confirmation that the plume has passed, continued sheltering-in-place should be re-evaluated by public officials.
- The administration of KI to partially block the uptake of radioiodines by the thyroid is a supplemental protective action. The PAG for administration of KI is 5 rem (50 mSv) projected child thyroid dose. Other medical countermeasures are available, as well.
- Dose calculations for PAGs are made using the dose parameter (DP) and derived response level (DRL) calculation methods referenced in the FRMAC Assessment Manuals. Emergency response organizations are encouraged to use the most current, applicable tools and methods for implementing the PAGs.

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CHAPTER 3. EMERGENCY WORKER PROTECTION

The emergency worker guidelines in this chapter were developed for a wide range of possible radiological scenarios, from a small transportation accident that may impact a single roadway to an IND that could potentially impact a large geographic region. Therefore, the 5, 10 and 25 rem (50, 100 and 250 mSv) guidelines (see Table 3-1 below) should not be viewed as inflexible limits applicable to the range of early phase emergency actions covered by this guidance. Because of the range of impacts and case-specific information needed, it is impossible to develop a single turn-back dose level for all responders to use in all events, especially those that involve lifesaving operations. Indeed, with proper preparedness measures (training, personal protective equipment (PPE), etc.) most radiological emergencies addressed by this document, even lifesaving operations, may be manageable within the 5 rem (50 mSv) occupational limit. Moreover, incident commanders should make every effort to employ the "as low as reasonably achievable" (ALARA) principle after an incident. Still, in some incidents doses above the annual occupational 5 rem (50 mSv) dose limit may be unavoidable. For instance, in the case of a catastrophic incident, such as an IND, incident commanders may need to consider raising the lifesaving and valuable property (i.e., necessary for public welfare) emergency worker guidelines in order to prevent further loss of life and prevent the spread of massive destruction. It is essential that emergency workers have full knowledge of the associated risks prior to initiating emergency action and medical evaluation of emergency workers after such exposure.

Worker and public protection guidance and standards for normal operations are developed through risk management approaches and are implemented in federal and state regulations (e.g., 10 CFR Part 20; 10 CFR Part 835; 29 CFR Part 1910.1096). However, many factors or decision criteria in a radiological emergency differ from those in normal operations. Although there are times when implementation of standards or guidelines can cause or enhance other risks, these secondary risks can be controlled. Standards for normal operations provide a margin of safety that is greater than that in guidelines for emergency response because that margin can be provided in a manner that ensures no significant increase in public health risk or detriment to the public welfare. Currently, the development of standards and guidelines for normal operations is done in a manner that provides reasonable assurance that implementation of the standards will not cause more risk than it averts.

Response organizations need to develop plans and protocols that address radiation protection during a radiological incident and that ensure appropriate training is provided to responders and decision-makers. Detailed reports on radiation risk, risk management decision-making, training and public communication should be consulted in the development of plans, protocols and training materials and may be obtained from organizations such as ICRP, NCRP, International Atomic Energy Agency (IAEA), the American Nuclear Society (ANS) and the Health Physics Society (HPS). Detailed information on the risks of radiological emergency response and worker protection procedures can be found in the FRMAC "Radiological Emergency Response Health and Safety Manual" (DOE 2012) and the NCRP's "Management of Terrorist Events Involving Radioactive Material, Report No. 138" (NCRP 2001) and "Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers, Report No. 165" (NCRP 2010).

1.10 CONTROLLING OCCUPATIONAL EXPOSURE AND DOSES TO EMERGENCY WORKERS

This section provides guidance on occupational doses of radiation during an emergency response. In many radiological incidents, actual exposure of workers, including emergency responders, may be controlled to low doses when proper precautions are taken. During some emergencies, radiation exposures to responders may be unavoidable and may have the potential to exceed limits used for normal operations.

However, even in emergency conditions, every reasonable effort should be made to control doses to levels that are as low as practicable (consider NCRP 138[20] and NCRP 165[21] for recommendations that support ALARA).

1.10.1 Maintaining the ALARA Principle

To minimize the risks from exposure to ionizing radiation, employers of emergency workers should prepare emergency response plans and protocols in advance to keep worker exposures ALARA, an acronym for "as low as reasonably achievable," which means making every reasonable effort to maintain exposures to radiation as far below the dose limits as is practical consistent with the purpose for which the activity is undertaken. Plans and protocols should include the following health physics and industrial hygiene practices to the maximum extent possible—

- Minimizing the time spent in the contaminated area.
- Maintaining the maximum distance from sources of radiation.
- Shielding of radiation sources.
- Tailoring of hazard controls to the work performed.
- Properly selecting and using respirators (see 29 CFR Part 1910.134) and other PPE.
- Using prophylactic medications, where medically appropriate, that either block the uptake or reduce the retention time of radioactive material in the body.

The incident commander's staff should be prepared to identify, to the extent possible, all hazardous conditions or substances and to perform appropriate site hazard analysis. Emergency management plans should include protocols to control worker exposures, establish exposure guidelines in advance and outline procedures for worker protection. Emergency procedures should include provisions for exposure monitoring, worker training commensurate with the hazards involved in response operations and ways to control them and medical monitoring.

1.10.2 Understanding Dose and Risk Relationships

Emergency worker guidelines are based on cumulative dose constraint levels. These are based on an assumption that doses acquired in response to a radiological incident would be "once in a lifetime" doses and that future radiological exposures would be substantially lower.

Recommendations in this Manual provide a guideline level of 5 rem (50 mSv) for worker protection and alternative emergency worker guidelines (see Table 3-1) for certain activities where exposures below 5 rem (50 mSv) cannot be maintained. For most radiological incidents, radiation control measures (e.g., minimizing time, maximizing distance, using shielding) will prevent doses from reaching the 5 rem (50 mSv) occupational exposure guideline while performing typical emergency response activities such as transportation, firefighting and medical treatment of contaminated victims at hospitals. However, in those situations in which victims are injured or trapped in high radiation areas or can only be reached via high radiation areas, exposure control options may be unavailable or insufficient and doses above 5 rem (50 mSv) may be unavoidable.

Decisions to take response actions that could result in doses in excess of 5 rem (50 mSv) can only be made at the time of the incident, under consideration of the actual situation. In such situations, incident commanders and other responders need to understand the risk posed by such exposures in order to make informed decisions. The emergency worker guidelines for life and property saving activities in Table 3-1 are provided to assist such decision-making. These guidelines apply to doses incurred over the duration of an emergency and are assumed to be once in a lifetime.

[20] "Management of Terrorist Events Involving Radioactive Material, Report No. 138" (NCRP 2001).
[21] "Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers, Report No. 165" (NCRP 2010).

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Emergency personnel may be exposed to increased radiation during the unique catastrophic event of an IND detonation resulting in firestorm and widespread destruction of structures. The emergency intervention needed to prevent further destruction and loss of life may result in increased exposure. Exceeding the emergency worker guidelines in Table 3-1 may be unavoidable in responding to such events. Emergency workers undertaking a mission covered under the emergency worker guidelines should be informed when radiation control measures may not prevent doses from exceeding the 5 rem (50 mSv), general occupational exposure guideline and should be made aware of risks involved, including numerical estimates of the risk of delayed health effects.

Table 3-1. Emergency Worker Guidelines

Guideline	Activity	Condition
5 rem (50 mSv)	All occupational exposures	All reasonably achievable actions have been taken to minimize dose.
10 rem (100 mSv)a	Protecting valuable property necessary for public welfare (e.g., a power plant).	Exceeding 5 rem (50 mSv) unavoidable and all appropriate actions taken to reduce dose. Monitoring available to project or measure dose.
25 rem (250 mSv)b	Lifesaving or protection of large populations	Exceeding 5 rem (50 mSv) unavoidable and all appropriate actions taken to reduce dose. Monitoring available to project or measure dose.
>25 rem (250 mSv)	Lifesaving or protection of large populations	Only on a voluntary basis for people fully aware of the risks involved (see Tables 3-2 and 3-3)

a For potential doses >5 rem (50 mSv), medical monitoring programs should be considered.
b In the case of a very large incident, such as an IND, incident commanders may need to consider raising the property and lifesaving emergency worker guidelines to prevent further loss of life and massive spread of destruction.

This guidance does not address or impact site cleanups occurring under other statutory authorities such as the United States Environmental Protection Agency's (EPA) Superfund program, the Nuclear Regulatory Commission's (NRC) decommissioning program, or other federal or state cleanup programs.

The 25 rem (250 mSv) lifesaving emergency worker guidelines provide assurance that exposures will not result in detrimental deterministic health effects (i.e., prompt or acute effects). However, it could increase the risk of stochastic (chronic) effects, such as the risk of cancer. Response actions that could cause exposures in excess of the 25 rem (250 mSv) emergency worker guideline should only be undertaken with an understanding of the potential acute effects of radiation to the exposed responder (see Table 3-2) and only when the benefits of the action clearly exceed the associated risks.

Higher doses could be received by emergency workers performing what NCRP Report No. 165, "Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers" calls "Time-Sensitive Mission-Critical" activities that could result in radiation doses higher than 25 rem. NCRP Report No. 165 expands the discussion on a Decision Dose of 50 rad. A Decision Dose can be used by the incident commander as a tool to address the need to and the consequences of exposing emergency workers to higher doses to accomplish Mission Critical actions. This is especially important in an IND incident.

The estimated risk of fatal cancer[22] for workers exposed to 10 rem (100 mSv) is slightly less than the corresponding general population risk of 0.6 percent (6 cases per thousand exposed). Workers exposed to 25 rem (250 mSv) have an estimated risk of fatal cancer of 1.5 percent (15 cases per thousand exposed). Because of the latency period of cancer, younger workers face a larger risk of fatal cancer than older workers (e.g., when exposed to 25 rem (250 mSv), 20 to 30-year-olds have a 9.1 per thousand risk of premature death, while 40 to 50-year-olds have a 5.3 per thousand risk of premature death).[23]

More specific risk determinations can be made when there is adequate information about the contaminants and the potential for human exposure. EPA's Federal Guidance Report #13 (EPA 1999) and Health Effects Assessment Summary Tables (EPA 1997) have risk factors for specific radionuclides.

Table 3-2. Acute Radiation Syndrome[a]

Feature or Illness	Effects of Whole Body Absorbed Dose from External Radiation or Internal Absorption, by dose range in rad (Gray)				
	0-100 (0-1 Gy)	100-200 (1-2 Gy)	200-600 (2-6 Gy)	600-800 (6-8 Gy)	>800 (>8 Gy)
Nausea, Vomiting	None	5-50%	50-100%	75-100%	90-100%
Time of Onset		3-6 hr	2-4 hr	1-2 hr	< 1 hr to
Duration		< 24 hr	< 24 hr	< 48 hr	< 48 hr
Lymphocyte Count	Unaffected	Minimally Decreased	<1000 at 24 hr	< 500 at 24 hr	Decreases within hours
Central Nervous System Function	No Impairment	No Impairment	Cognitive impairment for 6-20 hr	Cognitive impairment for > 20 hr	Rapid incapacitation
Mortality	None	Minimal	Low with aggressive therapy	High	Very High: Significant neurological symptoms indicate lethal dose

a Percentage of people receiving whole body doses within a few hours expected to experience acute health effects.

Source: Medical Management of Radiological Casualties, Second Edition, Armed Forces Radiobiology Research Institute. Bethesda, MD, April 2003.

[22] Risk per dose of a fatal cancer is assumed to be about $6x10^{-4}$ per rem ($6x10^{-5}$ per mSv). Cancer incidence is assumed to be about $8x10^{-4}$ per rem ($8x10^{-5}$ per mSv). (EPA 1999)

[23] The numerical estimate of cancer risk presented above (from Federal Guidance #13) was obtained by linear extrapolation using the nominal risk estimates based on data from human exposures at high doses and high dose rates. Other methods of extrapolation to the low-dose region could yield higher or lower numerical estimates of cancer deaths. Studies of human populations exposed at low doses are inadequate to demonstrate the actual magnitude of risk at low doses (about 0.1 Sv or 10 rem and below). There is scientific uncertainty about cancer risk in the low-dose region below the range of epidemiological observation and the possibility of no risk cannot be excluded. (EPA 1999)

Prior to the 5 rem (50 mSv) guideline being exceeded, workers should be provided the following—

- Site-specific training, if no prior training was available, with respect to the risk associated with exposure to ionizing radiation (incident commanders and responders should consider having someone on each team with radiation safety experience).
- A thorough explanation of the latent risks associated with receiving exposures greater than 5 rem (50 mSv).

If the 5 rem (50 mSv) guideline is exceeded, workers should be provided with a medical follow-up and monitoring should be considered.

In addition, these guidelines represent dose constraint levels (e.g., when this level of dose is accumulated, the responder should not take part in the later stages of the response that may significantly increase their dose). Incident commanders and responders need a thorough understanding of the worker exposure guidelines for radiological emergency response, including the associated risks and specific worker protection procedures. The FRMAC "Radiological Emergency Response Health and Safety Manual" (DOE 2012) provides detailed information. Additional resources for advance planning are available on the Radiation Emergency Medical Management (REMM) web site: http://www.remm.nlm.gov/.

1.11 OCCUPATIONAL SAFETY REGULATIONS FOR RADIOLOGICAL EMERGENCY RESPONSE

The Occupational Safety and Health Act requires employers to be responsible for the health and safety of their employees during routine and emergency operations. The primary occupational safety and health standard for emergency response is the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard (29 CFR Part 1910.120). Information about how the Occupational Safety and Health Administration (OSHA) applies HAZWOPER and other OSHA standards to emergency responses and cleanup operations is available at www.osha.gov.

Many U.S. states operate their own OSHA-approved state plans, which are required to be "at least as effective as" Federal OSHA standards and may impose additional or more stringent requirements.[24] Some states operate "complete" plans that cover both the private sector and state and local government employees, while others cover state and local government employees only. EPA's Worker Protection Standard (40 CFR 311) applies the HAZWOPER standard to state and local workers in states that do not have occupational health and safety plans.

In addition to the Occupational Safety and Health Act, several federal agencies (DOE, NRC and OSHA) and Agreement States issue occupational radiation safety standards (see Table 3-3). The occupational standards are not guidelines but instead are regulatory limits that cannot be exceeded except under certain conditions. These occupational limits allow workers to receive radiation exposure during the course of performing their jobs.

Federal and state radiation safety standards recognize that it may be necessary to exceed dose limits to take critical lifesaving actions.

Table 3-3. Regulations for Worker Protection

Agency	Regulatory Requirement	Title
Occupational Safety and Health Administration[a]	29 CFR Part 1910.120	Safety and Health — HAZWOPER

[24] For a list of state plans, see: http://www.osha.gov/dcsp/osp/index.html.

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	29 CFR Part 1910.1096	Ionizing Radiation
Environmental Protection Agency[a]	40 CFR Part 311	Occupational Radiation Protection
Nuclear Regulatory Commission[b]	10 CFR Part 20	Standards for Protection Against Radiation
Department of Energy[c]	10 CFR Part 835	Radiation Protection Regulations

a Worker safety and health is regulated in all states by federal OSHA or by respective state regulations under an OSHA-approved state plan. 40 CFR Part 311 applies the OSHA HAZWOPER standard (29 CFR 1910.120) to public-sector workers in states that do not operate their own occupational safety and health programs.

b NRC employees are covered by NRC Management Directive 10.131, ''Protection of NRC Employees Against Ionizing Radiation.'' Section VI, Guidance for Emergency Exposure Controls During Rescue and Recovery Activities, deals specifically with radiation exposure control during emergencies.

c These requirements apply to all DOE employees and contractors (except for Naval Nuclear Propulsion Program (NNPP)) who may be exposed to ionizing radiation as a result of their work for DOE, including work relating to emergency response activities. The NNPP has established requirements consistent with those contained in 10 CFR Part 835.

KEY POINTS IN CHAPTER 3 – EMERGENCY WORKER PROTECTION

- Emergency worker guidelines of 5, 10 or 25 rem (50, 100 or 250 mSv) are based on the urgency of activities and knowledge of the risks involved.
- Worker safety is key to a successful emergency response.
- Incident commanders are responsible for balancing the individual risks and public benefits of each worker action.
- Emergency workers should be adequately informed of, and have an adequate understanding of, the risks they may experience during any missions they accept, including the risk of short-term and long-term health effects from exposure to ionizing radiation.
- Emergency workers should have relevant training, personal protective equipment, and monitoring instruments so they are able to protect themselves and others.
- Since there is assumed to be no threshold below which there is not an associated risk from radiation dose, workers who are reasonably expected to receive an occupational dose exceeding the established dose limit for members of the public, 0.1 rem (0.001 Sv), should be properly trained and monitored.
- Emergency workers should be trained, to the extent feasible, on actions to be taken. All reasonable steps should be taken to provide appropriate protection during the emergency activity.
- Worker protection regulations are listed in Table 3-3.

CHAPTER 4. INTERMEDIATE PHASE PROTECTIVE ACTION GUIDES

This chapter presents PAGs for the intermediate phase and provides guidance for the implementation of corresponding protective actions. A PAG is the projected dose to an individual from the release of radioactive material at which a specific protective action should be taken to reduce or avoid that dose. The intermediate phase is defined as the period beginning after the source and releases have been brought under control and environmental measurements are available for use as a basis for decisions on protective actions and extending until these protective actions are terminated. The intermediate phase may last from weeks to months but is projected for one year for calculation purposes.

During the early phase, decisions must be made and implemented quickly by state and local officials before federal assistance may be available. In contrast, many decisions and actions during the intermediate phase may be taken after federal resources are present, as described in the "Nuclear/Radiological Incident Annex of the National Response Framework" (FEMA 2008 a, b). Decisions will be made during the intermediate phase concerning whether particular areas or properties from which people have been evacuated will be decontaminated and reoccupied or the occupants relocated for an extended period.

This chapter provides the PAGs and corresponding protective actions for use by state and local officials in developing their radiological emergency response plans to protect the public from exposure to radiation from deposited radioactive materials. Due to the wide variety of types of radiological incidents and radionuclide releases that could occur, it is not practical to provide implementing guidance for every possible situation.

This chapter also provides guidance for translating radiological conditions in the environment into projected doses that serve as the basis for decisions to take appropriate protective actions and basic planning guidance on reentry as informed by the Operational Guidelines (DOE 2009).

1.12 EXPOSURE PATHWAYS DURING THE INTERMEDIATE PHASE

During the intermediate phase, the following are the principal exposure pathways for the public occupying areas contaminated with deposited radioactive materials—

- **External exposure** to radiation from deposited radioactive materials (groundshine). External gamma radiation is the expected dominant pathway for NPP incidents and incidents involving RDDs and INDs. Typically, the health risks from other pathways are expected to be minor in comparison to the risks from external gamma radiation.
- **Internal exposure** from the inhalation of resuspended materials. Although normally expected to be of only minor importance for NPP incidents, the inhalation pathway would contribute additional doses to internal organs. Inhalation dose, however, would be an important exposure pathway for radiological incidents with significant fractions of pure beta emitters or alpha emitters.
- **Internal exposure** from the ingestion of food and water. In rare cases, where food or drinking water are contaminated to levels above the PAG for ingestion, and withdrawal of food and/or water from use would, in itself, create a health risk greater than that from the radiation dose, the committed effective dose from ingestion should be added to the dose from the above pathways.

Other potentially significant exposure pathways include exposure to beta radiation from surface contamination (e.g., beta dose to skin) and direct ingestion of contaminated soil. These pathways are not expected to be controlling for NPP incidents (Aaberg 1989).

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1.13 THE PROTECTIVE ACTION GUIDES AND PROTECTIVE ACTIONS FOR THE INTERMEDIATE PHASE: RELOCATION AND DOSE REDUCTION

The principal protective actions for reducing exposure of the public to deposited radioactive materials are:

- Relocation;
- Decontamination;
- Shielding;
- Time limits on exposure; and
- Control of the spread of surface contamination.

The most effective of these actions is relocation—the removal or continued exclusion of people (households) from contaminated areas to avoid chronic radiation exposure. Relocation is highly disruptive and therefore only implemented when the dose is sufficiently high to warrant it. The PAG for relocation is 2 rem (20 mSv) projected over the first year of exposure. After the first year, the PAG for relocation is 0.5 rem (5 mSv) per year.

The PAG level for relocation applies to doses that can be avoided by relocation; doses already incurred prior to relocation are not included in the calculations. PAGs for protection from deposited radioactivity during the intermediate phase are summarized in Table 4-1. The decision to relocate will be considered on a case-by-case basis. Efforts to decontaminate and remediate the contaminated area and the shielding offered by buildings and the residency factor attributable to the building, must be considered to see if the second year PAG (0.5 rem (5 mSv) in a year) will be exceeded.

It may be difficult to avoid exceeding the relocation PAGs for the radionuclides most likely associated with RDDs because of their longer half-lives. If these radionuclides are released, it may be necessary to relocate people in the affected areas even if exposure is less than 2 rem (20 mSv) in the first year provided decontamination and remediation measures during the first year are unsuccessful.

In most scenarios, relocation decisions will be based on doses from external exposure to the whole body from deposited radioactive materials and internal exposure from inhalation of resuspended deposited material.

Food and milk ingestion dose should be considered separately with decisions based on the FDA PAGs.[25] The FRMAC Assessment Manuals[26] provide guidance in calculating Ingestion Derived Response Levels that indicate the levels of deposited radioactive materials that may result in food exceeding the FDA PAGs.

Other protective actions, such as simple dose reduction techniques, can be applied in areas where levels of deposited radioactivity are not high enough to warrant relocation. Dose reduction actions can range from the simple—scrubbing or flushing surfaces, removal and disposal of small spots of highly contaminated soil (e.g., from settlement of water) and spending more time than usual in lower exposure rate areas (e.g., indoors)—to the difficult and time consuming processes of removal, disposal and replacement of contaminated surfaces. The simple processes would probably be most appropriate in contaminated areas outside the relocation area. Many of these can be carried out by the residents with support from officials for monitoring and guidance on appropriate actions and disposal. The more difficult processes will be

[25] Accidental Radioactive Contamination of Human Food and Animal Feeds: Recommendations for State and Local Agencies, FDA 1998, available online: http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM094513.pdf.
[26] See FRMAC Assessment Manuals at http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.

appropriate for recovery of areas where contamination is fixed (not removable) and from which the population is relocated.

Large areas may have to be restricted under these PAGs. As the land area increases, protective actions become more difficult and costly to implement, especially when the affected area is densely populated. There may be situations where full implementation of early and intermediate phase protective actions is impracticable (e.g., a release in a large city). Informed judgment must be exercised to assure priority of protection for individuals in areas having the highest exposure rates.

Table 4-1. PAGs and Protective Actions for Exposure to Deposited Radioactivity during the Intermediate Phase of a Radiological Incident[a]

Protective Action Recommendation	**PAG or Guideline**	**Comments**
Relocation of the public[b]	**PAG**: ≥ 2 rem (20 mSv) projected dose[c] in the first year, 0.5 rem (5 mSv)/year projected dose[c] in the second and subsequent years	Projected dose over one year of exposure
Apply simple dose reduction techniques[d]	**Guideline**: < 2 rem (20 mSv) projected dose[c] in the first year	These protective actions should be taken to reduce doses to as low as practicable levels
Food interdiction[e]	**PAG**: 0.5 rem (5 mSv)/year projected whole body dose, or 5 rem (50 mSv)/year to any individual organ or tissue, whichever is limiting	
Reentry	**Guideline**: Operational Guidelines[f] (stay times and concentrations) for specific reentry activities (see Section 4.6)	

a This guidance does not address or impact site cleanups occurring under other statutory authorities such as the United States Environmental Protection Agency's (EPA) Superfund program, the Nuclear Regulatory Commission's (NRC) decommissioning program, or other federal or state cleanup programs.

b People previously evacuated from areas outside the relocation area defined by this PAG may return to occupy their residences. Cases involving relocation of people at high risk from such action (e.g., patients under intensive care) may be evaluated individually.

c Projected dose refers to the dose that would be received in the absence of shielding from structures or the application of dose reduction techniques. These PAGs may not provide adequate protection from some long-lived radionuclides (see Section 4.6).

d Simple dose reduction techniques include scrubbing or flushing hard surfaces, minor removal of soil from spots where radioactive materials have concentrated, and spending more time than usual indoors or in other low exposure rate areas.

e For more information on food and animal feeds guidance, the complete FDA guidance may be found at http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM094513.pdf.

f For extensive technical and practical implementation information please see "Preliminary Report on Operational Guidelines Developed for Use in Emergency Preparedness and Response to a Radiological Dispersal Device Incident" (DOE 2009).

1.13.1 Removal of the 50 Year Relocation PAG

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For simplicity, the 1992 relocation PAG of 5 rem (50 mSv) over 50 years has been removed from this Manual. It is rarely, if ever, the driver for extending relocation area beyond that prompted by the first or second year relocation PAGs in scenarios that have been analyzed. Additionally, dose projections over 50 years after a radiological incident for various age groups show no significant differences for individuals exposed at 3 months of age versus adult. A response organization may wish to project 50-year doses to inform decision-making, but should consider weathering, decay, credit for time spent indoors, and to the extent it can be predicted, dose reduction from mitigation activities. To keep emergency management decisions as simple as possible, the recommended relocation PAGs are 2 rem (20 mSv) projected over the first year, and 0.5 rem (5 mSv) projected over any subsequent year.

1.13.2 The Population Affected

The PAGs for relocation are intended for use in establishing the boundary of a relocation area within an area where radioactive materials have been deposited. The relocation PAGs have been established at a level that will provide adequate protection for the general population, including higher risk groups such as children and fetuses. People residing in contaminated areas outside the relocation area will be at some risk from radiation dose. Therefore, guidance on the reduction of dose during the first year to residents outside this zone is also provided. Monitoring and simple dose reduction efforts are recommended in these areas to reduce doses to the extent practical. Such actions are unlikely to be practical where the dose reduction achieved is less than 10 percent.

Affected populations may perceive that intermediate phase protective actions are not consistent with those taken in the early phase. Early-phase decisions on sheltering-in-place and evacuation may have been implemented prior to verification of the path of the plume. Therefore, some people may have been evacuated from areas where validated doses are much lower than were projected. Others who were in the path of the plume may have been sheltered or not protected at all. During the intermediate phase of the response, dose projections may be revised based on environmental measurements. People should be relocated from areas where the projected dose exceeds the PAG for relocation without regard to prior evacuation status.

1.13.3 Areas Involved

Figure 4-1 provides a generalized example of the areas affected by different protective actions. Area 1 represents the plume deposition area. (In reality, variations in meteorological conditions would almost certainly produce a more complicated shape, but the same principles would apply.)

In situations such as an NPP accident, where early warning is given prior to a release of radioactive materials, people may already have been evacuated from Area 2 and sheltered in Area 3. People who have been evacuated from Area 2 or sheltered in Area 3 may go home if environmental monitoring verifies that their residences are outside the plume deposition area (Area 1).

Area 4 is the relocation area where projected doses are equal to or greater than the relocation PAG. People residing just outside the boundary of the relocation area may receive a dose approaching the PAG for relocation if decontamination or other dose reduction efforts are not implemented.

Area 1, with the exception of the relocation area, represents the area of contamination that may continue to be occupied by the general public during the intermediate phase. Nevertheless, there will be contamination levels in this area that will require continued monitoring and dose reduction efforts other than relocation. Incident-specific levels below the PAGs may be used to control exposure to contamination. The relative positions of the boundaries shown in Figure 4-1 depend on areas evacuated and sheltered and the radiological and meteorological characteristics of the release. For example, Area 4 (the relocation area) could fall entirely inside Area 2 (area evacuated), so that the only people to be relocated would be those residing in Area 4 who were either missed in the evacuation process or who,

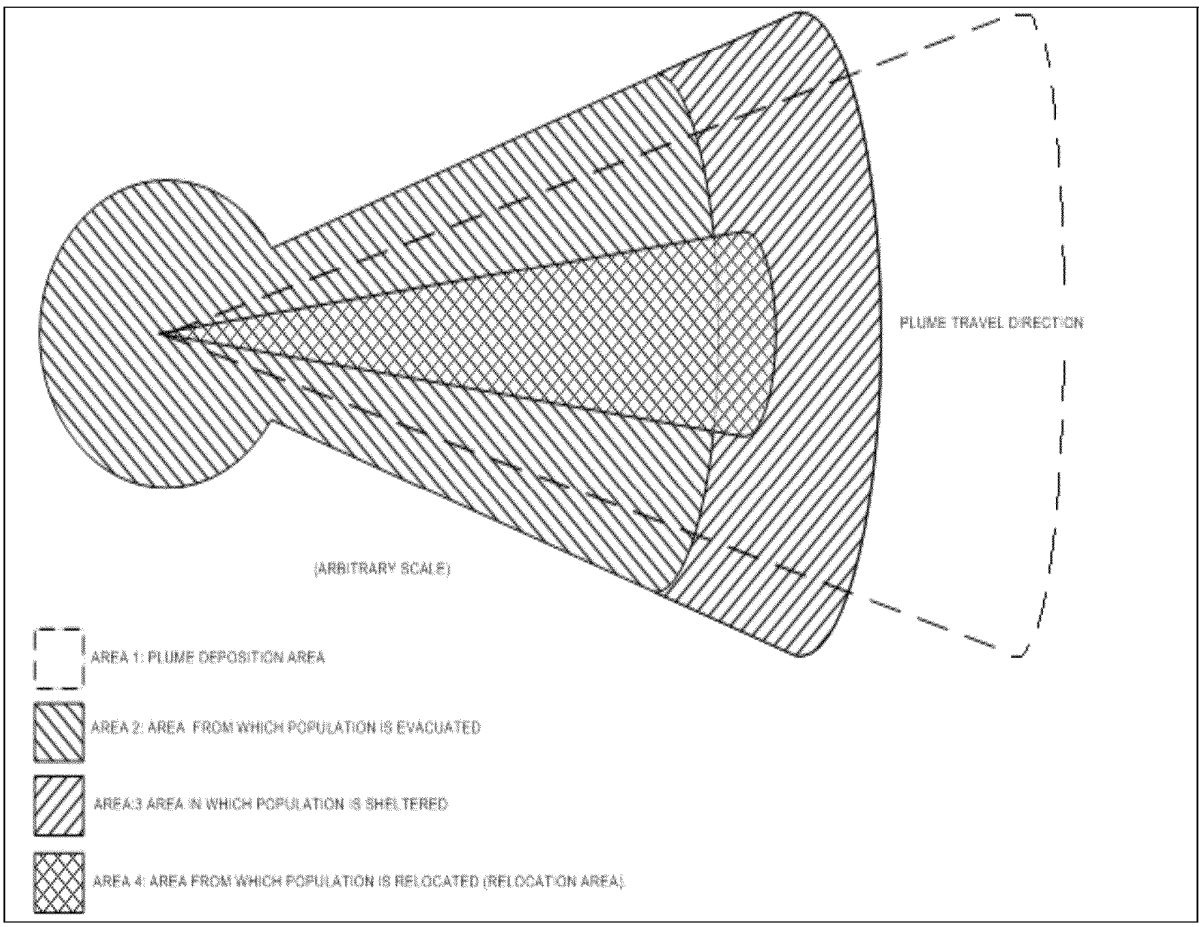
because of mobility constraints for their evacuation, had remained sheltered-in-place during plume passage.

Establishing the boundary of a relocation area creates three groups of affected people—

- People who have already been evacuated from an area that is now designated as a relocation area and who now must be assigned relocation status.
- People who were not previously evacuated, but who reside inside the relocation area and should now relocate.
- People who were previously evacuated, but reside outside the relocation area and may now return home. A gradual return is recommended.

Small adjustments to the boundary of the relocation area established based on the PAG may be justified based on ease of implementation. For example, the use of a convenient natural boundary could be a logical reason for adjustment of the relocation area. However, such decisions should be supported by demonstration that exposure rates to people not relocated can be promptly reduced by methods other than relocation to meet the PAG, as well as the longer dose objectives addressed in Section 4.6.

Figure 4-1. Generalized Protective Action Areas for NPP Incident



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The relocation PAGs apply principally to personal residences but may impact other facilities as well. For example, it could impact work locations, hospitals and park lands as well as the use of highways and other transportation facilities. For each type of facility, the occupancy time of individuals should be taken into account to determine the criteria for using a facility or area. It might be necessary to avoid continuous use of homes in an area because radiation levels are too high. However, a factory or office building in the same area could be used because occupancy times are shorter. Similarly, a highway could be used at higher contamination levels because the exposure time of highway users would be considerably less than the time spent at home.

1.13.4 Priorities

In most cases, protective actions during the intermediate phase will be carried out over a relatively long period of time (e.g., months). Setting priorities will be important, especially when the affected area is so large that it is impractical to relocate members of the public from areas that barely exceed the relocation PAGs. The following priorities are appropriate—

- First, protect all people from doses that could cause acute health effects from all exposure pathways, including previous exposure to the plume.
- Conduct radiological surveys to verify or adjust estimates of radiological impacts.
- Recommend that affected people reduce their exposures by using simple decontamination techniques and remaining indoors.

1.14 SEQUENCE OF EVENTS

The high-priority decisions on whether to relocate people from high exposure rate areas requires exposure rate measurements and dose analyses. Monitoring and dose assessment will be an ongoing process, with priority given to the areas with the highest exposure rates.

Following passage of the airborne plume, a number of tasks must be accomplished for the timely protection of the public. The general sequence of events is itemized below, but the time frames will overlap.

1. Determine the areas where the projected first-year dose will exceed the 2 rem (20 mSv) relocation PAG and relocate people from those areas, with priority given to people in the highest exposure rate areas.
2. Allow previously evacuated people to return as quickly as possible to areas where field gamma measurements indicate that exposure rates are near normal background levels. If there is a possibility that particles from high deposition areas could drift into the occupied areas, establish a buffer zone to restrict residential use until radiological measurements and assessments confirm that it is no longer necessary. Buffer zones are set with the understanding that conservatism is inherent in the PAGs.
3. Based on isodose-rate boundary (see Section 4.3.1), assign any evacuees who reside within the relocation area to be relocated. Evacuated people whose residence is in the area between the boundary of the plume deposition and the boundary to the relocation area may return gradually as dose projections allow.
4. Evaluate the dose reduction effectiveness of simple decontamination techniques and of sheltering-in-place in response to exposure from partial occupancy of residences and workplaces. Results of these evaluations may influence recommendations for reducing exposure rates for people who are not relocated from areas near, but outside, the relocation area.
5. Control access to and egress from the relocation area. This would be accomplished through control points at roadway accesses to the relocation area.

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6. Establish monitoring and decontamination stations to support control of the relocation area.
7. Implement simple decontamination techniques in contaminated areas outside the relocation area, giving priority to areas with higher exposure rates.
8. Collect data needed to establish long-term radiation protection criteria for decontamination and dose reduction and data to determine the effectiveness of various decontamination or other dose reduction techniques.
9. Begin operations to clean up and recover contaminated property in the relocation area.
10. If not already done, evaluate whether food grown or produced within the plume deposition area need to be interdicted per the FDA PAGs and evaluate drinking water systems within the plume deposition area. Provide guidance on planting or harvesting specific agricultural products.

1.14.1 Establishment of Isodose-Rate Lines

As soon as federal or other assistance is available for aerial and ground monitoring, a concentrated effort should begin to establish isodose-rate lines on maps and identify boundaries of the relocation area. Standard maps should be developed on which all response organizations would record monitoring data. Records on monitoring and decontamination of the public and workers should also be collected.

Aerial monitoring can be used to collect data for establishing general patterns of radiation exposure rates and may form the primary basis for the development of dose lines out to the limit of aerial detectability.

Initially during the early phase, detectability is limited to exposure rate changes of a few times natural background levels. Later during the intermediate phase, more sensitive measurements detect levels of radioactivity that are a small fraction of the natural background. Periodic air sample measurements will also be needed to verify the contribution to dose from inhalation of resuspended materials.

Gamma exposure rates measured at one meter (39 inches) will vary within a very small area because different surfaces have different deposition rates (e.g., smooth surfaces versus heavy vegetation). Rinsing or precipitation could also reduce levels in some areas and raise levels in others (e.g., where runoff settles). In general, where exposure rates vary within designated areas, dose projections should be estimated using an appropriate average exposure rate.

1.14.2 Dose Projections

The FRMAC Assessment Manuals[27] provide detailed guidance for dose projection and calculating DRLs and DPs. The FRMAC Assessment Manuals incorporate the ICRP dosimetry models (ICRP 60 series). In addition, the FRPCC encourages the use of computational tools such as DOE's Turbo FRMAC and NRC's RASCAL or other appropriate tools and methods to implement the PAGs.

The primary dose of interest in the intermediate phase is the sum of the effective dose from external exposure and the committed effective dose from inhalation. The exposure periods of interest are the first year and subsequent years after the incident. Other pathways should also be evaluated and their contributions considered, if significant. For example, any time alpha-emitting radionuclides are involved, the inhalation of resuspended material must be considered. Although beta exposure will contribute to skin dose, its contribution to the overall risk of health effects from the radionuclides expected to be associated with reactor incidents should not be controlling in comparison to the whole body gamma dose (Aaberg 1989). However, the skin beta dose may be important for particulates deposited or transferred to the skin, as may be the case for an RDD that contains Strontium-90.

The dominant intermediate phase exposure pathway for incidents involving alpha-emitters (e.g., a weapons accident) is inhalation of resuspended material. For these incidents, dispersal of alpha-emitting

[27] See FRMAC Assessment Manuals at http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.

material must be monitored carefully using proper measurement techniques. It is possible that there will be little or no associated gamma radiation or beta activity.

Calculation of the projected gamma dose from measurements will require knowledge of the principal radionuclides contributing to exposure and their relative abundances. Radiological characteristics can be compiled either through the use of portable gamma spectrometers or by radionuclide analysis of environmental samples. Several measurement locations may be required to determine whether any selective radionuclide deposition occurred as a function of meteorology, surface type, distance from the point of release, or other factors. In accordance with the "Nuclear/Radiological Incident Annex to the National Response Framework," DOE, EPA and other federal agencies have the capability to assist state officials in performing environmental measurements, including determination of radiological characteristics of deposited materials (FEMA 2008 a, b).

The gamma exposure rate may decrease rapidly if deposited materials include a significant fraction of short-lived radionuclides. Therefore, the relationship between instantaneous exposure rate and projected first- and second-year annual doses will change as a function of time. These relationships must be established for the particular mix of deposited radioactive materials present at the time of the gamma exposure rate measurement. Over time, residual doses from gamma emitters will depend largely upon the half-lives of the radionuclides involved and could potentially remain significant over many years. It should be noted that natural attenuation as well as nuclear decay can affect long-term dose assessments.

Because intermediate phase public protection decisions (e.g., relocation, reentry) have less urgency than early phase decisions and the contamination is better characterized in the intermediate phase, it may be possible to improve the public protection decisions by modifying dose estimates with more realistic inputs. For example, the external dose reductions provided by building structures and dose reductions resulting from partial occupancy in the contaminated zone, which accounts for routine time spent outside the contaminated zone (e.g., work, school, shopping), may be included in the dose projections to make improved public protection decisions.

Projected dose considers exposure rate reduction from radioactive decay and, generally, weathering. When one also considers the anticipated effects of shielding from normal part time occupancy in homes and other structures, people who are not relocated are likely to receive a dose substantially less than the projected dose. For commonly assumed reactor source-terms, it is estimated that 2 rem (20 mSv) projected dose in the first year will be reduced to about 1.2 rem (12 mSv) by this factor. The application of simple decontamination techniques shortly after the incident can be assumed to provide a further 30 percent or more reduction so that the maximum first year dose to people who are not relocated is expected to be less than 1 rem (10 mSv). Taking account of decay rates assumed to be associated with releases from NPP incidents (SNL 1982) and shielding from partial occupancy and weathering, a projected dose of 2 rem (20 mSv) in the first year is likely to amount to an actual dose of 0.5 rem (5 mSv) or less in the second year. The application of simple dose reduction techniques would reduce the dose further. Calculations supporting these projections are summarized in Table E-6 of the 1992 PAG Manual.[28]

Keeping below the 0.5 rem (5 mSv) PAG for subsequent years—the second year and beyond—may be achieved through natural decay of shorter half-life radioisotopes, through decontamination efforts, or through other means of controlling public exposures (such as limiting access to certain areas). In the case of an RDD, in which a longer half-life radioisotope would likely be utilized, reductions in dose may prove difficult to achieve without longer-term measures (see Chapter 5).

[28] The 1992 PAG Manual is available as a historical reference online at: http://www.epa.gov/radiation/protective-action-guides-pags.

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Exposure from ingestion of food and water is considered independently of decisions for relocation and decontamination. In rare instances, however, where withdrawal of food or water from use would pose a health risk in itself, relocation may be an appropriate protective action against exposure via ingestion. In this case, the dose from ingestion should be considered along with the projected dose from other exposure pathways for decisions on relocation.

1.14.3 Projected External Gamma Dose

Projected whole body external gamma doses at 1 meter height at particular locations during the first year and second year after the incident are the parameters of interest (DOE 1988). Measurements made at 1 meter to project whole body dose from gamma radiation should be made with instruments of the "closed window" type to avoid the detection of beta radiation. The environmental information available for calculating these doses is expected to be the current gamma exposure rate at 1 meter height and the relative abundance of each radionuclide contributing significantly to that exposure rate. Calculation models are available for predicting future exposure rates as a function of time with consideration of radioactive decay and weathering.

Relocation decisions can generally be made on the basis of the first year projected dose. However, projected doses during the second year are needed for decisions on protective actions for people who are not relocated. Conversion factors are therefore needed to convert environmental measurements to projected dose during the first year and second year following the incident (see FRMAC Assessment Manuals).[29] Of the many types of environmental measurements that can be made to project whole body external gamma dose, gamma exposure rate in air is the easiest to make and is the most directly linked to gamma dose rate. However, analyses of a few environmental samples (particularly soil samples) must be coupled with the gamma exposure rate to properly project decreasing dose rates.

In addition, measurements should be conducted to determine the dose reduction factors associated with simple, rapid, decontamination techniques so that these factors can be used in calculating dose to people who are not relocated. However, assumptions about these factors should not be included in calculating projected dose for decisions on relocation. Only dose reductions already accomplished should be considered.

1.14.4 Exposure Limits for People Reentering the Relocation Area

After the relocation area is established, people will need to reenter for a variety of reasons, including recovery activities, retrieval of property, security patrol, operation of vital services and, in some cases, care and feeding of farm and other animals. It may be possible to quickly decontaminate access ways to vital institutions and businesses in certain areas so that they can be occupied by adults either for living (i.e., institutions such as nursing homes and hospitals) or for employment. Clearance for occupancy of such areas will require dose reduction to meet exposure limits (EPA 1987). Dose projections should include both external exposure from deposited material and inhalation of resuspended deposited material for the duration of the planned exposure. People working in areas inside the relocation area should operate under the controlled conditions established for occupational exposure (EPA 1987). The emergency worker dose limitation does not need to include ongoing doses received from living in a contaminated area outside the relocation area. It is also not necessary to consider dose received previously from the plume or groundshine during the early phase of the radiological incident. See the Reentry Matrix in Table 4.2. It provides a quick reference for public and emergency worker dose guidelines and considerations for decontamination ongoing during this phase.

[29] See FRMAC Assessment Manuals at http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.

1.15 PROTECTIVE ACTION GUIDANCE FOR FOOD AND DRINKING WATER

Information on food and animal feeds protective action guidance is contained in FDA's "Accidental Radioactive Contamination of Human Food and Animal Feeds: Recommendations for State and Local Agencies" (FDA 1998).

The EPA is developing drinking water guidance on a separate timeline. The Agency has proposed a drinking water PAG for public comment with the intention of adding it as an Addendum to the PAG Manual once it is final.

1.16 LONGER-TERM OBJECTIVES OF THE PROTECTIVE ACTION GUIDES FOR THE INTERMEDIATE PHASE

It is an objective of the PAGs to ensure that doses in any single year after the first year will not exceed 0.5 rem (5 mSv). For source terms from NPP incidents, the PAG of 2 rem (20 mSv) projected dose in the first year is expected to meet this longer-term objective through radioactive decay, weathering and normal part-time occupancy in structures. If the release contains long-lived radionuclides, decontamination of areas outside the relocation area may be required during the first year to meet these objectives. For situations where it is impractical to meet these objectives through decontamination, relocation should be considered even if the projected first-year dose is lower than the relocation PAG.

Based on the relocation PAGs, reentry guidance can be found in the Reentry Matrix in Section 4.6, as well as in the "Preliminary Report on Operational Guidelines Developed for Use in Emergency Preparedness and Response to a Radiological Dispersal Device Incident" (DOE 2009),[30] referred to as "Operational Guidelines." After the population has been protected in accordance with the PAGs for relocation, reoccupancy of the relocation areas should be governed on the basis of cleanup criteria and late phase cleanup activities should proceed. Refer to the Operational Guidelines manual for more information on how to implement the reentry guides in emergency plans.

1.17 REENTRY MATRIX FOLLOWING A RADIOLOGICAL INCIDENT OR ACCIDENT

During the intermediate phase, people will need to enter the relocation area to collect their belongings, maintain or repair critical infrastructure and to work on preliminary recovery activities. The Reentry Matrix in Table 4-2 provides a quick reference for public and worker dose guidelines and considerations for decontamination ongoing during this phase.

The "Preliminary Report on Operational Guidelines Developed for Use in Emergency Preparedness and Response to a Radiological Dispersal Device Incident" (DOE 2009), referred to as "Operational Guidelines," include detailed numeric guidance, developed by a multi-agency working group as a follow-up to the RDD/IND Planning Guidance. That work focused specifically on response and recovery for an RDD event; however, that work can be expanded to include isotopes from a variety of incident types.

The Operational Guidelines are informative for this guidance, specifically the discussions about applicable dose-based limits, timeframes and pathways of exposure related to reentry tasks. The term reentry is used for emergency workers and members of the public going into radiologically contaminated areas, temporarily, under controlled conditions. Food and agriculture guides use FRMAC methods and models as well as the Operational Guidelines for implementation. These tools allow derivation of decontamination thresholds for the early and intermediate stages of a response.

[30] The Operational Guidelines were developed by federal agencies and published by DOE in February 2009 DOE/HS-0001; ANL/EVS/TM/09-1, online at http://web.ead.anl.gov/resrad/documents/ogt_manual_doe_hs_0001_2_24_2009c.pdf. (DOE 2009)

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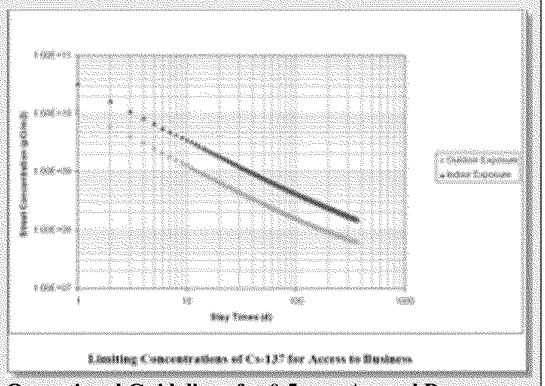
As part of the U.S. response to the Japanese Fukushima accident, scientists performed dose calculations to ensure that passengers and workers on train trips through contaminated areas do not exceed doses typically received from cosmic radiation during an international flight. DOE's Argonne National Laboratory scientists utilized the RESRAD-RDD tool and hand calculations to approximate doses from the NPP radionuclides.

Table 4-2. Reentry Matrix: Quick Reference to Operational Guidelines[a]

PHASE	ACTIVITY	SUGGESTED LEVELS	CLEANUP ACTIONS[b]
Early Phase	**Sheltering or Evacuation for the Public**	**Public**: 1-5 rem (10-50 mSv) projected over four days (see Chapter 2). A decision to evacuate weighs anticipated dose against feasibility of evacuating within a determined time frame, along with the risks associated with the evacuation itself.	It is too early for organized cleanup, due to chaos of the situation and higher priorities such as lifesaving activities and clearly identifying shelter and evacuation zones. Any cleanup or decontamination information should focus on personal decontamination. It is doubtful any large-scale effort could change evacuation or shelter recommendations during this period (first 4 days). Once evacuation is completed, there are simple actions that cities can implement themselves: rinsing roofs and streets, street sweeping. The objective of these actions is to move the bulk amounts of contamination away from occupied areas or areas where reoccupation is a priority. These actions should be based on measured amounts of contamination and priority of the location. Workers may face high dose levels and will need health physics support.
	Emergency Worker Protection	**Emergency Worker**: 5/10/25 rem (50/100/250 mSv) incurred over the response duration. The higher limits are based on task (e.g., protecting large populations or critical infrastructure or lifesaving). Emergency worker doses will be tracked with dosimeters. Emergency workers have knowledge of the risks associated with radiation exposure, training to protect themselves and dosimeters to track their doses (see Chapter 3).	
Inter-mediate Phase	**Relocation for the Public**	**Public**: 2 rem (20 mSv) projected first year, 0.5 rem (5 mSv) per year projected in subsequent years (See Chapter 4). In this phase, scientists run dose calculations with RESRAD-RDD or Turbo FRMAC; the user can choose sensitive age groups, or enter lower guidelines, if desired. Additionally, local decision-makers can adapt the guidelines with incident-specific considerations and implement variations as	Early cleanup efforts should focus on the removable portion of the contamination: vacuuming, washing, vegetation removal. ▪ Vacuuming has the advantage of collecting removable contamination without water or surface impact, but is limited by equipment availability and can also expose the operators to high dose levels as the vacuums collect the contamination. ▪ Washing and rinsing are simple to implement, but only move the contamination to less-populated areas and may move contamination deeper into porous surfaces. ▪ For unpaved areas, vegetation removal can effectively reduce the amount of contamination present, but is labor

		Public: 2 rem (20 mSv) in first year (Preliminary Report on Operational Guidelines Developed for Use in Emergency Preparedness and Response to a Radiological Dispersal Device Incident,[e] *Operational Guidelines Group C*). Dosimeters could be considered for the public.	intensive and can produce a large amount of waste. Having addressed the removable part of the contamination, later efforts can focus on fixed contamination. ▪ Paved surface removal is very effective, but requires specialized equipment and trained operators. ▪ Surface sealing is easier, but leaves the contamination in place, making it viable only in locations where the dose rates are low enough for occupation, or in low-occupancy areas. ▪ Repaving roads, lots and other paved surfaces is easy to implement, but can generate significant waste volumes. ▪ Unpaved areas can be further remediated by soil skimming (surface removal), deep plowing (turning the top foot or so of soil over) and appropriate chemical soil amendment methods like liming or chelating. As the intermediate phase progresses, knowledge and experience increases and these methods can be re-applied, refined or customized for problem areas. Decisions about more difficult areas will benefit from professional judgment, additional analyses and application of more sophisticated technologies.
Inter-mediate Phase	**Emergency Worker Protection**	**Emergency Worker Protection**: (dose not to exceed) 5 rem (50 mSv) per year ((*Radiation Protection Guidance to Federal Agencies for Occupational Exposure*, EPA 1987). Emergency workers have knowledge of the risks associated with radiation exposure, training to protect themselves and dosimeters to track their doses (see Chapter 3). During an incident response, workers (police, waste handlers) needed in contaminated areas could be trained and given dosimeters. The guidance for emergency workers applies throughout the response.	
	Reentry For Use of Roads and Walkways	**Public**: 2 rem (20 mSv) first year, 0.5 rem (5 mSv) per year in subsequent years (*Operational Guidelines, Group E*). While the dose values here are similar to those for Use of Critical Infrastructure above, the derived concentrations measured as triggers are different because the exposure conditions are different.	

Inter-mediate Phase	**Reentry** For Access to the Relocation Zone *"Stay time" is a term of art used in the radiation safety field. Stay times are the amount of time a person may access the contaminated area. These times vary based upon site-specific factors or incident character-istics such as indoor or outdoor work, sensitive populations and level of radioactivity.*	**Public**: 0.5 rem (5 mSv) over one year for temporary access with stay times (see definition below) dependent on reentry tasks and site-specific conditions (*Operational Guidelines, Group D*). Section 7.1 of the Operational Guidelines, "Worker Access to Businesses for Essential Actions," provides tables and graphs of stay times at various limiting concentrations (see adjacent graph and table). For example, if the maximum surface street concentration of Cesium-137 is 3.00E+09 pCi/m^2 (1.11E+08 Bq/m^2), people limited to 0.5 rem (5 mSv) should be in the contaminated area less than four 8-hour days if staying outdoors. This may apply to individuals retrieving belongings from homes or to workers providing security patrols, or even to people reopening businesses in the area. As contamination levels are reduced during cleanup, stay times can be extended and total doses reduced.	These graphics below are examples based on Operational Guidelines. Please refer to the full report for tables and graphics for use in emergency preparedness.  **Operational Guidelines for 0.5 rem Annual Dose: Residents Access to Houses (Indoor Exposure)** Surface Street Concentration (pCi/m^2) Radionuclide / 1 Day / 4 Days / 12 Days Am-241 / 7.51E+07 / 2.86E+07 / 1.59E+07 Cf-252 / 3.50E+08 / 1.32E+08 / 7.13E+07 Cm-244 / 1.27E+08 / 4.82E+07 / 2.68E+07 Co-60 / 2.72E+09 / 6.87E+08 / 2.33E+08 Cs-137 / 1.14E+10 / 2.94E+09 / 1.01E+09 Ir-192 / 9.93E+09 / 2.54E+09 / 8.92E+08 Po-210 / 1.17E+09 / 3.86E+08 / 1.74E+08 Pu-238 / 6.56E+07 / 2.50E+07 / 1.39E+07 Pu-239 / 6.01E+07 / 2.29E+07 / 1.27E+07 Ra-226 / 6.08E+08 / 2.10E+08 / 9.97E+07 Sr-90 / 2.48E+10 / 7.70E+09 / 3.18E+09
Operational Guidelines provide stay times and concentrations for several different sets of assumptions about the exposure. Residents retrieving possessions may spend most of their time indoors, where stay times are longer than they are for outdoor tasks. Stay time recommendations can be used to guide decisions about allowing entry into the contaminated area for a limited time and dose reduction techniques like wearing dust masks, cleaning shoes and car tires upon exit and using time wisely to keep radiation exposure "ALARA" below the Operational Guideline.			

[a] This guidance does not address or impact site cleanups occurring under other statutory authorities such as the United States Environmental Protection Agency's (EPA) Superfund program, the Nuclear Regulatory Commission's (NRC) decommissioning program, or other federal or state cleanup programs.

[b] This cleanup process does not rely on and does not affect any authority, including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq. and the National Contingency Plan (NCP), 40 CFR Part 300. This document expresses no view as to the availability of legal authority to implement this process in any particular situation.

[c] The Operational Guidelines were developed by federal agencies and published by DOE in February 2009 DOE/HS-0001; ANL/EVS/TM/09-1, online at http://web.ead.anl.gov/resrad/documents/ogt_manual_doe_hs_0001_2_24_2009c.pdf. (DOE 2009)

1.18 BASIS FOR INTERMEDIATE PHASE PAGs

For a full description of the risk-benefit analysis used to set the PAG levels, refer to the 1992 PAG Manual, Appendices B, C and E. The 1992 PAG Manual is available online in a searchable format.

Below is a short summary of the basis for the intermediate phase relocation PAGs.

In a prior section (see Section 2.5) for early phase (evacuation) PAGs, analysis was provided for the risks of health effects as a function of dose (Principles 1 and 2). Considerations for selection of PAGs for the intermediate phase of a radiological incident differ from those for selection of PAGs for the early phase primarily with regard to implementation factors (i.e., Principles 3 and 4). Specifically, they differ with regard to cost of avoiding dose, the practicability of leaving infirm people and prisoners in the restricted zone, and avoiding dose to fetuses. Although sheltering is not generally a suitable alternative to relocation, other alternatives (e.g., decontamination and shielding) are suitable.

For several assumed cumulative annual doses, the cost per day divided by the risk of fatality avoided by relocation was plotted for a radionuclide mixture from a hypothetical NPP accident. The cost per day of relocation is assumed to be constant, but with some nuclides decaying rapidly, the cost-effectiveness of relocation diminishes over time. Drawing only general trends from this, the cost analysis supports relocation at doses as low as 1 rem (10 mSv) for the first week and 2 rem (20 mSv) for up to 25 days after an accident.

Based on the avoidance of acute effects alone (Principle 1), relocation of the general population and fetuses at 50 rem and 10 rem (500 and 100 mSv), respectively, is justified. However, on the basis of control of chronic risks (Principle 2), a lower upper bound is appropriate. Five rem is taken as an upper bound on acceptable risk for controllable lifetime exposure to radiation, including avoidable exposure to accidentally deposited radioactive materials.

Analyses based on Principle 3 (cost/risk) indicate that considering cost alone would not drive the PAG to values less than 5 rem (50 mSv). Analyses in support of Principle 4 (risk of the protective action itself) provide a lower bound of 0.15 rem (1.5 mSv) for the relocation PAGs. Based on the above, 2 rem (20 mSv) projected committed effective dose equivalent from exposure in the first year is selected as the PAG for relocation. Implementation of relocation at this value will provide reasonable assurance that, for a reactor accident, a person relocated from the outer margin of the relocation zone will, by such action, avoid an exposure rate which, if continued over a period of one year, would result in a dose of about 1.2 rem (12 mSv). This assumes that 0.8 rem (8 mSv) would be avoided without relocation through normal partial occupancy of homes and other structures.

Contrary to the situation for evacuation during the early phase of an incident, it is generally not practical to leave a few people behind when most members of the general population have been relocated from a specified area for extended periods of time. It will usually be practicable to reduce these risks by establishing a high priority for efforts other than relocation to reduce the dose in cases where pregnant women reside near the boundary of the restricted zone.

The implementation of simple dose reduction techniques will further reduce dose to people who are not relocated from contaminated areas. In the case of non-reactor accidents, decay and weathering effects differ, and it may be necessary to base relocation decisions on the second and subsequent year dose projections.

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KEY POINTS IN CHAPTER 4 – INTERMEDIATE PHASE

- The principal protective actions for reducing exposure of the public to deposited radioactive materials are relocation, decontamination and time limits on exposure. The PAG for relocation is 2 rem (20 mSv) over the first year of exposure. After the first year, the PAG for relocation is 0.5 rem (5 mSv) per year.
- Boundaries of relocation areas should be established based on the relocation PAGs and site-specific geographical features such as rivers, mountains or roadways.
- Exposure limits must be set for people who must enter the relocation area to perform vital services.
- Other protective actions, such as focused decontamination and time limits on exposure, are applied to people in areas where levels of deposited radioactivity are not high enough to warrant relocation.
- Protective action guidance for food is contained in FDA's "Accidental Radioactive Contamination of Human Food and Animal Feeds: Recommendations for State and Local Agencies" (FDA 1998).
- To inform temporary reentry into relocation areas, use the Operational Guidelines (DOE 2009).

CHAPTER 5. PLANNING GUIDANCE FOR THE LATE PHASE

This chapter provides planning guidance for the long-term cleanup process for the late phase. As used in this Manual, the late phase is the period beginning when cleanup and recovery actions have begun and ending when all recovery actions have been completed. This phase may extend for months to years. This chapter also provides brief planning guidance and discusses options for radioactive waste disposal for a large-scale radiological incident.

1.19 LATE PHASE CLEANUP PROCESS

This section describes the remediation cleanup process for the late phase of a nationally significant radiological incident, like a disaster at an NPP, an RDD or an IND. It should be noted that the extent and scope of contamination as a result of an NPP, RDD or IND incident may be at a much larger scale than a site or facility decommissioning or remedial cleanup. This process identifies the late phase remediation or cleanup process steps, including factors for decision-makers to consider in determining final cleanup actions. For information on roles, responsibilities and authorities during emergency response and recovery, please refer to the National Response Framework: http://www.fema.gov/national-response-framework and specifically for radiological incidents, the Nuclear Radiological Incident Annex: http://www.fema.gov/pdf/about/divisions/thd/IncidentNucRad.pdf (FEMA 2008a, b).

1.19.1 Transitioning from Intermediate to Late Phase Cleanup

The late phase cleanup process begins sometime after the commencement of the intermediate phase and proceeds independently of intermediate phase protective action activities. The transition is characterized by a change in approach, from strategies predominantly driven by urgency, to strategies aimed at both reducing longer-term exposures and improving living conditions. The late phase involves the final cleanup of areas and property at which contamination directly attributable to the incident is present. It is in the late phase that final cleanup decisions are made and final recovery efforts following a radiological incident are implemented.

Unlike the early and intermediate phases of a radiological incident, decision-makers will have more time and information during the late phase to allow for better data collection, stakeholder involvement and options analysis. There will be opportunities to involve key stakeholders in providing sound, cost-effective cleanup recommendations. Generally, emergency phase decisions will be made directly by elected public officials, or their designees, with limited stakeholder involvement due to the need to act within a short timeframe. Longer-term decisions should be made with stakeholder involvement and can also include incident-specific technical working groups to provide expert advice to decision-makers on impacts, costs and alternatives. Community members will influence decisions such as if and when to allow people to return home to contaminated areas. There will be people living in contaminated areas, outside the evacuation and relocation zones, where efforts to reduce exposures will be ongoing.

Because of the extremely broad range of potential impacts that may occur from NPP incidents, RDDs and INDs (e.g., light contamination of one building to widespread destruction of a major metropolitan area), a process should be used to determine acceptable cleanup criteria based on the societal objectives for expected land uses and the options and approaches available. Implicit in these decisions is the ability to balance health protection with the desire of the community to resume normal life. Radiation protection considerations should be addressed in concert with health, environmental, economic, social, psychological, cultural, ethical, political, and other considerations. It is recognized that experience from existing programs, such as the U.S. EPA's Superfund program, the U.S. NRC's process for decommissioning and decontamination to terminate a nuclear facility license, and other national recommendations may be useful in planning cleanup and recovery efforts.

Consistent with the "Framework for Environmental Health Risk Management," mandated by the 1990 Clean Air Act Amendments and published by the Commission on Risk Assessment and Risk Management in 1997, the late phase cleanup process consists of multiple steps, including 1) characterization and stabilization, 2) development of goals and strategies, and 3) implementation and reoccupancy. Stakeholder involvement should be integrated throughout the process. Characterization in this phase consists of delineation, in detail, of the nature and extent of contamination in areas impacted by the incident. Stabilization is intended to reduce the spread of contamination to clean areas, airborne inhalation hazards and the volume of radioactive waste generated. Establishment of cleanup goals and strategies should consider overall community health, along with a variety of factors described further below; they are based upon anticipated land use and a variety of selection criteria. Key to these steps is the involvement and acceptance of the impacted state and local community. These steps are discussed in more detail below.[31]

1.19.2 Characterization and Stabilization

The first step in the late phase remediation or cleanup process is characterization, or the comprehensive mapping and monitoring of the distribution and level of radioactive contamination. Characterization activities are necessary in the preparation for and verification of a successful remediation or cleanup effort. The late phase characterization work is designed to define, in detail, the nature and extent of the contamination and to provide information needed to develop and evaluate cleanup alternatives.

The characterization performed in support of the late phase will be much more detailed and comprehensive than the earlier characterization work to support PAG decisions made during the early and intermediate phases. It delineates the nature of any actual threat posed to human health or the environment and defines the extent of that threat.

Stabilization techniques are designed to immobilize radioactive contamination on soils, buildings, roads and equipment. This becomes paramount in a large-scale radiological incident where the spread of contamination can occur from natural weathering effects to human and animal interactions with the environment. Stabilization reduces chronic low-level exposures to residual radiation, airborne hazards and volumes of secondary waste. These reductions can result in significant benefits to the long-term recovery in terms of time-to-normalcy and economic recovery.

1.19.3 Goals and Strategies

After late phase characterization and stabilization activities are accomplished, areas impacted by radioactive contamination are documented and defined to the best extent possible. At this point, decision-makers should establish cleanup goals and strategies for moving forward. The development of goals and strategies marks the second step in the late phase remediation or final cleanup process. As part of an ongoing iterative process, cleanup goals are informed by the feasibility of cleanup strategies and specific cleanup strategies adjust as experience is gained. That is, risk management goals may be refined as decision-makers and stakeholders gain appreciation for what is feasible, what the costs and benefits are and how the process of reducing exposures and risks can improve human and ecological health.

As cleanup levels for areas are determined, many factors come into play in decision-making, such as balancing risk reduction with other factors, background levels of radioactivity and tolerance for voluntary versus involuntary risk. Determining these levels will require consideration of a number of factors—

[31] This cleanup process does not rely on and does not affect any authority, including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq. and the National Contingency Plan (NCP), 40 CFR Part 300. This document expresses no view as to the availability of legal authority to implement this process in any particular situation.

- The types of contamination; the technical feasibility, cost, timeliness and effectiveness of decontamination measures; and the availability and cost of options for the disposal of wastes.
- The size and character of the areas that are contaminated; past and projected future uses for these areas; and the preservation or destruction of places of historical, national, or regional significance.
- Site-specific natural and anthropogenic background levels of radioactivity.
- Estimates of the impacts of both contamination and options for decontamination, on human health, communities, the economy, ecosystems and ecosystem services.
- Public acceptability and intergenerational equity.

Community involvement and sentiment are vital to this process. The stress from both the incident itself as well as the longer-term effects of separation from home will be important factors as overall community health is considered. In the United States, a range of one in a population of ten thousand (10_{-4}) to one in a population of one million (10_{-6}) excess cancer incidence outcomes is generally considered protective for both chemical and radioactive carcinogenic contaminant exposures. This range is the regulatory standard generally used in the context of EPA Superfund response actions. The NRC's decommissioning and decontamination process outcomes are usually in or near this range as well. A similar risk range may be an appropriate goal for radiological events that affect areas of comparable size. However, such risk ranges may not be practically achievable for major incidents that result in the contamination of very large areas. Every incident is unique. In making decisions about cleanup goals and strategies for a particular event, decision-makers should balance the desired level of exposure reduction with the extent of the measures that would be necessary to achieve it, in order to maximize overall human welfare.

While it may take many years to achieve final cleanup levels, a timely return to normalcy, including reoccupancy and a viable community, will require a cleanup process that is flexible, iterative and inclusive. Decisions should be made on a site-specific basis and should reflect the interim risks that are reasonable and acceptable to the affected community as active remediation, radioactive decay and natural weathering move the site toward long-term cleanup goals.

Cleanup strategies are adopted as decision-makers and stakeholders gain an understanding of all relevant factors. Tradeoffs between alternatives should be considered and balanced so that the best options are chosen. Local acceptance will be a key component of a fully transparent approach to long-term remediation and cleanup. Factors to consider in determining cleanup actions include evaluating:

- Areas impacted (e.g., size, location relative to population);
- Actions already taken during the early and intermediate phases;
- Ability of a remedy to maintain reliable protection of overall human health and the environment over time;
- Assessing the relative performance of treatment technologies on the toxicity, mobility or volume of contaminants;
- Success or effectiveness of the cleanup or remediation as the cleanup progresses (contaminant removal);
- Adverse impacts on human health and the environment that may be posed in the time it takes to implement the remedy and achieve the community-based remediation goals;
- Impacts of alternative cleanup levels on the local and regional economy (e.g., job loss due to closed businesses, job creation due to decontamination and waste handling operations) and on residents' sense of place (e.g., continued limited access to one's home and community until cleanup levels have been reached);
- Preservation or destruction of places of historical, national or regional significance;
- Technical and administrative feasibility of the remedy, including the availability of materials and services needed to implement each component of the option in question;

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- Cost of each alternative, including the estimated capital and operation and maintenance costs and net present value of capital and operation and maintenance costs;
- State concurrence with the remedy; and
- Community support for the remedy.

This may be an iterative process. As experience is gained, adjustments may be required to achieve long-term goals.

1.19.4 Implementation and Reoccupancy

To implement cleanup actions in each community, measurable quantities associated with cleanup goals should be derived taking into account exposures from all potential pathways and through all environmental media (e.g., soil, ground water, surface water, sediment, air, animals or plants). These values typically are derived considering reasonably anticipated future land use, dietary habits and commerce patterns. If meeting acceptable cleanup levels based upon the reasonably anticipated post-incident land use is not practicable and cost-effective, decision-makers can look to more restrictive land uses through institutional and engineering controls. This approach is based on the belief that early community involvement focusing on desired post-incident uses of the property will result in expedited, cost-effective and publicly-supported cleanups. Overall community health, including stress factors from the initial event and separation from home or family is a necessary consideration.

In some situations, a site or area may reasonably be anticipated to support a range of uses, so cleanup goals may be different for different subareas of the impacted area. Although it may take years to achieve the final cleanup goals for all land uses, reoccupancy of the affected area will be possible when interim cleanup can reduce short-term exposures to acceptable levels during the time it takes to achieve the long-term goals. There may be institutional or engineering controls placed on some portions of the site to prevent excessive exposures until further active remediation, radioactive decay, or natural weathering allow the site to meet cleanup goals. An example of an institutional control might be a restriction on planting vegetable gardens to avoid ingesting radionuclides that may be taken up by the plant roots from the soil. An example of an engineering control to limit exposures might be adding a layer of pavement or cement over gamma emitting radionuclides that have become fixed in place by sorbing onto the street and sidewalks.

In complex cases such as the situation represented by a wide-area NPP, RDD or IND event, cleanup and reoccupancy are likely to occur subarea by subarea in order of priority and community assessments. Critical infrastructure is likely to have been restored to some level of functionality and further remediation of the infrastructure should be evaluated against the cleanup goal. A community-based and transparent development of priorities would follow, resulting in sequential actions, whereby areas (e.g., residential, commercial) would be remediated and reoccupied utilizing temporary cleanup levels that would be considered acceptable for an interim period of time prior to final cleanup goals being achieved. Land use may need to be changed in a subarea where it is not feasible with a combination of remediation with engineering and institutional controls to support the pre-incident land use in a manner that protects human health. In all cases, an appropriate population health monitoring program should be implemented proportionate to the potential or estimated health risk.

1.19.5 Stakeholder Involvement

Generally, early (or emergency) phase decisions will be made directly by elected public officials, or their designees, with limited stakeholder involvement due to the need to act within a short timeframe. With additional time and an increased understanding of the situation, there will be opportunities to involve key stakeholders in providing sound, cost-effective cleanup recommendations that are protective of human health and the environment.

Affected citizens should be involved in all phases of cleanup planning and long-term remediation of their communities. Early in the process, decision-makers should bring together a broad group of stakeholders (e.g., residents, local business owners, local government officials and others) interested in the processes that will be required to restore their communities. The credibility of a community group is a function of its inclusiveness. It should represent all stakeholder interests to ensure it is a voice for the entire community rather than a few interested parties. Empowering individuals to assist in the process is important and effective. The affected local community will need to be involved until the site remediation activities are complete and possibly beyond that if institutional and engineering controls are placed on some subareas of the site.

1.19.6 Cleanup Process Implementation and Organization: An Example

This example, adapted closely from the "Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents" (DHS 2008), describes a hypothetical organization to integrate federal cleanup support activities with state and local governments and the public. In particular, it addresses a scenario where the federal government is expected to be the primary funding entity for cleanup and recovery activities. For some radiological scenarios, states might take the primary leadership role in cleanup and contribute significant resources toward recovery of the site. This example does not address such a scenario, although states may choose to follow a similar process.

5.1.6.1 Cleanup Implementation

This approach describes how federal departments and agencies may coordinate during a response with state and local government counterparts and the public, consistent with the National Response Framework (NRF) (FEMA 2008a) and the National Disaster Recovery Framework (NDRF). The approach does not attempt to provide detailed descriptions of state and local roles and expertise. It is assumed those details will be provided in state and local level planning documents that address radiological/nuclear terrorism incidents.

During the intermediate phase, site cleanup planners should begin the process described below, under the direction of the on-site incident command or unified command (IC/UC) and in close coordination with federal, state and local officials. After early and intermediate phase activities have come to conclusion and only long-term cleanup activities are ongoing, the IC/UC structure may continue to support planning and decision-making for the long-term cleanup. The IC/UC may make personnel changes and structural adaptations to suit the needs of a lengthy, multifaceted and highly visible remediation process. For example, a less formal and structured command, more focused on technical analysis and stakeholder involvement, may be preferable for extended site cleanup than what is required under emergency circumstances.

Radiological and nuclear incidents cover a broad range of potential scenarios and impacts. This example assumes that the incident is of sufficient size to trigger a state request for federal assistance and that the federal government is the primary funding agent for site cleanup. In particular, the process described for the late phase cleanup assumes an incident of relatively large size. For smaller incidents, all of the elements in this section may not be warranted. The process should be tailored to the circumstances of the particular incident. Decision-makers should recognize that for some radiological/nuclear incidents, states will take the primary leadership role and contribute significant resources toward cleanup of the site. This section does not address such a scenario, but states may choose to use the process described here.

5.1.6.2 Cleanup Activities Overview

As described earlier in the document, radiological/nuclear emergency responses are often divided roughly into three phases: 1) the early phase, when the plume is active and field data are lacking or not reliable; 2) the intermediate phase, when the plume has passed and field data are available for assessment and

analysis; and 3) the late phase, when long-term issues are addressed, such as cleanup of the site. For purposes of this example, the response to a radiological or nuclear incident is divided into two separate, but interrelated and overlapping, processes. The first is comprised of the early and intermediate phases of response, which consists of the immediate and near-term on-scene actions of state, local and federal emergency workers under the IC/UC. On-scene actions include incident stabilization, lifesaving activities, dose reduction actions for members of the public and emergency workers, access control and security, emergency decontamination of people and property, "hot spot" removal actions and resumption of basic infrastructure functions.

The second process pertains to environmental cleanup, which is initiated soon after the incident (during the intermediate phase) and continues into the late phase. The process starts with convening stakeholders and technical subject matter experts to begin identifying and evaluating options for the cleanup of the site. The environmental cleanup process overlaps the intermediate phase activities described above and should be coordinated with those activities. This process is interrelated with the ongoing intermediate phase activities and the intermediate phase protective actions may continue to apply through the late phase until cleanup is complete.

Cleanup planning and discussions should begin as soon as practicable after an incident to allow for selection of key stakeholders and subject matter experts, planning, analyses, contractual processes and cleanup activities. States may choose to pre-select stakeholders for major incident recovery coordination. These activities should proceed in parallel with ongoing intermediate phase activities and coordination between these activities should be maintained. Preliminary remediation activities during the intermediate phase—such as emergency removals, decontamination, resumption of basic infrastructure function and some return to normalcy in accordance with intermediate phase PAGs—should not be delayed for the final site remediation decisions.

A process for addressing environmental cleanup is presented below. This is a flexible process in which numerous factors are considered to achieve an end result that considers local needs and desires, health risks, costs, technical feasibility and other factors. The general process outlined below provides decision-makers with input from both technical experts and stakeholder representatives and also provides an opportunity for public comment. The extent and complexity of the process for an actual incident should be tailored to the needs of the specific incident; for smaller incidents, the workgroups discussed below may not be necessary.

The goals of the process described below are: 1) transparency—the basis for cleanup decisions should be available to stakeholder representatives and to the public at large; 2) inclusiveness—representative stakeholders should be involved in decision-making activities; 3) effectiveness—technical subject matter experts should analyze remediation options, consider established dose and risk benchmarks and assess various technologies in order to assist in identifying a final solution that is optimal for the incident; and 4) shared accountability—the final decision to proceed will be made jointly by federal, state and local officials.

Under the NRF and NDRF, FEMA may issue mission assignments to the involved federal agencies, as appropriate, to participate in the overall recovery process. Additional funding may be provided to state/local governments to perform response or recovery activities through other mechanisms. The components of the process are described below:

5.1.6.3 General Management Structure

Planning for the long-term cleanup should begin during the intermediate phase and at that time, a traditional National Incident Management System (NIMS) response structure should still be in place. However, NIMS was developed specifically for emergency management and may not be the most

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efficient response structure for long-term cleanup. If the cleanup will extend for years, the IC/UC may decide to transition at some point to a different long-term project management structure.

Under the NRF and NIMS, incidents are managed at the lowest possible jurisdictional level. In most cases, this will be at the level of the IC/UC. The IC/UC directs on-scene tactical operations. Responding local, state and federal agencies are represented in the IC/UC and Incident Command Post (ICP) in accordance with NIMS principles regarding jurisdictional authorities, functional responsibilities and resources provided. For a wide-area radiological incident, multiple ICPs may be established to manage the incident with an Area Command or Unified Area Command supporting the ICPs and prioritizing resources and activities among them. If the incident happens on a federal facility or involves federal materials, the representatives in the UC may change appropriately and the response will be conducted according to the applicable federal procedures.

Issues that cannot be resolved at the IC/UC or Unified Area Command level may be raised with the Joint Field Office (JFO) and JFO Unified Coordination Group for resolution. The JFO coordinates and prioritizes federal resources and when applicable, issues mission assignments to federal agencies under the Stafford Act. Issues that cannot be resolved at the JFO level may be raised to the DHS National Operations Center senior-level interagency management groups and the White House Homeland Security Council and National Security Council.

Day-to-day tactical management, planning and operations for the cleanup process will be managed at the IC/UC level, but for large-scale cleanups involving significant federal resources, it is expected that the JFO Unified Coordination Group and national level federal officials will review proposed cleanup plans and provide strategic and policy direction. The federal agency(s) with primary responsibility for site cleanup should be represented in the JFO Unified Coordination Group. The IC/UC will need to establish appropriate briefing venues as the cleanup process proceeds, including the affected mayor(s) and governor(s).

The discussion below assumes a traditional NIMS IC/UC structure; if the IC/UC transitions later to a different management structure for a longer-term cleanup, the IC/UC would need to determine the appropriate way to incorporate the workgroups described below into that structure.

This environmental cleanup process will be managed by the IC/UC, who ultimately determines the structure and organization of the ICP, but the discussion below provides one recommended approach for managing the cleanup process within a NIMS Incident Command System (ICS) response structure. The ICP Planning Section has the lead for response planning activities, working in conjunction with other sections and would have the lead for development of the cleanup options analysis, working closely with the Operations Section. The NIMS describes the units that make up the Planning Section and allows for additional units to be added depending on site-specific needs. NIMS states that for incidents involving the need to coordinate and manage large amounts of environmental sampling and analytical data from multiple sources, an Environmental Unit may be established within the Planning Section to facilitate interagency environmental data management, monitoring, sampling, analysis, assessment and site cleanup and waste disposal planning. Radiological incidents would involve the collection of not only large amounts of radiological data, but also data related to other environmental and health and safety hazards and therefore would likely warrant the establishment of an Environmental Unit in the Planning Section. Planning for FRMAC radiological sampling and monitoring activities will be integrated into the Planning Section and coordinated with other Situation and Environmental Unit data management activities.

The IC/UC may assign the Environmental Unit the responsibility for coordinating the development of the cleanup options analysis. For large incidents requiring more complicated tradeoffs or the evaluation of cleanup goals with broad implications, the IC/UC may choose to establish a separate unit in the Planning

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Section (e.g., a Cleanup Planning Unit) to coordinate the development of the cleanup options analysis. The IC/UC may then convene a technical working group and a stakeholder working group, managed by the Environmental or Cleanup Planning Unit, to analyze cleanup options and develop recommendations. The Environmental or Cleanup Planning Unit would coordinate working group processes and interactions and report the results of the cleanup options analysis and workgroup efforts to the IC/UC through the Planning Section Chief.

The development and completion of the cleanup options analysis is expected to be an iterative process and for large incidents, the cleanup will likely proceed in phases, most likely from the "outside in" toward the most contaminated areas. The extent of the cleanup options analysis and process used to develop it would be tailored to the needs of the specific incident, but the following working groups may be convened by the IC/UC to assist decision-makers in the cleanup options analysis process, particularly for large or complex cleanups.

5.1.6.4 Technical Working Group

A technical working group should be convened as soon as practicable, ideally within days or weeks of the incident. The technical working group would be managed by the Planning Section Unit that is assigned responsibility for the cleanup options analysis. The technical working group may or may not be physically located at the ICP. The group may review data and documents, provide input electronically and meet with incident management officials. The group may also be asked to participate in meetings with the JFO Unified Coordination Group if needed.

Function: The technical working group provides multi-agency, multi-disciplinary expert input on the cleanup options analysis, including advice on technical issues, analysis of relevant regulatory requirements and guidelines, risk analyses and development of cleanup options. The technical working group would provide expert technical input to the IC/UC; it would not be a decision-making body.

Makeup: The technical working group should include selected federal, state, local and private sector subject matter experts in such fields as environmental fate and transport modeling, risk analysis, technical remediation options analysis, cost, risk and benefit analysis, health physics and radiation protection, construction remediation practices and relevant regulatory requirements. The exact selection and balance of subject matter experts is incident-specific. The Advisory Team for Environment, Food and Health is comprised of federal radiological experts in various fields that may warrant representation on the technical working group, therefore, the Team or some of its members may be incorporated into this group as appropriate.

5.1.6.5 Stakeholder Working Group

The stakeholder working group should be convened as soon as practicable, ideally within days or weeks of the incident. The stakeholder working group would be managed by the Planning Section Unit that is assigned responsibility for the cleanup options analysis. The IC/UC may direct the Public Information Officer (PIO) (who would coordinate with the Joint Information Center (JIC)) to work with the group, including establishing a process for the group to report out its recommendations. How and where the stakeholder working group would meet to review information and provide its input would need to be determined in conjunction with the group members. The stakeholder working group may also be asked to participate in meetings with the JFO Unified Coordination Group, if needed.

Function: The function of the stakeholder working group is to provide input to the IC/UC concerning local needs and desires for site recovery, proposed cleanup options and other recommendations. The group should present local goals for the use of the site, prioritizing current and future potential land uses and functions, such as utilities and infrastructure, light industrial, downtown business and residential land uses. The stakeholder working group would not be a decision-making body.

Makeup: The stakeholder working group should include selected federal, state and local representatives, local non-governmental representatives as well as local and regional business stakeholders. The exact selection and balance of stakeholders is incident-specific.

5.1.6.6 Activities: Cleanup Planning and Recommendations

The IC/UC directs the management of the cleanup options analysis through the Planning Section. Technical and stakeholder working groups assist in performing analyses and developing cleanup options and provide input to the IC/UC and may be asked to participate in meetings with the JFO Unified Coordination Group. The IC/UC reviews cleanup options analyses and selects a proposed approach for site cleanup in close coordination with federal, state and local officials. Again, depending on the incident size, it may be necessary to conduct the cleanup in phases. Thus, decisions on cleanup approaches may also be made in phases. As appropriate for the magnitude of the cleanup task, the IC/UC would brief relevant federal, state and local government officials on proposed cleanup plans for approval. This may involve the office of the affected mayor and governor. At the federal level, it may involve the JFO Unified Coordination Group and higher-level officials.

5.1.6.7 Public Review of Decision

The IC/UC should work with the PIO and JIC to publish a summary of the process, the options analyzed and the recommendations for public comments. Public meetings should also be convened at appropriate times. Public comments should be considered and incorporated as appropriate. A reconvening of the stakeholder or technical working group may be useful for resolving particular issues.

5.1.6.8 Execution of Cleanup and Peer Review

Assuming a Presidential declaration of a major disaster or emergency, FEMA may issue mission assignments to the federal departments and agencies that have the capability to perform the required cleanup, remediation, or debris removal activities. Cleanup activities should commence as quickly as practicable and allow for incremental reoccupation of areas as cleanup proceeds. For significant decontamination efforts, the IC/UC may choose to employ a technical peer review advisory committee to conduct a review of the effectiveness of the cleanup. The technical peer review committee would evaluate pre- and post-decontamination sampling data, the decontamination plan and any other information key to assessing the effectiveness of the cleanup.

1.20 DISPOSAL OF LARGE VOLUMES OF RADIOLOGICAL WASTE

If a large-scale radiological incident were to occur in the United States, the complexity of radiological waste disposal would depend on the magnitude of the release and the decisions related to site cleanup, both of which will determine the amount and types of waste requiring disposal. Primary responsibility for waste management decisions falls to state and local officials. If there is a limited radiological incident with relatively small waste volumes, existing licensed radioactive waste capacity is available and may be sufficient to address waste disposal. However, in a situation involving a more significant release and certainly in an event such as the 2011 incident at the Fukushima nuclear facility, the waste resulting from such an incident would likely overwhelm current disposal capacity. When waste volumes exceed existing capacity, options available for consideration include supplements to existing commercial licensed radioactive waste disposal facilities, such as a combination of hazardous waste landfills, solid waste landfills, DOE facilities and construction of one or more new disposal facilities. New disposal capacity could be located at the site where the radionuclide release originated, elsewhere within the contaminated area, or away from the affected area altogether.

This section provides a short introduction to the issue, a summary of the types of available disposal options, a more detailed discussion of each disposal option, including disposal capabilities, and discussion of roles and responsibilities. Although not addressed explicitly in this section, the need to prepare for and

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conduct safe and environmentally protective storage of waste generated during remediation will also present a significant challenge, as illustrated by the challenges that Japan faced in the aftermath of the Fukushima accident. Many of the considerations for siting disposal facilities will also be applicable to storage sites.

Planners and decision-makers need to view the long-term remediation and recovery as a comprehensive process in which waste management and disposal needs are considered from the earliest stages. For example, the selected decontamination and remediation approach should involve consideration of a number of viable alternatives with regard to potential treatment and disposal options. The precise mix of treatment and disposal options employed would depend on the nature of the specific incident (e.g., location, waste volumes). The suitability of using any individual facility would depend on a number of factors, including but not limited to the toxicity, mobility and volume of radioactively-contaminated wastes (these would be evaluated as part of the characterization process), possible treatment technologies (e.g., volume reduction technologies at the incident location, thermal treatment, neutralization), cost-effectiveness and existing federal and state (and possibly local) legal requirements governing waste disposal.

1.20.1 Potential Waste Volumes and Existing Waste Disposal Options

As noted above, the complexity of radiological waste disposal decisions would depend on a number of factors, including the magnitude of the release and the decisions related to site cleanup. Consideration of these factors will determine the amount and types of waste requiring disposal. While disposal in a licensed low-level radioactive waste (LLRW) disposal facility may be the preferable first choice, there are a limited number of such facilities and not all states have access to all licensed commercial disposal facilities. If there is a limited radiological incident with relatively small waste volumes, existing capacity is available and may be sufficient to address waste disposal. However, waste resulting from a large-scale radiological incident would likely overwhelm current disposal capacity. For large waste volumes, supplements to existing commercial radioactive waste disposal facilities would need to be considered, such as a combination of hazardous waste landfills, solid waste landfills, DOE disposal facilities and potentially, the construction of a new disposal facility. Organizational and administrative issues related to federal and state government coordination and preparation are also important.

Discussions of waste disposal options often involve comparisons of estimated waste generation and available disposal capacity. The amount of waste generated is related to the cleanup approach, the selected approach to decontamination and remediation, as well as the long-term cleanup goals, and can affect the volume of waste actually requiring disposal. The projected amounts of wastes for a large-scale radiological incident may range from tens to hundreds of million cubic feet (or several million metric tons). Some of the waste may contain high radioactivity, especially at the incident's origin; however, most of the waste is expected to be only slightly contaminated, though in large quantities. The volume of contaminated soil in Japan resulting from the Fukushima incident is estimated to exceed one billion cubic feet.

As a point of comparison, roughly 28 million cubic feet of LLRW were disposed of at licensed commercial disposal facilities during the period 2002-2011. DOE disposed of approximately twice that volume in commercial facilities during the same period, in which it was involved in significant large-scale site cleanups.[32] Thus, over that ten-year period, an average annual volume of less than ten million cubic feet was disposed of in commercial facilities. Volumes from the non-governmental sector are not expected to increase significantly until the current fleet of NPPs is decommissioned. DOE generated additional waste volumes that were disposed of at DOE sites. For example, from 2000-2010, DOE disposed of approximately 20 million cubic feet of LLRW at the Nevada National Security Site (NNSS,

[32] Information on disposal in commercial disposal facilities provided by the Manifest Information Management System (MIMS), operated by the DOE at http://mims.apps.em.doe.gov.

formerly the Nevada Test Site). As it continues site cleanups, DOE projects generation of approximately 150 million cubic feet of LLRW for the period 2010-2015, most of which will be disposed of at the site of origin or other designated DOE sites.

Managing the large volumes of waste resulting from a large-scale radiological incident, such as with the Fukushima accident, would likely overwhelm existing capacity in the U.S. and thus require an overall strategy employing all available types of disposal facilities and integrating federal, state, local and private sector assets. For example, consider the following—

- At the beginning of 2016, more than 150 million cubic feet of capacity was licensed at commercial disposal facilities. An incident could consume all remaining licensed commercial LLRW disposal capacity, which would affect waste generators in the energy, industrial, research and medical sectors for whom the capacity was originally licensed. While there may be remaining property at the facilities that could be developed, there is no guarantee that additional capacity can be licensed or that states will allow all capacity to be consumed.
- Estimated waste volumes are comparable to projected generation from the entire DOE complex over the next several years, which includes DOE's large-scale site cleanups. While DOE is somewhat less constrained than non-DOE disposal sites in adding additional disposal capacity at its sites, displacement of projected DOE disposal with incident-related waste has the potential to interfere with ongoing cleanup activities, leading to extended on-site storage, slower cleanups and controversial efforts to expand disposal capacity at other DOE sites. Further, there is at present no mechanism to provide access to DOE disposal sites for disposal of incident-related waste.

1.20.2 Integrated Disposal Options

An effective response to a large-scale radiological incident will involve consideration of the entire range of potential disposal options. The precise mix of disposal options employed will depend on the nature of the specific incident (e.g., location, waste volumes). The process selected to plan and conduct the long-term decontamination and remediation should identify and make provisions for using the different available disposal options. In order to provide cleanup managers the use of all potential disposal capacity there are some issues that would need to be addressed, such as waste acceptance criteria for waste sites that have not been evaluated for radioactive material disposal. However, based on an understanding of the types of waste involved and the capabilities of existing disposal facilities, a generalized discussion of the attributes of the different disposal options, with qualifiers, can be developed and these attributes are discussed below.

- Licensed Commercial LLRW Disposal Facilities—
  - Can manage most anticipated waste types within license conditions.
  - Highest degree of public acceptance.
  - Significant bulk disposal volume possible.
  - Access restrictions may require special approval for waste from certain states.
  - Management of mixed radioactive and hazardous waste will need to ensure proper disposal and long-term groundwater monitoring.
- Solid and Hazardous Waste Landfills—
  - May offer local disposal option for expected large volumes with limited contamination.
  - May offer a disposal option at hazardous waste landfills for mixed wastes (mixtures of hazardous and radiological wastes); hazardous waste landfills have specified construction and engineering requirements.
  - Need to consider the location of the units in proximity to large or sensitive populations, sensitive ecosystems, and sole source aquifers.
  - May require design modifications to ensure that the waste can be managed protectively over time.

  - Difficulty in obtaining public acceptance, although some hazardous waste landfills have accepted waste with limited radionuclide content with state approval.
  - Requires additional demonstration of suitability to ensure protectiveness for radiological material (e.g., groundwater monitoring, additional engineering controls); many solid waste landfills have not been evaluated for disposal of radioactive material and may not be suitable for radiological material.
  - May require longer-term/special monitoring, as well as institutional controls.
- DOE Disposal Sites—
  - Could potentially handle high-activity waste if insufficient commercial access or capacity.
  - May be suitable for some problematic waste types (e.g., whole vehicles).
  - DOE disposal facilities generally accept only DOE-owned or DOE-generated waste. Disposal of non-DOE waste requires additional review and agreements involving the host state, consistent with DOE's authorities, particularly where existing agreements limit DOE's waste disposal activities.

Each of these potential disposal alternatives is discussed in more detail below. There may also be some remaining wastes that might require special consideration based on factors such as level of contamination, waste form, lack of access or capacity or presence of other hazardous or toxic contaminants. These wastes could include those containing both hazardous and toxic constituents (e.g., mercury and PCBs—polychlorinated biphenyls), animal carcasses or contaminated vehicles (where dismantling the vehicle may represent a greater potential for dispersal of contaminants and exposure of workers).

5.2.2.1 Commercially Licensed LLRW Disposal Facilities

Given that the bulk of the waste resulting from the release of radionuclides from a nuclear facility or a deliberate action will contain radionuclides commonly contained in LLRW, licensed commercial disposal facilities would be the most appropriate and publicly acceptable option for disposal if the volumes of waste from the incident were relatively small. It would be anticipated that the waste would be mostly at the lower end of radionuclide concentrations. Thus, these facilities will be capable of handling all but the most problematic waste types, if the amounts were limited. At present, all commercial LLRW disposal facilities are licensed by states (through agreements with NRC, referred to as "Agreement States").

As described earlier, available capacity and access are significant concerns in relying on commercial LLRW disposal facilities. Further, even if a facility would be generally available to all waste generators and it is found that all but a small portion of the waste would meet that facility's disposal criteria, it is possible that there may be objections to accepting all waste from an incident outside the state, even if the facility's capacity was sufficient.

Access to other facilities generally unavailable to the state(s) affected by the incident might be feasible in an emergency situation under NRC regulations, but it should not be expected that large volumes of waste will be accepted under these provisions. There is also the possibility that the affected state could construct a disposal facility to provide additional capacity. Several states conducted extensive studies of their geology in anticipation of constructing disposal facilities and these studies may be of use in such situations.

5.2.2.2 Solid and Hazardous Waste Landfills

Most states are authorized by the EPA under the Resource Conservation and Recovery Act (RCRA) to operate their own hazardous waste management programs in lieu of the federal Subtitle C program.[33] Management of nonhazardous solid wastes is governed by RCRA Subtitle D, which is administered

[33] Alaska, Iowa, Puerto Rico, the Virgin Islands, American Samoa and the Trust Territories and Northern Marianas Islands do not have authorized RCRA programs.

largely by the states. Compared to the number of licensed LLRW disposal facilities in the U.S., there are a greater number of commercial landfills operating under Subtitle C and many more operating under Subtitle D of RCRA for disposal of hazardous and solid wastes, respectively. It would not be expected that all of these facilities (particularly those operating under Subtitle D) would be appropriate disposal options. However, some of the hazardous waste landfills have accepted some radioactive material for disposal and a few have received the necessary state approvals to do so on a routine basis. Historically, most of the radiological waste streams accepted by hazardous waste landfills contain naturally-occurring radionuclides not regulated by NRC, such as wastes from the oil and gas or other resource extraction industries, as well as water treatment residuals. However, both NRC and DOE, in coordination with state regulators and facility operators, have approved disposal of radioactive waste in RCRA landfills on a case-by-case basis. Thus, there is reason to believe that one or more hazardous waste landfills could contribute to the disposal capacity for incident-related waste. The use of any particular RCRA facility for the disposal of radioactive contaminants or mixed contamination would require that the unit is well designed and managed appropriately. The uniform design and engineering requirements applicable to hazardous waste landfills would facilitate such an evaluation; by contrast, not all solid waste landfills are constructed to the same specifications. Further, the evaluation would include consideration of the waste characteristics, site characteristics, waste acceptance criteria and other facility attributes.

RCRA hazardous and solid waste landfills may also offer the advantage of disposal capacity suitable for large volumes of lightly-contaminated material (e.g., soil).[34] In addition, these facilities are more likely to be located near the incident location, which can facilitate their use if deemed appropriate by federal, state and local officials. However, use of these facilities for disposal of radionuclides typically found in low-level radioactive waste, even if it contains very low concentrations of those radionuclides, may generate public concern if the facilities have not been previously approved for this type of disposal. Therefore, additional effort by state and local officials would be necessary to ensure the facility can manage the waste in a protective manner, including technical modification, if appropriate.

5.2.2.3 DOE Disposal Sites

DOE facilities could potentially be a disposal alternative that may be most appropriate for limited volumes of waste for which there is no other disposal outlet (such as high-activity waste, certain mixed wastes, or other problematic waste streams). Waste disposed at DOE sites must meet the waste acceptance criteria for those sites. DOE does not generally accept non-DOE-owned or generated waste for disposal at its sites. In addition, DOE has significant ongoing remediation at a number of sites that will generate large volumes of waste over the coming years. Diverting DOE disposal capacity to incident-related waste may interfere with those efforts. DOE has also utilized commercial LLRW disposal facilities, primarily for bulk waste streams from cleanups, and this potential disposal alternative may also be affected by a large-scale radiological incident.

DOE's primary disposal site serving the DOE complex is the NNSS. DOE/NNSS continues to excavate additional disposal capacity as needed and estimates that significant additional capacity could be developed at NNSS.

DOE's other designated site for complex-wide disposal is Hanford, WA; however, DOE has an agreement with the State of Washington that it will not bring waste from other sites until certain remediation milestones have been met. Overall, DOE anticipates that most of its waste generated in the coming years will be disposed at the site of generation. Sites other than NNSS and Hanford are designated for disposal of waste generated at those sites, although exceptional situations may allow for disposal of waste

[34] EPA reports that about 132 million tons of municipal solid waste were landfilled in 2009, comparable to the rate over the past two decades. The 2009 figure represents about 54% of total generation. "Municipal Solid Waste in the United States: 2009 Facts and Figures," EPA530-R-10-012, December 2010.

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generated off-site and development of some additional disposal capacity. Additional disposal capacity would likely be dependent upon agreement from the state in which the facility is located.

1.20.3 Planning and Coordination among Federal and State Entities

A number of federal and state agencies may have important roles to play in making decisions on final disposal, depending on the extent of the waste. A framework for coordination with these various federal and state agencies should be an element of the process selected for long-term decontamination and remediation.

States should be intimately involved ahead of time in planning for a large-scale radiological incident and the resulting waste disposal. The following roles and responsibilities may exist with states—

- All existing commercial LLRW disposal facilities are licensed by Agreement States.
- Many, but not all, states have formed regional compacts (as authorized by Congress) to site and operate LLRW disposal facilities; compacts control access to these sites.
- Although statutorily required[35] to provide disposal capacity for low-level waste generated within the compact boundaries (with certain exceptions), states are under no obligation to accept waste from outside their compacts. States that are not members of compacts do not have the statutory protection to prohibit disposal of out-of-compact waste.
- All DOE disposal sites are located within states, many of which have agreements regarding the extent of long-term disposal or acceptance of off-site waste. States hosting DOE disposal sites should participate in planning for the potential disposal of incident-related off-site waste at DOE sites.
- States regulate hazardous waste landfills (when authorized by EPA) and solid waste landfills that may be used for disposal of waste with very low concentrations of radioactivity (see Section 5.2.2.2). In planning for disposal of incident-related waste, states should take into account any restrictions placed on the disposal of radionuclides in these facilities.
- It is anticipated that on-site disposal at a location affected by the incident, where appropriate, will be one location of choice and that an affected state could approve construction of a new disposal facility for that purpose.

Depending on the circumstances, coordination with numerous federal agencies would be necessary. Of particular note:

- EPA is the coordinating agency for long-term remediation and cleanup, as designated by the National Response Framework (FEMA 2008a) and has federal authority for hazardous waste disposal;
- DOE is “owner” of federal sites that might be used for waste disposal;
- NRC is the federal authority for commercial LLRW disposal; and
- USDA provides technical assistance for agricultural materials contaminated by the release, including animal carcasses.

1.20.4 Other Potential Options and Considerations

Potential federal actions to increase preparedness include:

- Develop criteria under which access to DOE disposal sites is acceptable and identify issues to be resolved.
- Facilitate agreements among regional LLRW compacts and states to address situations in which access to compact sites can be assured for all states.

[35] Pursuant to the Low-Level Radioactive Waste Policy Act of 1980 (LLRWPA) and the 1985 LLRWP Amendments Act of 1985.

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- Identify geographically strategic federal sites that can be used for staging and interim storage of large waste volumes.
- Identify federal sites that can be characterized in advance for construction of disposal capacity for incident-related waste, should the need arise.
- Clarify federal authorities that can be used in exceptional circumstances for acquisition of property for use as disposal or long-term storage capacity and indemnification of private sector service providers.
- Assist state and local officials in planning for and making decisions to use local disposal options (solid and hazardous waste landfills) for waste that contains relatively low concentrations of radionuclides, including:
  - developing criteria for case-by-case alternate disposal evaluations, such as those employed by NRC, EPA and DOE for limited volumes of waste;
  - establishing generally applicable criteria for disposal of radionuclides in solid and hazardous waste landfills;
  - supporting federal research into behavior of radionuclides and decontamination residuals in solid and hazardous waste landfills;
  - providing technical assistance and streamlined regulatory review (e.g., permitting) for states to evaluate existing sites and identify new sites for incident-related waste disposal capacity; and
  - developing and disseminating tools to support planning and decision-making regarding incident-related waste management.

It may be appropriate for the federal government to develop detailed guidance to address factors such as waste acceptance criteria needed for waste disposal at RCRA disposal facilities, safety evaluation of existing disposal facilities, or siting, development and regulatory approval of new disposal facilities.

Depending on the circumstances, it may be appropriate to create additional disposal capacity. This decision would most likely need to involve extensive discussion between the federal government and the affected state(s) where an incident occurred. Generally, there are two options for additional disposal capacity—

- **On-site disposal.** As a result of looking at the different choices, it may be advantageous to develop disposal capacity on-site (e.g., build a large disposal facility within the property boundaries where the facility causing the release is located), if the site is suitable.
- **Off-site disposal.** An additional option would be for a state or the federal government to build a disposal site on suitable public lands. The federal or state government could use the power of eminent domain to condemn property contaminated by a radiological incident and use it for waste disposal.

If it is determined that constructing a new disposal facility is the appropriate action, the proposed site(s) should be studied for suitability. Although the contemplated disposal actions would be taken in event of a national emergency, every effort should be made to ensure the protection of public health and the environment. Appropriate regulatory standards should be considered in developing a specific disposal plan. The disposal plan and site suitability should take into account the radiological characteristics of the waste. As discussed above, some slightly radioactive materials may be disposed in hazardous waste landfills if they are permitted for it. More radioactive materials may be sent to sites licensed as LLRW disposal facilities, though less contaminated materials may also be sent to LLRW disposal facilities. A small amount of waste from a radiological incident may have concentrated radioactivity, but most of the waste generated in a large-scale radiological incident would likely be contaminated with low levels of radioactivity. The different radiological characteristics of the waste would have a bearing on the stringency of containment required of a waste disposal facility. All waste sites would need to have

appropriate controls to protect public health and the environment for any level of radioactive contamination, but more highly radioactive materials would need more robust controls than slightly contaminated material.

The physical/geographic characteristics of the site and the availability of land will be important in determining the appropriateness of a potential disposal site. Sites with limited rainfall, high evapotranspiration, deep water tables and soil characteristics that limit migration of radionuclides have been found to be best suited for disposal of radioactive waste, although waste management and engineering can be applied to improve performance at sites with less favorable characteristics (e.g., controls on the waste form or level of allowable radioactivity, addition of liners, cover requirements or through construction of concrete bunkers or vaults). Other characteristics, such as location in a high risk area (e.g., flood plain or seismic zone) or sensitive ecologic area, should also be considered. A disposal cell for 1 million cubic feet of waste will occupy 1 acre or more of surface area, assuming disposal to a depth of about 30 feet. Large-scale disposal operations may also require extensive surface facilities.

Additional considerations can also be applied to make finer distinctions among potentially suitable sites. These criteria include:

- Proximity to the incident: it may be useful to consider sites in different regions of the country to limit transportation demands;
- Proximity to residential areas or commercial districts: the potential for disposal activities to affect nearby populations or commercial activities, whether located within the site boundaries or on adjacent property, should be considered;
- Proximity to transportation: access to timely and direct transportation that can accommodate large shipments is desirable—action to facilitate: construction of transportation infrastructure (e.g., direct rail lines);
- Experience in waste disposal: waste disposal sites will have infrastructure, procedures and trained personnel that can make most efficient use of the site—action to facilitate: development of infrastructure, training, construction of disposal cells and engineered containment (e.g., vaults or bunkers); and
- Level of existing contamination: areas that are unlikely to be remediated in the near future or unlikely to be released for public use may be more acceptable for disposal.

1.20.5 Potential Federal Actions to Develop New Disposal Capacity

In addition to criteria for siting new disposal facilities, the federal government has control of a large amount of land throughout the U.S. that could be repurposed, or could offer assistance to support state governments in developing new facilities.

5.2.5.1 DOE Sites

DOE has decades of experience in radioactive waste management. In considering the primary selection criteria described above, DOE sites in the western U.S. generally have more favorable characteristics and readily available property compared to those in the eastern U.S. However, DOE has successfully implemented disposal at the eastern sites, often with some engineering enhancements. DOE has several categories of sites for consideration, beginning with the most suitable—

- Active disposal or cleanup sites in the western U.S.
- Active disposal or cleanup sites in the eastern U.S.
- Closed sites with disposal areas.
- Closed uranium milling sites.
- Other long-term stewardship sites.

Considerations: Some DOE sites have agreements with states or other stakeholders regarding further disposal or cleanup activities. Current disposal sites have waste acceptance criteria by DOE policy or statute. Closed and long-term stewardship sites may not have large amounts of additional property available for disposal.

5.2.5.2 DoD Installations

DoD maintains some installations with large land areas, primarily in the western U.S. Many of these sites have been contaminated through extensive training or other activities. DoD likely has more sites in the eastern U.S. than does DOE. Categories of sites that could be considered suitable include:

- Bombing and firing ranges;
- Chemical weapons demilitarization and storage sites;
- Ammunition plants and arsenals; and
- Surplus properties (e.g., BRAC – base realignment and closure, FUDS – formerly used defense site).

Considerations: Section 2692 of title 10, United States Code, "Storage, Treatment and Disposal of NonDefense Toxic and Hazardous Materials," generally provides that the Secretary of Defense may not permit the use of an installation of the DoD for the storage, treatment, or disposal of any material that is a toxic or hazardous material and that is not owned either by the DoD or by a member of the armed forces (or by a dependent of the member) assigned to or provided military housing on the installation. Radiological waste resulting from either a nuclear accident or a terrorist attack may fall under this prohibition. The Secretary of Defense may grant exceptions to this restriction when "essential to protect the health and safety of the public from imminent danger." A determination of whether or not radiological waste meets the "imminent danger" threshold would be required.

Additionally, some DoD properties, including ranges in the western U.S., are on "withdrawn" lands, which are part of the public domain supervised by the Bureau of Land Management (BLM). Withdrawn land statutes permit DoD to use the property for specific military mission needs. The use of withdrawn lands to manage radiological waste would violate those statutes.

5.2.5.3 Other Federal Properties

Agencies such as the Department of Interior or USDA own large properties that could be considered suitable for disposal, many of which are in the western U.S. These properties may be administered by discrete entities within the cabinet-level departments, such as the National Park Service, BLM, or Forest Service. Some properties may be in proximity to DOE or DoD lands.

Considerations: Properties may be designated for public use or for protection (e.g., wilderness areas or preserves). Many properties are also in rugged terrain with difficult access or border tribal lands.

KEY POINTS IN CHAPTER 5 – LATE PHASE

- Numeric PAGs will not be used to guide restoration and recovery of areas impacted by a radiological incident; rather, planning activities should include a process to involve stakeholders in setting priorities and determining actions. Such a process should be flexible enough to adapt to a variety of situations.
- Planning considerations for worst case scenarios are provided. Smaller radiological incidents may be well addressed by existing emergency response and environmental cleanup programs at local, state, tribal and federal levels.
- Reoccupying households and businesses should be considered in balance with progress made in reducing radiation risks through decontamination, radioactive decay and managing contaminated waste.
- Exposure limits in a range of one in a population of ten thousand (10^{-4}) to one in a population of one million (10^{-6}) excess lifetime cancer incidence outcomes are generally considered protective, though this may not be achievable after a large-scale radiological incident. In making decisions about cleanup goals and strategies for a particular event, decision-makers must balance the desired level of exposure reduction with the extent of the measures that would be necessary to achieve it, in order to maximize overall human welfare.
- Incidents that create large volumes of waste from a large-scale radiological incident would likely overwhelm existing radioactive waste disposal capacity in the U.S.
- Following a nuclear accident, the states bear primary responsibility to identify and provide waste management options, including disposal capacity; in the event of a terrorist attack, the federal government can offer a range of assistance to state governments to identify and implement waste management options.
- Safely managing and disposing of radioactive waste will require pre-planning at all levels of government and careful coordination with stakeholders at all stages of the decision-making process.

APPENDIX A – REFERENCES

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APPENDIX B – GLOSSARY

Acute health effects: Health problems caused by high radiation doses received in a short period of time. Examples of acute effects include erythema (reddening of skin), blistering, epilation (hair loss) and vomiting.

ALARA: Acronym for "as low as reasonably achievable" means making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical consistent with the purpose for which the activity is undertaken.

Alpha radiation: Alpha radiation comes from the ejection of alpha particles from the nuclei of some unstable atoms. An alpha particle is identical to a helium nucleus and consists of two protons and two neutrons. Alpha particles are highly energetic, but can only travel a few centimeters in air. They have low penetrating power and can be stopped by a sheet of paper. Alpha particles generally cannot even penetrate the layer of dead cells on the skin, but can pose a health risk when inhaled or ingested.

Avoided dose: The radiation dose saved by implementing a protective action.

Beta radiation: Beta radiation comes from the emission of beta particles during radioactive decay. Beta particles are highly energetic and fast-moving. They carry a positive or negative charge and can be stopped by a layer of clothing or few millimeters of a solid material. Beta particles can penetrate the skin and cause skin burns, but tissue damage is limited by their small size. Beta particles are most hazardous when inhaled or ingested.

Centigray (cGy): One cGy is equal to one hundredth of a gray (0.01Gy). See Gray. One cGy is equivalent to one rad. See Rad.

Cloudshine: Gamma radiation emitted from an airborne plume overhead.

Committed effective dose: The sum of the committed equivalent doses following intake (inhalation or ingestion) of a radionuclide to each organ multiplied by a tissue weighting factor.

Contamination: Radionuclides on a surface or in the environment as a result of an accidental release.

Concentration: Radionuclide activity per unit of mass.

Chronic effects: Health problems caused by radiation doses delivered over a long period. Examples of chronic effects include cancer and genetic mutations.

Derived Intervention Level (DIL): Concentration derived from the intervention level of dose at which introduction of protective measures should be considered. (FDA 1998)

Derived Response Level (DRL): A level of radioactivity in an environmental medium that would be expected to produce a dose equal to its corresponding Protective Action Guide.

Dose: The amount of radiation exposure a person has received, calculated considering the effectiveness of the radiation type (alpha, beta, gamma), the timeframe of the exposure and the sensitivity of the person or individual organs.

Dose parameter (DP): Any factor that is used to change an environmental measurement to dose in the units of concern.

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Dose projection: A calculated future dose that an individual might receive; also the process of making these calculations.

Dose reduction factor: A factor by which a decontamination technique or protective action reduces the radiation dose to a person.

Dosimetry: The system for assessing radiation doses from external radiation exposures and from intakes of radionuclides using biokinetic models and dosimetric quantities developed by the ICRP and the International Commission on Radiation Units and Measurements (ICRU).

Early phase: The beginning of a radiological incident for which immediate decisions for effective use of protective actions are required and must therefore be based primarily on the status of the radiological incident and the prognosis for worsening conditions. This phase may last from hours to days.

Effective dose: The sum of organ equivalent doses weighted by ICRP organ weighting factors.

Emergency Planning Zone: A designated zone around a commercial nuclear power plant for which radiological response plans must be maintained under Nuclear Regulatory Commission regulations.

Emergency worker: Anyone with a role in responding to the incident whether a radiation worker previously or not, who should be protected from radiation exposure.

Evacuation: The urgent removal of people from an area to avoid or reduce high-level, short-term exposure, from the plume or from deposited radioactivity. Evacuation may be a preemptive action taken in response to a facility condition rather than an actual release.

Gamma radiation: Gamma radiation comes from the emission of high-energy, weightless, chargeless photons during radioactive decay. Gamma photons are pure electromagnetic energy and highly penetrating—several inches of lead or a few feet of concrete may be required to attenuate them. External exposure to gamma rays poses a health threat to the entire body. Inhalation and ingestion of gamma emitters also poses a health threat.

Graves' disease: An autoimmune disorder that leads to the over activity of the thyroid.

Gray (Gy): International unit of absorbed radiation dose. One Gy is equivalent to 100 rad. See Rad.

Groundshine: Gamma radiation emitted from radioactive materials deposited on the ground.

Half-life: The time required for half the atoms of a given radioisotope to transform by radioactive decay.

Hashimoto's thyroiditis: An autoimmune disorder that leads to underactive thyroid with bouts of over activity.

Improvised Nuclear Device (IND): A crude, yield-producing nuclear weapon fabricated from diverted fissile material.

Intermediate phase: The period beginning after the source and releases have been brought under control (has not necessarily stopped but is no longer growing) and reliable environmental measurements are available for use as a basis for decisions on protective actions and extending until these additional protective actions are no longer needed. This phase may overlap the early phase and late phase and may last from weeks to months.

Isodose-rate line: A contour line that is used to connect points of equal radiation dose rates.

Late phase: The period beginning when recovery actions designed to reduce radiation levels in the environment to acceptable levels are commenced and ending when all recovery actions have been completed. This phase may extend from months to years. A PAG level, or dose to avoid, is not appropriate for long-term cleanup.

Latency period, cancer: The time elapsed between radiation exposure and the onset of cancer.

Microsievert (µSv): One millionth of a Sievert. See Sievert. One ten-thousandth of a rem. See Rem. (1 µSv = 0.1 mrem (millirem))

Millirem (mrem): One thousandth of a rem. See Rem.
(1 mrem = 0.00001 Sv (sievert) = 0.01 mSv (millisievert) = 10 µSv (microsievert))

Millisievert (mSv): One thousandth of a sievert. See Sievert.
(1 mSv = 100 mrem (millirem) = 0.1 rem)

Noble gases: A group of elemental gases that are tasteless, odorless and that do not undergo chemical reactions under natural conditions. The noble gases consist of Helium (He), Neon (Ne), Argon (Ar), Krypton (Kr), Xenon (Xe), and Radon (Rn).

Off-site: Areas outside the controlled border of a facility, such as a nuclear power plant. For an incident not involving a facility, this term may also be used to refer to areas impacted by contamination.

On-site: Areas inside the controlled border of a facility, such as a nuclear power plant. For an incident not involving a facility, this term may refer to areas controlled during a response.

Potassium iodide: A salt of stable, nonradioactive iodine in medicine form. The administration of potassium iodine saturates the thyroid with non-radioactive iodine, so it does not absorb radioactive iodine released into the environment from a radiological incident.

Projected dose: The prediction of the dose that a population or individual could receive.

Protective actions: An activity conducted in response to an incident or potential incident to avoid or reduce radiation dose to members of the public.

Protective Action Guide (PAG): The projected dose to an individual, resulting from a radiological incident at which a specific protective action to reduce or avoid that dose is warranted.

Prophylactic: A treatment or medication designed to prevent exposure to radiation.

Rad (radiation absorbed dose)**:** A basic unit of absorbed radiation dose. It is being replaced by the "gray," which is equivalent to 100 rad. One rad equals the dose delivered to an object of 100 ergs of energy, per gram of material.

Radioactive: Quality of a material that emits alpha particles, beta particles, gamma rays, or neutrons.

Radiological dispersal device (RDD): A device or mechanism that is intended to spread radioactive material from the detonation of conventional explosives or other means. An RDD is commonly known as a "dirty bomb."

Radiopharmaceutical: A radioactive chemical used for diagnosis, cure, treatment, or prevention of diseases.

Recovery: The phase after response when efforts focus on remediation, or the process of reducing radiation exposure rates and concentrations of radioactive material in the environment to levels acceptable for unconditional occupancy or use.

Reentry: Workers or members of the public going into relocation or radiological contaminated areas on a temporary basis under controlled conditions.

Release: Uncontrolled distribution of radioactive material to the environment.

Relocation: The removal or continued exclusion of people (households) from contaminated areas to avoid chronic radiation exposure. Not to be confused with *evacuation*.

Reoccupancy: The return of households and communities to relocation areas during the cleanup process, at radiation levels acceptable to the community.

Rem (roentgen equivalent man): The product of the absorbed dose in rads and a weighting factor which accounts for the effectiveness of the radiation to cause biological damage; a conventional unit for equivalent dose. One rem equals 0.01 Sv.

Release rate: The measure of the amount of radioactive material dispersed per unit of time.

Return: Permanent resettlement in evacuation or relocation areas with no restrictions, based on acceptable environmental and public health conditions.

Roentgen (R): A conventional unit for exposure.

Shelter-in-place: The action of staying or going indoors immediately.

Sievert (Sv): International unit of equivalent dose. One sievert equals 100 rem.
(1 Sv = 1,000 mSv (millisieverts) = 1,000,000 µSv (microsieverts) = 100 rem = 100,000 mrem (millirem))

Source term: The amount of a contaminant available in a scenario or actually released to the environment.

Stay time: Term of art used in the radiation safety field. Stay times are the amount of time a person may access the contaminated area. These times vary based upon site-specific factors or incident characteristics such as indoor or outdoor work, sensitive populations and level of radioactivity.

Total Effective Dose (TED): The sum of the effective dose (for external exposures) and the committed effective dose; also referred to in this Manual as whole body dose. See Section 2.4.

Whole Body Dose: See Total Effective Dose.

APPENDIX C – LIST OF ACRONYMS

AEA	Atomic Energy Act
ALARA	As Low as Reasonably Achievable
ANS	American Nuclear Society
BEIR	Committee on the Biological Effects of Ionizing Radiation (BEIR) of the National Academy of Sciences
BLM	Bureau of Land Management
Bq	Becquerel (measurement unit)
CDC	Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cGy	Centigray (measurement unit)
Ci	Curie (measurement unit)
cpm	Counts per minute (measurement unit)
DHS	Department of Homeland Security
DIL	Derived Intervention Levels
DoD	Department of Defense
DOE	Department of Energy
DOL	Department of Labor
DP	Dose Parameter
DRL	Derived Response Level
EAL	Emergency Action Level
EPA	Environmental Protection Agency
EPZ	Emergency Planning Zone
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
FRC	Federal Radiation Council
FRMAC	Federal Radiological Monitoring and Assessment Center
FRPCC	Federal Radiological Preparedness Coordination Committee
Gy	Gray (measurement unit)
HAZWOPER	Hazardous Waste Operations and Emergency Response
HHS	Department of Health and Human Services
HPS	Health Physics Society
IAEA	International Atomic Energy Agency
ICP	Incident Command Post
ICRP	International Commission on Radiological Protection
ICRU	International Commission on Radiation Units and Measurements
IC/UC	Incident Command/Unified Command
ICS	Incident Command System
IND	Improvised Nuclear Device
JFO	Joint Field Office
JIC	Joint Information Center
KI	Potassium Iodide
LLRW	Low-level radioactive waste
LLRWPA	Low-Level Radioactive Waste Policy Act
mg	Milligram (measurement unit)
MIMS	Manifest Information Management System

µR	Microroentgen (measurement unit)
µSv	Microsievert (measurement unit)
mSv	Millisievert (measurement unit)
mrem	Millirem (measurement unit)
mR	Milliroentgen (measurement unit)
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection and Measurements
NIMS	National Incident Management System
NNPP	Naval Nuclear Propulsion Program
NNSS	Nevada National Security Site
NPP	Nuclear Power Plant
NRC	Nuclear Regulatory Commission
NRF	National Response Framework
NDRF	National Disaster Recovery Framework
NSS	National Security Staff
NUREG	NRC technical report designation (Nuclear Regulatory Commission)
OSHA	Occupational Safety and Health Administration
PAG	Protective Action Guide
PIO	Public Information Officer
PPE	Personal Protective Equipment
R	Roentgen (measurement unit)
RASCAL	Radiological Assessment System for Consequence Analysis
Rem	Roentgen equivalent man (measurement unit)
REMM	Radiation Emergency Medical Management
RESRAD	RESidual RADioactivity (computer code developed by Argonne National Laboratory)
RCRA	Resource Conservation and Recovery Act
RDD	Radiological Dispersal Device
SNL	Sandia National Laboratories
Sv	Sievert (measurement unit)
TED	Total Effective Dose
USDA	United States Department of Agriculture

To: Perrin, Alan[Perrin.Alan@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]
From: DeCair, Sara
Sent: Thur 2/25/2016 3:38:20 PM
Subject: New Manual, fewer highlights
PAG Manual draft Final 2-25-2016 reduced deletions.docx

Less colors to scare people, we were being too literal about marking changes ☺ This is going on the OneDrive. Oh and it's down to 94 pages!

Sara D. DeCair

http://www.epa.gov/radiation/rert/pags.html

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Room 1416 B in WJC West

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PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents

XXXX EDITION

KEY TO THIS MARKUP: gray = additions and ~~yellow = deletions~~

Office of Radiation and Indoor Air
Radiation Protection Division
U.S. Environmental Protection Agency
Washington, DC 20460

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LIMITS ON SCOPE

This guidance does not address or impact site cleanups occurring under other statutory authorities such as the United States Environmental Protection Agency's (EPA) Superfund program, the Nuclear Regulatory Commission's (NRC) decommissioning program, or other federal or state cleanup programs.

As indicated by the use of non-mandatory language such as "may," "should" and "can," this Manual only provides recommendations and does not confer any legal rights or impose any legally binding requirements upon any member of the public, state, tribe, locality, or any ~~other~~ federal agency.

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Figure 4-1	Generalized Protective Action Areas for NPP Incident	

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CHAPTER 1. OVERVIEW

1.1 PLANNING GUIDANCE AND PROTECTIVE ACTION GUIDES

The U.S. Environmental Protection Agency (EPA) has developed this Manual to assist public officials in planning for emergency response to radiological incidents. For purposes of this document, a radiological incident is an event or a series of events, deliberate or accidental, leading to the release or potential release into the environment of radioactive materials in sufficient quantity to warrant consideration of protective actions. This Manual provides radiological protection criteria for application to all incidents that would require consideration of protective actions, with the exception of nuclear war.

During an incident with an uncontrolled source of radiation, protection of the public from unnecessary exposure to radiation may require some form of intervention that will disrupt normal living. Such intervention is termed a protective action. Examples of protective actions include:

- Evacuating an area;
- Sheltering-in-place within a building or protective structure;
- Administering potassium iodide (KI) as a supplemental action;
- Relocation;
- Acquiring an alternate source of drinking water; and
- Interdiction of food/milk.

This Manual provides recommended numerical protective action guides (PAGs) for the principal protective actions available to public officials during a radiological incident. A PAG is defined for purposes of this document as the projected dose to an individual from a release of radioactive material at which a specific protective action to reduce or avoid that dose is recommended. PAGs are guides to help officials select protective actions under emergency conditions during which exposures would occur for relatively short time periods. They are not meant to be applied as strict numeric criteria, but rather as guidelines to be considered in the context of incident-specific factors. PAGs do not establish an acceptable level of risk for normal, nonemergency conditions, nor do they represent the boundary between safe and unsafe conditions. The PAGs are not legally binding regulations or standards and do not supersede any environmental laws. For information on roles, responsibilities and authorities during emergency response and recovery, please refer to the National Response Framework: http://www.fema.gov/national-response-framework and specifically for radiological incidents, the Nuclear Radiological Incident Annex: http://www.fema.gov/pdf/about/divisions/thd/IncidentNucRad.pdf (FEMA 2008a,b).

Some protective actions are not associated with a numerical PAG. For example, the control of access to areas is a protective action implemented in concert with other protective actions; it does not have its own PAG. Any reasonable action to reduce radiation dose is encouraged even if it is not associated with a PAG, such as recommending that individuals use ad hoc respiratory protection with a handkerchief or piece of folded cloth. Or in areas where PAGs are not exceeded, but airborne radioactivity is present, people might be asked to stay indoors to the extent practicable to reduce their exposures. To further develop radiological emergency plans, brief planning guides have been provided for reentry to relocation areas, the cleanup planning process and considerations for radioactive waste disposal.

1.2 APPLICABILITY

Protective actions may be recommended for a wide range of incidents, but generally apply to incidents involving relatively significant releases of radionuclides. Radiological incidents with potential for significant releases include:

- A fire in a major facility such as a nuclear fuel manufacturing plant;
- An accident at a federal nuclear weapons complex facility;
- An accident at a commercial nuclear power plant (NPP);
- A transportation accident involving radioactive material; and

- A terrorist act involving a radiological dispersal device (RDD) or yield-producing Improvised Nuclear Device (IND).

Each type of incident would pose a unique threat to public health and should be planned for and managed accordingly. Emergency response planning for a given facility or scenario should consider:

- The radionuclides involved;
- The dynamics of the release including size and magnitude;
- The feasibility of specific protective actions; and
- The timing of notification, response and protective action implementation.

The decision to advise members of the public to take a protective action during a radiological incident involves a complex judgment in which the radiological risk must be weighed against the action's inherent risks. This decision may have to be made under emergency conditions, with limited information and little time to analyze options. Advance planning reduces the complexity of the decision-making process during an incident. The planning process can identify the viability of responses to various incidents, the courses of action that can be set in motion in advance and the decisions that can only be made during an actual emergency. While many aspects of protective actions can be considered well in advance of an emergency, the situations and conditions that exist at the time of emergency must be considered if the most effective action is to be selected.

The unpredictable locations of certain radiological incidents make advance planning challenging. For example, an RDD could detonate anywhere and spread radiological contaminants over a wide variety of surfaces and terrain. Emergency planners should be prepared to apply PAGs to a wide scope of facilities and circumstances.

1.3 BACKGROUND ON THE UPDATED PAGS

This Manual updates the "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (EPA-400-R-92-001, May 1992), published by ~~the U.S.~~ EPA (EPA 1992b) (hereinafter referred to as the "1992 PAG Manual"). The guidance in this Manual was developed cooperatively with the Federal Radiological Preparedness Coordination Committee (FRPCC), with representation from the EPA; the Department of Energy (DOE); the Department of Defense (DoD); the Department of Homeland Security (DHS) Federal Emergency Management Agency (FEMA); the Nuclear Regulatory Commission (NRC); the Department of Health and Human Services (HHS), including the Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA); the U.S. Department of Agriculture (USDA); and the Department of Labor (DOL).

1.3.1 Legal Basis

The historical and legal basis of EPA's role in developing this guidance begins with Reorganization Plan No. 3 of 1970, in which the Administrator of EPA assumed all the functions of the Federal Radiation Council (FRC), including the charge to "…advise the President with respect to radiation matters, directly or indirectly affecting health, including guidance for all federal agencies in the formulation of radiation standards and in the establishment and execution of programs of cooperation with states" (Reorg. Plan No. 3 of 1970, sec. 2(a) (7), 6(a) (2); § 274.h of the Atomic Energy Act of 1954, as amended (AEA), codified at 42 U.S.C. § 2021(h)). Recognizing this role, FEMA, in its ~~their~~ Radiological Emergency Planning and Preparedness Regulations, directed EPA to "establish Protective Action Guides (PAGs) for all aspects of radiological emergency planning in coordination with appropriate federal agencies" (44 Code of Federal Regulations (CFR) §351.22(a)). FEMA also tasked EPA with preparing "guidance for state and local governments on implementing PAGs, including recommendations on protective actions which can be taken to mitigate the potential radiation dose to the population" (44 CFR §351.22(b)). All of this information was to "be presented in the EPA Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (44 CFR §351.22(b)).

Additionally, section 2021(h) charged the Administrator with performing "such other functions as the President may assign to him [or her] by Executive Order." Executive Order 12656 states that the Administrator shall "develop, for national security emergencies, guidance on acceptable emergency levels of nuclear

radiation…." (Executive Order No. 12656, sec. 1601(2)). EPA's role in the development of PAGs was also recognized in the "Nuclear/Radiological Incident Annex of the National Response Framework" of June 2008.

1.3.2 Interaction with Federal Radiation Council (FRC) Reports No. 5 and 7

In the 1960s, the Federal Radiation Council (FRC) defined PAGs and established limiting guides for ingestion of strontium-89, strontium-90, cesium-137, and iodine-131 (FRC 1964; FRC 1965). That guidance applied to restricting the use of food products that had become contaminated as the result of release of radioactivity to the stratosphere from weapons testing. During the period immediately following an incident at any domestic nuclear facility, when the critical source of exposure is expected to be a nearby airborne plume, the principal protective actions are evacuation or sheltering. The PAGs developed here thus do not supersede previous guidance, but provide additional guidance for prompt exposure pathways specific to a domestic nuclear incident.

1.3.3 Technical Basis

The FRC introduced the concept of a PAG in a series of recommendations issued in the 1960s. A key concept about PAGs is that the decision to implement protective actions should be based on the projected dose that would be avoided if the protective actions were implemented. Developers of the EPA PAGs considered the following three principles in establishing exposure levels for the PAGs—

1. Prevent acute effects.
2. Balance protection with other important factors and ensure that actions result in more benefit than harm.
3. Reduce risk of chronic effects.

These principles apply to the determination of any PAG. Principles 1 and 2 have been proposed for use by the international community as essential bases for decisions to intervene during an incident. Principle 3 has been recognized as an appropriate additional consideration (IAEA 2002). Although it is important during emergency planning to consider a range of source terms to assess the costs associated with their implementation, the PAGs are pre-determined for use in emergencies without regard to the magnitude or type of radiological release.

1.3.4 Changes in Scenarios since the Issuance of the 1992 PAG Manual

EPA's 1992 PAG Manual provided emergency management officials at the federal, state, tribal and local levels with the technical basis to plan responses to radiological emergencies. The 1992 PAG Manual was written to accommodate the worst release scenario deemed likely at the time – a major accident at a commercial NPP that would result in a significant off-site release of radioactive material. ("Site" and "off-site" in this Manual refer to locations where the radiological incident occurs and are not limited to facility-type incidents.) Certain characteristics typify NPPs, including: fixed locations at which an accident might occur; a known suite of radionuclides on site, the dose from which is dominated by short- lived radioisotopes; tight regulatory controls and requirements; skilled operational personnel who plan for and exercise emergency responses; state and local involvement in emergency planning; well-developed and zoned emergency evacuation plans and routes; and advance notice (generally hours to days) from deteriorating plant conditions prior to accidental release of radioactive material into the environment. Therefore, the 1992 PAG Manual provided decision-makers with radiation dose-based PAG values for various exposure pathways (such as whole body, skin dose and food ingestion) and associated protective actions that were adapted to the mix of radionuclides and operational environments associated with commercial NPPs.

In late 1991, EPA conducted a symposium titled "Implementing Protective Actions for Radiological Incidents at Other Than Nuclear Power Reactors," to evaluate PAGs for incidents other than accidents at NPPs and concluded that the PAGs could be applied to all radiological incidents (EPA 1992a). Since then, new radiological and nuclear scenarios involving terrorist use of radioactive materials have gained status in radiological emergency response planning.

In 2008, the Department of Homeland Security (DHS) published "Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents" (DHS 2008). An RDD is a device or mechanism that is intended to spread radioactive material from the detonation of conventional explosives or other means. An IND is a crude, yield-producing nuclear weapon fabricated from diverted fissile material. Incidents like these may occur anywhere with little or no warning. The DHS guidance, developed cooperatively with EPA, DOE, DoD, DOL, HHS, Department of Commerce, and the NRC, affirms the applicability of existing 1992 EPA PAGs to terrorist acts, while acknowledging that the PAGs were inadequate for early response planning needs specific to an IND. To address this gap, "Planning Guidance for Response to a Nuclear Detonation" (NSS 2010) was subsequently published.

This Manual substantively incorporates late phase cleanup guidance provided in the 2008 DHS document and refers readers to additional planning resources.

1.3.5 Key Changes to PAGs in this Updated Manual

This updated Manual applies PAGs and protective actions to an expanded range of sources of potential radiological releases, including commercial nuclear power facilities, uranium fuel cycle facilities, nuclear weapons facilities, transportation accidents, radiopharmaceutical manufacturers and users, space vehicle launch and reentry, RDDs and INDs.

Dosimetry for all the PAGs was updated using the International Commission on Radiological Protection (ICRP) Publication 60 series (ICRP 1991). The PAGs in this Manual may be implemented using calculated, measurable values contained in the Federal Radiological Monitoring and Assessment Center (FRMAC) Assessment Manuals,[1] though using other incident-specific dose assessment methodologies is encouraged, where appropriate. EPA anticipates that radiological assessment methods will be periodically updated as improved models and methods become available. Therefore, readers are encouraged to review the FRMAC Assessment Manual to understand the most current, default radiological assessment methods. For simplicity, specific organ dose thresholds for evacuation and sheltering were removed.

This Manual incorporates several related guidance documents published subsequent to the 1992 guidance, including FDA's 1998 update of the PAGs for interdiction of food. This Manual also incorporates FDA's 2001 decision to lower the PAG for administration of stable iodine to 5 rem (50 millisieverts (mSv)) projected child thyroid dose. ~~Finally,~~ This update removes the intermediate phase relocation PAG of 5 rem (50 mSv) over 50 years to avoid confusion with long-term cleanup. ~~All other~~ Most of the PAGs and corresponding protective actions from the 1992 PAG Manual remain unchanged.

Recommended limits of exposure for emergency workers also remain unchanged from the 1992 PAG Manual. The emergency worker guides in this manual are consistent with federal and state regulations. Responsible officials should use judgment when doses may exceed regulatory limits and must advise workers of the risks. Table 1-1 presents PAGs with their principal associated protective actions or planning guides.

To further develop radiological emergency plans, brief planning guides have been provided for reentry to relocation areas, a cleanup planning process and considerations for radioactive waste disposal. In this Manual, the term reentry is used for emergency workers and members of the public going into relocation areas temporarily, under controlled conditions.

1.4 RADIOLOGICAL INCIDENT PHASES AND APPLICABILITY OF PROTECTIVE ACTIONS

Emergency planners divide responses to radiological incidents into three phases of activity—

[1] See FRMAC Assessment Manuals at http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.

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- **Early Phase** — The beginning of a radiological incident ~~when~~ for which immediate decisions for effective use of protective actions are required and must therefore be based primarily on the status of the radiological incident and the prognosis for worsening conditions. When available, predictions of radiological conditions in the environment based on the condition of the source or actual environmental measurements may be used. Protective actions based on the PAGs may be preceded by precautionary actions during the period. This phase may last from hours to days.
- **Intermediate Phase** — The period beginning after the source and releases have been brought under control (has not necessarily stopped but is no longer growing) and reliable environmental measurements are available for use as a basis for decisions on protective actions and extending until these additional protective actions are no longer needed. This phase may overlap the early phase and late phase and may last from weeks to months.
- **Late Phase** — The period beginning when recovery actions designed to reduce radiation levels in the environment to acceptable levels are commenced and ending when all recovery actions have been completed. This phase may extend from months to years. A PAG level, or dose to avoid, is not appropriate for long-term cleanup.

The phases cannot be represented by precise periods of time—and may even overlap—but to view them in terms of activities, rather than time spans, can provide a useful framework for emergency response planning.

In the early phase, sheltering-in-place and evacuation are the principal protective actions. These actions are meant to avoid inhalation of gases or particulates in an atmospheric plume and to minimize external radiation exposures. Administration of prophylactic drugs may be employed depending on the specific radionuclides released; in particular, KI, also called "stable iodine," may be administered as a supplementary protective action in incidents involving the release of significant quantities of radioactive iodine, such as NPP incidents. Some protective actions may begin prior to the release of radioactive material when there is advance notice.

Planning considerations for reentry to relocation areas for specific tasks are suggested and basic planning guidance for late phase cleanup is provided in Chapters 3 and 4.

1.4.1 Implementation of Protective Action Guides and Protective Actions

Immediately upon becoming aware that an incident is about to occur or has occurred that may result in exposure of the population, responsible authorities should make a preliminary evaluation to determine the nature and potential magnitude of the incident. This evaluation should determine whether conditions indicate a significant possibility of a major release and, to the extent feasible, determine potential exposure pathways, populations at risk and projected doses. The incident evaluation and recommendations should then be presented to emergency response authorities for consideration and implementation.

During the early phase, the sequence of events includes—evaluation of conditions at the location of the incident, notification of responsible authorities, prediction or evaluation of potential consequences to the general public, recommendations for action and implementation of actions for the protection of the public.

In the intermediate phase, dose projections used to support decisions about protective actions may be based on measurements of environmental radioactivity and dose models. When conditions warrant relocation of populations, the collection of extensive radiological and cost-of-cleanup data will be necessary to form the decision basis for cleanup and recovery of the affected areas.

Table 1-1: Planning Guidance and Protective Action Guides for Radiological Incidents

Phase	Protective Action ~~Recommendation~~	Protective Action Guide or Planning Guide
Early[a] (Chapter 2)	Sheltering-in-place or evacuation of the public[b]	1 to 5 rem (10 mSv to 50 mSv) projected dose/4 days[c]
	Administration of prophylactic drugs KI[d]	5 rem (50 mSv) projected child thyroid dose[e] from radioactive iodine
	Limit emergency worker exposure	5 rem (50 mSv)/year (or greater under exceptional circumstances)[f]
Intermediate[a] (Chapter 3)	Relocation of the public	2 rem (20 mSv) projected dose first year[c] Subsequent years, 0.5 rem (5 mSv)/year projected dose
	Food interdiction[g]	0.5 rem (5 mSv)/year projected dose, or 5 rem (50 mSv)/year to any individual organ or tissue, whichever is limiting
	Limit emergency worker exposure	5 rem (50 mSv)/year[c]
	Reentry	Operational Guidelines[h] (Stay times and concentrations) for specific activities (see Section 3.7)
Late[i] (Chapter 4)	Cleanup	Brief description of planning process
	Waste Disposal	Brief description of planning process

a This guidance does not address or impact site cleanups occurring under other statutory authorities such as the United States Environmental Protection Agency's (EPA) Superfund program, the Nuclear Regulatory Commission's (NRC) decommissioning program, or other federal or state cleanup programs.

b Should begin at 1 rem (10 mSv); take whichever action (or combination of actions) that results in the lowest exposure for the majority of the population. Sheltering may begin at lower levels if advantageous.

c Projected dose- the sum of the effective dose from external radiation exposure (i.e., groundshine and cloudshine) and the committed effective dose from inhaled radioactive material.

d A supplemental protective action that provides thyroid protection from ~~internal exposure to~~ radioactive iodines only. The complete FDA guidance may be found at http://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/ucm080542.pdf. Further information is also available: http://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/ucm080546.pdf and http://www.fda.gov/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness/ucm072265.htm.

e Thyroid equivalent dose. For information on other radiological prophylactics and treatment, refer to...http://www.fda.gov/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness/ucm063807.htm http://www.bt.cdc.gov/radiation and www.orau.gov/reacts

f When radiation control options are not available, or, due to the magnitude of the incident, are not sufficient, doses to emergency workers above 5 rem (50 mSv) may be unavoidable and are generally approved by competent authority. For further discussion see Chapter 2, Section 2.6.

g For more information on food and animal feeds guidance, the complete FDA guidance may be found at http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM094513.pdf

h For extensive technical and practical implementation information please see "Preliminary Report on Operational Guidelines Developed for Use in Emergency Preparedness and Response to a Radiological Dispersal Device Incident" (DOE 2009)

I This cleanup process does not rely on and does not affect any authority, including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq. and the National Contingency Plan (NCP), 40 CFR Part 300. This document expresses no view as to the availability of legal authority to implement this process in any particular situation.

Protective actions may already be designated in existing emergency response plans. Under NRC regulations, large commercial NPPs must maintain detailed radiological response plans for an emergency planning zone (EPZ) within a 10 mile (16.1 km) radius of the plant and for a separate ingestion pathway EPZ within a 50 mile (80.5 km) radius. ~~Emergency Responders~~ Emergency Workers should be prepared to select and implement appropriate protective actions when standing response plans are not available or applicable.

1.4.2 Conservatism built into the PAGs

Conservatism is built into the PAG levels themselves, as described in Sections 2.3.1 and 4.3.3 about the risk-benefit balancing process used to derive the PAGs. Additionally, assumptions made to generate default parameters and derived response levels in the FRMAC Assessment Manual, Volume 1, Appendix C, includes some conservative assumptions to ensure PAGs are appropriate emergency guides for all members of the public, including sensitive subpopulations such as young children. For example, Early Phase derived levels are based on the assumption that a person is outdoors twenty-four hours a day for four days being exposed to the plume. Intermediate Phase derived levels also conservatively do not account for shielding provided by being indoors part of each day of the projection year. People are assumed to remain in the contaminated area during the entire time (not going to work or school in an uncontaminated area, for instance.) Another example of conservatism is assuming that radionuclides are in the chemical and physical form that yields the highest dose, (e.g., the particle size is one micrometer mean aerodynamic diameter). These conservatisms allow dose assessors to project whole body doses (TED) to a reference person, for simplicity, and then decision makers can make protective action decisions that apply to entire communities including children, adults and the elderly.

Radiological assessors are encouraged to utilize realistic inputs when site- or source-specific information is available to limit the amount of conservatism built into the calculations. For example, if the radionuclide does not exist in a chemical or physical form or particle size that yields the highest dose, then assessors should use appropriate inputs to avoid overly conservative dose estimates that may lead to unnecessary protective actions.

Certain guidelines that lend themselves to different PAGs for different subpopulations are the PAGs for potassium iodide, food and water. These guidelines provide age-specific recommendations because of the radiosensitivity of the thyroid and young children with respect to ingestion and inhalation doses in particular.

Taking protective actions like use of KI, avoiding certain foods or using alternative sources of drinking water can be relatively simple to implement by the parents of younger children. Clear public messages can convey which age groups should take which action, unlike how an evacuation or relocation order should apply to entire households or neighborhoods.

An evaluation of dose consequences to several age groups across many radiological scenarios was done and, for the early phase including the plume, child whole body doses are typically no more than 15% higher than adult whole body doses. That margin is well within the conservatism discussed above, so that separate PAGs or projections need not be required. Therefore, basing evacuation, shelter in place and relocation dose projections on an adult is appropriate for all age groups. Sensitive age groups should be evaluated separately for KI, food and water decisions. Keeping calculations and decision making simple in the face of a disaster can enable timely actions to protect communities.

1.4.3 Early Phase Protective Action Guides and Protective Actions

In the early phase, there may be little or no data on actual releases to the environment and responders may have to rely on crude estimates of airborne releases. Decision time frames are short and preparation is critical to make prudent decisions when data are lacking or insufficient.

The principal protective actions for the early phase are evacuation and sheltering-in-place. These protective actions would be taken if whole body doses are projected to exceed 1 to 5 rem (10 to 50 mSv) over four days. The decision to evacuate must weigh the anticipated radiation dose to individuals in the affected population against the feasibility of evacuating within a determined time frame and the risks associated with the evacuation itself. For example, evacuating a population of 50,000 carries with it a statistical risk of injury or death from transportation hazards or increased exposure. Evacuation also takes time. In the case of an accident at an NPP, there ~~may~~ will likely be time for an orderly and relatively safe evacuation. In the case of a fire or explosion of an RDD in an urban area, evacuating a large group of people could leave them exposed to the plume and actually increase radiation dose. Sheltering-in-place may be warranted in situations where evacuation poses a greater risk of exposure or physical harm.

In addition, there are actions that are advisable, but not associated with a numerical PAG. For example, individuals should be instructed to cover airways (nose and mouth) with available filtering material when airborne radionuclides may be present. Decontamination is another protective action that may be utilized in the early phase and may include washing of contaminated individuals, removing contaminated clothing and decontaminating surfaces of critical areas and objects. Further, in areas where airborne radioactivity is present but PAGs are not exceeded, officials can consider asking people to stay indoors to the extent practicable. In such cases, individuals are not prevented from carrying out necessary tasks (e.g., seeking medical care, purchasing food). Similar to actions used in major cities on high pollution days, these measures can be effective to reduce radiation doses when prolonged releases occur, as was the case for the Fukushima accident in Japan.

In cases where significant quantities of radioiodine may have been released, administration of the radioprotectant KI should be considered as a supplementary protective action if the projected child thyroid dose exceeds 5 rem (50 mSv). This PAG is lower than the 1992 guidance. The lower dose, which FDA adopted in 2001, is for protection of children based on early studies of Chernobyl exposure data.

The choice of protective action will be based on the status of the incident site and the prognosis for worsening conditions. In the early phase, precautionary actions based on worst-case scenarios may be used before implementation of protective actions based on PAGs. For example, in the case of RDD detonation, governments may instruct affected populations to shelter in place as a precautionary action while radiation levels are being measured to determine appropriate PAG-based protective actions. Officials should plan for rapid broadcast and dissemination of protective action orders to the public.

When available, predictions of radiological conditions in the environment based on an estimate of the source or actual environmental measurements may be used. Nuclear facilities, for example, have continuous, real-time radioactive effluent monitoring capabilities to monitor radioactive material released to the environment and may have a network of off-site measurement stations.

1.4.4 Intermediate Phase Protective Action Guides and Protective Actions

Intermediate phase activities are intended to reduce or avoid dose to the public, to control worker exposures, to control the spread of radioactive contamination and to prepare for late phase cleanup operations.

During the intermediate phase, relocation is the principal protective action against whole body external exposure from deposited material and internal exposure from inhalation of radioactive particulates.

People may need to be relocated for weeks or months.

It is necessary to distinguish between evacuation and relocation. Evacuation is the urgent removal of people from an area to avoid or reduce high-level, short-term exposure from the plume or deposited activity. Relocation is the removal or continued exclusion of people (households) from contaminated areas to avoid chronic radiation exposure. Site-specific conditions may allow some groups evacuated in an emergency to return, while others may have to relocate. In other cases, some groups that were not previously evacuated may have to relocate (see Section 3.3.1 for more details).

Intermediate phase PAGs are based on doses projected in the first several years. The PAG for relocation of the public is 2 rem (20 mSv) in the first year and 0.5 rem (5 mSv) in any subsequent year. (Note: Relocation PAGs are treated separately from food and water ingestion. That is, projection of intermediate phase doses should not include these ingestion pathways. In some instances, however, where withdrawal of food and/or water from use would, in itself, create a~~,~~ health risk, relocation may be an appropriate alternative protective action. In this case, the ingestion dose should be considered along with the projected dose from deposited radionuclides via other pathways, for decisions on relocation.) When projected doses are less than the relocation PAG of 2 rem (20 mSv) in the first year, focused environmental decontamination and cleanup may be able to reduce doses to populations that are not relocated. Decontamination and focused cleanup techniques can range from simple actions such as the scrubbing and flushing of surfaces with uncontaminated water to the removal and disposal of soil and contaminated debris.

Keeping projected doses below the 0.5 rem (5 mSv) PAG ~~for out years –~~ in the second and subsequent years ~~and beyond~~ – may be achieved through the decay of shorter half-life radioisotopes (as in the case of an accident at an NPP), through environmental decontamination and cleanup efforts or through other means of controlling public exposures, such as limiting access to certain areas. Information on food and animal feeds protective action guidance is contained in FDA's "Accidental Radioactive Contamination of Human Food and Animal Feeds: Recommendations for State and Local Agencies" (FDA 1998). Workers and members of the public may be allowed to re-enter relocation area for tasks related to critical infrastructure and key resources, to care for animals and to assess the condition of closed zones. Reoccupancy may be allowed under dose constraints acceptable to the community. In this Manual, the term reoccupancy refers to households and communities moving back into relocation areas where the cleanup process is still ongoing, based on radiation levels acceptable to those communities.

~~EPA is not proposing a specific drinking water PAG at this time. EPA has established enforceable drinking water standards for radionuclides under the Safe Drinking Water Act (SDWA). EPA recommends that, to the extent practicable, emergency measures for drinking water be based on the National Primary Drinking Water Regulations (NPDWR) for Radionuclides. The Radionuclides Rule provides states with flexibility when responding to radiological events. If a public water system exceeds the radionuclides standard it must work to get back into compliance as soon as feasible. States have the authority to determine if other corrective actions are needed (e.g. providing alternative water). Guidance on monitoring, notification and protective actions is provided in Chapter 3, along with several online resources for drinking water system operators.~~

~~However, in light the Fukushima nuclear power plant accident, in which some Japanese drinking water supplies were impacted, the Agency recognizes a short-term emergency drinking water guide may be useful for public health protection The Agency requests input on the appropriateness of, and possible values for, a drinking water PAG.~~

~~While the NPDWR provide for a regulatory standard of 4 mrem/year (beta, photon emitters) based on life-time exposure, international organizations have developed technical approaches and methodologies that have produced a range of emergency guidelines related to drinking water (e.g., the World Health Organization[2], the International Atomic Energy Agency[3]), as have other federal agencies (e.g. the Department of Homeland Security[4], the Food and Drug Administration[5]) and non-federal organizations. EPA is seeking input on an approach and technical rationale for a drinking water PAG designed to help officials select protective actions under emergency conditions when exposures would occur over shorter time periods than those envisioned in the NPDWR.~~

{Placeholder for brief description of the final drinking water PAG}

During the intermediate phase, government officials may convene to discuss late phase cleanup and site restoration strategies. All actions taken during the early and intermediate phases should be considered with respect to the impact they may have on late phase remediation, such as avoiding the use of fixatives that could hinder surface decontamination at a later date.

1.4.5 Late Phase

The late phase, as used in this Manual, is the period beginning when cleanup and recovery actions have begun and ending when all recovery actions have been completed. This phase may extend from months to years.

The late phase cleanup process, as described in this guidance, begins sometime after the commencement of the intermediate phase and proceeds independently of intermediate phase protective action activities. The transition is characterized by a change in approach, from strategies predominantly driven by urgency, to strategies aimed at both reducing longer-term exposures and improving living conditions. The late phase involves the final cleanup of areas and property at which contamination directly attributable to the incident is present. It is in the late phase that final cleanup decisions are made and final recovery efforts following a radiological incident are implemented.

Unlike the early and intermediate phases of a radiological incident, decision makers will have more time and information during the late phase to allow for better data collection, stakeholder involvement and options analysis. Community members will influence decisions such as if and when to allow people to return home to contaminated areas. There will be populations, who were not relocated or evacuated, living in contaminated areas where efforts to reduce exposures will be ongoing. Implicit in these decisions is the ability to balance health protection with the desire of the community to resume normal life.

Radiation protection considerations must be addressed in concert with health, environmental, economic, social, psychological, cultural, ethical, political and other considerations. Many federal, state, and local agencies have important roles to play. It is recognized that experience from existing programs, such as the

U.S. EPA's Superfund program, the U.S. NRC's process for decommissioning and decontamination to terminate a nuclear facility license and other national recommendations may be useful for designing cleanup and recovery efforts that could apply to a radiological incident. The cleanup process described in Chapter 4, however, does not rely on and does not affect any authority, including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq. and the National Contingency

~~[2] See http://www.who.int/water_sanitation_health/dwq/gdwq3rev/en/ and http://www.who.int/hac/crises/jpn/faqs/en/index8.html~~
~~[3] See http://www-pub.iaea.org/MTCD/publications/PDF/Pub1467_web.pdf~~
~~[4] See http://ogems.energy.gov/73fr45029.pdf~~
~~[5] See http://www.fda.gov/downloads/MedicalDevices/.../UCM094513.pdf~~

Plan (NCP), 40 CFR Part 300. For information on roles, responsibilities and authorities during emergency response and recovery please refer to the National Response Framework: http://www.fema.gov/national-response-framework and specifically for radiological incidents, the Nuclear Radiological Incident Annex: http://www.fema.gov/pdf/about/divisions/thd/IncidentNucRad.pdf (FEMA 2008a, b).

The late phase or cleanup process described in Chapter 5 consists of multiple steps, namely 1) characterization and stabilization, 2) development of goals and strategies and 3) implementation and reoccupancy; meaningful stakeholder involvement should be integrated *throughout* the process.

While radioactive waste handling and disposal will be an ongoing endeavor during the entire emergency response, brief planning guidance is provided in Chapter 4, the late phase. This guidance addresses both locations that may be identified by state and local officials and locations owned by the federal government, and lists criteria for evaluating their suitability for disposal, as well as actions that can be taken to facilitate their use. Legal and other considerations are also discussed. This guidance assumes that on-site disposal at a location affected by the incident, where appropriate, will be one of the locations of choice. Though recommended as the first consideration for discussion post-accident or attack, this guidance assumes that existing non-federal radioactive waste disposal capacity already available to impacted states and their regions is overwhelmed or otherwise eliminated from consideration, which drives the need to identify other disposal options or develop new disposal capacity.

KEY POINTS IN CHAPTER 1 – OVERVIEW

- A PAG is the projected dose to an individual from a release of radioactive material at which a specific protective action to reduce or avoid that dose is recommended. PAGs are guides to help officials select protective actions under emergency conditions when exposures would occur over relatively short time periods.
- EPA provides the PAG Manual to assist public officials with their radiological emergency response planning activities. The PAG Manual is a guidance document, not a legally binding regulation and does not affect or supersede any environmental laws. The PAG recommendations do not represent the boundary between safe and unsafe conditions.
- PAGs may be implemented to protect the public in a wide variety of radiological emergencies, including terrorist incidents and accidents involving nuclear power plants, transportation and the space program.
- PAGs are appropriate for implementation in the early and intermediate phases of radiological incidents. The early phase—lasting hours to days—is the period beginning at the projected (or actual) initiation of a release when immediate decisions for effective use of protective actions are required and must therefore be based primarily on the status of the release and the prognosis for worsening conditions. Little environmental data may be available in the early phase. The intermediate phase— lasting weeks to months—is the period beginning after the source and releases have been brought under control and environmental measurements are available for use as a basis for decisions on protective actions.
- Reentry and reoccupancy decisions will be made using incident-specific circumstances and the Operational Guidelines (DOE 2009).
- Cleanup and waste disposal decisions may be informed by planning guidance provided in Chapter 5 .
- What's new in this updated Manual—
  - The PAGs in this Manual are implemented using the calculations and methods in the FRMAC Assessment Manual. Dosimetry in that Manual has been updated using the ICRP Publication 60 series (ICRP 1991).
  - EPA adopts the FDA guidance issued in 2001 that recommended lowering the projected thyroid dose at which the administration of KI is warranted as a supplementary protective action.
  - {Placeholder for mention of drinking water guidance }
  - EPA adopts the 1998 FDA Food PAGs.
  - Planning guidance has been provided for reentry, late phase cleanup and waste disposal.

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CHAPTER 2. EARLY PHASE PROTECTIVE ACTION GUIDES

1.5 INTRODUCTION

Decisions regarding protective actions for workers and the public during radiological incidents are risk management decisions and the recommendations in this Manual are provided in that context. Rapid action may be required to protect members of the public in the event of an incident involving a large release of radioactive materials into the environment. In all cases, all practical and reasonable means should be used to reduce or eliminate exposures.

This chapter presents PAGs for use in the early phase of a radiological incident. A PAG is the projected dose to an individual from a release of radioactive material at which a specific protective action should be taken to reduce or avoid that dose. The early phase begins at the actual or projected start of a release— most likely before ambient environmental and radiological data become available for quantitative risk- based actions. The exact duration of the early phase depends upon site conditions, but one should plan to project doses for four days.

Many radiological emergency scenarios would involve airborne releases, so this chapter provides guidance for estimating projected doses from exposure to an airborne plume of radioactive material and for implementing protective actions. Dose calculations for implementing the PAGs are made using the ~~dose conversion factors (DCFs)~~ dose parameter (DP) and derived response level (DRL) methods referenced in the FRMAC Assessment Manuals[6] Note that FRMAC refers to dose parameters in emergency response dose assessment methods to avoid confusion with dose coefficients and dose conversion factors published for radiation protection in general. Other calculation methods to implement PAGs may be appropriate.

1.6 EXPOSURE PATHWAYS DURING THE EARLY PHASE

During the early phase of an incident, there are three main exposure pathways from airborne releases—

- **Direct exposure** to radioactive materials in an atmospheric plume. The contents of such a plume will depend on the source of radiation involved and conditions of the incident. For example, in the case of an incident at an NPP, the plume may contain radioactive noble gases, radioiodines and radioactive particulate materials. Many of these materials emit gamma radiation that can expose people in the vicinity of the passing plume.
- **Inhalation** of radionuclides from immersion in a radioactive atmospheric plume and inhalation of ground-deposited radionuclides that are resuspended into a breathing zone. Inhaled radioactive particulates, depending on their solubility in body fluids, may remain in the lungs or move via the bloodstream to other organs, prior to elimination from the body. Some radionuclides become concentrated in a single body organ, with only small amounts going to other organs. For example, a significant fraction of inhaled radioiodines will move through the bloodstream to the thyroid gland.
- **Deposition** of radioiodine and particulates from a radioactive plume. Deposited materials can continue to emit "groundshine" (e.g., beta and gamma radiation) after the plume has passed causing continued exposure to skin and internal body organs. ~~Deposited materials can continue to emit beta and gamma radiation as "groundshine" after the plume has passed causing continued exposure to skin and internal body organs~~. ~~Similarly, skin and clothes may become contaminated.~~

A plume may deposit materials on surfaces, posing a risk of longer-term exposures via ingestion, direct external exposure and inhalation pathways. If the release contains large quantities of radioactive iodines or particulates, the resulting long-term exposure to this "groundshine" can be more significant than external

[6] See FRMAC Assessment Manuals at http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.

exposure from the passing plume if the exposure time to the ground contamination is long in comparison to the plume passage time. The early phase PAGs assume four days of exposure to ground contamination to address this possibility. Doses from groundshine can be readily measured by field monitoring teams dispatched at the onset of a significant radioactive release. Holding a detector probe horizontal and three feet (approximately one meter) above the contaminated surface provides a direct measurement of groundshine dose. Such assessments can confirm dose projections based upon effluent release data and the adequacy of protective actions in the early phase. More detailed analyses (e.g., isotopic) would be needed to support long-term dose projections in the intermediate phase. Doses for groundshine can be calculated during the intermediate phase (see Chapter 4). Exposure pathways that contribute less than ten percent to the total dose incurred need not be considered during the early phase.

1.6.1 The Establishment of Exposure Patterns

It is unlikely that sufficient environmental data will be available for accurate dose projections during and immediately following the early response to a radiological incident. Dose projections are needed to determine whether protective actions should be implemented in additional areas during the early phase.

For dose projections in the early phase there are two sources of data: current data from initial environmental measurements or estimates of the source term and estimated data using modeled or historical atmospheric transport data. Source term measurements, or exposure rates or concentrations measured in the plume at a few selected locations, may be used to estimate the extent of the exposed area in a variety of ways, depending on the types of data and computation methods available. The most accurate method of projecting doses is through the use of an atmospheric diffusion and transport model that has been verified for use at the site in question or for similar site conditions. A variety of computer software packages can be used to estimate dose in real time, or to extrapolate a series of previously-prepared isopleths for unit releases under various meteorological conditions. The latter can be adjusted for the estimated source magnitude or environmental measurements at a few locations during the incident. If the model projections have some semblance of consistency with environmental measurements, extrapolation to other distances and areas can be made with greater confidence. If projections using a sophisticated site-specific model are not available, a simple but crude method is to measure the plume centerline exposure rate[7] at ground level (measured at approximately 1 m height) at a known distance downwind from the release point and then to calculate exposure rates at other downwind locations by assuming that the plume centerline exposure rate is a known function of the distance from the release point.

The following relationship can be used for this calculation:

$$D_2 = D_1 (R_1/R_2)_y$$

where D_1 and D_2 are exposure rates at the centerline of the plume at distances R_1 and R_2 from the release, respectively and y is a constant that depends on atmospheric stability. For stability classes[8] A and B, y = 2; for stability classes C and D, y = 1.5; and for stability classes E and F, y = 1. Classes A and B (unstable) occur with light winds and strong sunlight and classes E and F (stable) with light winds at night. Classes C and D generally occur with winds stronger than about 10 mph. This method of extrapolation is risky because the measurements available at the reference distance may be unrepresentative, especially if the plume is aloft and has a looping behavior. In the case of an elevated plume, the ground level concentration increases with distance from the source and then decreases, whereas any high-energy gamma radiation from the overhead cloud continuously decreases with distance. For these reasons, this method of extrapolation will perform best for surface releases or if the point of measurement for an elevated release is sufficiently distant (usually more than

[7] The centerline exposure rate can be determined by traversing the plume at a point sufficiently far downwind that it has stabilized (usually more than one mile from the release point) while taking continuous exposure rate measurements.

[8] Pasquill stability classes categorize atmospheric turbulence into six stability classes named A, B, C, D, E and F, class A being the most unstable or most turbulence and class F the most stable or least turbulence. Pasquill, F. 1961. The Estimation of the Dispersion of Windborne Material. The Meteorological Magazine 90, No. 1063, 33-49.

1 mile) from the point of release for the plume to have expanded to ground level. The accuracy of this method will be improved by the use of measurements from many locations averaged over time.

1.7 THE PROTECTIVE ACTION GUIDES AND PROTECTIVE ACTIONS FOR THE EARLY PHASE: EVACUATION, SHELTERING-IN-PLACE AND ADMINISTRATION OF POTASSIUM IODIDE

The principal protective actions for the early phase are evacuation or sheltering-in-place. Evacuation is the urgent removal of people from an area to avoid or reduce high-level, short-term exposure from the plume or deposited activity. Sheltering-in-place is the action of staying or going indoors immediately. The administration of KI (stable iodine) to partially block the uptake of radioiodines by the thyroid is a supplemental protective action.

In addition, washing the body and changing clothing as soon as possible after significant exposure to a radioactive plume of any composition may be recommended protective actions. Changing of clothing is recommended primarily to provide protection from beta radiation from radioiodines and particulate materials deposited on the clothing.

The PAGs and corresponding protective actions for response during the early phase of an incident are summarized in Table 2-1. Evacuation or sheltering-in-place will be justified when the projected dose to an individual is 1 rem (10 mSv) projected over four days. This conclusion is based primarily on EPA's determination concerning acceptable levels of risk of health effects from radiation exposure in an emergency situation, while weighing costs and risks associated with any protective action. ~~The basis for the PAGs for the early phase is given in Appendix C of the 1992 PAG Manual, available online as a historical reference at http://www.epa.gov/radiation/rert/pags.html.~~

Table 2-1: PAGs and Protective Actions for the Early Phase of a Radiological Incident

Protective Action ~~Response~~	PAG (projected dose)	Comments
Sheltering-in-place or evacuation of the public[a]	1 to 5 rem (10 mSv to 50 mSv) over four days[b]	Evacuation (or, for some situations, sheltering-in-place) should be initiated when projected dose is 1 rem (10 mSv).
Supplementary administration of prophylactic drugs – KI[c]	5 rem (50 mSv) projected dose to child thyroid from exposure to iodine[d]	KI is most effective if taken prior to exposure. May require approval of state medical officials (or in accordance with established emergency plans).

[a]Should begin at 1 rem (10 mSv) if advantageous except when practical or safety considerations warrant using 5 rem (50 mSv); take whichever action (or combination of actions) that results in the lowest exposure for the majority of the population. Sheltering may begin at lower levels if advantageous.

[b]Calculated dose is the projected sum of the effective dose from external radiation exposure (i.e., groundshine and plume submersion) and the committed effective dose from inhaled radioactive material.

[c]A supplemental protective action that provides thyroid protection from radioactive iodines only. For other information on radiological prophylactics and treatment, refer to http://www.fda.gov/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness, http://www.emergency.cdc.gov/radiation or http://www.orau.gov/reacts.

[d]~~Thyroid equivalent dose (see Section 2.3.5).~~ Thyroid dose (see Section 2.3.4)

This guidance does not address or impact site cleanups occurring under other statutory authorities such as the United States Environmental Protection Agency's (EPA) Superfund program, the Nuclear Regulatory Commission's (NRC) decommissioning program, or other federal or state cleanup programs.

1.7.1 Thyroid Based Evacuation

This revised PAG Manual does not include a footnote from the 1992 PAG Manual Early Phase PAG table, which noted that 'thyroid and skin may be 5 and 50 times larger, respectively.' That footnote effectively provided organ dose based evacuation thresholds in addition to the whole-body dose PAG range of 1 to 5 rem (10 to 50 mSv). Because of the factors described above, these organ dose based Early Phase PAGs are not necessary.

Regarding sensitive subpopulations, child thyroid doses typically are about twice as high as adult thyroid doses. The former range recommended for thyroid dose-based evacuation (5 to 25 rem adult thyroid dose) is well covered by projections of whole body dose, with evacuation recommended at 1 to 5 rem (10 to 50 mSv) adult TED. The conservatism built into the PAG levels when they were set results in an appropriate level of dose avoidance for the whole community, including all age groups, for an emergency. Planners should consider instituting public messaging templates in advance to address concerns the public may have about how protective the PAG recommendations are for all members of an impacted community.

The PAG Manual is guidance, and intentionally not prescriptive. This set of recommendations does not preclude an emergency manager from setting local or state protective action guidelines for actions based on specific organ or age group dose levels, as warranted by specific needs of that community.

1.7.2 Basis for Early Phase PAGs

For a full description of the risk-benefit analysis used to set the PAG levels, refer to the 1992 PAG Manual, Appendices B, C and E. The Manual is available online in a searchable format. Below is a short summary on the basis for the Early Phase evacuation/sheltering PAG of 1 to 5 rem (10 to 50 mSv) projected over 4 days.

PAGs are intended to apply to all individuals in a population other than workers performing emergency services. However, there may be identifiable groups that have different average sensitivity to radiation or, because of their living situation, will receive higher or lower doses. In addition, some groups may be at greater risk from taking a given protective action. Special circumstances and age groups (e.g., fetal dose) were considered, when appropriate, in establishing values for the PAGs.

The following four principles provided the basis for establishing values for Protective Action Guides:

a. Acute effects on health (those that would be observable within a short period of time and which have a dose threshold below which they are not likely to occur) should be avoided.

b. The risk of delayed effects on health (primarily cancer and genetic effects, for which linear non-threshold relationships to dose are assumed) should not exceed upper bounds that are judged to be adequately protective of public health, under emergency conditions, and are reasonably achievable.

c. PAGs should not be higher than justified on the basis of optimization of cost and the collective risk of effects on health. That is, any reduction of risk to public health achievable at acceptable cost should be carried out.

d. Regardless of the above principles, the risk to health from a protective action should not itself exceed the risk to health from the dose that would be avoided.

EPA considered the acceptable range of costs for avoiding a statistical death from pollutants other than radiation and using a rounded value from the BEIR III risk of 0.0003 cancer deaths per person-rem. Further evaluation of thyroid, skin and fetal dose consequences was conducted as well.

Costs of evacuation:

Based on a prior published study ("An Analysis of Evacuation Options for Nuclear Accidents, EPA 520/1-87-023, 1987) evaluating evacuation options for several accident types, this analysis focused on the smallest

category of fuel melt accident yielding effective dose equivalents during the first 4 days of exposure that are greater than 0.5 rem outside the assumed 2-mile evacuation circle for all stability classes. For this scenario, total and incremental costs were calculated for several different sized evacuation areas. Data on costs versus dose avoided for several meteorological stability classes and evacuation options (sizes) were summarized in tables in the 1992 PAG Manual, Appendix C.

For a risk of 0.0003 cancer deaths per person-rem, the range of evacuation costs can be compared to the marginal cost-effectiveness (dollars per person-rem) of evacuation over an angle of 90 degrees. The resulting ranges of upper bounds on dose are in tables in Appendix C, for three different accident scenarios. The maximum upper bounds (based on minimum costs for avoiding risk) range from 1 to 10 rem, with most values being approximately 5 rem. The minimum upper bounds (based on maximum costs for avoiding risk) range from 0.15 to 0.8 rem, with 0.5 rem dose incurred being representative of most situations.

From these data we conclude that, based on the cost of evacuation, a PAG larger than the range of values 0.5 to 5 rem would be incompatible with Principle 3.

Based on comparison of exposures from evacuation versus the presumed alternative of sheltering in various building types for several timeframes, the dose actually avoided by evacuation is one half of the projected dose.

Risk from evacuation:

Principle 4 requires that the risk of the protective action not exceed the risk associated with the dose that will be avoided. Risk from evacuation can come from several sources, including (1) transportation incidents for both pedestrians and vehicle passengers, (2) exposure to severe weather conditions or a competing disaster, and (3), in the case of immobile persons, anxiety, unusual activity, and separation from medical care or services. While all these factors must be considered, transportation incidents is the only category for which the risk has been quantified.

Conformance to Principle 1 (avoidance of acute health effects) is assured by the low risk required to satisfy Principle 2 (acceptable risk of delayed health effects), and thus requires no additional consideration. Based on Principle 2, evacuation of the general population is not justified below 0.5 rem. This represents a risk of about 0.0002 of fatal cancer. Maximum lifetime risk levels considered acceptable by EPA from routine operations of individual sources range from 0.000001 to 0.0001. Risk levels that are higher than this must be justified on the basis of the emergency nature of a situation. In this case, we judge that up to an order of magnitude higher combined risk from all phases of an incident may be justifiable. The choice of 0.5 rem avoided dose as an appropriate criterion for an acceptable level of risk during the early phase is a subjective judgment that includes consideration of possible contributions from exposure during other phases of the incident.

Principle 4 (risk from the protective action must be less than that from the radiation risk avoided) supplies a lower bound of 0.03 rem on the dose at which evacuation of most members of the public is justified. The lower bound was derived from the risk of death from traffic accidents in emergency evacuations, using the factor of 0.0003 cancer deaths per person-rem. Finally, under Principle 3 (cost/risk considerations) evacuation is justified only at values equal to or greater than 0.5 rem. This will be limiting unless lower values are required for purely health-based reasons (Principle 2). But this is not the case.

In summary, we have selected the value 0.5 rem as the avoided dose which justifies evacuation, because 1) it limits the risk of delayed effects on health to levels adequately protective of public health under emergency conditions, 2) the cost of implementation is justified, and 3) it satisfies the two bounding requirements to avoid acute radiation effects and to avoid increasing risk through the protective action itself.

The value of the PAG for evacuation of the general public is therefore chosen as one rem projected total effective dose from inhalation of radionuclides and exposure to external radiation.

1.7.3 Evacuation vs. Sheltering-in-Place

Evacuation and sheltering-in-place provide different levels of dose reduction from the principal exposure pathways: direct gamma exposure and inhalation. Both sheltering and evacuation may be implemented during the same response in different areas or timeframes. Evacuation, if completed before plume arrival, can be 100 percent effective in avoiding radiation exposure. A decontamination station, with simple decontamination actions, may need to be collocated at shelters during the pre-evacuation period. This may reduce the spread of contamination and provide for greater protection during evacuation. Medical stations should also be collocated at shelters during the pre-evacuation period to ensure simple triage capabilities are met and to manage the distribution of prophylactic drugs. The effectiveness of evacuation will depend on many factors, such as how rapidly it can be implemented and the nature of the incident. For incidents where the principal source of dose is inhalation, evacuation could increase exposure if it is implemented during the passage of a short-term plume, because the air inside a vehicle rapidly equalizes with the outside air even when all of the windows and vents are closed. ~~since vehicles used to transport evacuees provide little protection against exposure~~ (DOE 1990). Below 1 rem (10 mSv), evacuation is not recommended because of risks associated. ~~Evacuation will seldom be justified at less than 1 rem (10 mSv) over the first four days.~~

Sheltering-in-place is a low-cost, low-risk protective action that can provide protection with an efficiency ranging from zero to almost 100 percent, depending on the type of release, the type of shelter available, the duration of the plume passage and climatic conditions. Because of these advantages, planners and decision makers may consider implementing sheltering-in-place when projected doses are below 1 rem (10 mSv) over the first four days. More guidance on the unique challenges posed by an IND can be found in the "Planning Guidance for Response to a Nuclear Detonation" (NSS 2010).[9]

Sheltering-in-place may be preferred for special populations (e.g., those who are not readily mobile) as a protective action at projected doses of up to 5 rem (50 mSv) over four days. When environmental, physical, or weather hazards impede evacuation, sheltering-in-place may be justified at projected doses up to 5 rem (50 mSv) for the general population (and up to 10 rem (100 mSv) for special populations). It is also comparatively easy to communicate with populations that have sheltered-in-place. Dose projections use a four-day exposure duration, but sheltering in place duration is intentionally not specified. Incident- specific decisions must be made to determine how long people should shelter in place.

Selection of evacuation or sheltering-in-place is far from an exact science, particularly in light of time constraints that may prevent thorough analysis at the time of an incident. The selection process should be based on realistic or "best estimate" dose models and should take into account the unavoidable dose incurred during evacuation and potential failure scenarios for sheltering-in-place (e.g., leaking ventilation system).

Advance planning and exercises can facilitate the decision process. In a commercial NPP incident, early decisions should be based on information from the response plans for the EPZ and on actual conditions at the nuclear facility (see Section 2.3.5). For transportation accidents, RDDs, INDs and other incident scenarios for which EPZs are not practicable, best estimates of dose projections should be used for deciding on evacuation, sheltering-in-place or a combination thereof.

Sheltering-in-place should be preferred to evacuation whenever it provides equal or greater protection.
Sheltering-in-place followed by informed evacuation may be most protective.

1.7.4 ~~General Guidance for Evacuation and Sheltering-in-PlaceConsiderations for Evacuation~~

The following is a summary of planning guidance for evacuation and sheltering-in-place—Evacuation may be the only effective protective action close to the plume source.

- Evacuation will be most effective if it is completed before arrival of the plume.

[9] See http://www.epa.gov/rpdweb00/docs/er/planning-guidance-for-response-to-nuclear-detonation-2-edition-final.pdf

- Evacuation may increase exposure if carried out during the plume passage.
- Evacuation is also appropriate for protection from groundshine in areas with high exposure rates from deposited materials when suitable shelter is not available.
- Sheltering-in-place may be appropriate for areas not designated for immediate evacuation—
  - It may provide protection equal to or greater than evacuation for rapidly developing releases (e.g., RDDs) if followed by evacuation.
  - It positions the public to receive additional instructions.
  - Since it may be implemented rapidly, sheltering-in-place may be the protective action of choice (followed with evacuation when feasible) if rapid evacuation is impeded by:
    - severe environmental conditions (e.g., severe weather or floods);
    - uncertainty in contamination levels along routes;
    - health constraints (e.g., patients and workers in hospitals and nursing homes);
    - long mobilization times that may be associated with certain individuals, such as industrial and farm workers, or prisoners and guards;
    - physical constraints to evacuation (e.g., inadequate roads or blockage due to debris).
- If a major release of radioiodine or particulate materials occurs, inhalation dose may be a controlling criterion for protective actions—
  - Breathing air filtered through common household items (e.g., folded handkerchiefs or towels) may help reduce exposures.
  - After confirmation that the plume has passed, continued sheltering-in-place should be re-evaluated. Shelters may ~~should~~ be opened to vent any airborne radioactivity trapped inside and people should remain sheltered until official notice about leaving high exposure areas as soon as possible to avoid exposure to deposited radioactive material.

1.7.5 ~~Considerations for Evacuation and Sheltering-In-Place~~

Advance planning is essential to identify potential problems that may occur in an evacuation. An NRC case study cites the following aspects of planning as contributing to efficiency and effectiveness of evacuation (NRC 2005)—

- High level of cooperation among agencies.
- Use of multiple forms of emergency communications.
- Community familiarity with alerting methods, the nature of the hazard and evacuation procedures.
- Community communication.
- Well-trained ~~emergency responders~~ emergency workers.

The NRC 2005 study included an evaluation of 50 incidents of public evacuation involving 1,000 or more people. The evacuations studied were initiated in response to natural disasters, technological hazards and malevolent acts occurring between January 1, 1990 and June 30, 2003. The report indicated that public familiarity with alerting methods and door-to-door notification were statistically significant factors for the efficiency of evacuation. The report also indicated that many communities are making improvements to response capabilities by modernizing communication systems, improving traffic flow, local education awareness and developing interagency and cross-boundary coordination plans.

~~Regardless of size,~~ Large or small population groups can be evacuated effectively with minimal risk of injury or death. In the NRC report, only six of the 50 cases studied involved deaths from the hazard and of those six, only one involved death from the evacuation itself (NRC 2005).

However, in 2005, not long after this report was published, the gulf coast of the United States was hit by a series of hurricanes that resulted in the evacuation of approximately 5 million people. During the evacuation that accompanied Hurricane Rita in Houston, Texas, 106 people were reported to have died as a direct result of the evacuation. It is estimated that at least two-thirds of the evacuees did not need to evacuate but did so because of poor communication, fear and poor traffic management (NRC 2008).

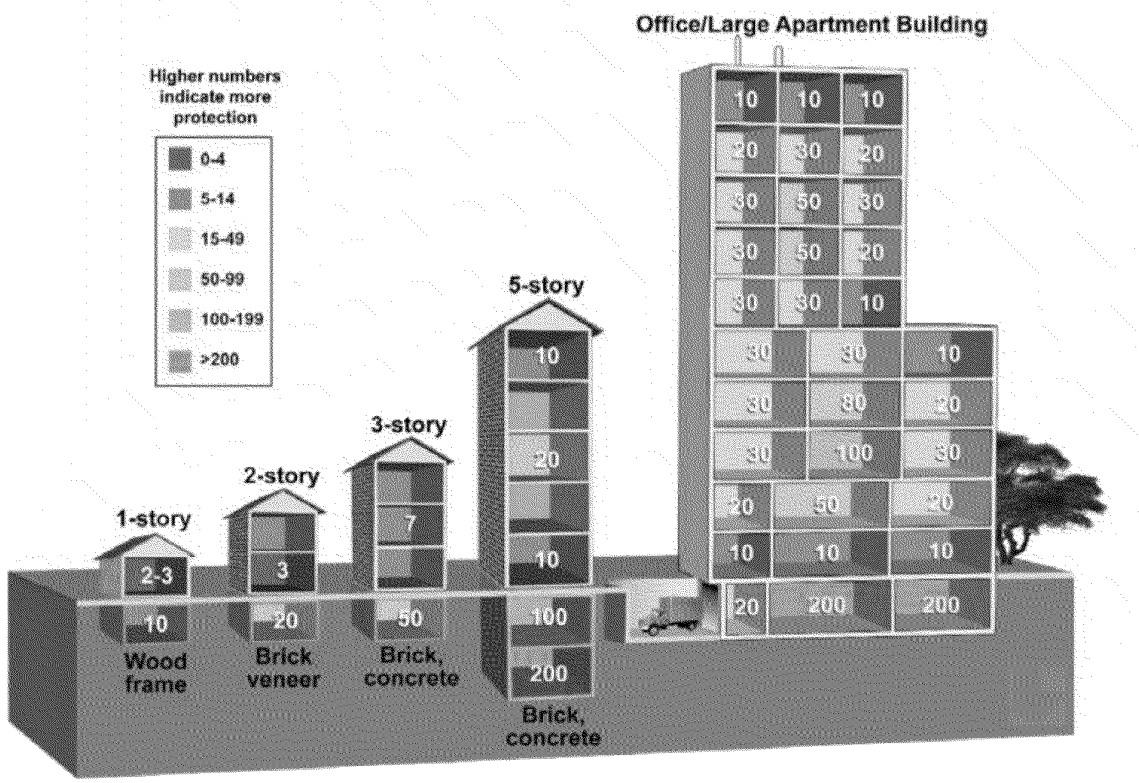
In a ~~recent~~ study of 230 mass evacuations in the U.S. ("Identification and Analysis of Factors Affecting Emergency Evacuations" NUREG/CR-6484, 2004) only six cases involved deaths from the hazard itself, and of these six, only one case involved deaths during the evacuation itself. Only two cases involved injuries during the evacuation. Traffic issues, such as traffic congestion, were reported in 28% of the evacuation cases studied. However, traffic accidents occurred in only 8% of the cases.

During the tsunami and nuclear disaster response in Japan in 2011, over 1,000 deaths occurred during evacuations, primarily among elderly hospital patients being moved from areas without power. Compounded disaster conditions including aftershocks, widespread power outages and radiation releases led to prolonged transit along routes extended to avoid hazards.

The emergency planning process for radiological incidents should include effective traffic management plans and communications plans, including pre-scripted messages, provisions for evacuation of special needs populations, such as children in schools and child care facilities, people in institutions and people who have impaired mobility or lack personal transportation.

The degree of protection provided by structures is affected by factors such as attenuation of gamma radiation (shielding) by structural components (the mass of walls, ceilings, etc.) and outside/inside air exchange rates (see Figure 2-2). The use of large structures, such as shopping centers, schools, churches and commercial buildings, as collection points during evacuation mobilization will generally provide greater protection against gamma radiation than use of small structures. As with evacuation, delay in taking shelter during plume passage will result in higher exposure to radiation.

Figure 2-1: Exposure reduction from external radiation from nuclear fallout as a function of building type and location.



The numbers represent dose reduction factors. A dose reduction factor of 10 indicates that a person in that area would receive 1/10th of the dose of a person in the open. A dose reduction factor of 200 indicates that a person in that area would receive 1/200th of the dose of a person out in the open.
Figure taken from Planning Guidance for Response to a Nuclear Detonation, Second Edition, National Security Staff

Interagency Policy Coordination Subcommittee for Preparedness and Response to Radiological and Nuclear Threats, June 2010, courtesy of Lawrence Livermore National Laboratory. The protection factors in this figure are specific to nuclear detonation fallout, but the variations in factors throughout typical buildings may be informative for other airborne radiological releases.

1.7.6 Considerations for Potassium Iodide (KI)

FDA updated its guidance on the use of KI as a thyroid blocking agent during radiological emergencies in 2001 (FDA 2001[10] and FDA 2002[11]). FDA based these dose recommendations on a review of the thyroid cancer data from the Chernobyl reactor accident of April 1986 and the experience of Poland in administering KI following the Chernobyl release (FDA 2001).

Table 2-2

Threshold Thyroid Radioactive Exposures and Recommended Doses of KI for Different Risk Groups

	Predicted Thyroid exposure (cGy)	KI dose (mg)	# of 130 mg tablets	# of 65 mg tablets
Adults over 40 yrs	≥500	130	1	2
Adults over 18 through 40 yrs	≥10			
Pregnant or lactating women	≥5			
Adults. Over 12 through 18 yrs*		65	1/2	1
Children over 3 through 12 yrs				
Over 1 month through 3 yrs		32	1/4	1/2
Birth through 1 month		16	1/8	1/4

However, FDA understands that a KI administration program that sets different projected thyroid radioactive exposure thresholds for treatment of different population groups may be logistically impractical to implement during a radiological emergency. In such cases, FDA recommends that KI be administered to both children and adults at the lowest intervention threshold (i.e., >5 rem (50 mSv) projected internal thyroid exposure in children)[12] (FDA 2002).

Regarding dosage of KI, FDA's guidance adheres to principles of minimum effective dose and therefore recommends graded dosing according to age (and thus, in effect, body size). There is ample evidence that the recommended doses, as well as higher doses (e.g., up to 130 mg), will effectively block thyroidal uptake of radioactive iodine if taken in advance of exposure. Furthermore, particularly among school-age children, higher milligram doses are extremely safe. However, FDA continues to emphasize attention to KI dosing in infants. Excess iodine intake can lead to transient iodine-induced hypothyroidism. Individuals who are intolerant of KI at protective doses, as well as neonates, pregnant, and lactating women, should be given priority with regard to other protective measures (i.e., sheltering, evacuation, and control of the food supply). In summary, if local emergency planners conclude that graded dosing is logistically impractical, FDA believes that for populations at risk for radioiodine exposure, the overall benefits of taking up to 130 mg of KI instead of the lower doses recommended for certain age groups far exceed the small risks of overdosing. However, where feasible, adherence to FDA guidance should be attempted when dosing infants. (FDA 2002).

[10] Food and Drug Administration [FDA]. Guidance Potassium Iodide as a Thyroid Blocking Agent in Radiation Emergencies. Federal Register, 66, 64045: 2001.

[11] Food and Drug Administration [FDA]. Guidance for Industry - KI in Radiation Emergencies -- Questions and Answers. Food and Drug Administration, Center for Drug Evaluation and Research. Procedural, Revision 1. Rockville, MD, (2002).

[12] Food and Drug Administration [FDA]. Guidance for Industry - KI in Radiation Emergencies -- Questions and Answers. Food and Drug Administration, Center for Drug Evaluation and Research. Procedural, Revision 1. Rockville, MD, (2002).

Note that KI is effective only against uptake of radioiodine, and is best taken prior to or just after exposure. The protective effect of a single dose of KI lasts approximately 24 hours. It should be administered daily until the risk of significant exposure to radioiodine (either by inhalation or ingestion) no longer exists, i.e., once the plume has passed. KI is a supplemental action, secondary to evacuation or sheltering. It should not be used as a substitute for evacuation or sheltering. Many communities do not use KI.

It should be noted that adults over 40 need to take KI only in the case of a projected large internal radiation dose to the thyroid (>500 rem (5 Sv) to prevent hypothyroidism which could lead to lifelong dependence on thyroid hormone replacement therapy. Thyroid irradiation in adults over 40 years of age is associated with an extremely low incidence of cancer (FDA 2001).

Some people should not take KI. As a rule, individuals with known allergy to iodine or with pre-existing thyroid disease (e.g., Graves' disease, thyroid nodules, Hashimoto's thyroiditis) that might predispose them to adverse reactions should avoid KI. Allergies to iodine and to shellfish are not related. People allergic to shellfish need not worry about cross reactions with stable iodine. More information is available at: http://www.foodallergy.org/allergens/shellfish-allergy and http://www.acaai.org/allergist/Resources/ask-allergist/Pages/Is_Shellfish_Allergy_Related_to_Iodine.aspx

Pregnant women should be given KI for their own protection and for that of the fetus, as iodine (whether stable or radioactive) readily crosses the placenta. However, because of the risk of blocking fetal thyroid function with excess stable iodine, repeat dosing with KI of pregnant women should be avoided.

Lactating females should be administered KI for their own protection, as for other young adults, and potentially to reduce the radioiodine content of the breast milk, but not as a means to deliver KI to infants, who should get their KI directly. As for direct administration of KI, stable iodine as a component of breast milk may also pose a risk of hypothyroidism in nursing neonates. Therefore, repeat dosing with KI should be avoided in the lactating mother, except during continuing severe contamination. If repeat dosing of the mother is necessary, the nursing neonate should be monitored.

Once the plume has passed, protective actions such as evacuation and/or sheltering-in-place and food control measures to limit exposure to radioiodine should be implemented and the administration of KI should be suspended. Food control measures include providing the public with non-contaminated food supplies while awaiting the eventual radioactive decay of contaminated food. Consumption of contaminated food may be permitted on a case-by-case basis after surveying the foodstuffs and determining the level of contamination consistent with FDA food and animal feeds guidance. As a result of radioactive decay, grain products and canned milk and vegetables from sources affected by radioactive fallout will not present a risk from radioiodine if they have been stored for weeks to months after production.

An RDD is not likely to contain radioiodine, so administration of KI would not be necessary in such incidents. The administration of other prophylactic drugs should be evaluated on a case-by-case basis depending on the nature of the event and the radioisotopes involved. For more information on radiological prophylactics and treatments, see: http://www.fda.gov/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness.

1.7.7 PAGs and Nuclear Facilities Emergency Planning Zones (EPZ)

Under NRC regulations, before a nuclear power reactor may be issued a license, the NRC must find that licensee, state and local emergency plans are adequate and that they can be implemented. For nuclear power reactors, there is a plume exposure EPZ within a 10 mile (16.1 km) radius of the plant and for a separate ingestion pathway EPZ within a 50 mile (80.5 km) radius. The sizes of these EPZs were developed by the NRC/EPA Task Force Report on Emergency Planning, NUREG-0396/EPA 520/1-7-016 and are based, in part, on the numerical values of the PAGs for the plume exposure and ingestion pathway EPZ. The licensee develops and maintains a detailed emergency plan for its facility while state and local authorities within the EPZ develop and maintain detailed emergency response plans for their respective jurisdictions. Guidance to these licensees, states and local agencies for developing these emergency response plans, including guidance

on arrangements for implementing immediate protective actions is primarily contained in NUREG-0654/FEMA-REP-1 (NRC 1980)[13] and supplemented with other guidance issued by NRC (for licensees) and FEMA (for off-site response organizations).

Planning for incidents at other types of nuclear facilities should be developed using similar considerations. Emergency preparedness requirements for non-power reactors (e.g., test and research facilities) are provided in 10 CFR Part 50 Appendix E with supporting guidance in NRC Regulatory Guide 2.6, "Emergency Planning for Research and Test Reactors." Emergency preparedness requirements for fuel cycle and materials facilities are provided in 10 CFR Parts 30, 40, and 70 with supporting guidance in NRC Regulatory Guide 3.67, "Standard Format and Content for Emergency Plans for Fuel Cycle and Materials Facilities." Because of the relatively limited number and diverse nature of these facilities, the size of the EPZ, is determined, if needed, on a case-by-case basis for reactors with an authorized power level less than 250 MW thermal.

Within an EPZ, an area should be pre-designated for immediate response based on specified plant conditions prior to a release, or, given a release, prior to the availability of information on quantities of radioactive materials released. The shape of this area will depend on local topography, as well as political and other boundaries. Additional areas of the EPZ, particularly in the downwind direction, may require evacuation or sheltering-in-place, as determined by dose projections. The size of these areas will be based on the potential magnitude of the release and on an angular spread determined by meteorological conditions and any other relevant factors.

The pre-designated areas for immediate protective action may be reserved for use only in the most severe incidents and in cases when the facility operator cannot provide a quick estimate of projected dose based on actual releases. For lesser incidents, or if the facility operator is able to provide prompt off-site dose projections, the area for immediate protective action may be specified at the time of the incident instead of using a pre-designated area. Regardless of the basis for the initial protective action, radiological assessments need to continue through the duration of the event and if warranted, the initial protective actions extended into additional geographical areas.

Such prompt off-site dose projections may be possible when the facility operator can estimate the potential off-site dose based on information at the facility, using relationships developed during planning that relate abnormal plant conditions and meteorological conditions to potential off-site doses. After the release starts and the release rate is measurable, or when plant conditions or measurements can be used to estimate the characteristics and rate of the release, then these factors, along with atmospheric stability, the accuracy of these methods for estimating projected dose will be uncertain prior to confirmatory field measurements because of unknown or uncertain factors affecting environmental pathways, inadequacies of computer modeling and uncertainty in the data for release terms.

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[13] ~~Immediate protective actions based on in-plant conditions and EPZs established by NUREG-0654/FEMA-REP-1 are not applicable to naval nuclear propulsion plants. The largest naval reactors are rated at less than one-fifth of a large U.S. commercial NPP. In addition, since reactor power is directly linked to propulsion requirements, naval nuclear propulsion plants typically operate at low power when the ship is close to shore where high speeds are not required and are normally shut down when in port. Therefore, less than about 1% of the radioactivity contained in a typical commercial NPP could be released from a naval nuclear propulsion plant, limiting the possible dose to the general public and the size of the area of potential concern. Therefore, there is no need for towns and cities to have special emergency response plans such as those required for cities near commercial NPPs.~~ Immediate protective actions based on in-plant conditions and EPZs established by NUREG-0654/FEMA-REP-1 are not applicable to naval nuclear propulsion plants. The largest naval reactors are rated at less than one-fifth of a large U.S. commercial NPP. In addition, since reactor power is directly linked to propulsion requirements, naval nuclear propulsion plants typically operate at low power when the ship is close to shore where high speeds are not required and are normally shut down when in port. Therefore, less than about 1% of the radioactivity contained in a typical commercial NPP could be released from a naval nuclear propulsion plant, limiting the possible dose to the general public and the size of the area of potential concern. Therefore, existing all-hazards emergency response plans for responding to natural and industrial disasters are adequate to protect the public in areas around facilities where naval nuclear powered ships are located. However, the NNPP maintains close relationships with civil authorities to ensure that communications and emergency responses are coordinated, if required. Periodic exercises are conducted with all States and Guam where U.S. nuclear-powered warships are homeported and NNPP facilities are located.

The EPZs should be large enough to cover affected urban and rural areas and accommodate the various organizations needed for emergency response.[14]Although the size of the EPZ is based on the maximum distance at which a PAG might be exceeded, the actual boundary of an EPZ should be demarcated by features readily identifiable by people within that area. Such boundaries generally include major topographical features (e.g., rivers, roads, transmission line corridors, rail rights of way) and political boundaries. The EPZ should be further subdivided, using similarly identifiable features, to facilitate implementing protective actions when the entire EPZ is not affected. Maps, showing the boundaries of the EPZ and the sub-areas and evacuation routes should be provided to the public within the EPZ on a periodic basis in a format that will likely be available if the emergency occurs (e.g., inserted sections in local phone directories, wall calendars, etc.) EPZs are not necessary at those facilities where it is not possible for PAGs to be exceeded off-site.

1.8 DOSE PROJECTIONS

The PAGs in this chapter are specified in terms of the projected whole body dose. This projected dose is the sum of the effective dose from external exposure to the plume and the committed effective dose from inhaled radionuclides. Guidance is also provided on the thyroid equivalent dose. Further references to effective or organ dose equivalent refer to these two quantities, respectively. The FRMAC Assessment Manuals[15] provide detailed methods for estimating projected dose. These methods require knowledge of, or assumptions for, the intensity and duration of exposure and make use of standard assumptions on the relation, for each radioisotope, between exposure and dose. Exposure and dose projections should be based on the best estimates available. The FRMAC methods and models may be modified as necessary for specific sites for improved accuracy. Emergency response organizations are encouraged to use the most current, applicable tools and methods for implementing PAGs, understanding that differing approaches and assumptions will produce results with minor differences.

1.8.1 Dose Projection during the Early Phase

PAGs are expressed in terms of projected dose. The calculation of projected doses should be based on realistic dose models, to the extent practicable. Public protection decisions should be based upon the dose that can be avoided (i.e., avoidable dose) by taking some protective action (e.g., evacuation, sheltering). Unavoidable dose or doses incurred before the start of the protective action being considered generally should not be included in evaluating the need for protective action. Similarly, doses that may be incurred at later times than those affected by the specific protective action should not be included. As noted earlier, the projection of doses in the early phase needs to include only those exposure pathways that contribute a significant fraction (i.e., more than 10 percent) of the dose to an individual.

In the early phase of an incident, parameters other than projected dose may provide a more appropriate basis for decisions to implement protective actions. When a facility is operating outside its design basis and a substantial release to the environment has started, or is imminent but has not yet occurred, data adequate to directly estimate the projected dose may not be available. Emergency response plans should anticipate specific conditions at the source of a potential release and the possible consequences off-site. Emergency response plans for NPPs and facilities should make use of emergency action levels (EALs), based on in-plant conditions, to trigger notification and initial protective action recommendations to off-site officials.[16]Once the initial protective actions have been implemented, accident assessment should continue. Although initial assessments may be uncertain, the subsequent assessments will be less uncertain as additional information on facility condition and prognosis, effluent radiation monitoring data and environmental data become available. The results of these continuing radiological assessments, including dose projections, should be used as the basis for

[14] The development of EPZs for nuclear power facilities is discussed in the NUREG 0396 (NRC 1978).

[15] See FRMAC Assessment Manuals at http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.

[16] Immediate protective actions based on in-plant conditions are not applicable to naval nuclear propulsion plants. See Footnote 13 for additional information. In addition, because of differences in design and operation, EALs based on in-plant conditions are not applicable to naval nuclear propulsion plants.

refining the initial protective actions. In the case of transportation accidents, an RDD or IND, or other incidents that are not related to a facility, it may not be practicable to establish EALs.

Doses that may be incurred from ingestion of food and water, long-term radiation exposure (i.e., longer than four days), radiation exposure to deposited radioactive materials, or long-term inhalation of resuspended materials are chronic exposures for which neither emergency evacuation nor sheltering-in- place are appropriate protective actions. PAGs for the intermediate phase cover these exposure pathways (see Chapter 4).

1.8.2 Duration of Exposure

The projected dose for comparison to the early phase PAGs is calculated for exposure during the first four days following the anticipated (or actual) start of a release. The objective is to encompass the entire period of exposure to the plume and deposited material prior to implementation of any further, longer- term protective action such as relocation. For planning purposes, the four-day period is chosen as the duration of exposure during the early phase because it is a reasonable estimate of the time necessary to make measurements, reach decisions and prepare to implement further protective actions (such as relocation) if necessary. However, officials at the site at the time of the emergency may decide that a different time frame is more appropriate.

For example, doses incurred through ingestion pathways or long-term exposure to deposited radioactive materials take place over a longer time period. Protective actions for such exposures should be based on guidance addressed in Chapter 4.

The projected dose from each radionuclide in a plume is proportional to the time-integrated concentration of the radionuclide in the plume at each location. This concentration will depend on the rate and the duration of the release and meteorological conditions. Release rates will vary with time and this time-dependence cannot usually be predicted accurately. In the absence of more specific information, the release rate may be assumed to be constant.

Another factor affecting the estimation of projected dose is the duration of the plume at a particular location. For purposes of calculating projected dose from most pathways, exposure will start at a particular location when the plume arrives and will end when the plume is no longer present. Exposure from deposited materials will continue for an extended period as long as people are present. Other factors such as the aerodynamic diameter and solubility of particles, shape of the plume and terrain may also affect estimated dose and may be considered on a site- or source- specific basis.

Prediction of time frames for releases is difficult because of the wide range associated with the spectrum of potential incidents. Therefore, planners should consider the possible time periods between an initiating event and arrival of a plume and the duration of releases in relation to the time needed to implement competing protective actions (i.e., evacuation and sheltering-in-place). Analyses of commercial nuclear power reactors (NRC 1975) have shown that some incidents may take several days to develop to the point of a release while others may begin as early as a half hour after an initiating event. Furthermore, the duration of a release may range from less than 1 hour to several days, with the major portion of the release likely occurring within the first day.

Wind speed also influences radiological exposure rates from a plume. As a general rule, air concentration is inversely related to the wind speed at the point of release. Concentrations are also affected by the turbulence of the air, which tends to increase with wind speed and sunlight and by wandering of the plume, which is greater at the lower wind speeds. This results in higher concentrations generally being associated with low winds near the source and with moderate winds at larger distances. Higher wind speed also shortens the travel time of the plume. Planning information on time frames for releases from nuclear power facilities may be found in references NRC 1978 and EPA 1978. Time frames for releases from other facilities will depend on the characteristics of the facility.

1.8.3 Derived Response Levels and Dose Parameters

A Derived Response Level (DRL) is a level of radioactivity in an environmental medium that would be expected to produce a dose equal to its corresponding PAG. Depending on the exposure pathway, many factors such as ground roughness, weathering and resuspension may be required to calculate the Dose Parameter (DP) that converts an environmental measurement into a projected dose over a given time period (e.g., Early Phase). ~~A Dose Conversion Factor (DCF) is any factor used to change an environmental measurement to dose in the units of concern. Depending on the exposure pathway, other factors besides the DCF may be required to convert an environmental measurement into a dose~~.

The FRMAC Assessment Manuals[17] provide guidance in calculating DRLs and DPs ~~DCFs~~ based on the ICRP dosimetry models (ICRP 60 series). In addition, the FRPCC encourages the use of computational tools such as DOE's Turbo FRMAC and NRC's Radiological Assessment System for Consequence Analysis (RASCAL) as well as other appropriate or more current tools to implement the PAGs.

1.8.4 Higher PAGs for Special Circumstances

Hazardous environmental conditions (e.g., severe weather or a competing disaster) could create transportation risks from evacuation that would be higher than normal. It is therefore appropriate to allow higher projected doses for evacuation decisions under these circumstances. In the absence of any definitive information on such higher risks from evacuation, one should assume that it would be appropriate to increase the recommended projected dose for evacuation of the general population under hazardous environmental conditions up to a factor of five higher than that used under normal environmental conditions.

It is also recognized that people who are not readily mobile are at higher risk from evacuation than are average members of the population. It would be appropriate to adopt higher PAGs for evacuation of individuals who would be at greater risk from evacuation itself than for the typically healthy members of the population, who are at low risk from evacuation. In the absence of definitive information on the higher risk associated with the evacuation of this group, one should assume that it is appropriate to adopt PAGs a factor of five higher for evacuation of high risk groups under normal environmental conditions. If both conditions exist, (high risk groups and hazardous environmental conditions) projected doses up to ten times higher than the PAGs for evacuation of the general population under normal conditions may be justified. These doses are expected to satisfy Principle 4 without violating Principles 1 and 3. Although they violate Principle 2, Principle 4 becomes, for such cases, the overriding consideration.

1.9 CONTAMINATION LEVELS AND MONITORING OF THE ENVIRONMENT AND POPULATIONS

Areas under the plume can be expected to contain deposited radioactive materials if aerosols or particulate materials were released during the incident. In extreme cases, individuals and equipment may be highly contaminated and monitoring stations will be required for emergency monitoring, decontamination of individuals and medical evaluations. Equipment should be checked and decontaminated as necessary to avoid the spread of contamination to other locations. This monitoring service would be required for only a few days following plume passage until all ~~such people~~ have been evacuated ~~or relocated~~. Guidance on surface contamination levels for use at such monitoring stations is provided below.

Adults may reenter restricted areas under controlled conditions in accordance with occupational exposure standards. The need for monitoring stations should be evaluated along highways, which serve as the major evacuation or transportation routes, to control surface contamination at exits from the more highly contaminated areas. Decontamination and other measures should be implemented to maintain low- exposure rates at monitoring stations.

[17] See FRMAC Assessment Manuals at http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.

A contaminated item should not be released to an unrestricted area. Based on incident and locality specific considerations, it may be acceptable to release contaminated materials if the level of surface contamination is below acceptable release criteria. As an alternative to decontamination, contaminated items (i.e., not people or animals) may be retained in the restricted area while the radiological contamination decays.

In some extreme cases, decontamination may be impractical. Evacuating a large area requires resources, and decontamination may conflict with priority use of those resources. Screening and decontamination can slow egress, which could result in increased dose to the evacuees. Emergency managers should consult with their state radiation control authority to establish proposed radiation screening criteria. Refer to CDC's "Population Monitoring in Radiation Emergencies: A Guide for State and Local Public Health Planners" (CDC 2014)[18] for additional in-depth discussion in Appendix D on radiological screening criteria for external contamination. These simple initial screening guides from CDC are more general than FEMA REP-21 and REP-22 on use of handheld instruments and portal monitors for screening the public.

Surface Contamination Control

Surface contamination must be controlled both before and after evacuation protective actions are implemented. The contamination level for screening people, animals and objects for surface contamination at monitoring stations should be influenced by the potential for the contamination to be ingested, inhaled or transferred to other locations. The principal exposure pathways for loose surface contamination on people, clothing and equipment are:

- Internal doses from ingestion by direct transfer;
- Internal doses from inhalation of resuspended materials;
- Beta dose to skin from contaminated skin or clothing or from nearby surfaces;
- Dose to the whole body from external gamma radiation; and
- Internal doses from absorption of contamination into wounds.

It is not practical to set surface contamination screening levels significantly lower than residual contamination levels in uncontrolled areas. Although the contamination levels recommended in this manual are accordingly set high, consideration should be given as the incident event progresses to using lower contamination screening levels (and more sensitive monitoring instruments) once people are removed from areas causing high external doses. Such efforts will minimize cross-contamination of people located outside of the affected areas. For incidents involving fixed nuclear facilities, some evacuation reception centers or shelters will have walk-through portal monitors.

The recommended "2x existing background" level for screening for surface contamination at monitoring stations is merely a simplified basis for responders to set their own instrument trigger levels based on practical circumstances at the time and location of each screening center. Local and state officials may choose to establish a screening level expressed in measurements units (e.g., cpm, μR/h) that are compatible with radiation detection instruments being used and appropriate for local conditions, taking into account the number of people in need of screening and available resources.[19] The following guidance documents provide more detailed information about initial screening levels:

- "Population Monitoring and Radionuclide Decorporation Following a Radiological or Nuclear Incident," (NCRP Report No. 166), Bethesda, MD, 2011.
- "Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers," (NCRP Report No. 165), Bethesda, MD, 2010.
- "Management of Persons Contaminated with Radionuclides: Scientific and Technical Bases," (NCRP

[18] See: http://emergency.cdc.gov/radiation/pdf/population-monitoring-guide.pdf (CDC 2014)

Report No. 161, Vol. II), Bethesda, MD, 2010. Chapter 5: Performing Surveys and Controlling Personnel and Area Contamination.

- "Management of Persons Contaminated With Radionuclides: Handbook" (NCRP Report No. 161, Vol. I), Bethesda, MD, 2008.

Priorities for Control of Contaminated Areas

The following priorities are recommended—

- Do not delay urgent medical care for decontamination efforts or for time-consuming protection of attendants, such as donning of additional anti-contamination clothing.
- In early phase scenarios where it might not be practical or would interfere with other lifesaving and public health protection priorities, do not waste effort trying to contain contaminated wash water and be sure to notify sewage treatment plants.
- Do not allow monitoring and decontamination to delay an ordered evacuation.
- When early screening is needed after a major incident — After plume passage, it may be necessary to establish emergency contamination monitoring stations in areas not qualifying as low background areas. These monitoring stations should be used only during the early phase after major atmospheric releases to monitor people emerging from possible high exposure areas. The stations should be set up to provide simple (rapid) decontamination if needed and to evaluate whether affected people should undergo more extensive decontamination or other special care. Section 2.3.3 provides guidance on surface contamination levels for use if such emergency contamination monitoring stations centers are needed.
- Establish screening to control surface contamination — Establish monitoring and personnel decontamination (e.g., bathing) facilities at evacuation centers or other locations in low background areas (less than 0.1 millirem (1 µSv) per hour gamma exposure rate). Section 2.3.4 provides surface contamination guidance for monitoring stations in low background areas. These surface contamination screening levels are examples derived primarily on the basis of easily measurable radiation levels using portable instruments. The background may be elevated because of the incident, so these screening levels refer to a "2x existing background" level in a low radiation area.
- Encourage self-decontamination — Encourage evacuated people who were exposed in areas where release of particulate materials would have warranted evacuation to change and bag the clothes they were wearing and store them in an area away from people and pets until authorities provide further instructions on their disposition, to wash other exposed surfaces such as cars and trucks and their contents and then report to evacuation centers or other established locations for monitoring.
- After the evacuation area has been established, consider the need to set up monitoring and decontamination stations at exits from the more highly contaminated parts of the area. Low levels of contamination may be undetectable because of high background radiation levels at these locations. Monitoring should be done at lowest practical background levels. Nevertheless, these individuals should be advised to bathe and change clothes at their first opportunity—no later than within the next 24 hours. If, after decontamination, people still exceed the surface contamination screening levels for the station, they should be sent for further decontamination or for medical or other special attention.
- ~~**Table 2-5**. Recommended surface contamination screening levels for emergency screening of people and objects at monitoring station in high background radiation areas with elevated background area (0.1 mR/h to 1 mR/h or 1 to 10 µSv/h Gamma Exposure Rate)).~~

~~Condition~~	~~Appropriate detection instrument reading~~	~~Recommended Action~~
~~Before Decontamination~~	~~<2x existing background~~	~~Unconditional release~~ ~~Release for further screening outside affected area~~

	>2x existing background	Decontaminate. Equipment may be stored or disposed of as appropriate.
After Decontamination	<2x existing background	Unconditional release Release for further screening outside affected area
	>2x existing background	Continue to decontaminate or refer to low background monitoring and decon station. Equipment may be stored for decay or disposed of as appropriate.

[b] Monitoring stations in such high exposure rate areas are for use only during the early phase of an incident involving major atmospheric releases of particulates. Otherwise use Table 2-6.

Table 2-6. Recommended Surface Contamination Screening Levels for Peoplea and Objects at Monitoring Stations in Low Background Radiation Areas (<0.1 mR/h Gamma Exposure Rate)b

Condition	**Appropriate detection instrument reading**	**Recommended Action**
Before decontamination	<2x existing background	Unconditional release
	>2x existing background	Decontaminate Partial Decontamination
After simple[c] decontamination effort	<2x existing background	Unconditional release
	>2x existing background	Full decontamination
After full[d] decontamination effort	<2x existing background	Unconditional release
	>2x existing background	Continue to decontaminate people Release animals and equipment
After additional full decontamination effort	<2x existing background	Unconditional full release
	>2x existing background	Send people for further evaluation Release animals and equipment

[a] People reporting to monitoring stations in low background radiation areas have been previously instructed to change and bag clothes, wash other exposed surfaces such as cars and their contents and then report to these centers for monitoring.
[b] Levels higher than 2x existing background (not to exceed the meter reading corresponding to 0.1 mR/h) may be used to speed the monitoring of evacuees in very low background areas.
[c] Washing hands and face and localized wiping are examples of a partial decontamination effort.
[d] Changing clothes and/or showering are examples of a full decontamination effort.

Recommendations for Emergency Screening in Areas Not Qualifying as Low Background Areas

This section provides the recommended surface contamination screening levels for emergency screening of people and objects at monitoring stations in high background radiation areas in areas with elevated background radiation (exceeding 0.1 mR/h or 1 µSv/h gamma exposure rate). Monitoring stations in such high exposure rate areas are for use only during the early phase of an incident involving major atmospheric releases of particulates (otherwise see Section 2.3.4). For such emergency screening at monitoring stations, recommended actions for a detection instrument reading at either less than or greater than 2x existing background are outlined

below.

- **Before Decontamination**:
  - If <2x existing background — Recommended action: Release for further screening outside affected area.
  - If >2x existing background — Recommended action: Perform gross decontamination (carefully remove outer layer of clothing) and/or simple decontamination (examples include washing hands and face, wiping of exposed skin, washing feet or soles of shoes). Equipment may be stored for decay, reuse or disposal in the same area, as appropriate.

- **After Decontamination**:
  - If <2x existing background — *Recommended action:* Release for further screening outside affected area.
  - If >2x existing background — *Recommended action:* Continue to decontaminate or refer to low background monitoring and decontamination station. Equipment may be stored for decay, reuse or disposal in the same area, as appropriate.

Recommendations for Screening in Low Background Areas

This section provides the recommended surface contamination screening levels for people and objects at monitoring stations in low background radiation areas (<0.1 mR/h or 1 µSv/h gamma exposure rate). People reporting to monitoring stations in low background radiation areas have been previously instructed to change and bag clothes, wash other exposed surfaces such as cars and their contents and then report to these centers for monitoring. Levels higher than 2x existing background (not to exceed the meter reading corresponding to 0.1 mR/h) may be used to speed the monitoring of evacuees in very low background areas. For screening at monitoring stations in low background areas, recommended actions for a detection instrument reading at either less than or greater than 2x existing background are outlined below.

- **Before Decontamination**:
  - If <2x existing background — Recommended action: Unconditional release.
  - If >2x existing background — Recommended action: Perform gross decontamination (carefully remove outer layer of clothing) and/or simple decontamination (examples include washing hands and face, wiping of exposed skin, washing feet or soles of shoes).

- **After Simple Decontamination Effort**:
  - If <2x existing background — Recommended action: Unconditional release.
  - If >2x existing background — Recommended action: Full decontamination.

- **After Full Decontamination Effort** (Changing clothes and/or showering are examples of a full decontamination effort. Washing or gentle scrubbing with soap or other mild detergent followed by flushing is another example of a full decontamination effort.):
  - If <2x existing background — Recommended action: Unconditional release.
  - If >2x existing background — Recommended action: Continue to decontaminate people.

- **After Additional Full Decontamination Effort**:
  - If <2x existing background — Recommended action: Unconditional full release.
  - If >2x existing background — Recommended action: Send people for further evaluation.

The recommended "2x existing background" level for screening for surface contamination at monitoring stations is merely a simplified basis for responders to set their own instrument trigger levels based on practical circumstances at the time and location of each screening center. Local and state officials may choose to

establish a screening level expressed in measurements units (e.g., cpm, µR/h) that are compatible with radiation detection instruments being used and appropriate for local conditions, taking into account the number of people in need of screening and available resources.

KEY POINTS IN CHAPTER 2 – EARLY PHASE

- The principal protective actions for the early phase are evacuation or sheltering-in-place. Evacuation is the urgent removal of people from an area to avoid or reduce high-level, short-term exposure from the plume or deposited activity. Sheltering-in-place refers to the use of a readily available structure that will provide protection from exposure to the plume.
- The PAG for evacuation or sheltering-in-place is a projected whole body dose of 1 to 5 rem (10 – 50 mSv) total effective dose (TED) over four days.
- Evacuation is appropriate when its risks and secondary effects are less severe than the risk of the projected radiation dose. Evacuation will be most effective in avoiding dose if completed before plume arrival.
- In general, sheltering-in-place should be preferred to evacuation whenever it provides equal or greater protection. After confirmation that the plume has passed, continued sheltering-in-place should be re-evaluated by public officials.
- The administration of KI to partially block the uptake of radioiodines by the thyroid is a supplemental protective action. The PAG for administration of KI is 5 rem (50 mSv) projected child thyroid dose. Other medical countermeasures are available, as well.
- Dose calculations for PAGs are made using the dose parameter (DP) and derived response level (DRL) calculation methods referenced in the FRMAC Assessment Manuals. Emergency response organizations are encouraged to use the most current, applicable tools and methods for implementing the PAGs. ~~Dose calculations for PAGs are made using the DCF and DRL calculation methods referenced in the FRMAC Assessment Manuals. Emergency response organizations are encouraged to use the most current, applicable tools and methods for implementing the PAGs.~~

CHAPTER 3. EMERGENCY WORKER PROTECTION

1.10 INTRODUCTION

These emergency worker guidelines were developed for a wide range of possible radiological scenarios, from a small transportation accident that may impact a single roadway to an IND that could potentially impact a large geographic region. Therefore, the 5, 10 and 25 rem (50, 100 and 250 mSv) guidelines (Table 2-2) should not be viewed as inflexible limits applicable to the range of early phase emergency actions covered by this guidance. Because of the range of impacts and case-specific information needed, it is impossible to develop a single turn-back dose level for all responders to use in all events, especially those that involve lifesaving operations. Indeed, with proper preparedness measures (training, personal protective equipment (PPE), etc.) most radiological emergencies addressed by this document, even lifesaving operations, may be manageable within the 5 rem (50 mSv) occupational limit. Moreover, Incident Commanders should make every effort to employ the ''as low as reasonably achievable'' (ALARA) principle after an incident. Still, in some incidents doses above the annual occupational 5 rem (50 mSv) dose limit may be unavoidable. For instance, in the case of a catastrophic incident, such as an IND, Incident Commanders may need to consider raising the lifesaving and valuable property (i.e., necessary for public welfare) emergency worker guidelines in order to prevent further loss of life and prevent the spread of massive destruction. It is essential that emergency workers have full knowledge of the associated risks prior to initiating emergency action and medical evaluation of emergency workers after such exposure.

Worker and public protection guidance and standards for normal operations are developed through risk management approaches and are implemented in federal and state regulations (e.g., 10 CFR Part 20; 10 CFR Part 835; 29 CFR Part 1910.1096). However, many factors or decision criteria in a radiological emergency differ from those in normal operations. Although there are times when implementation of standards or guidelines can cause or enhance other risks, these secondary risks can be controlled. Standards for normal operations provide a margin of safety that is greater than that in guidelines for emergency response because that margin can be provided in a manner that ensures no significant increase in public health risk or detriment to the public welfare. Currently, the development of standards and guidelines for normal operations is done in a manner that provides reasonable assurance that implementation of the standards will not cause more risk than it averts.

Response organizations need to develop plans and protocols that address radiation protection during a radiological incident and that ensure appropriate training is provided to responders and decision makers. Detailed reports on radiation risk, risk management decision making, training and public communication should be consulted in the development of plans, protocols and training materials and may be obtained from organizations such as ICRP, the National Council on Radiation Protection and Measurements (NCRP), International Atomic Energy Agency (IAEA), the American Nuclear Society (ANS) and the Health Physics Society (HPS). Detailed information on the risks of radiological emergency response and worker protection procedures can be found in the FRMAC "Radiological Emergency Response Health and Safety Manual" (DOE 2012) and the NCRP's "Management of Terrorist Events Involving Radioactive Material, Report No. 138" (NCRP 2001) and "Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers, Report No. 165" (NCRP 2010).

"Higher doses could be received by ~~emergency responders~~ emergency workers performing what NCRP Report No. 165, "Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers" calls "Time-Sensitive Mission-Critical" activities that could result in radiation doses higher than 25 rem. NCRP Report No. 165 expands the discussion on a Decision Dose of 50 rad. A Decision Dose can be used by the Incident Commander as a tool to address the need to and the consequences of exposing ~~emergency responders~~ emergency workers to higher doses to accomplish Mission Critical actions. This is especially important in an Improvised Nuclear Device (IND) incident."

~~1.11~~ CONTROLLING OCCUPATIONAL EXPOSURE AND DOSES TO ~~emergency responders~~ EMERGENCY WORKERS

This section provides guidance on occupational doses of radiation during an emergency response. In many radiological incidents, actual exposure of workers, including emergency responders, may be controlled to low doses when proper precautions are taken. During some emergencies, radiation exposures to responders may be unavoidable and may have the potential to exceed limits used for normal operations.

However, even in emergency conditions, every reasonable effort should be made to control doses to levels that are as low as practicable (consider NCRP 138[20] and NCRP 165[21] for recommendations that support ALARA).

1.11.1 Maintaining the ALARA Principle

To minimize the risks from exposure to ionizing radiation, employers of ~~emergency responders~~ emergency workers should prepare emergency response plans and protocols in advance to keep worker exposures ALARA, an acronym for "as low as is reasonably achievable" means making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical consistent with the purpose for which the activity is undertaken. Plans and protocols should include the following health physics and industrial hygiene practices to the maximum extent possible—

- Minimizing the time spent in the contaminated area.
- Maintaining the maximum distance from sources of radiation.
- Shielding of radiation sources.
- Tailoring of hazard controls to the work performed.
- Properly selecting and using respirators (see 29 CFR Part 1910.134) and other PPE.
- Using prophylactic medications, where medically appropriate, that either block the uptake or reduce the retention time of radioactive material in the body.

The incident commander's staff should be prepared to identify, to the extent possible, all hazardous conditions or substances and to perform appropriate site hazard analysis. Emergency management plans should include protocols to control worker exposures, establish exposure guidelines in advance and outline procedures for worker protection. Emergency procedures should include provisions for exposure monitoring, worker training commensurate with the hazards involved in response operations and ways to control them and medical monitoring.

1.11.2 Understanding Dose and Risk Relationships

~~response worker~~ Emergency worker guidelines are based on cumulative dose constraint levels. These are based on an assumption that doses acquired in response to a radiological incident would be ''once in a lifetime'' doses and that future radiological exposures would be substantially lower.

Recommendations in this document provide a guideline level of 5 rem (50 mSv) for worker protection and alternative ~~response worker~~ emergency worker guidelines (see Table 2-2) for certain activities where exposures below 5 rem (50 mSv) cannot be maintained. For most radiological incidents, radiation control measures (e.g., minimizing time, maximizing distance, using shielding) will prevent doses from reaching the 5 rem (50 mSv) occupational exposure guide while performing typical emergency response activities such as transportation, firefighting and medical treatment of contaminated victims at hospitals. However, in those situations in which victims are injured or trapped in high radiation areas or can only be reached via high radiation areas, exposure control options may be unavailable or insufficient and doses above 5 rem (50 mSv) may be unavoidable.

Decisions to take response actions that could result in doses in excess of 5 rem (50 mSv) can only be made at the time of the incident, under consideration of the actual situation. In such situations, incident commanders

[20] "Management of Terrorist Events Involving Radioactive Material, Report No. 138" (NCRP 2001).
[21] "Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers, Report No. 165" (NCRP 2010).

and other responders need to understand the risk posed by such exposures in order to make informed decisions. The ~~response worker~~ emergency worker Guidelines for life and property saving activities in Table 2-2 are provided to assist such decision-making. These guidelines apply to doses incurred over the duration of an emergency and are assumed to be once in a lifetime.

Emergency personnel may be exposed to increased radiation during the unique catastrophic event of an IND detonation resulting in firestorm and widespread destruction of structures. The emergency intervention needed to prevent further destruction and loss of life may result in increased exposure. Exceeding the ~~response worker~~ emergency worker Guidelines in Table 2-2 may be unavoidable in responding to such events. ~~emergency responders~~ Emergency workers undertaking a mission covered under the ~~response worker~~ emergency worker guidelines should be informed when radiation control measures may not prevent doses from exceeding the 5 rem (50 mSv), general occupational exposure guideline and should be made ~~fully~~ aware of ~~the sub-chronic and chronic~~ risks involved, including numerical estimates of the risk of delayed health effects.

Table 3-1. ~~response worker~~ Emergency Worker Guidelines

Guideline	Activity	Condition
5 rem (50 mSv)	All occupational exposures	All reasonably achievable actions have been taken to minimize
10 rem (100 mSv)[a]	Protecting valuable property necessary for public welfare (e.g., a power plant).	Exceeding 5 rem (50 mSv) unavoidable and all appropriate actions taken to reduce dose. Monitoring available to project or measure dose.
25 rem (250 mSv)[b]	Lifesaving or protection of large populations	Exceeding 5 rem (50 mSv) unavoidable and all appropriate actions taken to reduce dose. Monitoring available to project or measure dose.
>25 rem (250 mSv)	Lifesaving or protection of large populations	Only on a voluntary basis for people fully aware of the risks involved (See Tables 3-2 and 3-3)"

[a] For potential doses >5 rem (50 mSv), medical monitoring programs should be considered.

[b] In the case of a very large incident, such as an IND, incident commanders may need to consider raising the property and lifesaving ~~response worker~~ emergency worker guidelines to prevent further loss of life and massive spread of destruction.

This guidance does not address or impact site cleanups occurring under other statutory authorities such as the United States Environmental Protection Agency's (EPA) Superfund program, the Nuclear Regulatory Commission's (NRC) decommissioning program, or other federal or state cleanup programs.

The 25 rem (250 mSv) lifesaving ~~response worker~~ emergency worker guidelines provide assurance that exposures will not result in detrimental deterministic health effects (i.e., prompt or acute effects). However, it could increase the risk of stochastic (chronic) effects, such as the risk of cancer. Response actions that could cause exposures in excess of the 25 rem (250 mSv) ~~response worker~~ emergency worker Guideline should only be undertaken with an understanding of the potential acute effects of radiation to the exposed responder (see Table 3-2) and only when the benefits of the action clearly exceed the associated risks.

The estimated risk of fatal cancer[22] for workers exposed to 10 rem (100 mSv) is slightly less than the corresponding general population risk of 0.6 percent (6 cases per thousand exposed). Workers exposed to 25

[22] Risk per dose of a fatal cancer is assumed to be about 6×10^{-4} per rem (6×10^{-5} per mSv). Cancer incidence is

rem (250 mSv) have an estimated risk of fatal cancer of 1.5 percent (15 cases per thousand exposed). Because of the latency period of cancer, younger workers face a larger risk of fatal cancer than older workers (for example, when exposed to 25 rem (250 mSv), 20 to 30-year-olds have a 9.1 per thousand risk of premature death, while 40 to 50-year-olds have a 5.3 per thousand risk of premature death).[23]

More specific risk determinations can be made when there is adequate information about the contaminants and the potential for human exposure. EPA's Federal Guidance Report #13 (EPA 1999) and Health Effects Assessment Summary Tables have risk factors for specific radionuclides.

Table 3-2. Acute Radiation Syndrome [a]

Feature or Illness	Effects of Whole Body Absorbed Dose from external radiation or internal absorption, by dose range in rad (Gray)				
	0-100 (0-1 Gy)	100-200 (1-2 Gy)	200-600 (2-6 Gy)	600-800 (6-8 Gy)	>800 (>8 Gy)
Nausea, Vomiting	None	5-50%	50-100%	75-100%	90-100%
Time of Onset		3-6 hr	2-4 hr	1-2 hr	<1r h to minutes
Duration		<24 hr	<24 hr	<48	<48 hr
Lymphocyte Count	Unaffected	Minimally Decreased	<1000 at 24 hr	<500 at 24 hr	Decreases within hours
Central Nervous System Function	No Impairment	No Impairment	Cognitive impairment for 6-20 hr	Cognitive impairment for > 20 hr	Rapid incapacitation
Mortality	None	Minimal	Low with aggressive therapy	High	Very High: Significant neurological symptoms indicate lethal dose

Source: Medical Management of Radiological Casualties, Second Edition, Armed Forces Radiobiology Research Institute. Bethesda, MD, April 2003.

[a] Percentage of people receiving whole-body doses within a few hours expected to experience acute health effects.

Prior to 5 rem (50 mSv) guideline being exceeded, workers should be provided the following—

- Site specific training, if no prior training was available, with respect to the risk associated with exposure to ionizing radiation (incident commanders and responders should consider having someone on each team with radiation safety experience).

assumed to be about 8×10^{-4} per rem (8×10^{-5} per mSv). (EPA 1999)

[23] The numerical estimate of cancer risk presented above (from Federal Guidance #13) was obtained by linear extrapolation using the nominal risk estimates based on data from human exposures at high doses and high dose rates. Other methods of extrapolation to the low-dose region could yield higher or lower numerical estimates of cancer deaths. Studies of human populations exposed at low doses are inadequate to demonstrate the actual magnitude of risk at low doses (about 0.1 Sv or 10 rem and below). There is scientific uncertainty about cancer risk in the low-dose region below the range of epidemiological observation and the possibility of no risk cannot be excluded. (EPA 1999)

- A thorough explanation of the latent risks associated with receiving exposures greater than 5 rem (50 mSv).

If the 5 rem (50 mSv) guideline is exceeded, workers should be provided with a medical follow-up and monitoring should be considered.

In addition, these guidelines represent dose constraint levels (e.g., when this level of dose is accumulated, the responder should not take part in the later stages of the response that may significantly increase their dose). Incident commanders and responders need a thorough understanding of the worker exposure guidelines for radiological emergency response, including the associated risks and specific worker protection procedures. The FRMAC "Radiological Emergency Response Health and Safety Manual" (FRMAC 2001) provides detailed information. Additional resources for advance planning are available on the Radiological Emergency Medical Management (REMM) web site: http://www.remm.nlm.gov/.

1.11.3 Occupational Safety Regulations for Radiological Emergency Response

The Occupational Safety and Health Act, requires employers to be responsible for the health and safety of their employees during routine and emergency operations. The primary occupational safety and health standard for emergency response is the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard (29 CFR Part 1910.120).

Many U.S. states operate their own OSHA-approved state plans, which are required to be "at least as effective as" Federal OSHA standards and may impose additional or more stringent requirements.[24]Some states operate "complete" plans that cover both the private sector and state and local government employees, while others cover state and local government employees only. EPA's Worker Protection Standard (40 CFR 311) applies the HAZWOPER standard to state and local workers in states that do not have occupational health and safety plans.

In addition to the Occupational Safety and Health Act, several federal agencies (DOE, NRC and OSHA) and Agreement States issue occupational radiation safety standards (see Table 3-3). The occupational standards are not guidelines but instead are regulatory limits that cannot be exceeded except under certain conditions. These occupational limits allow workers to receive radiation exposure during the course of performing their jobs.

Federal and state radiation safety standards recognize that it may be necessary to exceed dose limits to take critical lifesaving actions.

[24] For a list of state plans, see: http://www.osha.gov/dcsp/osp/index.html

Table 3-3. Regulations for Worker Protection

Agency	Statutory Requirement	Title
Occupational Safety and Health Administration[a]	29 CFR Part 1910.120	Safety and Health-- HAZWOPER
	29 CFR Part 1910. 1096	Ionizing Radiation
Environmental Protection Agency[a]	40 CFR Part 311	Occupational Radiation Protection
Nuclear Regulatory Commission[b]	10 CFR Part 20	Standards for Protection Against Radiation
Department of Energy[c]	10 CFR Part 835	Radiation Protection Regulations

a. Worker safety and health is regulated in all states by federal OSHA or by respective state regulations under an OSHA-approved state plan. 40 CFR Part 311 applies the OSHA HAZWOPER standard (29 CFR 1910.120) to public-sector workers in states that do not operate their own occupational safety and health programs.

b. NRC employees are covered by NRC Management Directive 10.131, ''Protection of NRC Employees Against Ionizing Radiation.'' Section VI, Guidance for Emergency Exposure Controls During Rescue and Recovery Activities, deals specifically with radiation exposure control during emergencies.

c. These requirements apply to all DOE employees and contractors (except for Naval Nuclear Propulsion Program (NNPP)) who may be exposed to ionizing radiation as a result of their work for DOE, including work relating to emergency response activities. The NNPP has established requirements consistent with those contained in 10 CFR Part 835.

KEY POINTS IN CHAPTER 3 – EMERGENCY WORKER PROTECTION

- ~~response worker~~ Emergency worker guidelines of 5, 10 or 25 rem (50, 100 or 250 mSv) are based on the urgency of activities and knowledge of the risks involved.
- Worker safety is key to a successful emergency response.
- Incident commanders are responsible for balancing the individual risks and public benefits of each worker action.
- Emergency workers should be adequately informed of, and have an adequate understanding of, the risks they may experience during any missions they accept, including the risk of short-term and long-term health effects from exposure to ionizing radiation.
- Emergency workers should have relevant training, personal protective equipment, and monitoring instruments so they are able to protect themselves and others.
- Since there is assumed to be no threshold below which there is not an associated risk from radiation dose, workers who are reasonably expected to receive an occupational dose exceeding the established dose limit for members of the public, 0.1 rem (0.001 Sv), should be properly trained and monitored.
- Emergency workers should be trained, to the extent feasible, on actions to be taken. All reasonable steps have been taken to provide appropriate protection during the emergency activity.
- Worker protection statutes are listed in Table 3-3.

CHAPTER 4. INTERMEDIATE PHASE PROTECTIVE ACTION GUIDES

1.12 INTRODUCTION

This chapter presents PAGs for the intermediate phase and provides guidance for the implementation of corresponding protective actions. A PAG is the projected dose to an individual from the release of radioactive material at which a specific protective action should be taken to reduce or avoid that dose. The intermediate phase is defined as the period beginning after the source and releases have been brought under control and environmental measurements are available for use as a basis for decisions on protective actions and extending until these protective actions are terminated. The intermediate phase may last from weeks to months but is ~~assumed to last~~ projected for one year for calculation purposes ~~of dose projection~~.

During the early phase, decisions must be made and implemented quickly by state and local officials before federal assistance ~~is~~ may be available. In contrast, many decisions and actions during the intermediate phase may be taken after federal resources are present, as described in the Nuclear/Radiological Incident Annex of the National Response Framework (FEMA 2008 a, b). Decisions will be made during the intermediate phase concerning whether particular areas or properties from which people have been evacuated will be decontaminated and reoccupied or the occupants relocated for an extended period.

This chapter provides the PAGs and corresponding protective actions for use by state and local officials in developing their radiological emergency response plans to protect the public from exposure to radiation from deposited radioactive materials. Due to the wide variety of types of radiological incidents and radionuclide releases that could occur, it is not practical to provide implementing guidance for every possible situation.

This chapter also provides guidance for translating radiological conditions in the environment into projected doses that serve as the basis for decisions to take appropriate protective actions and basic planning guidance on reentry as informed by the Operational Guidelines (DOE 2009).

1.13 EXPOSURE PATHWAYS DURING THE INTERMEDIATE PHASE

During the intermediate phase, the following are the principal exposure pathways for the public occupying areas contaminated with deposited radioactive materials—

- **External exposure** ~~**of the whole body**~~ to external ~~gamma~~ radiation from deposited radioactive materials (groundshine). External gamma radiation is the expected dominant pathway for NPP incidents ~~reactor accidents~~ and incidents involving RDDs and INDs. Typically, the health risks from other pathways are expected to be minor in comparison to the risks due to external gamma radiation.
- **Internal exposure** from the inhalation of resuspended materials. Although normally expected to be of only minor importance for NPP incidents, the inhalation pathway would contribute additional doses to internal organs. Inhalation dose would, however, be an important exposure pathway for radiological incidents with significant fractions of pure beta emitters or alpha emitters.
- **Internal exposure** from the ingestion of food and water. In rare cases, where food or drinking water are contaminated to levels above the PAG for ingestion, and withdrawal of food and/or water from use would, in itself, create a health risk greater than that from the radiation dose, the committed effective dose from ingestion should be added to the dose from the above pathways.

Other potentially significant exposure pathways include exposure to beta radiation from surface contamination (e.g. beta dose to skin) and direct ingestion of contaminated soil. These pathways are not expected to be controlling for NPP incidents (Aaberg 1989).

1.14 THE PROTECTIVE ACTION GUIDES AND PROTECTIVE ACTIONS FOR THE INTERMEDIATE PHASE: RELOCATION AND DOSE REDUCTION

The principal protective actions for reducing exposure of the public to deposited radioactive materials are:

- Relocation;
- Decontamination;
- Shielding;
- Time limits on exposure; and
- Control of the spread of surface contamination.

The most effective of these actions is relocation—the removal or continued exclusion of people (households) from contaminated areas to avoid chronic radiation exposure. Relocation is highly disruptive and therefore only implemented when the dose is sufficiently high to warrant it. The PAG for relocation is 2 rem (20 mSv) projected over the first year of exposure. After the first year, the PAG for relocation is 0.5 rem (5 mSv) per year.

The PAG level for relocation applies to doses that can be avoided by relocation; doses already incurred prior to relocation are not included in the calculations. PAGs for protection from deposited radioactivity during the intermediate phase are summarized in Table 3-1. ~~The basis for these values is presented in detail in Chapters 4 and 7 and Appendix E of the 1992 PAG Manual, available online as a historical reference at http://www.epa.gov/radiation/rert/pags.html.~~ The decision to relocate will be considered on a case-by-case basis. Efforts to decontaminate and remediate the contaminated area and the shielding offered by buildings and the residency factor attributable to the building, must be considered to see if the second year PAG (0.5 rem (5 mSv) in a year) will be exceeded.

It may be difficult to avoid exceeding the relocation PAGs for the radionuclides most likely associated with RDDs because of their longer half-lives. If these radionuclides are released, it may be necessary to relocate people in the affected areas even if exposure is less than 2 rem (20 mSv) in the first year provided decontamination and remediation measures during the first year are unsuccessful.

In most scenarios, relocation decisions will be based on doses from external exposure to the whole body from deposited materials and internal exposure from inhalation of resuspended contamination.

Food and milk ingestion dose should be considered separately with decisions based on the FDA PAGs.[25] The FRMAC Assessment Manual provides guidance in calculating Ingestion Derived Response Levels that indicate the levels of deposited radioactive materials that may result in food exceeding the FDA PAGs

~~In most scenarios, relocation decisions will be based on doses from whole-body and internal exposure from inhalation of resuspended contamination. Food and milk ingestion dose should be considered separately with decisions based on the FDA PAGs.[21]~~

Other protective actions, such as simple dose reduction techniques, can be applied in areas where levels of deposited radioactivity are not high enough to warrant relocation. Dose reduction actions can range from the simple—scrubbing or flushing surfaces, removal and disposal of small spots of highly contaminated soil (e.g., from settlement of water) and spending more time than usual in lower exposure rate areas (e.g., indoors)—to the difficult and time consuming processes of removal, disposal and replacement of contaminated surfaces. The simple processes would probably be most appropriate in contaminated areas outside the relocation area. Many of these can be carried out by the residents with support from officials for monitoring and guidance on

[25] Accidental Radioactive Contamination of Human Food and Animal Feeds: Recommendations for State and Local Agencies, FDA 1998, available online: http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM094513.pdf

appropriate actions and disposal. The more difficult processes will be appropriate for recovery of areas where contamination is fixed (not removable) and from which the population is relocated.

Large areas may have to be restricted under these PAGs. As the land area increases, protective actions become more difficult and costly to implement, especially when the affected area is densely populated. There may be situations where full implementation of early and intermediate phase protective actions is impracticable (e.g., a release in a large city). Informed judgment must be exercised to assure priority of protection for individuals in areas having the highest exposure rates.

Table 4-1: Protective Action Guides for Exposure to Deposited Radioactivity during the Intermediate Phase of a Radiological Incident

Protective Action ~~Recommendation~~	PAG (Projected Dose)[a]	Comments
Relocate the general population[b]	≥ 2 rem (20 mSv) in the first year, 0.5 rem (5 mSv)/year in the second and subsequent years	Projected dose over one year
Apply simple dose reduction techniques[c]	~~< 2 rem (20 mSv)~~ < 2 rem (20 mSv) projected in the first year	These protective actions should be taken to reduce doses to as low as practicable levels

[a] Projected dose refers to the dose that would be received in the absence of shielding from structures or the application of dose reduction techniques. These PAGs may not provide adequate protection from some long-lived radionuclides (see Section 4.6).

[b] People previously evacuated from areas outside the relocation zone defined by this PAG may return to occupy their residences.

Cases involving relocation of people at high risk from such action (e.g., patients under intensive care) may be evaluated individually.

[c] Simple dose reduction techniques include scrubbing or flushing hard surfaces, minor removal of soil from spots where radioactive materials have concentrated and spending more time than usual indoors or in other low exposure rate areas.

This guidance does not address or impact site cleanups occurring under other statutory authorities such as the United States Environmental Protection Agency's (EPA) Superfund program, the Nuclear Regulatory Commission's (NRC)

1.14.1 Removal of the 50 Year Relocation PAG

For simplicity, the relocation PAG of 5 rem (50 mSv) over 50 years has been removed from this guidance. It is rarely, if ever, the driver for extending relocation area beyond that prompted by the first or second year relocation PAGs in scenarios that have been analyzed. Additionally, dose projections over 50 years after a radiological incident for various age groups showed no significant differences for individuals exposed at 3 months age versus adult. A response organization may wish to project 50-year doses to inform decision making, but should consider weathering, decay, credit for time spent indoors, and to the extent it can be predicted, dose reduction from mitigation activities. To keep emergency management decisions as simple as possible, however, the recommended relocation PAGs are 2 rem (20 mSv) projected over the first year, and 0.5 rem (5 mSv) projected over any subsequent year.

1.14.2 The Population Affected

The PAGs for relocation are intended for use in establishing the boundary of a relocation area within an area where radioactive materials have been deposited. The relocation PAGs have been established at a level that will provide adequate protection for the general population, including higher risk groups such as children and fetuses. People residing in contaminated areas outside the relocation area will be at some risk from radiation dose. Therefore, guidance on the reduction of dose during the first year to residents outside this zone is also

provided. Monitoring and simple dose reduction efforts are recommended in these areas to reduce doses to the extent practical. Such actions are unlikely to be practical where the dose reduction achieved is less than 10 percent.

Affected populations may perceive that intermediate phase protective actions are not consistent with those taken in the early phase. Early-phase decisions on sheltering-in-place and evacuation may have been implemented prior to verification of the path of the plume. Therefore, some people may have been evacuated from areas where validated doses are much lower than were projected. Others who were in the path of the plume may have been sheltered or not protected at all. During the intermediate phase of the response, dose projections may be revised based on environmental measurements. People should be relocated from areas where the projected dose exceeds the PAG for relocation without regard to prior evacuation status.

1.14.3 Basis for Intermediate Phase PAGs

For a full description of the risk-benefit analysis used to set the PAG levels, refer to the 1992 PAG Manual, Appendices B, C and E. The Manual is available online in a searchable format. Below is a short summary on the basis for the Intermediate Phase relocation PAGs.

In a prior section, for early phase (evacuation) PAGs, analysis was provided for the risks of health effects as a function of dose (Principles 1 and 2). Considerations for selection of PAGs for the intermediate phase of a radiological incident differ from those for selection of PAGs for the early phase primarily with regard to implementation factors (i.e., Principles 3 and 4). Specifically, they differ with regard to cost of avoiding dose, the practicability of leaving infirm people and prisoners in the restricted zone, and avoiding dose to fetuses. Although sheltering is not generally a suitable alternative to relocation, other alternatives (e.g., decontamination and shielding) are suitable.

For several assumed cumulative annual doses, the cost per day divided by the risk of fatality avoided by relocation was plotted for a radionuclide mixture from a hypothetical nuclear power plant accident. The cost per day of relocation is assumed to be constant, but with some nuclides decaying rapidly, the cost effectiveness of relocation diminishes over time. Drawing only general trends from this, the cost analysis supports relocation at doses as low as one rem (10 mSv) for the first week and two rem (20 mSv) for up to 25 days after an accident.

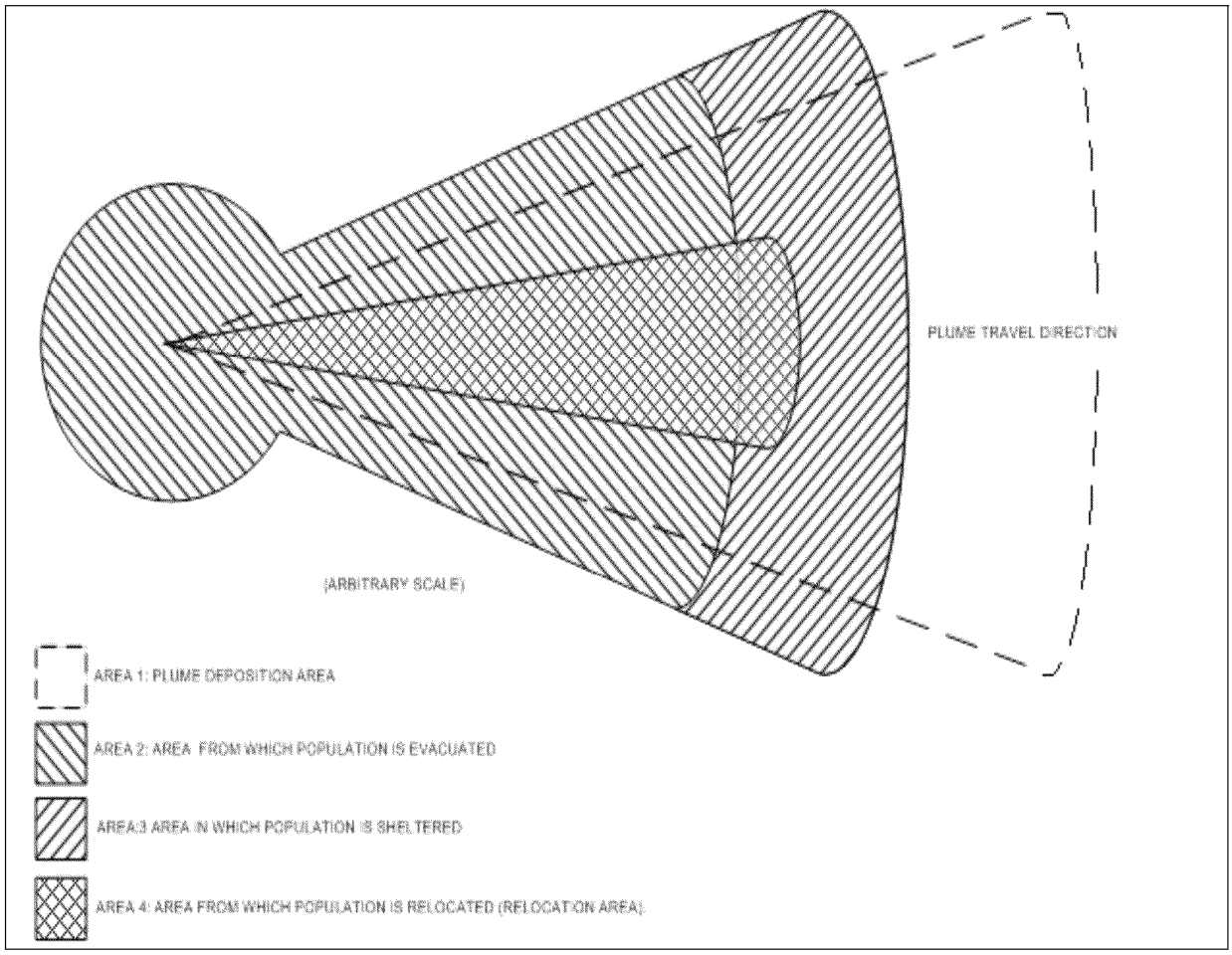
Based on the avoidance of acute effects alone (Principle 1) relocation of the general population and fetuses at 50 rem and 10 rem (500 and 100 mSv), respectively, is justified. However, on the basis of control of chronic risks (Principle 2) a lower upper bound is appropriate. Five rem is taken as an upper bound on acceptable risk for controllable lifetime exposure to radiation, including avoidable exposure to accidentally deposited radioactive materials.

Analyses based on Principle 3 (cost/risk) indicate that considering cost alone would not drive the PAG to values less than 5 rem (50 mSv). Analyses in support of Principle 4 (risk of the protective action itself) provide a lower bound for relocation PAGs of 0.15 rem (1.5 mSv). Based on the above, 2 rem (20 mSv) projected committed effective dose equivalent from exposure in the first year is selected as the PAG for relocation. Implementation of relocation at this value will provide reasonable assurance that, for a reactor accident, a person relocated from the outer margin of the relocation zone will, by such action, avoid an exposure rate which, if continued over a period of one year, would result in a dose of about 1.2 rem (12 mSv). This assumes that 0.8 rem (8 mSv) would be avoided without relocation through normal partial occupancy of homes and other structures.

Contrary to the situation for evacuation during the early phase of an incident, it is generally not practical to leave a few people behind when most members of the general population have been relocated from a specified area for extended periods of time. It will usually be practicable to reduce these risks by establishing a high priority for efforts other than relocation to reduce the dose in cases where pregnant women reside near the boundary of the restricted zone.

The implementation of simple dose reduction techniques will further reduce dose to people who are not relocated from contaminated areas. In the case of non-reactor accidents, decay and weathering effects differ, and it may be necessary to base relocation decisions on the second and subsequent year dose projections.

Figure 4-1: Generalized Protective Action Areas for NPP Incident



1.14.4 Areas Involved

Figure 4-1 provides a generalized example of the areas affected by different protective actions. Area 1 represents the plume deposition area. (In reality, variations in meteorological conditions would almost certainly produce a more complicated shape, but the same principles would apply.)

In situations such as an NPP accident, where early warning is given prior to a release of radioactive materials, people may already have been evacuated from Area 2 and sheltered in Area 3. People who have been evacuated from Area 2 or sheltered in Area 3 may go home if environmental monitoring verifies that their residences are outside the plume deposition area (Area 1).

Area 4 is the relocation area where projected doses are equal to or greater than the relocation PAG. People residing just outside the boundary of the relocation area may receive a dose approaching the PAG for relocation if decontamination or other dose reduction efforts are not implemented.

Area 1, with the exception of the relocation area, represents the area of contamination that may continue to be occupied by the general public during the intermediate phase. Nevertheless, there will be contamination levels in this area that will require continued monitoring and dose reduction efforts other than relocation. Incident-

specific levels below the PAGs may be used to control exposure to contamination. The relative positions of the boundaries shown in Figure 4-1 depend on areas evacuated and sheltered and the radiological and meteorological characteristics of the release. For example, Area 4 (the relocation area) could fall entirely inside Area 2 (area evacuated), so that the only people to be relocated would be those residing in Area 4 who were either missed in the evacuation process or who, because of mobility constraints for their evacuation, had remained sheltered during plume passage.

Establishing the boundary of a relocation area creates three groups of affected people—

- People who have already been evacuated from an area that is now designated as a relocation area and who now must be assigned relocation status.
- People who were not previously evacuated, but who reside inside the relocation area and should now relocate.
- People who were previously evacuated, but reside outside the relocation area and may now return home. A gradual return is recommended.

Small adjustments to the boundary of the relocation area established based on the PAG may be justified based on ease of implementation. For example, the use of a convenient natural boundary could be a logical reason for adjustment of the relocation area. However, such decisions should be supported by demonstration that exposure rates to people not relocated can be promptly reduced by methods other than relocation to meet the PAG, as well as the longer dose objectives addressed in Section 4.6.

The relocation PAG applies principally to personal residences but may impact other facilities as well. For example, it could impact work locations, hospitals and park lands as well as the use of highways and other transportation facilities. For each type of facility, the occupancy time of individuals should be taken into account to determine the criteria for using a facility or area. It might be necessary to avoid continuous use of homes in an area because radiation levels are too high. However, a factory or office building in the same area could be used because occupancy times are shorter. Similarly, a highway could be used at higher contamination levels because the exposure time of highway users would be considerably less than the time spent at home.

1.14.5 Priorities

In most cases, protective actions during the intermediate phase will be carried out over a relatively long period of time (e.g., months). Setting priorities will be important, especially when the affected area is so large that it is impractical to relocate members of the public from areas that barely exceed the relocation PAGs. The following priorities are appropriate—

- First, protect all people from doses that could cause acute health effects from all exposure pathways, including previous exposure to the plume.
- Conduct radiological surveys to verify or adjust estimates of radiological impacts.
- Recommend that affected people reduce their exposures by using simple decontamination techniques and remaining indoors.

1.15 SEQUENCE OF EVENTS

The high-priority decisions on whether to relocate people from high exposure rate areas requires exposure rate measurements and dose analyses. Monitoring and dose assessment will be an ongoing process, with priority given to the areas with the highest exposure rates.

Following passage of the airborne plume, a number of tasks must be accomplished for the timely protection of the public. The general sequence of events is itemized below, but the time frames will overlap.

1. Determine the areas where the projected first-year dose will exceed the 2 rem (20 mSv) relocation PAG and relocate people from those areas, with priority given for people in the highest exposure rate areas.

2. Allow previously evacuated people to return as quickly as possible to areas where field gamma measurements indicate that exposure rates are near normal background levels. If there is a possibility that particles from high deposition areas could drift into the occupied areas, establish a buffer zone to restrict residential use until radiological measurements and assessments confirm that it is no longer necessary. Buffer zones are set with the understanding that conservatism is inherent in the PAGs.
3. Based on isodose-rate boundary (see Section 4.4.1, below), assign any evacuees who reside within the relocation area to be relocated. Evacuated people whose residence is in the area between the boundary of the plume deposition and the boundary to the relocation area may return gradually as dose projections allow.
4. Evaluate the dose reduction effectiveness of simple decontamination techniques and of sheltering-in-place in response to exposure from partial occupancy of residences and workplaces. Results of these evaluations may influence recommendations for reducing exposure rates for people who are not relocated from areas near, but outside, the relocation area.
5. Control access to and egress from the relocation area. This would be accomplished through control points at roadway accesses to the relocation area.
6. Establish monitoring and decontamination stations to support control of the relocation area.
7. Implement simple decontamination techniques in contaminated areas outside the relocation area, giving priority to areas with higher exposure rates.
8. Collect data needed to establish long-term radiation protection criteria for decontamination and dose reduction and data to determine the effectiveness of various decontamination or other dose reduction techniques.
9. Begin operations to clean up and recover contaminated property in the relocation area.
10. If not already done, evaluate whether food grown or produced within the plume deposition area need to be interdicted per the FDA PAGs and evaluate drinking water systems within the plume deposition area. Provide guidance on planting or harvesting specific agricultural products.

1.15.1 Establishment of Isodose-Rate Lines

As soon as federal or other assistance is available for aerial and ground monitoring, a concentrated effort should begin to establish isodose-rate lines on maps and identify boundaries of the relocation area. Standard maps should be developed on which all response organizations would record monitoring data. Records on monitoring and decontamination of the public and workers should also be collected.

Aerial monitoring can be used to collect data for establishing general patterns of radiation exposure rates and may form the primary basis for the development of dose lines out to the limit of aerial detectability.

Initially during the early phase, detectability is limited to exposure rate changes of a few times natural background levels. Later during the intermediate phase, more sensitive measurements detect levels of radioactivity that are a small fraction of the natural background. Periodic air sample measurements will also be needed to verify the contribution to dose from inhalation of resuspended materials.

Gamma exposure rates measured at one meter (39 inches) will vary within a very small area because different surfaces have different deposition rates (e.g., smooth surfaces versus heavy vegetation). Rinsing or precipitation could also reduce levels in some areas and raise levels in others where runoff settles. In general, where exposure rates vary within designated areas, dose projections should be estimated using an appropriate average exposure rate.

1.15.2 Dose Projections

The FRMAC Assessment Manuals[26] provide detailed guidance for dose projection and calculating DRLs and DPs ~~DCFs~~ . The FRMAC Assessment Manuals incorporate the ICRP dosimetry models (ICRP 60 series). In

[26] See FRMAC Assessment Manuals at http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.

addition, the FRPCC encourages the use of computational tools such as DOE's Turbo FRMAC and NRC's RASCAL or other appropriate tools and methods to implement the PAGs.

The primary dose of interest in the intermediate phase is the sum of the effective dose from external exposure and the committed effective dose from inhalation. The exposure periods of interest are the first year and subsequent years after the incident. Other pathways should also be evaluated and their contributions considered, if significant. For example, anytime alpha-emitting radionuclides are involved, the inhalation of resuspended material must be considered. Although beta exposure will contribute to skin dose, its contribution to the overall risk of health effects from the radionuclides expected to be associated with reactor incidents should not be controlling in comparison to the whole body gamma dose (Aaberg 1989). However, the skin beta dose may be important for particulates deposited or transferred to the skin, as may be the case for an RDD that contains Strontium-90.

The dominant intermediate phase exposure pathway for incidents involving alpha-emitters (e.g. a weapons accident) is inhalation of resuspended material. For these incidents, dispersal of alpha-emitting material must be monitored carefully using proper measurement techniques. It is possible that there will be little or no associated gamma radiation or beta activity.

Calculation of the projected gamma dose from measurements will require knowledge of the principal radionuclides contributing to exposure and their relative abundances. Radiological characteristics can be compiled either through the use of portable gamma spectrometers or by radionuclide analysis of environmental samples. Several measurement locations may be required to determine whether any selective radionuclide deposition occurred as a function of meteorology, surface type, distance from the point of release, or other factors. In accordance with the Nuclear/Radiological Incident Annex to the National Response Framework, DOE, EPA and other federal agencies have the capability to assist state officials in performing environmental measurements, including determination of radiological characteristics of deposited materials (FEMA 2008 a, b).

The gamma exposure rate may decrease rapidly if deposited materials include a significant fraction of short-lived radionuclides. Therefore, the relationship between instantaneous exposure rate and projected first- and second-year annual doses will change as a function of time. These relationships must be established for the particular mix of deposited radioactive materials present at the time of the gamma exposure rate measurement. Over time, residual doses from gamma emitters will depend largely upon the half-lives of the radionuclides involved and could potentially remain significant over many years. It should be noted that natural attenuation as well as nuclear decay can affect long term dose assessments.

Because Intermediate Phase public protection decisions (e.g., relocation, re-entry) have less urgency than Early Phase decisions and the contamination is better characterized in the Intermediate Phase, it may be desired to improve the public protection decisions by modifying dose estimates with more realistic inputs. For example, the external dose reductions provided by building structures and dose reductions resulting from partial occupancy in the contaminated zone, which accounts for routine time spent outside the contaminated zone (e.g., work, school, shopping), may be included in the dose projections to make improved public protection decisions.

Projected dose considers exposure rate reduction from radioactive decay and, generally, weathering. When one also considers the anticipated effects of shielding from normal part time occupancy in homes and other structures, people who are not relocated should receive a dose substantially less than the projected dose. For commonly assumed reactor source-terms, it is estimated that 2 rem (20 mSv) projected dose in the first year will be reduced to about 1.2 rem (12 mSv) by this factor. The application of simple decontamination techniques shortly after the incident can be assumed to provide a further 30 percent or more reduction so that the maximum first year dose to people who are not relocated is expected to be less than 1 rem (10 mSv). Taking account of decay rates assumed to be associated with releases from NPP incidents (SNL 1982) and shielding from partial occupancy and weathering, a projected dose of 2 rem (20 mSv) in the first year is likely to amount

to an actual dose of 0.5 rem (5 mSv) or less in the second year. The application of simple dose reduction techniques would reduce the dose further.

Calculations supporting these projections are summarized in Table E-6 of the 1992 PAG Manual.[27]

Keeping below the 0.5 rem (5 mSv) PAG for ~~out~~ subsequent years—the second year and beyond—may be achieved through natural decay of shorter half-life radioisotopes, through decontamination efforts, or through other means of controlling public exposures (such as limiting access to certain areas). In the case of an RDD, in which a longer half-life radioisotope would likely be utilized, reductions in dose may prove difficult to achieve without longer term measures (see Chapter 5).

Exposure from ingestion of food and water is considered independently of decisions for relocation and decontamination. In rare instances, however, where withdrawal of food or water from use would pose a health risk in itself, relocation may be an appropriate protective action against exposure via ingestion. In this case, the dose from ingestion should be considered along with the projected dose from other exposure pathways for decisions on relocation.

1.15.3 Projected External Gamma Dose

Projected whole body external gamma doses at 1 meter height at particular locations during the first year and second year after the incident are the parameters of interest (DOE 1988). Measurements made at 1 meter to project whole-body dose from gamma radiation should be made with instruments of the "closed window" type to avoid the detection of beta radiation. The environmental information available for calculating these doses is expected to be the current gamma exposure rate at 1 m height and the relative abundance of each radionuclide contributing significantly to that exposure rate. Calculation models are available for predicting future exposure rates as a function of time with consideration of radioactive decay and weathering.

Relocation decisions can generally be made on the basis of the first year projected dose. However, projected doses during the second year are needed for decisions on protective actions for people who are not relocated. ~~DCFs~~ Conversion factors are therefore needed to convert environmental measurements to projected dose during the first year and second year following the incident (See FRMAC Assessment Manuals). Of the many types of environmental measurements that can be made to project whole body external gamma dose, gamma exposure rate in air is the easiest to make and is the most directly linked to gamma dose rate. However, analyses of a few environmental samples (particularly, soil samples) must be coupled with the gamma exposure rate to properly project decreasing dose rates.

In addition, measurements should be conducted to determine the dose reduction factors associated with simple, rapid, decontamination techniques so that these factors can be used in calculating dose to people who are not relocated. However, assumptions about these factors should not be included in calculating projected dose for decisions on relocation. Only dose reductions already accomplished can be considered.

1.15.4 Exposure Limits for People Reentering the Relocation Area

After the relocation area is established, people will need to reenter for a variety of reasons, including recovery activities, retrieval of property, security patrol, operation of vital services and, in some cases, care and feeding of farm and other animals. It may be possible to quickly decontaminate access ways to vital institutions and businesses in certain areas so that they can be occupied by adults either for living (i.e., institutions such as nursing homes and hospitals) or for employment. Clearance for occupancy of such areas will require dose reduction to meet exposure limits (EPA 1987). Dose projections should include both external exposure from deposited material and inhalation of resuspended deposited material for the duration of the planned exposure. People working in areas inside the ~~emergency~~ relocation area should operate under the controlled conditions established for occupational exposure (EPA 1987). The worker dose limitation does not need to include

[27] The 1992 PAG Manual is available as a historical reference online at: <http://www.epa.gov/radiation/rert/pags.html>

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ongoing doses received from living in a contaminated area outside the relocation area. It is also not necessary to consider dose received previously from the plume or groundshine during the early phase of the radiological incident.

1.16 PROTECTIVE ACTION GUIDANCE FOR FOOD AND DRINKING WATER

Information on food and animal feeds protective action guidance is contained in FDA's "Accidental Radioactive Contamination of Human Food and Animal Feeds: Recommendations for State and Local Agencies" (FDA 1998).

{placeholder for drinking water PAG once final}

~~EPA is not proposing a specific drinking water PAG at this time. EPA has established enforceable drinking water standards for radionuclides under the Safe Drinking Water Act (SDWA). EPA recommends that to the extent practicable, emergency measures for drinking water be based on the National Primary Drinking Water Regulations (NPDWR) for Radionuclides. The Radionuclides Rule provides states with flexibility when responding to radiological events. If a public water system exceeds the radionuclides standard it must work to get back into compliance as soon as feasible. States have the authority to determine if other corrective actions are needed (e.g. providing alternative water).~~

~~However, the Agency recognizes a short-term emergency drinking water guide may be useful for public health protection in light of the Fukushima nuclear power plant accident, which impacted some Japanese drinking water supplies. Input on the appropriateness of, and possible values for, an intermediate phase emergency drinking water PAG is being sought during the public review of this Manual.~~

~~While the NPDWR provide for a regulatory standard of 4 mrem/year (beta, photon emitters) based on life-time exposure, international organizations have developed technical approaches and methodologies that have produced a range of emergency guidelines related to drinking water (e.g., the World Health Organization, the International Atomic Energy Agency) as have other federal agencies (e.g., the Department of Homeland Security, the Food and Drug Administration) and non-federal organizations. EPA is seeking input on an approach and technical rationale for a drinking water PAG designed to help officials select protective actions under emergency conditions when exposures would occur over shorter time periods than those envisioned in the NPDWR.~~

~~Monitoring & Characterization of Contaminants~~

~~The Radionuclides Rule requires community water systems (CWS) to monitor at each entry point to the distribution system to ensure that every customer's water does not exceed the maximum contaminant levels (MCLs) for radionuclides. All CWS are required to monitor for gross alpha, radium-226/228 and uranium. In addition, CWS designated by the state as "vulnerable" or if they use waters contaminated by effluents from nuclear facilities must also conduct monitoring for beta particle and photon radioactivity.~~

~~In the event of a radiological event incident, the state, at its own discretion, may exercise regulatory flexibility and require systems to collect samples for radionuclides, including beta particle and photon activity (40 CFR 141.26(e)). For more information about monitoring requirements for the Radionuclides Rule see the "Radionuclides Rule: A Quick Reference Guide" (EPA816-F-01-003, June 2001) or "Implementation Guidance for Radionuclides" (EPA 816-F-00-002, March 2002).~~

THESE FOOTNOTES WERE DELETED FROM THIS SECTION

~~See: http://www.who.int/water_sanitation_health/dwq/gdwq3rev/en/ and http://www.who.int/hac/crises/jpn/faqs/en/index8.html.~~

~~See: http://www-pub.iaea.org/MTCD/publications/PDF/Pub1467_web.pdf.~~

~~See: http://ogcms.energy.gov/73fr45029.pdf~~

~~See: http://www.fda.gov/downloads/MedicalDevices/.../UCM094513.pdf~~

~~See: http://www.epa.gov/ogwdw/radionuclides/pdfs/qrg_radionuclides.pdf~~

~~See: http://water.epa.gov/lawsregs/rulesregs/sdwa/radionuclides/upload/2009_04_16_radionuclides_guide_radionuclides_stateimplementation.pdf~~

~~To determine if there is radiological contamination of drinking water sources and the extent to which such contamination is occurring, systems sampling for radionuclides must use approved EPA methods.~~

~~Public Notification~~

~~If water sample monitoring indicates that contamination levels exceed the MCL for any radionuclide, water systems are required to issue a Tier 2 Public Notification (i.e., within 30 days).~~

~~States have the flexibility to elevate the notification if warranted to a Tier 1 Public Notification (i.e., within 24 hours) (40 CFR 141.201(a)(3) Special public notices: Occurrence of a waterborne disease outbreak or other waterborne emergency.~~

~~During a radiological event, water systems may be dealing with a number of requirements and operating procedures and may not be prepared to issue public notification. The state may issue public notification on behalf of the water system (40 CFR 141.210(a)). This would allow the state to develop and deliver a consistent message to all affected customers and also allows the system to concentrate its efforts on returning the system [illegible] MCL violations. For more information see the Revised Public Notification Handbook (EPA 816-R-09-013, March 2010).~~

~~Corrective Actions to Reduce Levels of Contamination~~

~~Water distribution systems all incorporate reserve and storage capacity. During the early phase of an incident it is unlikely that contamination could affect water which is directly available for consumption through distribution systems. It would take some time for radionuclides to be deposited from the plume into the supply system water source and then subsequently be distributed. During the early phase, recommendations to the public (i.e., about drinking tap water) should reflect these considerations. The public should be advised that the water is safe to drink unless otherwise informed by state officials. Some useful and practical actions water systems can take during the intermediate phase to provide drinking water to customers are described below.~~

~~Wait for Flow-By~~

~~If radionuclides are deposited over a river, a section of the water can become contaminated and can be repeatedly contaminated as rain re-deposits radioactive particles. As this section flows down the river, this section of contaminated water is called a plume. This action calls for closing down any source intake valves along the path of the plume of contaminated water. While the intake valve is closed, no contaminated water can enter the water supply system; therefore the contaminated water is allowed to flow by the system. During this time, the system's existing storage capacity can be depended upon. If the stored water supplies could be depleted before the affected valves can be reopened, treatment of the contaminated water while using available stored water supplies should be considered. This assumes that the treatment technology will be in place or readily accessible. In the event of no other option, contaminated water could be temporarily replaced with large quantities of purchased uncontaminated water.~~

~~Treat Contaminated Water~~

~~Various treatment options exist for reducing or eliminating the contamination of drinking water by man-made radionuclides. Only a small percentage of all water systems treat specifically for radionuclides.~~

THESE FOOTNOTES WERE DELETED FROM THIS SECTION

- A list of EPA approved analytical methods for Radionuclides is available at: http://www.epa.gov/ogwdw/methods/pdfs/methods/methods_radionuclides.pdf

- See: http://water.epa.gov/lawsregs/rulesregs/sdwa/publicnotification/upload/PNrevisedPNHandbookMarch2010.pdf.

However, typical technologies used to treat water for other contaminants can reduce the concentration of radioactivity. These technologies include coagulation/filtration, ion exchange, lime softening and reverse osmosis. Their actual removal efficiency depends on the radionuclide and the type of treatment.

Activate Existing Connections to Neighboring Systems

If the water supply system is part of a larger, regional supply system, activation of existing connections to a neighboring area could be considered. Most large water systems can establish connections with other large systems for emergency purposes. As in many cases, this option may have already been considered during emergency planning. If this option is implemented, steps must be taken to ensure that the "clean" systems do not become contaminated from water backflow.

Smaller water supply systems (i.e., that serve between 10,000 and 75,000 people), or sparsely populated or rural areas, may not be connected to a neighboring system. In this case, regionalization may be a part of emergency planning to explore. This involves connecting smaller systems to larger systems, thus forming a regional water supply system. This is obviously a long-term proposition, but it does have the added advantage of reducing system vulnerability to water shortages or water quality problems other than those resulting from a radiological incident.

Establish Pipeline Connections to Closest Sources/Systems

Running a pipeline from a "clean" water supply system to various distribution centers located throughout the affected community is a routine means of providing clean water. For example, when water mains must be repaired or cleaned of debris, community water needs have been met through the assembly of temporary pipes and hoses. This is a relatively simple procedure, requiring very little construction and technical expertise. For medium- to long-term emergencies, the construction of a temporary pipeline could be cost-effective. PVC pipe, fire hoses and steel pipe have been used to provide emergency drinking water for periods of up to 2 months when service has been disrupted by earthquakes, drought, or bacterial contamination.

Import Water in Tanker Trucks

If an uncontaminated source of water is close to the affected area, it may be more efficient to arrange to transport water from that source by truck, rail, or barge to distribution centers located throughout the community. The most significant obstacle for the use of this option is the cleanliness and availability of transport vehicles. State and local laws may also affect this option.

Import Bottled Water

Importing bottled water into the affected community is another possible option. The water may come from a nearby water supply system or from a water bottling company. This option may be cost-effective during an emergency if water is needed quickly and if the length of the emergency does not merit long- term action, such as the construction of a temporary pipeline.

Ration Clean Water Supplies

Rationing uncontaminated water is also a possibility. This is particularly true if water reserves can provide each individual in the community with 1 L (0.264G, about 1 qt) of water per day until the contaminated plume has passed, the contaminated water is treated, or the water supply system has returned to normal operating conditions. If this option is chosen, it is important that efficient methods for rationing are in place. Rationing water might also be required if water treatment capabilities are limited. Consider a scheme to ration water as part of emergency planning efforts.

THESE FOOTNOTES WERE DELETED FROM THIS SECTION

~~Additional information about treatment options and compliance guidance is available at the following website: http://water.epa.gov/lawsregs/rulesregs/sdwa/radionuclides/compliancehelp.cfm.~~

1.17 LONGER-TERM OBJECTIVES OF THE PROTECTIVE ACTION GUIDES FOR THE INTERMEDIATE PHASE

It is an objective of the PAGs to ensure that doses in any single year after the first will not exceed 0.5 rem (5 mSv). For source terms from NPP incidents, the PAG of 2 rem (20 mSv) projected dose in the first year is expected to meet this longer-term objective through radioactive decay, weathering and normal part-time occupancy in structures. If the release contains long-lived radionuclides, decontamination of areas outside the relocation area may be required during the first year to meet these objectives. For situations where it is impractical to meet these objectives through decontamination, relocation should be considered even if the projected first-year dose is lower than the relocation PAG.

Based on the relocation PAGs, reentry guidance can be found in the Reentry Matrix in Section 3.8, as well as in the Preliminary Report on Operational Guidelines Developed for Use in Emergency Preparedness and Response to a Radiological Dispersal Device Incident, Group C (DOE 2009). After the population has been protected in accordance with the PAGs for relocation, ~~return for~~ reoccupancy of the relocation areas should be governed on the basis of cleanup criteria and late phase cleanup activities should proceed. Refer to the Operational Guidelines manual for more information on how to implement the reentry guides in emergency plans.

1.18 REENTRY MATRIX FOLLOWING A RADIOLOGICAL INCIDENT OR ACCIDENT

~~**Assumptions and Definitions**~~

~~The term reentry is used for emergency workers and members of the public going into radiologically-contaminated areas temporarily under controlled conditions.~~

~~The incident response is divided into three activity planning phases. Early Phase begins with the incident and may last from hours to days. Intermediate Phase begins with control and characterization of the release; it may overlap early and late phase activity and last from weeks to months. , and is assumed to last for one year for purposes of dose projection only.~~

~~Late Phase begins when recovery actions to reduce radiation in the environment begin and ends when all recovery actions are complete. The matrix below only addresses Early and Intermediate Phase activity.~~

~~**Approach and Discussion**~~

~~Interagency guidance informed this section, including—~~

- ~~"Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (EPA, 1992).~~
- ~~"Preliminary Report on Operational Guidelines Developed for Use in Emergency Preparedness and Response to a Radiological Dispersal Device Incident" (DOE 2009).~~
- ~~FRMAC Assessment Manual (Sandia National Lab, 2010).~~

The "Preliminary Report on Operational Guidelines Developed for Use in Emergency Preparedness and Response to a Radiological Dispersal Device Incident" (DOE 2009), referred to as "Operational Guidelines" include detailed numeric guidance, developed by a multi-agency working group as a follow-up to the RDD/IND Planning Guidance. That work focused specifically on response and recovery for an RDD event;

however, that work can be expanded to include isotopes from a variety of incident types.

The Operational Guidelines are informative for this guidance, specifically the discussions about applicable dose-based limits, timeframes and pathways of exposure related to reentry tasks. The term reentry is used for emergency workers and members of the public going into radiologically contaminated areas, temporarily, under controlled conditions. Food and agriculture guides use FRMAC assessment methods as well as the Operational Guidelines for implementation. These tools allow derivation of decontamination thresholds for the early and intermediate stages of a response.

As part of the U.S. response to the Japanese Fukushima accident, scientists performed dose calculations to ensure that passengers and workers on train trips through contaminated areas do not exceed doses typically received from cosmic radiation during an international flight. DOE's Argonne National Laboratory scientists utilized the RESRAD-RDD tool and hand calculations to approximate doses from the NPP radionuclides.

THESE FOOTNOTES WERE DELETED FROM THIS SECTION

~~PAGs Manual online at http://www2.epa.gov/radiation/protective-action-guides-pags.~~

~~The Operational Guidelines were developed by federal agencies and published in draft form by DOE in February 2009 DOE/HS-0001; ANL/EVS/TM/09-1, on-line at http://web.ead.anl.gov/resrad/documents/ogt_manual_doe_hs_0001_2_24_2009c.pdf.~~

~~FRMAC Assessment Manual, Overview, and Methods online at: http://www.nv.doe.gov/nationalsecurity/homelandsecurity/frmac/manuals.aspx.~~

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Table 4.2: Reentry: Quick Reference to Operational Guidelines

PHASE	ACTIVITY	SUGGESTED LEVELS [a]	CLEANUP ACTIONS [b]
Early Phase ~~(first 4 days)~~	**Sheltering or Evacuation for the Public** **Emergency Worker Protection**	**Public**: 1-5 rem (10-50 mSv) projected over four days (See Ch. 2). A decision to evacuate weighs anticipated dose against feasibility of evacuating within a determined time frame, along with the risks associated with the evacuation itself. ~~response worker~~ Emergency Worker: 5/10/25 rem (50/100/250 mSv) incurred over the response duration. The higher limits are based on task (e.g., protecting large populations or critical infrastructure or lifesaving). Responder doses will be tracked with dosimeters. Emergency workers have knowledge of the risks associated with radiation exposure, training to protect themselves and dosimeters to track their doses.	It is too early for organized cleanup, due to chaos of the situation and higher priorities such as life-saving activities and clearly identifying shelter and evacuation zones. Any cleanup or decontamination information should focus on personal decontamination. It is doubtful any large-scale effort could change evacuation or shelter recommendations during this period (1st 4 days). Once evacuation is completed, there are simple actions cities can implement themselves: rinsing roofs and streets, street sweeping. The objective of these efforts is to move the bulk amounts of contamination away from occupied areas or areas where reoccupation is a priority. These actions should be based on measured amounts of contamination and priority of the location. Workers may face high dose levels and will need health physics
Intermediate Phase ~~(first 30 days and up to a year)~~	**Relocation for the Public**	**Public**: 2 rem (20 mSv) projected first year, 0.5 rem (5 mSv) per year projected in subsequent years (See Ch. 3). In this phase, scientists run dose calculations with RESRAD RDD or Turbo FRMAC; the user can choose sensitive age groups, or enter lower guidelines, if desired. Additionally, local decision makers can adapt the guides with incident-specific considerations and implement variations as needed.	Early cleanup efforts should focus on the removable portion of the contamination: vacuuming, washing, vegetation removal. Vacuuming has the advantage of collecting removable contamination without water or surface impact, but is limited by equipment availability and can also expose the operators to high dose levels as the vacuums collect the contamination. Washing and rinsing are simple to implement, but only move the contamination to less-populated areas and may move contamination deeper into porous surfaces. For unpaved areas, vegetation removal can effectively reduce the amount of contamination present, but is labor intensive and can produce large amount of waste. Having addressed the removable part of the contamination, later efforts can focus on fixed contamination. Paved surface
Intermediate Phase ~~(first 30 days and~~	**Reentry** **For Use of Critical**	**Public**: 2 rem (20 mSv) in first year (Preliminary Report on Operational Guidelines Developed for Use in Emergency Preparedness and Response to a Radiological Dispersal Device	removal is very effective, but requires specialized equipment and trained operators. Surface sealing is easier, but leaves the contamination in place, making it viable only in locations where the

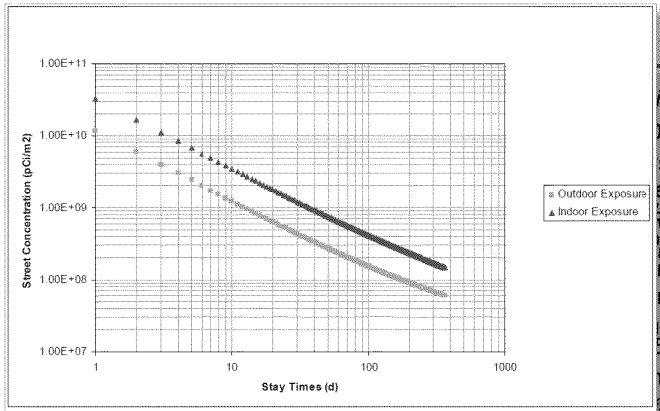

FIGURE 7.5 Limiting Concentrations of Cs-137 for Access to Business

ional Guidelines Group C). Dosimeters could be
mSv) first year, 0.5 rem (5 mSv) per year in
s (*Operational Guidelines, Group E*).
er Protection: (dose not to exceed) 5 rem (50
alues here are similar to those for Use of Critical
Radiation Protection Guidance to Federal
upational Exposure, EPA 1987).
rent because the exposure conditions are
rs have knowledge of the risks associated with
re, training to protect themselves and
5 mSv) over one year for temporary access with
ack their doses.
ndent on reentry tasks and site-specific
ational Guidelines, Group D).
minated areas could be trained and given
erm of art used in the radiation safety field. Stay
times are the amount of time a person may access the
contaminated area. These times vary based upon site-specific factors or incident characteristics such as indoor or outdoor work, sensitive populations and level of radioactivity.

Section 7.1 of the Operational Guidelines, "Worker Access to Businesses for Essential Actions," provides tables and graphs of stay times at various limiting concentrations (see Figure 7.5 and Table 7.8). For example, if the maximum surface street

These graphics below are examples based on Operational Guidelines.

dose rates are low enough for occupation, or in low-occupancy areas. Repaving roads, lots and other paved surfaces is easy to implement, but can generate significant waste volumes. Unpaved areas can be further remediated by soil skimming (surface removal), deep plowing (turning the top foot or so of soil over) and appropriate chemical soil amendment methods like liming or chelating.

As the Intermediate phase progresses, knowledge and experience increases and these methods can be re-applied, refined or customized for problem areas. Decisions about more difficult areas will benefit from professional judgment, additional analyses and application of more sophisticated technologies.

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concentration of Cesium-137 is 3.00E+09 pCi/m2 (1.11E+08 Bq/m2), people limited to 0.5 rem (5 mSv) should be in the contaminated area less than four 8-hour days if staying outdoors.

This may apply to individuals retrieving belongings from homes or to workers providing security patrols, or even to people reopening businesses in the area. As contamination levels are reduced during cleanup, stay times can be extended and total doses reduced.

Operational Guidelines provide stay times and concentrations for several different sets of assumptions about the exposure. Residents retrieving possessions may spend most of their time indoors, where stay times are longer than they are for outdoors tasks. Stay time recommendations can be used to guide decisions about allowing entry into the contaminated area for a limited time and dose reduction techniques like wearing dust masks, cleaning shoes and car tires upon exit and using time wisely keep radiation exposure "ALARA" below the Operational Guideline.

Table 7.8 Scenario D2-2 Operational Guidelines for 0.5 rem Annual Dose: Residents Access to Houses (Indoor Exposure)

	Surface Street Concentration (pCi/m^2)		
Radionuclide	1 Day	4 Days	12 Days
Am-241	7.51E+07	2.86E+07	1.59E+07
Cf-252	3.50E+08	1.32E+08	7.13E+07
Cm-244	1.27E+08	4.82E+07	2.68E+07
Co-60	2.72E+09	6.87E+08	2.33E+08
Cs-137	1.14E+10	2.94E+09	1.01E+09
Ir-192	9.93E+09	2.54E+09	8.92E+08
Po-210	1.17E+09	3.86E+08	1.74E+08
Pu-238	6.56E+07	2.50E+07	1.39E+07
Pu-239	6.01E+07	2.29E+07	1.27E+07
Ra-226	6.08E+08	2.10E+08	9.97E+07
Sr-90	2.48E+10	7.70E+09	3.18E+09

[a] This guidance does not address or impact site cleanups occurring under other statutory authorities such as the United States Environmental Protection Agency's (EPA) Superfund program, the Nuclear Regulatory Commission's (NRC) decommissioning program, or other federal or state cleanup programs.

[b] This cleanup process does not rely on and does not affect any authority, including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq. and the National Contingency Plan (NCP), 40 CFR Part 300. This document expresses no view as to the availability of legal authority to implement this process in any particular situation.

The Operational Guidelines were developed by federal agencies and published in draft form by DOE in February 2009 DOE/HS-0001; ANL/EVS/TM/09-1, on-line at http://web.ead.anl.gov/resrad/documents/ogt_manual_doe_hs_0001_2_24_2009c.pdf. (DOE 2009)

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KEY POINTS IN CHAPTER 4 – INTERMEDIATE PHASE

- The principal protective actions for reducing exposure of the public to deposited radioactive materials are relocation, decontamination and time limits on exposure. The PAG for relocation is 2 rem (20 mSv) over the first year of exposure. After the first year, the PAG for relocation is 0.5 rem (5 mSv) per year.
- Boundaries of relocation areas should be established based on the relocation PAG and site-specific geographical features such as rivers, mountains or roadways.
- Exposure limits must be set for people who must enter the relocation area to perform vital services.
- Other protective actions, such as focused decontamination and time limits on exposure, are applied to people in areas where levels of deposited radioactivity are not high enough to warrant relocation.
- Protective action guidance for food is contained in FDA's "Accidental Radioactive Contamination of Human Food and Animal Feeds: Recommendations for State and Local Agencies" (FDA 1998).
- EPA has established enforceable drinking water standards for radionuclides under the SDWA. EPA recommends that to the extent practicable, emergency measures for drinking water be based on the NPDWR for radionuclides. The Radionuclides Rule provides states with flexibility when responding to radiological events. Input on the appropriateness of, and possible values for, an intermediate phase emergency drinking water PAG is being sought during the public review of this Manual.
- {placeholder for drinking water}
- To inform temporary reentry into relocation areas, use the Operational Guidelines (DOE 2009).

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CHAPTER 5. PLANNING GUIDANCE FOR THE LATE PHASE

1.19 INTRODUCTION

This section describes the remediation cleanup process for the late phase of a nationally significant radiological incident, like a disaster at an NPP, an RDD or an IND. It should be noted that the extent and scope of contamination as a result of an NPP, RDD or IND incident may be at a much larger scale than a site or facility decommissioning or remedial cleanup. This process identifies the late phase remediation or cleanup process steps, including factors for decision makers to consider in determining final cleanup actions. For information on roles, responsibilities and authorities during emergency response and recovery please refer to the National Response Framework: http://www.fema.gov/national-response-framework and specifically for radiological incidents, the Nuclear Radiological Incident Annex:http://www.fema.gov/pdf/about/divisions/thd/IncidentNucRad.pdf (FEMA 2008a, b).

1.19.1 Transitioning from Intermediate to Late Phase Cleanup

The late phase cleanup process begins sometime after the commencement of the intermediate phase and proceeds independently of intermediate phase protective action activities. The transition is characterized by a change in approach, from strategies predominantly driven by urgency, to strategies aimed at both reducing longer-term exposures and improving living conditions. The late phase involves the final cleanup of areas and property at which contamination directly attributable to the incident is present. It is in the late phase that final cleanup decisions are made and final recovery efforts following a radiological incident are implemented.

Unlike the early and intermediate phases of a radiological incident, decision makers will have more time and information during the late phase to allow for better data collection, stakeholder involvement and options analysis. There will be opportunities to involve key stakeholders in providing sound, cost- effective cleanup recommendations. Generally, emergency phase decisions will be made directly by elected public officials, or their designees, with limited stakeholder involvement due to the need to act within a short timeframe. Longer-term decisions should be made with stakeholder involvement and can also include incident-specific technical working groups to provide expert advice to decision makers on impacts, costs and alternatives. Community members will influence decisions such as if and when to allow people to return home to contaminated areas. There will be people living in contaminated areas, outside the evacuation and relocation zones, where efforts to reduce exposures will be ongoing.

Because of the extremely broad range of potential impacts that may occur from NPP incidents, RDDs and INDs (e.g., light contamination of one building to widespread destruction of a major metropolitan area), a process should be used to determine acceptable cleanup criteria based on the societal objectives for expected land uses and the options and approaches available. Implicit in these decisions is the ability to balance health protection with the desire of the community to resume normal life. Radiation protection considerations ~~must~~ should be addressed in concert with health, environmental, economic, social, psychological, cultural, ethical, political, and other considerations. It is recognized that experience from existing programs, such as the U.S. EPA's Superfund program, the U.S. NRC's process for decommissioning and decontamination to terminate a nuclear facility license and other national recommendations may be useful in planning cleanup and recovery efforts.

Consistent with the "Framework for Environmental Health Risk Management," mandated by the 1990 Clean Air Act Amendments and published by the Commission on Risk Assessment and Risk Management in 1997, the late phase cleanup process consists of multiple steps, including 1) characterization and stabilization, 2) development of goals and strategies and 3) implementation and reoccupancy. Stakeholder involvement should be integrated throughout the process. Characterization in this phase consists of delineation, in detail, of the nature and extent of contamination in areas impacted by the incident. Stabilization is intended to reduce the

spread of contamination to clean areas, airborne inhalation hazards and the volume of radioactive waste generated. Establishment of cleanup goals and strategies should consider overall community health, along with a variety of factors described further below; they are based upon anticipated land use and a variety of selection criteria. Key to these steps is the involvement and acceptance of the impacted state and local community. These steps are discussed in more detail below.[28]

1.19.2 Characterization and Stabilization

The first step in the late phase remediation or cleanup process is characterization, or the comprehensive mapping and monitoring of the distribution and level of radioactive contamination. Characterization activities are necessary in the preparation for and verification of a successful remediation or cleanup effort. The late phase characterization work is designed to define, in detail, the nature and extent of the contamination and to provide information needed to develop and evaluate cleanup alternatives.

The characterization performed in support of the late phase will be much more detailed and comprehensive than the earlier characterization work to support PAG decisions made during the early and intermediate phases. It delineates the nature of any actual threat posed to human health or the environment and defines the extent of that threat.

Stabilization techniques are designed to immobilize radioactive contamination on soils, buildings, roads and equipment. This becomes paramount in a large-scale incident where the spread of contamination can occur from natural weathering effects to human and animal interactions with the environment. Stabilization reduces chronic low-level exposures to residual radiation, airborne hazards and volumes of secondary waste. These reductions can result in significant benefits to the long-term recovery in terms of time-to-normalcy and economic recovery.

1.19.3 Goals and Strategies

After late phase characterization and stabilization activities are accomplished, areas impacted by radioactive contamination are documented and defined to the best extent possible. At this point, decision makers ~~must~~ should establish cleanup goals and strategies for moving forward. The development of goals and strategies marks the second step in the late phase remediation or final cleanup process. As part of an ongoing iterative process, cleanup goals are informed by the feasibility of cleanup strategies and specific cleanup strategies adjust as experience is gained. That is, risk management goals may be refined as decision makers and stakeholders gain appreciation for what is feasible, what the costs and benefits are and how the process of reducing exposures and risks can improve human and ecological health.

As actual levels for areas are determined, many factors come into play in decision making, such as balancing risk reduction with other factors, background levels of radioactivity and tolerance for voluntary versus involuntary risk. Determining these levels will require consideration of a number of factors—

- The types of contamination; the technical feasibility, cost, timeliness and effectiveness of decontamination measures; and the availability and cost of options for the disposal of wastes.
- The size and character of the areas that are contaminated; past and projected future uses for these areas; and the preservation or destruction of places of historical, national, or regional significance.
- Site-specific natural and anthropogenic background levels of radioactivity.
- Estimates of the impacts of both contamination and options for decontamination, on human health, communities, the economy, ecosystems and ecosystem services.
- Public acceptability and intergenerational equity.

[28] This cleanup process does not rely on and does not affect any authority, including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq. and the National Contingency Plan (NCP), 40 CFR Part 300. This document expresses no view as to the availability of legal authority to implement this process in any particular situation.

Community involvement and sentiment are vital to this process. The stress from both the incident itself as well as the longer term effects of separation from home will be important factors as overall community health is considered. In the United States, a range of one in a population of ten thousand (10^{-4}) to one in a population of one million (10^{-6}) excess cancer incidence outcomes is generally considered protective for both chemical and radioactive carcinogenic contaminant exposures. This range is the regulatory standard generally used in the context of EPA Superfund response actions. The NRC's decommissioning and decontamination process outcomes are usually in or near this range as well. A similar risk range may be an appropriate goal for radiological events that affect areas of comparable size. However, such risk ranges may not be practically achievable for major incidents that result in the contamination of very large areas. Every incident is unique. In making decisions about cleanup goals and strategies for a particular event, decision makers ~~must~~ should balance the desired level of exposure reduction with the extent of the measures that would be necessary to achieve it, in order to maximize overall human welfare.

While it may take many years to achieve final cleanup levels, a timely return to normalcy, including reoccupancy and a viable community, will require a cleanup process that is flexible, iterative and inclusive. Decisions ~~must~~ should be made on a site-specific basis and should reflect the interim risks that are reasonable and acceptable to the affected community as active remediation, radioactive decay and natural weathering move the site toward long-term cleanup goals.

Cleanup strategies are adopted as decision makers and stakeholders gain an understanding of all relevant factors. Tradeoffs between alternatives should be considered and balanced so that the best options are chosen. Local acceptance will be a key component of a fully transparent approach to long-term remediation and cleanup. Factors to consider in determining cleanup actions include evaluating:

- Areas impacted (e.g., size, location relative to population);
- Actions already taken during the early and intermediate phases;
- Ability of a remedy to maintain reliable protection of overall human health and the environment over time;
- Assessing the relative performance of treatment technologies on the toxicity, mobility or volume of contaminants;
- Success or effectiveness of the cleanup or remediation as the cleanup progresses (contaminant removal);
- Adverse impacts on human health and the environment that may be posed in the time it takes to implement the remedy and achieve the community-based remediation goals;
- Impacts of alternative levels of clean up on the local and regional economy (e.g., job loss due to closed businesses, job creation due to decontamination and waste handling operations) and on residents' sense of place (e.g., continued limited access to one's home and community until clean up levels have been reached);
- Preservation or destruction of places of historical, national or regional significance;
- Technical and administrative feasibility of the remedy, including the availability of materials and services needed to implement each component of the option in question;
- Cost of each alternative, including the estimated capital and operation and maintenance costs and net present value of capital and operation and maintenance costs;
- State concurrence with the remedy; and
- Community support for the remedy.

This may be an iterative process. As experience is gained, adjustments may be required to achieve long-term goals.

1.19.4 Implementation and Reoccupancy

To implement cleanup actions in each community, measurable quantities associated with cleanup goals should be derived taking into account exposures from all potential pathways and through all environmental media (e.g., soil, ground water, surface water, sediment, air, animals or plants). These values typically are derived considering reasonably anticipated future land use, dietary habits and commerce patterns. If meeting acceptable levels based upon the reasonably anticipated post-incident land use is not practicable and cost-effective, decision-makers can look to more restrictive land uses through institutional and engineering controls. This approach is based on the belief that early community involvement focusing on desired post-incident uses of the property will result in expedited, cost-effective and publicly-supported cleanups. Overall community health, including stress factors from the initial event and separation from home or family is a necessary consideration.

In some situations, a site or area may reasonably be anticipated to support a range of uses, so cleanup goals may be different for different subareas of the impacted area. Although it may take years to achieve the final cleanup goals for all land uses, reoccupancy of the affected area will be possible when interim cleanup can reduce short-term exposures to acceptable levels during the time it takes to achieve the long- term goals. There may be institutional or engineering controls placed on some portions of the site to prevent excessive exposures until further active remediation, radioactive decay, or natural weathering allow the site to meet cleanup goals. An example of an institutional control might be a restriction on planting vegetable gardens to avoid ingesting radionuclides that may be taken up by the plant roots from the soil. An example of an engineering control to limit exposures might be adding a layer of pavement or cement over gamma emitting radionuclides that have become fixed in place by sorbing onto the street and sidewalks.

In complex cases such as the situation represented by a wide-area NPP, RDD or IND event, cleanup and reoccupancy are likely to occur subarea by subarea in order of priority and community assessments. Critical infrastructure is likely to have been restored to some level of functionality and further remediation of the infrastructure should be evaluated against the cleanup goal. A community-based and transparent development of priorities would follow, resulting in sequential actions, whereby areas (e.g., residential, commercial) would be remediated and reoccupied utilizing temporary cleanup levels that would be considered acceptable for an interim period of time prior to final cleanup goals being achieved. Land use may need to be changed in a subarea where it is not feasible with a combination of remediation, engineering and institutional controls to support the pre-incident land use in a manner that protects human health. In all cases, an appropriate population health monitoring program should be implemented proportionate to the potential or estimated health risk.

1.19.5 Stakeholder Involvement

Generally, early (or emergency) phase decisions will be made directly by elected public officials, or their designees, with limited stakeholder involvement due to the need to act within a short timeframe. With additional time and an increased understanding of the situation, there will be opportunities to involve key stakeholders in providing sound, cost-effective cleanup recommendations that are protective of human health and the environment.

Affected citizens should be involved in all phases of cleanup planning and long-term remediation of their communities. Early in the process, decision makers should bring together a broad group of stakeholders, e.g., residents, local business owners, local government officials and others interested in the processes that will be required to restore their communities. The credibility of a community group is a function of its inclusiveness. It ~~must~~ should represent all stakeholder interests to ensure it is a voice for the entire community rather than a few interested parties. Empowering individuals to assist in the process is important and effective. The affected local community will need to be involved until the site remediation activities are complete and possibly beyond that if institutional and engineering controls are placed on some subareas of the site.

1.19.6 Cleanup Process Implementation and Organization: An Example

This example, reprinted from the Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents (DHS 2008), describes a hypothetical organization to integrate federal cleanup support activities with state and local governments and the public. In particular, it addresses a scenario where the federal government is expected to be the primary funding entity for cleanup and recovery activities. For some radiological scenarios, states might take the primary leadership role in cleanup and contribute significant resources toward recovery of the site. This example does not address such a scenario, although states may choose to follow a similar process.

1.19.6.1 Cleanup Implementation

This approach describes how federal departments and agencies may coordinate during a response with state and local government counterparts and the public, consistent with the National Response Framework (NRF) (FEMA 2008a) and the National Disaster Recovery Framework (NDRF). The approach does not attempt to provide detailed descriptions of state and local roles and expertise. It is assumed those details will be provided in state and local level planning documents that address radiological/nuclear terrorism incidents.

During the intermediate phase, site cleanup planners should begin the process described below, under the direction of the on-site incident command or unified command (IC/UC) and in close coordination with federal, state and local officials. After early and intermediate phase activities have come to conclusion and only long-term cleanup activities are ongoing, the IC/UC structure may continue to support planning and decision-making for the long-term cleanup. The IC/UC may make personnel changes and structural adaptations to suit the needs of a lengthy, multifaceted and highly visible remediation process. For example, a less formal and structured command, more focused on technical analysis and stakeholder involvement, may be preferable for site extended site cleanup than what is required under emergency circumstances.

Radiological and nuclear incidents cover a broad range of potential scenarios and impacts. This example assumes that the incident is of sufficient size to trigger a state request for federal assistance and that the federal government is the primary funding agent for site cleanup. In particular, the process described for the late phase cleanup assumes an incident of relatively large size. For smaller incidents, all of the elements in this section may not be warranted. The process should be tailored to the circumstances of the particular incident. Decision makers should recognize that for some radiological/nuclear incidents, states will take the primary leadership role and contribute significant resources toward cleanup of the site. This section does not address such a scenario, but states may choose to use the process described here.

1.19.6.2 Cleanup Activities Overview

As described earlier in the document, radiological/nuclear emergency responses are often divided roughly into three phases: (1) the early phase, when the plume is active and field data are lacking or not reliable; (2) the intermediate phase, when the plume has passed and field data are available for assessment and analysis; and (3) the late phase, when long-term issues are addressed, such as cleanup of the site. For purposes of this example, the response to a radiological or nuclear incident is divided into two separate, but interrelated and overlapping, processes. The first is comprised of the early and intermediate phases of response, which consists of the immediate and near-term on-scene actions of state, local and federal ~~emergency responders~~ emergency workers under the IC/UC. On-scene actions include incident stabilization, lifesaving activities, dose reduction actions for members of the public and ~~emergency responders~~ emergency workers, access control and security, emergency decontamination of people and property, "hot spot" removal actions and resumption of basic infrastructure functions.

The second process pertains to environmental cleanup, which is initiated soon after the incident (during the intermediate phase) and continues into the late phase. The process starts with convening stakeholders and technical subject matter experts to begin identifying and evaluating options for the cleanup of the site. The

environmental cleanup process overlaps the intermediate phase activities described above and should be coordinated with those activities. This process is interrelated with the ongoing intermediate phase activities and the intermediate phase protective actions may continue to apply through the late phase until cleanup is complete.

Cleanup planning and discussions should begin as soon as practicable after an incident to allow for selection of key stakeholders and subject matter experts, planning, analyses, contractual processes and cleanup activities. States may choose to pre-select stakeholders for major incident recovery coordination. These activities should proceed in parallel with ongoing intermediate phase activities and coordination between these activities should be maintained. Preliminary remediation activities during the intermediate phase—such as emergency removals, decontamination, resumption of basic infrastructure function and some return to normalcy in accordance with intermediate phase PAGs—should not be delayed for the final site remediation decisions.

A process for addressing environmental cleanup is presented below. This is a flexible process in which numerous factors are considered to achieve an end result that considers local needs and desires, health risks, costs, technical feasibility and other factors. The general process outlined below provides decision makers with input from both technical experts and stakeholder representatives and also provides an opportunity for public comment. The extent and complexity of the process for an actual incident should be tailored to the needs of the specific incident; for smaller incidents, the workgroups discussed below may not be necessary.

The goals of the process described below are: 1) transparency—the basis for cleanup decisions should be available to stakeholder representatives and to the public at large; 2) inclusiveness—representative stakeholders should be involved in decision-making activities; 3) effectiveness—technical subject matter experts should analyze remediation options, consider established dose and risk benchmarks and assess various technologies in order to assist in identifying a final solution that is optimal for the incident; and 4) shared accountability—the final decision to proceed will be made jointly by federal, state and local officials.

Under the NRF and NDRF, FEMA may issue mission assignments to the involved federal agencies, as appropriate, to participate in the overall recovery process. Additional funding may be provided to state/local governments to perform response or recovery activities through other mechanisms. The components of the process are as follows:

1.19.6.3 General Management Structure

Planning for the long-term cleanup should begin during the intermediate phase and at that time, a traditional National Incident Management System (NIMS) response structure should still be in place. However, NIMS was developed specifically for emergency management and may not be the most efficient response structure for long-term cleanup. If the cleanup will extend for years, the IC/UC may decide to transition at some point to a different long-term project management structure.

Under the NRF and NIMS, incidents are managed at the lowest possible jurisdictional level. In most cases, this will be at the level of the IC/UC. The IC/UC directs on-scene tactical operations. Responding local, state and federal agencies are represented in the IC/UC and Incident Command Post in accordance with NIMS principles regarding jurisdictional authorities, functional responsibilities and resources provided. For a wide-area radiological incident, multiple Incident Command Posts (ICPs) may be established to manage the incident with an Area Command or Unified Area Command supporting the ICPs and prioritizing resources and activities among them. If the incident happens on a federal facility or involves federal materials, the representatives in the UC may change appropriately and the response will be conducted according to the applicable federal procedures.

Issues that cannot be resolved at the IC/UC or Unified Area Command level may be raised with the Joint

Field Office (JFO) and JFO Unified Coordination Group for resolution. The JFO coordinates and prioritizes federal resources and when applicable, issues mission assignments to federal agencies under the Stafford Act. Issues that cannot be resolved at the JFO level may be raised to the DHS National Operations Center senior-level interagency management groups and the White House Homeland Security Council and National Security Council.

Day-to-day tactical management, planning and operations for the cleanup process will be managed at the IC/UC level, but for large-scale cleanups involving significant federal resources, it is expected that the JFO Unified Coordination Group and national level federal officials will review proposed cleanup plans and provide strategic and policy direction. The federal agency(s) with primary responsibility for site cleanup should be represented in the JFO Unified Coordination Group. The IC/UC will need to establish appropriate briefing venues as the cleanup process proceeds, including the affected mayor(s) and governor(s).

The discussion below assumes a traditional NIMS IC/UC structure; if the IC/UC transitions later to a different management structure for a longer-term cleanup, the IC/UC would need to determine the appropriate way to incorporate the workgroups described below into that structure.

This process will be managed by the IC/UC, who ultimately determines the structure and organization of the Incident Command Post, but the discussion below provides one recommended approach for managing the cleanup process within a NIMS ICS response structure. The Incident Command Post Planning Section has the lead for response planning activities, working in conjunction with other sections and would have the lead for development of the cleanup options analysis, working closely with the Operations Section. The NIMS describes the units that make up the Planning Section and allows for additional units to be added depending on site-specific needs. NIMS states that for incidents involving the need to coordinate and manage large amounts of environmental sampling and analytical data from multiple sources, an Environmental Unit may be established within the Planning Section to facilitate interagency environmental data management, monitoring, sampling, analysis, assessment and site cleanup and waste disposal planning. Radiological incidents would involve the collection of not only large amounts of radiological data, but also data related to other environmental and health and safety hazards and therefore would likely warrant the establishment of an Environmental Unit in the Planning Section. Planning for FRMAC radiological sampling and monitoring activities will be integrated into the Planning Section and coordinated with other Situation and Environmental Unit data management activities.

The IC/UC may assign the Environmental Unit the responsibility for coordinating the development of the cleanup options analysis. For large incidents requiring more complicated tradeoffs or the evaluation of cleanup goals with broad implications, the IC/UC may choose to establish a separate unit in the Planning Section (for example, a Cleanup Planning Unit) to coordinate the development of the cleanup options analysis. The IC/UC may then convene a technical working group and a stakeholder working group, managed by the Environmental or Cleanup Planning Unit, to analyze cleanup options and develop recommendations. The Environmental or Cleanup Planning Unit would coordinate working group processes and interactions and report the results of the cleanup options analysis and workgroup efforts to the IC/UC through the Planning Section Chief.

The development and completion of the cleanup options analysis is expected to be an iterative process and for large incidents, the cleanup will likely proceed in phases, most likely from the "outside in" toward the most contaminated areas. The extent of the analysis and process used to develop it would be tailored to the needs of the specific incident, but the following working groups may be convened by the IC/UC to assist decision makers in the cleanup options process, particularly for large or complex cleanups.

1.19.6.4 Technical Working Group

A technical working group should be convened as soon as practicable, ideally within days or weeks of the incident. The technical working group would be managed by the Planning Section Unit that is assigned responsibility for the cleanup options analysis. The technical working group may or may not be physically located at the ICP. The group may review data and documents, provide input electronically and meet with incident management officials. The group may also be asked to participate in meetings with the JFO Unified Coordination Group if needed.

Function: The technical working group provides multi-agency, multi-disciplinary expert input on the cleanup options analysis, including advice on technical issues, analysis of relevant regulatory requirements and guidelines, risk analyses and development of cleanup options. The technical working group would provide expert technical input to the IC/UC; it would not be a decision-making body.

Makeup: The technical working group should include selected federal, state, local and private sector subject matter experts in such fields as environmental fate and transport modeling, risk analysis, technical remediation options analysis, cost, risk and benefit analysis, health physics and radiation protection, construction remediation practices and relevant regulatory requirements. The exact selection and balance of subject matter experts is incident-specific. The Advisory Team for Environment, Food and Health is comprised of federal radiological experts in various fields that may warrant representation on the technical working group, therefore, the Team or some of its members may be incorporated into this group as appropriate.

1.19.6.5 Stakeholder Working Group

The stakeholder working group should be convened as soon as practicable, ideally within days or weeks of the incident. The stakeholder working group would be managed by the Planning Section Unit that is assigned responsibility for the cleanup options analysis. The IC/UC may direct the Public Information Officer (PIO) (who would coordinate with the Joint Information Center (JIC)) to work with the group, including establishing a process for the group to report out its recommendations. How and where the stakeholder working group would meet to review information and provide its input would need to be determined in conjunction with the group members. The stakeholder working group may also be asked to participate in meetings with the JFO Unified Coordination Group if needed.

Function: The function of the stakeholder working group is to provide input to the IC/UC concerning local needs and desires for site recovery, proposed cleanup options and other recommendations. The group should present local goals for the use of the site, prioritizing current and future potential land uses and functions, such as utilities and infrastructure, light industrial, downtown business and residential land uses. The stakeholder working group would not be a decision-making body.

Makeup: The stakeholder working group should include selected federal, state and local representatives, local non-governmental representatives as well as local and regional business stakeholders. The exact selection and balance of stakeholders is incident specific.

1.19.6.6 Activities: Cleanup Planning and Recommendations

The IC/UC directs the management of the cleanup options analysis through the Planning Section. Technical and stakeholder working groups assist in performing analyses and developing cleanup options and provide input to the IC/UC and may be asked to participate in meetings with the JFO Unified Coordination Group. The IC/UC reviews cleanup options analysis and selects a proposed approach for site cleanup in close coordination with federal, state and local officials. Again, depending on the incident size, it may be necessary to conduct the cleanup in phases. Thus, decisions on cleanup approaches may also be made in phases. As appropriate for the magnitude of the cleanup task, the IC/UC would brief relevant federal, state and local government officials on proposed cleanup plans for approval. This may involve the office of the affected

mayor and governor. At the federal level, it may involve the JFO Unified Coordination Group and higher-level officials.

1.19.6.7 Public Review of Decision

The IC/UC should work with the PIO and JIC to publish a summary of the process, the options analyzed and the recommendations for public comments. Public meetings should also be convened at appropriate times. Public comments should be considered and incorporated as appropriate. A reconvening of the stakeholder or technical working group may be useful for resolving particular issues.

1.19.6.8 Execution of Cleanup and Peer Review

Assuming a Presidential declaration of a major disaster or emergency, FEMA may issue mission assignments to the federal departments and agencies that have the capability to perform the required cleanup, remediation, or debris removal activities. Cleanup activities should commence as quickly as practicable and allow for incremental reoccupation of areas as cleanup proceeds. For significant decontamination efforts, the IC/UC may choose to employ a technical peer review advisory committee to conduct a review of the effectiveness of the cleanup. The technical peer review committee would evaluate pre- and post-decontamination sampling data, the decontamination plan and any other information key to assessing the effectiveness of the cleanup.

1.20 DISPOSAL OF LARGE VOLUMES OF RADIOLOGICAL WASTE

If a large scale radiological incident were to occur in the United States, the complexity of radiological waste disposal would depend on the magnitude of the release and the decisions related to site cleanup, both of which will determine the amount and types of waste requiring disposal. Primary responsibility for waste management decisions falls to state and local officials. If there is a limited radiological incident with relatively small waste volumes, existing licensed radioactive waste capacity is available and may be sufficient to address waste disposal. However, in a situation involving a more significant release and certainly in an event such as the 2011 incident at the Fukushima nuclear facility, the waste resulting from such an incident would likely overwhelm current disposal capacity. When waste volumes exceed existing capacity, options available for consideration include supplements to existing commercial licensed radioactive waste disposal facilities, such as a combination of hazardous waste landfills, solid waste landfills, DOE facilities and construction of one or more new disposal facilities. New disposal capacity could be located at the site where the radionuclide release originated, elsewhere within the contaminated area, or away from the affected area altogether.

This section provides a short introduction to the issue, a summary of the types of available disposal options, a more detailed discussion of each disposal option, including disposal capabilities and discussion of roles and responsibilities. Although not addressed explicitly in this section, the need to prepare for and conduct safe and environmentally protective storage of waste generated during remediation will also present a significant challenge, as illustrated by the challenges that Japan faced in the aftermath of the Fukushima accident. Many of the considerations for siting disposal facilities will also be applicable to storage sites.

Planners and decision-makers need to view the long-term remediation and recovery as a comprehensive process in which waste management and disposal needs are considered from the earliest stages. For example, the selected decontamination and remediation approach should involve consideration of a number of viable alternatives with regard to potential treatment and disposal options. The precise mix of treatment and disposal options employed would depend on the nature of the specific incident (e.g., location, waste volumes). The suitability of using any individual facility would depend on a number of factors, including but not limited to the toxicity, mobility and volume of radioactively-contaminated wastes (these would be evaluated as part of the characterization process), possible treatment technologies (e.g., volume reduction technologies at the incident location; thermal treatment; neutralization), cost- effectiveness and existing federal and state (and possibly local) legal requirements governing waste disposal.

1.20.1 Potential Waste Volumes and Existing Waste Disposal Options

As noted above, the complexity of radiological waste disposal decisions would depend on a number of factors, including the magnitude of the release and the decisions related to site cleanup. Consideration of these factors will determine the amount and types of waste requiring disposal. While disposal in a licensed low-level radioactive waste (LLRW) disposal facility may be the preferable first choice, there are a limited number of such facilities and not all states have access to all licensed commercial disposal facilities. If there is a limited radiological incident with relatively small waste volumes, existing capacity is available and may be sufficient to address waste disposal. However, waste resulting from a large scale incident would likely overwhelm current disposal capacity. For large waste volumes, supplements to existing commercial radioactive waste disposal facilities would need to be considered, such as a combination of hazardous waste landfills, solid waste landfills, DOE disposal facilities and potentially, the construction of a new disposal facility. Organizational and administrative issues related to federal and state government coordination and preparation are also important.

Discussions of waste disposal options often involve comparisons of estimated waste generation and available disposal capacity. The amount of waste generated is related to the cleanup approach, as the selected approach to decontamination and remediation, as well as the long-term cleanup goals, can affect the volume of waste actually requiring disposal. The projected amounts of wastes for a large scale radiological incident may range from tens to hundreds of million cubic feet (or several million metric tons). Some of the waste may contain high radioactivity, especially at the incident's origin; however, most of the waste is expected to be only slightly contaminated, though in large quantities. The volume of contaminated soil in Japan resulting from the Fukushima incident is estimated to exceed one billion cubic feet.

As a point of comparison, roughly 28 million cubic feet of LLRW were disposed of at licensed commercial disposal facilities during the period 2002-2011. DOE disposed of approximately twice that volume in commercial facilities during the same period, in which it was involved in significant large-scale site cleanups.[29]Thus, over that ten-year period, an average annual volume of less than ten million cubic feet was disposed of in commercial facilities. Volumes from the non-governmental sector are not expected to increase significantly until the current fleet of NPPs is decommissioned. DOE generated additional waste volumes that were disposed of at DOE sites. For example, from 2000-2010, DOE disposed of approximately 20 million cubic feet of LLRW at the Nevada National Security Site (NNSS, formerly the Nevada Test Site). As it continues site cleanups, DOE projects generation of approximately 150 million cubic feet of LLRW for the period 2010-2015, most of which will be disposed at the site of origin or other designated DOE sites.

Managing the large volumes of waste resulting from a wide-scale radiological incident, such as with the Fukushima accident, would likely overwhelm existing capacity in the U.S. and thus require an overall strategy employing all available types of disposal facilities and integrating federal, state, local and private sector assets. For example, consider the following—

- At the beginning of 2016, more than 150 million cubic feet of capacity was licensed at commercial disposal facilities. An incident could consume all remaining licensed commercial LLRW disposal capacity, which would affect waste generators in the energy, industrial, research and medical sectors for whom the capacity was originally licensed. While there may be remaining property at the facilities that could be developed, there is no guarantee that additional capacity can be licensed or that states will allow all capacity to be consumed.
- Estimated waste volumes are comparable to projected generation from the entire DOE complex over the next several years, which include large-scale cleanups. While DOE is somewhat less constrained

[29] Information on disposal in commercial disposal facilities provided by the Manifest Information Management System (MIMS), operated by the DOE at http://mims.apps.em.doe.gov/.

than non-DOE disposal sites in adding additional disposal capacity at its sites, displacement of projected DOE disposal with incident-related waste has the potential to interfere with ongoing cleanup activities, leading to extended on-site storage, slower cleanups and controversial efforts to expand disposal capacity at other DOE sites. Further, there is at present no mechanism to provide access to DOE disposal sites for disposal of incident-related waste.

1.20.2 Integrated Disposal Options

An effective response to a large-scale radiological incident will involve consideration of the entire range of potential disposal options. The precise mix of disposal options employed will depend on the nature of the specific incident (e.g., location, waste volumes). The process selected to plan and conduct the long-term decontamination and remediation should identify and make provisions for using the different available disposal options. In order to provide cleanup managers the use of all potential disposal capacity there are some issues that would need to be addressed, such as waste acceptance criteria for waste sites that have not been evaluated for radioactive material disposal. However, based on an understanding of the types of waste involved and the capabilities of existing disposal facilities, a generalized discussion of the attributes of the different disposal options, with qualifiers, can be developed and are discussed below.

- Licensed Commercial LLRW Disposal Facilities—
  - Can manage most anticipated waste types within license conditions.
  - Highest degree of public acceptance.
  - Significant bulk disposal volume possible.
  - Access restrictions may require special approval for waste from certain states.
  - Management of mixed radioactive and hazardous waste will need to ensure proper disposal and long-term groundwater monitoring.
- Solid and Hazardous Waste Landfills—
  - May offer local disposal option for expected large volumes with limited contamination.
  - May offer a disposal option at hazardous waste landfills for mixed wastes (mixtures of hazardous and radiological wastes); hazardous waste landfills have specified construction and engineering requirements.
  - Need to consider the location of the units in proximity to large or sensitive populations, sensitive ecosystems, and sole source aquifers.
  - May require design modifications to ensure that the waste can be managed protectively over time.
  - Difficulty in obtaining public acceptance, although some hazardous waste landfills have accepted waste with limited radionuclide content with state approval.
  - Requires additional demonstration of suitability to ensure protectiveness for radiological material (e.g., groundwater monitoring, additional engineering controls); many solid waste landfills have not been evaluated for disposal of radioactive material and may not be suitable for radiological material.
  - May require longer-term/special monitoring, as well as institutional controls.
- DOE Disposal Sites—
  - Could potentially handle higher-activity waste if insufficient commercial access/capacity.
  - May be suitable for some problematic waste types (e.g., whole vehicles).
  - DOE disposal facilities generally accept only DOE-owned or DOE-generated waste. Disposal of non-DOE waste requires additional review and agreements involving the host state, consistent with DOE's authorities particularly where existing agreements limit DOE's waste disposal activities.

Each of these potential disposal alternatives is discussed in more detail below. There may also be some remaining wastes that might require special consideration based on factors such as level of contamination, waste form, lack of access or capacity or presence of other hazardous or toxic contaminants. These wastes

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could include those containing both hazardous and toxic constituents (e.g., mercury and PCBs), animal carcasses or contaminated vehicles (where dismantling the vehicle may represent a greater potential for dispersal of contaminants and exposure of workers).

1.20.2.1 Commercially Licensed LLRW Disposal Facilities

Given that the bulk of the waste resulting from the release of radionuclides from a nuclear facility or a deliberate action will contain radionuclides commonly contained in LLRW, licensed commercial disposal facilities would be the most appropriate and publicly acceptable option for disposal if the volumes of waste from the incident were relatively small. It would be anticipated that the waste would be mostly at the lower end of radionuclide concentrations. Thus, these facilities will be capable of handling all but the most problematic waste types, if the amounts were limited. At present, all commercial LLRW disposal facilities are licensed by states (through agreements with NRC, referred to as "Agreement States").

As described earlier, available capacity and access are significant concerns in relying on commercial LLRW disposal facilities. Further, even if a facility would be generally available to all waste generators and it is found that all but a small portion of the waste would meet that facility's disposal criteria, it is possible that there may be objections to accepting all waste from an incident outside the state, even if the facility's capacity was sufficient.

Access to other facilities generally unavailable to the state(s) affected by the incident might be feasible in an emergency situation under NRC regulations, but it should not be expected that large volumes of waste will be accepted under these provisions. There is also the possibility that the affected state could construct a disposal facility to provide additional capacity. Several states conducted extensive studies of their geology in anticipation of constructing disposal facilities and these studies may be of use in such situations.

1.20.2.2 Solid and hazardous waste landfills

Most states are authorized by the EPA under the Resource Conservation and Recovery Act (RCRA) to operate their own hazardous waste management programs in lieu of the federal Subtitle C program.[30] Management of nonhazardous solid wastes is governed by RCRA Subtitle D, which is administered largely by the states. Compared to the number of licensed LLRW disposal facilities in the U.S., there are a greater number of commercial landfills operating under Subtitle C and many more operating under Subtitle D of RCRA for disposal of hazardous and solid wastes, respectively. It would not be expected that all of these facilities (particularly those operating under Subtitle D) would be appropriate disposal options. However, some of the hazardous waste landfills have accepted some radioactive material for disposal and a few have received the necessary state approvals to do so on a routine basis. Historically, most of the radiological waste streams accepted by hazardous waste landfills contain naturally-occurring radionuclides not regulated by NRC, such as wastes from the oil and gas or other resource extraction industries, as well as water treatment residuals. However, both NRC and DOE, in coordination with state regulators and facility operators have approved disposal of radioactive waste in RCRA landfills on a case-by-case basis. Thus, there is reason to believe that one or more hazardous waste landfills could contribute to the disposal capacity for incident-related waste. The use of any particular RCRA facility for the disposal of radioactive contaminants or mixed contamination would require that the unit is well designed and managed appropriately. The uniform design and engineering requirements applicable to hazardous waste landfills would facilitate such an evaluation; by contrast, not all solid waste landfills are constructed to the same specifications. Further, the evaluation would include consideration of the waste characteristics, site characteristics, waste acceptance criteria and other facility attributes.

RCRA hazardous and solid waste landfills may also offer the advantage of disposal capacity suitable for

[30] Alaska, Iowa, Puerto Rico, the Virgin Islands, American Samoa and the Trust Territories and Northern Marianas Islands do not have authorized RCRA programs.

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large volumes of lightly-contaminated material (e.g., soil)[31]. In addition, these facilities are more likely to be located near the incident location, which can facilitate their use if deemed appropriate by federal, state and local officials. However, use of these facilities for disposal of radionuclides typically found in low-level radioactive waste, even if it contains very low concentrations of those radionuclides, may generate public concern if the facilities have not been previously approved for this type of disposal. Therefore, additional effort by state and local officials would be necessary to ensure the facility can manage the waste in a protective manner, including technical modification, if appropriate.

1.20.2.3 DOE Disposal Sites

DOE facilities could potentially be a disposal alternative that may be most appropriate for limited volumes of waste for which there is no other disposal outlet (such as high-activity waste, certain mixed wastes, or other problematic waste streams). Waste disposed at DOE sites must meet the waste acceptance criteria for those sites. DOE does not generally accept non-DOE-owned or generated waste for disposal at its sites. In addition, ~~DOE has significant ongoing reme~~diation at a number of sites that will generate large volumes of waste over the coming years. Diverting DOE disposal capacity to incident-related waste may interfere with those efforts. DOE has also utilized commercial low-level radioactive disposal, primarily for bulk waste streams from cleanups and this potential disposal alternative may also be affected by a wide-scale incident.

DOE's primary disposal site serving the DOE complex is the NNSS. DOE/NNSS continues to excavate additional disposal capacity as needed and estimates that significant additional capacity could be developed at NNSS.

DOE's other designated site for complex-wide disposal is Hanford, WA; however, DOE has an agreement with the State of Washington that it will not bring waste from other sites until certain remediation milestones have been met. Overall, DOE anticipates that most of its waste generated in the coming years will be disposed at the site of generation. Sites other than NNSS and Hanford are designated for disposal of waste generated at those sites, although exceptional situations may allow for disposal of waste generated off-site and development of some additional disposal capacity. Additional disposal capacity would likely be dependent upon agreement from the state in which the facility is located.

1.20.3 Planning and Coordination among Federal and State Entities

A number of federal and state agencies may have important roles to play in making decisions on final disposal, depending on the extent of the waste. A framework for coordination with these various federal and state agencies should be an element of the process selected for long-term decontamination and remediation.

States ~~must~~ should be intimately involved ahead of time in planning for a large-scale radiological incident and the resulting waste disposal. The following roles and responsibilities may exist with states—

- All existing commercial LLRW disposal facilities are licensed by Agreement States.
- Many, but not all, states have formed regional compacts (as authorized by Congress) to site and operate LLRW disposal facilities; compacts control access to these sites.
- Although statutorily required[32] to provide disposal capacity for low-level waste generated within the compact boundaries (with certain exceptions), states are under no obligation to accept waste from outside their compacts. States that are not members of compacts do not have the statutory protection to

[31] EPA reports that about 132 million tons of municipal solid waste were landfilled in 2009, comparable to the rate over the past two decades. The 2009 figure represents about 54% of total generation. "Municipal Solid Waste in the United States: 2009 Facts and Figures," EPA530-R-10-012, December 2010.

[32] Pursuant to the Low-Level Radioactive Waste Policy Act of 1980 (LLRWPA) and the 1985 LLRWP Amendments Act of 1985.

prohibit disposal of out-of-compact waste.

- All DOE disposal sites are located within states, many of which have agreements regarding the extent of long-term disposal or acceptance of off-site waste; states hosting DOE disposal sites should participate in planning for the potential disposal of incident-related off-site waste at DOE sites.
- States regulate hazardous waste (when authorized by EPA) and solid waste landfills that may be used for disposal of waste with very low concentrations of radioactivity; in planning for disposal of incident-related waste, states should take into account any restrictions placed on the disposal of radionuclides in these facilities.
- It is anticipated that on-site disposal at a location affected by the incident, where appropriate, will be one location of choice and that an affected state could approve construction of a new disposal facility for that purpose.

Depending on the circumstances, coordination with numerous federal agencies would be necessary. Of particular note:

- EPA is the coordinating agency for long-term remediation and cleanup, as designated by the National Response Framework (FEMA 2008a) and has federal authority for hazardous waste disposal;
- DOE is "owner" of federal sites that might be used for waste disposal;
- NRC is the federal authority for commercial LLRW disposal; and
- USDA provides technical assistance for agricultural materials contaminated by the release, including animal carcasses.

1.20.4 Other Potential Options and Considerations

Potential federal actions to increase preparedness include:

- Develop criteria under which access to DOE disposal sites is acceptable and identify issues to be resolved.
- Facilitate agreements among regional LLRW compacts and states to address situations in which access to compact sites can be assured for all states.
- Identify geographically strategic federal sites that can be used for staging and interim storage of large waste volumes.
- Identify federal sites that can be characterized in advance for construction of disposal capacity for incident-related waste, should the need arise.
- Clarify federal authorities that can be used in exceptional circumstances for acquisition of property for use as disposal or long-term storage capacity and indemnification of private sector service providers.
- Assist state and local officials in planning for and making decisions to use local disposal options (solid and hazardous waste landfills) for waste that contains relatively low concentrations of radionuclides, including:
  - developing criteria for case-by-case alternate disposal evaluations, such as those employed by NRC, EPA and DOE for limited volumes of waste;
  - establishing generally applicable criteria for disposal of radionuclides in solid and hazardous waste landfills;
  - supporting federal research into behavior of radionuclides and decontamination residuals in solid and hazardous waste landfills;
  - providing technical assistance and streamlined regulatory review (e.g., permitting) for states to evaluate existing sites and identify new sites for incident-related waste disposal capacity; and
  - developing and disseminating tools to support planning and decision-making regarding incident-related waste management.

It may be appropriate for the federal government to develop detailed guidance to address factors such as waste acceptance criteria needed for waste disposal at RCRA disposal facilities, safety evaluation of existing disposal facilities, or siting, development and regulatory approval of new disposal facilities.

Depending on the circumstances, it may be appropriate to create additional disposal capacity. This decision would most likely need to involve extensive discussion between the federal government and the affected state(s) where an incident occurred. Generally, there are two options for additional disposal capacity—

- **On-site disposal.** As a result of looking at the different choices, it may be advantageous to develop disposal capacity on-site (e.g., build a large disposal facility within the property boundaries where the facility causing the release is located), if the site is suitable.
- **Off-site disposal.** An additional option would be for a state or the federal government to build a disposal site on suitable public lands. The federal or state government could use the power of eminent domain to condemn property contaminated by a radiological incident and use it for waste disposal.

If it is determined that constructing a new disposal facility is the appropriate action, the proposed site(s) should be studied for suitability. Although the contemplated disposal actions would be taken in event of a national emergency, every effort should be made to ensure the protection of public health and the environment. Appropriate regulatory standards should be considered in developing a specific disposal plan. The disposal path and site suitability ~~must~~ should take into account the radiological characteristics of the waste. As discussed above, some slightly radioactive materials are disposed in hazardous waste landfills if they are permitted for it. More radioactive materials are sent to sites licensed as LLRW disposal sites, though less contaminated materials are also sent to LLRW disposal sites. A small amount of waste from a radiological incident may have concentrated radioactivity, but most of the waste generated in a large scale radiological incident would likely be contaminated with low levels of radioactivity. The different radiological characteristics of the waste would have a bearing on the stringency of containment required of a waste disposal facility. All waste sites would need to have appropriate controls to protect public health and the environment for any level of radioactive contamination, but more highly radioactive materials would need more robust controls than slightly contaminated material.

The physical/geographic characteristics of the site and the availability of land will be important in determining the appropriateness of a potential disposal site. Sites with limited rainfall, high evapotranspiration, deep water tables and soil characteristics that limit migration of radionuclides have been found to be best suited to disposal of radioactive waste, although waste management and engineering can be applied to improve performance at sites with less favorable characteristics (e.g., controls on the waste form or level of allowable radioactivity, addition of liners, cover requirements or through construction of concrete bunkers or vaults). Other characteristics, such as location in a high risk area (e.g., flood plain or seismic zone) or sensitive ecologic area, should also be considered. A disposal cell for 1 million cubic feet of waste will occupy 1 acre or more of surface area, assuming disposal to a depth of about 30 feet. Large-scale disposal operations may also require extensive surface facilities.

Additional considerations can also be applied to make finer distinctions among potentially suitable sites. These criteria include:

- Proximity to the incident: it may be useful to consider sites in different regions of the country to limit transportation demands;
- Proximity to residential areas or commercial districts: the potential for disposal activities to affect nearby populations or commercial activities, whether located within the site boundaries or on adjacent property, should be considered;
- Proximity to transportation: access to timely and direct transportation that can accommodate large shipments is desirable—action to facilitate: construction of transportation infrastructure (e.g., direct

rail lines);

- Experience in waste disposal: waste disposal sites will have infrastructure, procedures and trained personnel that can make most efficient use of the site—action to facilitate: development of infrastructure, training, construction of disposal cells and engineered containment (e.g., vaults or bunkers); and
- Level of existing contamination: areas that are unlikely to be remediated in the near future or unlikely to be released for public use may be more acceptable for disposal.

1.20.5 Potential Federal Actions to Develop New Disposal Capacity

In addition to criteria for siting new disposal facilities, the federal government has control of a large amount of land throughout the U.S. that could be repurposed, or could offer assistance to support state governments in developing new facilities.

1.20.5.1 DOE Sites

DOE has decades of experience in radioactive waste management. In considering the primary selection criteria described above, DOE sites in the western U.S. generally have more favorable characteristics and readily available property compared to those in the eastern U.S. However, DOE has successfully implemented disposal at the eastern sites, often with some engineering enhancements. DOE has several categories of sites for consideration, beginning with the most suitable—

- Active disposal or cleanup sites in the western U.S.
- Active disposal or cleanup sites in the eastern U.S.
- Closed sites with disposal areas.
- Closed uranium milling sites.
- Other long-term stewardship sites.

Considerations: Some DOE sites have agreements with states or other stakeholders regarding further disposal or cleanup activities. Current disposal sites have waste acceptance criteria by DOE policy or statute. Closed and long-term stewardship sites may not have large amounts of additional property available for disposal.

1.20.5.2 DoD Installations

DoD maintains some installations with large land areas, primarily in the western U.S. Many of these sites have been contaminated through extensive training or other activities. DoD likely has more sites in the eastern U.S. than does DOE. Categories of sites that could be considered suitable include:

- Bombing and firing ranges;
- Chemical weapons demilitarization and storage sites;
- Ammunition plants and arsenals; and
- Surplus properties (e.g., BRAC – base realignment and closure, FUDS – formerly used defense site).

Considerations: Section 2692 of title 10, United States Code, "Storage, Treatment and Disposal of NonDefense Toxic and Hazardous Materials," generally provides that the Secretary of Defense may not permit the use of an installation of the DoD for the storage, treatment, or disposal of any material that is a toxic or hazardous material and that is not owned either by the DoD or by a member of the armed forces (or by a dependent of the member) assigned to or provided military housing on the installation. Radiological waste resulting from either a nuclear accident or a terrorist attack may fall under this prohibition. The Secretary of Defense may grant exceptions to this restriction when "essential to protect the health and safety of the public from imminent danger." A determination whether or not radiological waste meets the "imminent danger" threshold would be required.

Additionally, some DoD properties, including ranges in the western U.S., are on "withdrawn" lands, which are part of the public domain supervised by the Bureau of Land Management (BLM). Withdrawn land statutes permit DoD to use the property for specific military mission needs. The use of withdrawn lands to manage radiological waste would violate those statutes.

1.20.5.3 Other Federal Properties

Agencies such as the Department of Interior or USDA own large properties that could be considered suitable for disposal, many of which are in the western U.S. These properties may be administered by discrete entities within the cabinet-level departments, such as the National Park Service (NPS), BLM, or Forest Service. Some properties may be in proximity to DOE or DoD lands.

Considerations: Properties may be designated for protection or public use (e.g., wilderness areas or preserves). Many properties are also in rugged terrain with difficult access or border tribal lands.

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KEY POINTS IN CHAPTER 5 – LATE PHASE

- PAGs will not be used to guide restoration and recovery of areas impacted by a radiological incident; rather, planning activities should include developing a process to involve stakeholders in setting priorities and determining actions. Such a process should be flexible enough to adapt to a variety of situations.
- Planning considerations for worst case scenarios are provided. Smaller radiological incidents may be well addressed by existing emergency response and environmental cleanup programs at local, state, tribal and federal levels.
- Reoccupying households and businesses should be considered in balance with progress made in reducing radiation risks through decontamination, radioactive decay and managing contaminated waste.
- Exposure limits in a range of one in a population of ten thousand (10^{-4}) to one in a population of one million (10^{-6}) excess lifetime cancer incidence outcomes are generally considered protective, though this may not be achievable after a large radiological incident. In making decisions about cleanup goals and strategies for a particular event, decision makers must balance the desired level of exposure reduction with the extent of the measures that would be necessary to achieve it, in order to maximize overall human welfare.
- Incidents that create large volumes of waste from a wide-scale radiological incident would likely overwhelm existing radioactive waste disposal capacity in the U.S.
- Following a nuclear accident, the states bear primary responsibility to identify and provide waste management options, including disposal capacity; in the event of a terrorist attack, the federal government can offer a range of assistance to state governments to identify and implement waste management options.
- Safely managing and disposing of radioactive waste will require pre-planning at all levels of government and careful coordination with stakeholders at all stages of the decision-making process.

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APPENDIX B – GLOSSARY

Acute health effects: health problems caused by high radiation doses received in a short period of time. Examples of acute effects include erythema (reddening of skin), blistering, epilation (hair loss) and vomiting.

ALARA: acronym for "as low as ~~is~~ reasonably achievable" means making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical consistent with the purpose for which the activity is undertaken.

Alpha radiation: alpha radiation comes from the ejection of alpha particles from the nuclei of some unstable atoms. An alpha particle is identical to a helium nucleus and consists of two protons and two neutrons. Alpha particles are highly energetic, but can only travel a few centimeters in air. They have low penetrating power and can be stopped by a sheet of paper. Alpha particles generally cannot even penetrate the layer of dead cells on the skin, but can pose a health risk when inhaled or ingested.

Avoided dose: The radiation dose saved by implementing a protective action. (ICRP 1991b)

Beta radiation: beta radiation comes from the emission of beta particles during radioactive decay. Beta particles are highly energetic and fast-moving. They carry a positive or negative charge and can be stopped by a layer of clothing or few millimeters of a solid material. Beta particles can penetrate the skin and cause skin burns, but tissue damage is limited by their small size. Beta particles are most hazardous when inhaled or ingested.

Cloudshine: Gamma radiation emitted from an airborne plume overhead.

Committed effective dose: The sum of the committed equivalent doses following intake (inhalation or ingestion) of a radionuclide to each organ multiplied by a tissue weighting factor.

Contamination: Radionuclides on surface or in the environment as a result of an accidental release.

Concentration: Radionuclide activity per unit of mass.

cGy: Centigray (measurement unit)

Chronic effects: Health problems caused by radiation doses delivered over a long period. Examples of chronic effects include cancer and genetic mutations.

Derived Intervention Level (DIL): Concentration derived from the intervention level of dose at which introduction of protective measures should be considered. (FDA 1998)

Derived Response Level (DRL): A level of radioactivity in an environmental medium that would be expected to produce a dose equal to its corresponding Protective Action Guide.

Dose: The amount of radiation exposure a person has received, calculated considering the effectiveness of the radiation type (alpha, beta, gamma), the timeframe of the exposure and the sensitivity of the person or individual organs.

Dose ~~conversion factor~~ parameter ~~(DCF)~~ (DP): Any factor that is used to change an environmental measurement to dose in the units of concern.

Dose projection: A calculated future dose that an individual might receive; also the process of making these calculations.

Dose reduction factor: A factor by which a decontamination technique or protective action reduces the

radiation dose to a person.

Dosimetry: The system for assessing radiation doses from external radiation exposures and from intakes of radionuclides using biokinetic models and dosimetric quantities developed by the ICRP and the International Commission on Radiation Units and Measurements (ICRU).

Early phase: The beginning of a radiological incident for which immediate decisions for effective use of protective actions are required and must therefore be based primarily on the status of the radiological incident and the prognosis for worsening conditions. This phase may last from hours to days.

Effective dose: The sum of organ equivalent doses weighted by ICRP organ weighting factors.

Emergency Planning Zone: A designated zone around a commercial nuclear power plant for which radiological response plans must be maintained under Nuclear Regulatory Commission regulations.

Emergency Worker – Anyone with a role in responding to the incident whether a radiation worker previously or not, who should be protected from radiation exposure.

Evacuation: The urgent removal of people from an area to avoid or reduce high-level, short-term exposure, from the plume or from deposited activity. Evacuation may be a preemptive action taken in response to a facility condition rather than an actual release.

Gamma radiation: Gamma radiation comes from the emission of high-energy, weightless, chargeless photons during radioactive decay. Gamma photons are pure electromagnetic energy and highly penetrating--several inches of lead or a few feet of concrete may be required to attenuate them. External exposure to gamma rays poses a health threat to the entire body. Inhalation and ingestion of gamma emitters also poses a health threat.

Graves' disease: An autoimmune disorder that leads to the over activity of the thyroid.

Groundshine: Gamma radiation emitted from radioactive materials deposited on the ground.

Gy: Grey (measurement unit).

Half-life: The time required for the half the atoms of a given radioisotope to transform by radioactive decay.

Hashimoto's thyroiditis: An autoimmune disorder that leads to underactive thyroid with bouts of over activity.

Intermediate phase: The period beginning after the source and releases have been brought under control (has not necessarily stopped but is no longer growing) and reliable environmental measurements are available for use as a basis for decisions on protective actions and extending until these additional protective actions are no longer needed. This phase may overlap the early phase and late phase and may last from weeks to months.

Isodose-rate line: A contour line that is used to connect points of equal radiation dose rates.

Late phase: The period beginning when recovery actions designed to reduce radiation levels.

Latency period, cancer: The time elapsed between radiation exposure and the onset of cancer.

Microsievert: One ten-thousandth of a rem. See Rem.

Millirem: One thousandth of a rem. See Rem.

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Millisievert: One thousandth of a Sievert. See Sievert.

Noble gases: A group of elemental gases that are tasteless, odorless and that do not undergo chemical reactions under natural conditions. The noble gases consist of Helium (He), Neon (Ne), Argon (Ar), Krypton (Kr), Xenon (Xe), and Radon (Rn).

Off-site: Areas outside the controlled border of a facility, such as a nuclear power plant. For an incident not involving a facility, this term may also be used to refer to areas impacted by contamination.

On-site: areas inside the controlled border of a facility, such as a nuclear power plant. For an incident not involving a facility, this term may refer to areas controlled during a response.

Potassium iodide: A salt of stable, nonradioactive iodine in medicine form. The administration of potassium iodine saturates the thyroid with non-radioactive iodine, so it does not absorb radioactive iodine released into the environment from a radiological incident.

Projected dose: The prediction of the dose that a population or individual could receive.

Protective actions: An activity conducted in response to an incident or potential incident to avoid or reduce radiation dose to members of the public.

Protective Action Guide (PAG): The projected dose to an individual, resulting from a radiological incident at which a specific protective action to reduce or avoid that dose is warranted.

Prophylactic: A treatment or medication designed to prevent exposure to radiation.

Rad (radiation absorbed dose): A basic unit of absorbed radiation dose. It is being replaced by the 'gray,' which is equivalent to 100 rad. One rad equals the dose delivered to an object of 100 ergs of energy, per gram of material.

Radioactive: Quality of a material that emits alpha particles, beta particles, gamma rays, or neutrons.

Radiological dispersion device (RDD): A device or mechanism that is intended to spread radioactive material from the detonation of conventional explosives or other means. An RDD is commonly known as a "dirty bomb."

Radiopharmaceutical: A radioactive chemical used for diagnosis, cure, treatment, or prevention of diseases.

Recovery: The phase after response when efforts focus on remediation, or the process of reducing radiation exposure rates and concentrations of radioactive material in the environment to levels acceptable for unconditional occupancy or use.

Reentry: Workers or members of the public going into relocation or radiological contaminated areas on a temporary basis under controlled conditions.

Release: Uncontrolled distribution of radioactive material to the environment.

Relocation: The removal or continued exclusion of people (households) from contaminated areas to avoid chronic radiation exposure. Not to be confused with *evacuation*.

Reoccupancy: The return of households and communities to relocation areas during the cleanup process, at radiation levels acceptable to the community.

Rem (roentgen equivalent man): The product of the absorbed dose in rads and a weighting factor which

accounts for the effectiveness of the radiation to cause biological damage; a conventional unit for equivalent dose. One rem equals 0.01 Sv.

Release rate: The measure of the amount of radioactive dispersed per unit of time.

Return: Permanent resettlement in evacuation or relocation areas with no restrictions, based on acceptable environmental and public health conditions.

Shelter in place: the action of staying or going indoors immediately.

Sievert (Sv): International unit of equivalent dose.

Source term: The amount of a contaminant available in a scenario or actually released to the environment.

Total Effective Dose (TED): The sum of the effective dose (for external exposures) and the committed effective dose; also referred to in this Manual as whole body dose. See Section 2.4.

Yield-producing improvised nuclear device: A crude weapon fabricated from diverted fissile material that produces a nuclear explosion.

APPENDIX C – LIST OF ACRONYMS

AEA	Atomic Energy Act
ALARA	As Low as Reasonably Achievable
BLM	Bureau of Land Management
CDC	Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cGy	Centigray (measurement unit)
CWS	Community Water System
DC	Dose Coefficient
DHS	Department of Homeland Security
DIL	Derived Intervention Levels
DoD	Department of Defense
DOE	Department of Energy
DOL	Department of Labor
DP	Dose Parameter
DRL	Derived Response Level
EAL	Emergency Action Level
EPA	Environmental Protection Agency
EPZ	Emergency Planning Zone
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
FRC	Federal Radiation Council
FRMAC	Federal Radiological Monitoring and Assessment Center
FRPCC	Federal Radiological Preparedness Coordination Committee
FUDS	Formerly Used Defense Site
Gy	Gray (measurement unit)
HAZWOPER	Hazardous Waste Operations and Emergency Response
HHS	Department of Health and Human Services
HPS	Health Physics Society
IAEA	International Atomic Energy Agency
ICP	Incident Command Post
ICRP	International Commission on Radiological Protection
~~ICRU~~	~~Only used in glossary above~~
IC/UC	Incident Command/Unified Command
IND	Improvised Nuclear Device
JFO	Joint Field Office
JIC	Joint Information Center
KI	Potassium Iodide
LLRW	Low-level radioactive waste
LLRWPA	Low-Level Radioactive Waste Policy Act
MCL	Maximum Contaminant Level
mSv	Millisievert (measurement unit)
mrem	Millirem (measurement unit)
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection and Measurements
NIMS	National Incident Management System
NNPP	Naval Nuclear Propulsion Program

NNSS	Nevada National Security Site
NPDWR	National Primary Drinking Water Regulations
NPP	Nuclear Power Plant
NRC	Nuclear Regulatory Commission
NRF	National Response Framework
NDRF	National Disaster Recovery Framework
NSS	National Security Staff
NUREG	NRC technical report designation (Nuclear Regulatory Commission)
OSHA	Occupational Safety and Health Administration
PAG	Protective Action Guide
PIO	Public Information Officer
PPE	Personal Protective Equipment
RASCAL	Radiological Assessment System for Consequence Analysis
REMM	Radiation Emergency Medical Management
RESRAD	RESidual RADioactivity (computer code developed by Argonne National Laboratory)
RCRA	Resource Conservation and Recovery Act
RDD	Radiological Dispersal Device
SDWA	Safe Drinking Water Act
SNL	Sandia National Laboratories
TED	Total Effective Dose
USDA	United States Department of Agriculture

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To: Veal, Lee[Veal.Lee@epa.gov]
From: DeCair, Sara
Sent: Mon 11/23/2015 3:40:39 PM
Subject: PAG process alternative
Finalization proposal 11-19-2015.docx
Redline PAG Manual 11-17-2015.docx

Lee,

Alan thought since the changes in the redline (actually yellow and gray, attached) are so few, we could suggest a less cumbersome internal review process. I've attached an updated note but I'm still struggling with how to make it look kind of like a calendar so you get a sense of how much time is suggested for each step. Got any ideas?

Alan has a print copy of the edited Manual and has already caught a couple things I need to go back and check. I also need to check all the links again, after Glynis caught a broken link in the water proposal!

Now I'm going through the comment spreadsheet to QA the proposed resolutions we wrote. We didn't write anything in the Cleanup and Waste comment sections, so I think I'll put "No change" and leave it at that. We have a call at 1 pm today with Jon and Alan.

S.

Protective Action Guide (PAG) Manual Finalization

EPA Internal Review Coordination Team:

OGC: Sue Stahle	OW: Sam Hernandez	OEM: Paul Kudarauskas	ORIA: Sara DeCair
OSRTI: Mike Scozzofava	OP: Glynis Hill	OHS: Lisa Nanko	ORIA: Lee Veal

Federal Radiological Preparedness Coordinating Committee (FRPCC) PAGs Subcommittee members:

NRC: Trish Milligan	FDA: Mike Noska	CDC: Armin Ansari	FEMA: Mike Howe
DHS: John Mackinney	OSHA: Jeff Lodwick	USDA: John Jensen	DoD: Rick Reyes
Navy: Lee Nickel	NNSA: Terry Kraus	DOE: Ed Regnier	

Short process note to EPA partners:

To work toward finalization of the full PAG Manual in this Administration, ORIA has pulled together an internal-use only compilation of the public comments by topic area, and a proposed revision of the 2013 PAG Manual. It has placeholders for the pending drinking water PAG overview and chapter. Since the changes from the approved 2013 version are so few and minor, we'd suggest a fairly simple internal review process.

		Dec. 2: OSWER, OGC, OHS review the public comments and the marked up Manual. We focused on adding clarifying explanations based on comments, changing Manual language as little as possible to minimize implementation work for states on their plans and procedures that paraphrase the Manual.		
		Jan 6: We'll get together to discuss your thoughts on the proposed changes. We'd propose to focus first on Late Phase since most OSWER equities are in these guidance areas: waste management and long term remediation. There are no proposed changes in that section based on public comments because these papers were finalized at a very senior level and any changes would have to clear a very high bar.		
		Jan. 20: Finalize an agreed-upon revised 2013 PAG Manual for FRPCC PAGs Subcommittee review for two weeks. Adjudicate any showstoppers at the OD level, with OSWER, OGC, OHS and the PAG Subcommittee member agencies.		

Nov. 19, 2015

		Feb. 10: In order to finish the full Manual concurrently with OMB review and public comment on the drinking water proposal, all before the change in Administration, we have to get the finalized Manual (with a drinking water placeholder) to OMB in early March.		
		Mar. 2: Submit full Manual (w/ placeholder) to OMB for 90 day review.		

Alternative (long) process:

November *Agree on process* *Send complete redline Manual to EPA partners*
December Dec. 1: Overview: Advance materials to EPA partners, Subcommittee webinar, EPA call Dec. 15: Early Phase: Advance materials to EPA partners, Subcommittee webinar, EPA call *Drinking water proposal over to OMB, when we'll ask if OMB will do concurrent reviews*
January Jan. 12: Intermediate Phase: Advance materials to EPA partners, Subcommittee webinar, EPA call Jan. 26: Food & Water: Advance materials to EPA partners, Subcommittee webinar, EPA call *Host an ODs meeting to approve finalization of the Overview & Early Phase sections*
February Feb. 9: Late Phase: Advance materials to EPA partners, Subcommittee webinar, EPA call *Host an ODs meeting to approve finalization of Intermediate, Food & Water and Late Phase sections*

Nov. 19, 2015

Finalize FR package materials: FR Notice, Comms Plan, final PAG Manual, Internal Q&A, Desk Stmt
<u>March</u> *Brief OAR AA and Deputy Administrator (who will sign the FR)* *Submit FR package to OP for OMB review*