Interagency Modeling and Atmospheric Assessment Center (IMAAC) Senior Decision Support Meeting FEMA 500 C Street, Washington, DC and Via Teleconference 29 June 2016

PARTICIPANTS

The FEMA CBRNE Office hosted an Interagency Modeling and Atmospheric Assessment Center (IMAAC) meeting focused on clarifying the critical information requirements for senior leaders from IMAAC modeling products in order to fully inform strategic leadership decisions during real-world CBRNE event. The meeting occurred in person at FEMA HQ and over the phone on 29 June 2016, from 1300–1400 HRS EST. Participants included:

Name	Organization	Name	Organization
Sean Crawford	(FEMA CBRNE)	Daniel Porter	(NOAA)
Josh Dozor	(FEMA/Response)	COL James Rollins	(NGB/NORTHCOM)
Robert Farmer	(FEMA)	Kathryn Snead	(EPA)
Bruce Foreman	(FEMA CBRNE)	Jay Tilden	(DOE)
Andy Grose	(DTRA)	Christopher Wamsley	(NWS)
Corey Gruber	(FEMA)	Brendan Zinn	(DTRA)
CAPT Lito Ignacio	(FEMA CBRNE)	Celestino Abrego	(FEMA CBRNE (CTR))
Scott Lundgren	(NOAA)	Christian Howieson	(FEMA CBRNE (CTR))
John Nasstrom	(DOE)	Michael Podguski	(FEMA CBRNE (CTR))
Damon Penn	(FEMA)	Kara Simmons	(FEMA CBRNE (CTR))

TOPICS AND DESIRED OUTCOMES

Topics of discussion for this meeting were:

- Discussion of critical information requirements and decision support needs from IMAAC products for senior leaders during a real-world CBRNE incident.
- Action Item Recap and Closing Remarks

Other issues were discussed as they related to the items above.

MEETING MINUTES:

Overview and Opening Remarks:

- Introduction by CAPT Lito Ignacio
  - DTRA Reach back and Hub are represented
  - Others from the IMAAC are here as well
- Purpose is to look at IMAAC decision support and to look at the tools provided to leadership, with the intent of improving those products. About a month ago IMAAC had a meeting with the IMAAC members. The group generally agreed that the information IMAAC provided during the recent series of exercises was valuable, but that there were clearly areas of information that needed to be more concise. Today we would like to determine what the information requirements are.

Summary of Discussions

- Mr. Penn: Noted that timing is everything; decision makers need an initial product that gives an overall assessment of what the overall containment and areas of concern are.
    - Also noted that all of the tools are tools for decision makers. The tools themselves do not make the decisions.
    - Keep in mind that the tools need to answer the 'so what' question:
        - Numbers vs. percentages; percentages are more useful than plain numbers.
        - IMAAC needs to consider various audiences. There are at least three levels of decision makers (e.g., staff, field operations, senior leadership, etc.).
        - IMAAC needs to determine what the product is meant to achieve:
            - Is thc product informational?
            - Is the product a decision tool?
        - Ensure that the technical information is both correct and appropriate for a lay reader, which means that products should provide enough context.

- Mr. Gruber: Tools should also answer questions such as:
    - How do we get people out?
    - How do we get resources in and out?
    - Where are the safe zones, death zones, sick zones, etc.?
    - Where can I put a base camp?
    - Timing is critical, so emphasize that as time progresses, information will get better.
    - Also important to keep plots, graphics, and charts in similar formats. Important to consistently use the same scale across products.
        - Mr. Penn referenced the example of a danger zone that inconsistently oriented and caused confusion.
    - Understanding how to make the decision to shelter in place vs. evacuate is critical.
    - Assumptions about the threat need to be highlighted and easily visible, need to drive to senior leaders what the key points are.

- Mr. Dozer: Discussion regarding the importance of automatic calculations to increase speed and efficiency.
    - What is enormously important is understanding the zones that are intended for re-entry. First responders and state and locals will need this information almost immediately. Leadership also needs to provide guidance with respect to how soon the next product will be needed.
    - Talking through the data collection process: For each layer, you have to pull different information, different assumptions, different variables, etc. Right now it is human. If we could get to a place where some of that is automated, it would be more efficient.

- Mr. Tilden noted that he was present with senior leaders during briefings. He also noted that for the practitioners, IMAAC is a true asset. The challenge is determine how that

ED_001057_00022014

information gets configured and how the packet gets improved for the range of audiences those products are meant to inform—from first responders to senior leaders.

- A particular concern highlighted at the deputy level was that this is not a decision, but information that will enable their decision-making. IMAAC needs to provide something that is meaningful and clear.
- Key questions/considerations/information needs for future IMAAC product development included:
    - How do you synthesize this information to what the deputies need to know?
    - What does this mean to the populations affected? (for example: sheltering vs. evacuation)
    - When do you notify the Mayor/Governor?
    - Are we closing the Federal Government?
    - Understanding the magnitude (i.e. size) of the problem is critical. It is important to convey to product consumers that the models are best guesses, in order to communicate information without losing credibility.
    - Levels of confidence and uncertainty.
        - Low, Medium, and High levels of confidence
        - Do we really want to introduce additional complexity?
            - CAPT Ignacio suggested a level of confidence indicator, and generating thresholds for Low, Medium, and High.
            - Mr. Tilden asked this group to determine what would be necessary to generate a high level of confidence.
            - There was general disagreement between CAPT Ignacio/Mr. Tilden regarding threshold vs non-threshold approach. The concern is that there may never be a high confidence result, which would hinder the objectives of the initial reports by undermining credibility.
    - Mr. Tilden: How do we simplify products without losing our credibility, in order to queue up decisions for decision makers? If we start doing some of this confidence level characterization—which is very intel-esque—the product recipients/consumers are very power-intel focused. They will start digging into levels of confidence and want to know how we know what we know. Mr. Tilden cautioned that including confidence levels would be adding additional complexity to products and not be an improvement for decision maker products.
    - Dr. Grose: Noted DTRA's past work with their IND checklist and the high number of things that need to be include in the models. What are the details/information required for level of uncertainty?
    - CAPT Ignacio suggested providing a level of confidence relative to the time the model is released.
        - Mr. Penn: Acknowledged that it could be a training issue with their leadership and perhaps leadership can take into account the timing of when models are coming in so that they have a better understanding that confidence in products gets better over time.
    - Mr. Tilden: Referenced the Fukushima reactor incident and the need to determine how many reactors were involved and the related need to reflect that in modeling. Adding a confidence level to the products might be adding an unnecessary level of complexity to the information presented.
        - Also noted that Rebecca Hersman was of the opinion that you need to get rid

of the plume models, but noted that she sees plume models as good for responders (although not helpful for the general population). For example, the general population interprets plume models literally. They see one side of the street is affected while the other side isn't. Whereas IMAAC really needs to be helping decision-makers determine what the rescue zone is and what the maneuver zone is.
    - Reference was made to the 2006 TOPOFF exercise when deputies debated on sheltering versus evacuation. Issues of secrecy came up then too and that is an issue that will continue.
    - Noted that there needs to be a universally understood and accepted lexicon as part of these products. For example: What do you mean by the term hot zone?
        - CAPT Ignacio: A hot zone is an elevated radiation zone either whereby you should either shelter in place or evacuate in 1 to 3 days.
        - Mr. Penn: In a real world event, some people will evacuate on their own and not wait for guidance. Hope that the deputy level delegates that decision to state and local authorities.
  - It was noted by COL Rollins that focus needs to be on if the model is plausible for decision-making. A reference to nuclear detonation modeling, and order of magnitude is sufficient for plausibility.
  - Mr. Penn noted that his boss cares about the scaling of the problem (i.e. how many people are affected). Ultimately the scale is very important.
  - Ms. Snead: Asked what is the biggest uncertainty in the model.
    - Often it is the source terms.
  - Mr. Porter: Suggested using something similar to ensemble modeling done at the National Hurricane Center. Suggested an iterative approach as more information comes in.
    - Not aware of how we can integrate that into a spaghetti type model. The challenge is that each of the models has varying levels of uncertainty and assumptions. Generally increases level of uncertainty.
    - Mr. Dozor: During the Alabama scenario, they didn't really care about thinking what would possibly happen tomorrow, but rather opening the eyes for what the potential impact was now (and that they needed to be prepared to respond); this allowed them to get in the door to do crisis action planning; the point was to get the message across. The Hurricane Center developed their uncertainty models based off of focus group feedback.
- A discussion occurred regarding information provided to deputies that came from two sources which seemed to be in conflict, and this highlights the importance of communicating the data. It was noted that that could happen in a real scenario.
  - CAPT Ignacio noted that this is part of the reason why IMAAC exists—to be a central point for models serving as a single federal voice.
    - Mr. Penn: We lost the deputies in the initial meeting where we didn't have anything to tell them, and then the meeting leading up to it where we sent them two products that appeared different.
        - CAPT Ignacio: It was the same product, but there was confusion on the part of the NSC who wondered why there were two different products; they were actually looking at two different parts of the same product.

ED_001057_00022014

- Mr. Tilden: Noted that this was a transmission/communication problem.
- CAPT Ignacio: Stated that usage of 'pre-canned' models should not be used for the Guardian Shield exercise next year. He noted that their hands were previously tied during the Capstone exercise because it was already identified. In an exercise, it is important to go through the struggle of not using canned data while at the same time recognizing some things may need to remain artificial.
    - Noted an IMAAC due out is sharing PPD 25 and the associated classified brief, which has relevant information.
- Mr. Penn: Small details like the time of day of the event can impact modeling results. For example, when approaching rush-hour in DC, there will be different population information to use because while 500,000 people reside in Washington, during the middle of the workday there are closer to 3 million people in the city.

Action Item Recap and Closing Remarks

- CAPT Ignacio: IMAAC will focus on exploring the issue of portraying increased levels of confidence in relation to time progression, including order of magnitude in products, identifying assumptions in products, and producing consistent messaging.
- At the next meeting we will share product examples. We will stick to IND examples because if we can get that right we can expand to chem/bio. We will reconvene in 3 to 4 weeks to present ideas to Mr. Tilden for feedback.
- CAPT Ignacio noted the meeting was productive and thanked all for participating.
- Meeting adjourned.

ACTION ITEMS:

Action items identified during this discussion are captured below, along with assigned parties and suspense dates.

Action	Assigned To	Suspense Date
Provide PPD 25 and the associated classified brief which as relevant information to IMAAC members.	CAPT Ignacio	TBD
Generate and share product examples based on results of meeting.	IMAAC	3-4 weeks

ED_001057_00022014

Interagency Modeling and Atmospheric Assessment Center (IMAAC) Decision Support Product Development Meeting Via Teleconference and Adobe Connect 15 July 2016

PARTICIPANTS

The FEMA CBRNE Office hosted a meeting of the IMAAC on 15 July 2016 from 1300–1400 HRS EST. The meeting focused on potential modifications to existing decision support products in order to better enable strategic leaders to quickly digest modeling information during a real-world CBRN event. The meeting was conducted via teleconference and materials were reviewed via Adobe Connect. Participants included:

Name		Organization	Name		Organization
Dan	Blumenthal	DOE/NNSA	Robert	Shankman	HHS
Andy	Grose	DTRA	John	Sokich	NOAA
Joselito	Ignacio	FEMA	Lee	Veal	EPA
John	Kobiasyi	NOAA	Chris	Wamsley	NWS
Michelle	Laver	DOE	Glen	Watabayashi	NOAA
John	Nasstrom	LLNL	Michael	Podguski	(FEMA (CTR))
Brenda	Pobanz	NARAC	Kara	Simmons	(FEMA (CTR))
Daniel	Porter	NOAA	Celestino	Abrego	(FEMA (CTR))
Jean	Schuman	NOAA			

TOPICS AND DESIRED OUTCOMES

Topics of discussion and desired outcomes for the meeting were:

- Review of the draft Decision Support Briefing slides prepared by the Department of Energy (DOE);
- Solicit comments regarding the applicability, level of detail, and usability of Decision Support Briefing slides for the intended purpose (briefing of senior federal officials).

Other issues were discussed as they related to the items above.

MEETING MINUTES:

Overview and Opening Remarks:

- Mr. Podguski: Thanked everyone for participating. The Adobe Connect site will be used to share the draft briefing slides prepared by DOE.

- CAPT Ignacio: This meeting is a follow-on from a recent meeting with FEMA Management held on 29 June 2016. The goal of the Decision Support Product Development meeting is to develop a IMAAC modeling product that effectively supports senior federal officials (such as the Secretary or Deputy Secretary, or even the White House) by addressing unique information needs.

ED_001057_00022015

Summary of Discussions

- **DOE Presentation and Discussion of the Draft Decision Support Slides**
  Slide One
    - Dan Blumenthal: DOE developed a set of five slides that are more appropriate for briefing high-level decision-makers. It was noted that the original presentation was given at the last meeting on 29 June 2016 and the most recent version incorporates feedback from multiple sources. The draft slides were shared with the DOE Deputy Secretary earlier this week, and the resulting changes stemming from that conversation have been inserted into the slides. These changes were focused largely on clarifying language.
    - Michelle Laver: The notional scenario selected for the slides is a 1 KT IND detonation in Washington, D.C. The first slide shows the Lethal and Immediately Dangerous Areas in the vicinity of the detonation. The labels affiliated with each region on the map emphasize that near-term (immediate) lifesaving steps should be initiated for each zone. It also emphasizes that the displayed zones are the result of model predictions, not field measurements. It was noted that DOE leadership did not feel like they had sufficient information to make decisions such as shelter-in-place vs. evacuate.
        - The biggest question from the DOE Deputy Secretary was, "Do I keep people in place, or try and move them?" It was noted there is no clear answer, and factors such as threat intelligence weigh may heavily into that decision.
        - Ms. Laver emphasized the continued need for IMAAC to develop products for senior leaders where the information was at the lowest level for them to process.
        - DOE has a Deputy Secretary who has some national security and nuclear background. It was noted that the next person in that office may not have that background. As such, IMAAC needs to operate under the assumption that senior leadership does not have a deep background in national security or nuclear issues and create products accordingly.
    - Robert Shankman: Noted that the data would have to be overlaid with HHS infrastructure. Is the data going to be sent out with it? Will it have the various levels of information included?
        - Ms. Laver noted that these products are designed for the people [subject matter experts] sitting in the room with the decision makers.
    - Robert Shankman: Expressed concern regarding the need to use the same data in the same format to ensure consistency between products. In the past, every organization took IMAAC products and created their own products with their own filters and published conflicting information. This is a big concern.
        - Michelle Laver: Agreed and referenced her similar experience with CAPSTONE 2016. During the exercise, products went from 30 to 120 in number due to organizations creating tailored products for publication.
    - Glen Watabayashi: Referenced past experience with Deep Water Horizon and the need to produce daily briefing materials. He emphasized the importance of the forecaster being in contact with the briefer to ensure interpretations are consistent. He also noted that IMAAC should establish a way to provide the forecaster's notes to

ED_001057_00022015

the briefer.

- Dan Blumenthal: Referencing DOE's sample briefing, Mr. Blumenthal noted that the talking points and background information are still available and still valid. It was also noted that the briefing is a starting point for what is presented to senior leaders.
- CAPT Ignacio: Asked about the order of magnitude estimate of the affected population.
    - Michelle Laver: The DOE Deputy Secretary said these numbers should be available, but not necessarily on the front page. In this draft set of simplified slides, DOE relegated the population impact numbers to the notes page.
- Don Ponikvar: Suggested that a top-level roll-up of the estimated population impacted—aggregated by the red/orange/yellow color code used in the zones mapping scheme—could be added to the lower left corner of the summary slide, with the by-zone breakout remaining on the notes page.
    - Dan Blumenthal stated that DOE would take that under advisement.
- Andy Grose: There is a difference between predictive model results and measured/observed reality.
    - Dan Blumenthal agreed and asked if we need two separate simplified products, one predictive in nature which would be issued pre-detonation (or immediately post-detonation before field measurements are available) and one based on field survey data issued post-detonation. These would require different language labeling the depicted zones. The latter version would also need to roll in any available intelligence data.
    - CAPT Ignacio and John Nasstrom agreed. The pre-event product will emphasize preparedness and immediate mitigation actions, to include the highest priority lifesaving objectives.
    - Michelle Laver: Noted that while the model may not change, the language and keys might dependent on whether you are pre or post-event.
- Michelle Laver: Recommendations can be made based on radiation fallout, but without the intelligence community (IC) and law enforcement (LE) community pieces, it is critical to recognize that scientific recommendations are not the final decision in these types of scenarios. IMAAC needs to consider and take for action how IMAAC better involves the IC and LE to pair with our modeling to make the recommendations that senior leaders need.
- It was also noted that there is a need to define the number of responders necessary to do the work during a real event. Robert Shankman said the detailed information that accompanies the simplified chart—coupled with the presence of SMEs at a receiving headquarters—can address this need.
- Glen Watabayashi: Suggested labeling the slide as a pre-event product and updating the label as field data is generated. Also, it was suggested to add Date/Time information on the slides to show when it was created.

Slide Two

- Dan Blumenthal and Michelle Laver: Introduced the second map display, showing the Public Health and Safety Areas. There was some discussion on the meaning of the downwind zone depicted here and ensuring there was sufficient information for people to understand the meaning. CAPT Ignacio questioned the "elevated cancer risk" nomenclature. Dan Blumenthal and John Nasstrom defended it, distinguishing

ED_001057_00022015

this slide from the immediate threat to health and safety depicted on the previous slide.

- Lee Veal: Related the zone to the Protective Action Guides (PAGs) for radiation protection. Ms. Veal suggested that perhaps this slide needs a better title, denoting the longer available timeline. It should not imply "safe" areas. Change the wording from "take additional time" (implying a mandate to do so) to "allow for additional time" (implying that time is available to define a proper course of action).
- CAPT Ignacio: Referenced his past experience in the recent CAPSTONE exercise where leadership expressed concerns about populations sheltering in place for the first 72 hours to avoid exposure to radiation. 72 hours seemed like a long time for decision makers. CAPT Ignacio's response at that time was to say that sheltering was advisable, because if you do not shelter them for that period of time you then expose them to too much radiation. So you either shelter them for 72 hours or expose them to radiation. This highlighted the need for leaders to have sufficient training relative to INDs and their effects.
- Robert Shankman: Mentioned the need for senior leaders to understand how many responders are required to actually do the work during a real event. In addition to the number of responders, leadership must also consider stay time, accumulated dose, and time in hot zone.
- Glen Watabayashi: Suggested changing the name of the slide because that is not representative of the intent of the slide. Outside the dotted area means you have more time, so the title needs to reflect that. We need to take a look at the language. More clearly and effectively indicate in this product that the outer areas has some additional time. Or in other words, this area [the area outside of the dotted line] is the area you will have to think about next.

Slide Three

- Glen Watabayashi: Questioned if using range values instead of specific number had been considered. It was noted by DOE that justification for a range be required and adds additional layers of complication.
- Lee Veal: Noted that fewer words would be useful based on her past experiences. Suggested a tabular format for the notes page. She will provide some examples for the group's consideration.

Slide Four

- Dan Blumenthal: Introduced a third map display, showing the time decay of the downwind fallout plume. The slide depicts the predicted downwind extent at 12, 24, 48, and 96 hours post-detonation.
- CAPT Ignacio asked if it was possible to overlay the time progression of on one chart.
    - DOE noted it was possible but would create a very busy slide.
    - Mr. Blumenthal noted that every map has seven time steps and it will get very long and not a White House level piece of information.
- Don Ponikvar asked if the first quadrant might be tailored to depict the maximum downwind extent (which will vary according to the ambient conditions at the time of the detonation) prior to the "shrinkage" of the downwind fallout zone (due to the rapid radiological decay of the fallout isotopes). The maximum downwind extent will not necessarily occur at 12 hours post-detonation. No clear action on this.
- It was also agreed that time stamping will be used on the next iteration of the slides.

ED_001057_00022015

Slide Five

- Dan Blumenthal: Introduced a notional fifth chart that showed the downwind fallout region at 12 hours but without the "Lower Risk Area" depicted on the third map display slide. The consensus of the participants was that this slide did not add to the story and should be deleted from the final packet.

Action Item Recap and Closing Remarks

CAPT Ignacio: Slides will be sent to all the participants. Comments are requested within a week of distribution.

Michelle Laver: She is co-sponsoring Sean Crawford's NIRT project at FEMA/CBRNE. CAPT Ignacio would like to see the products resulting from the NIRT program and this program [IMAAC] synchronized. Also, mentioned concern relative to avoiding duplication of effort. It was noted that the two efforts synergize well.

Michael Podguski to send today's briefing to everyone for comments (Dan Blumenthal then indicated that DOE could do it). Comments should be sent to Dan Blumenthal and Michelle Laver. The next meeting will be scheduled no sooner than the first week of August, depending on availability.

Meeting adjourned.

ACTION ITEMS:

Action items identified during this discussion are captured below, along with assigned parties and suspense dates.

Action	Assigned To	Suspense Date
Update slides per meeting discussion.	DOE	TBD
Send DOE Executive briefing example to IMAAC team for review	DOE	July 15, 2016
Review DOE Executive briefing example and provide comments.	IMAAC Team	July 22, 2016
Schedule Meeting for first week of August depending on availability.	FEMA CBRNE	TBD

ED_001057_00022015

To: Veal, Lee[Veal.Lee@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]
From: DeCair, Sara
Sent: Mon 7/25/2016 7:47:56 PM
Subject: Fwd: Supplemental OMB Comments on PAG Manual

FYI

Sent from my iPhone

Begin forwarded message:

From: "Dorjets, Vlad" Ex. 6 - Personal Privacy >
To: "Hill, Glynis" <Hill.Glynis@epa.gov>
Cc: "DeCair, Sara" <DeCair.Sara@epa.gov>
Subject: Supplemental OMB Comments on PAG Manual

Glynis,

Attached please find additional comments from OMB on the PAG Manual. Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Vlad

Vlad Dorjets
Natural Resources and Environment Branch
Office of Information and Regulatory Affairs
White House Office of Management and Budget
(202) 395-7315 | Ex. 6 - Personal Privacy

To: Milligan, Patricia[Patricia.Milligan@nrc.gov]; Ansari, Armin (CDC/ONDIEH/NCEH)[asa4@cdc.gov]; Howe, Michael[Michael.Howe@fema.dhs.gov]; MacKinney, John A[john.mackinney@HQ.DHS.GOV]; DeCair, Sara[DeCair.Sara@epa.gov]; Amy Doll[adoll@endyna.com]; Andrew.Wallo@eh.doe.gov[Andrew.Wallo@eh.doe.gov]; Cacioppo, Ben A Jr CIV DTRA J3-7 (US)[ben.a.cacioppo.civ@mail.mil]; derek.favret@hq.doe.gov[derek.favret@hq.doe.gov]; Edward.Regnier@hq.doe.gov[Edward.Regnier@hq.doe.gov]; John.Jensen@dm.usda.gov[John.Jensen@dm.usda.gov]; john.madrid@dtra.mil[john.madrid@dtra.mil]; Nickel, Lee A CDR USN (US)[lee.a.nickel1@navy.mil]; lodwick.jeffrey@dol.gov[lodwick.jeffrey@dol.gov]; Noska, Michael A (FDA/OC)[Michael.Noska@fda.hhs.gov]; Ward, Paul[Paul.Ward@fema.dhs.gov]; Reyes, Ricardo A LTC USARMY DHA DHSS (US)[ricardo.a.reyes.mil@mail.mil]; siddhanti@endyna.com[siddhanti@endyna.com]; tdkraus@sandia.gov[tdkraus@sandia.gov]; Veal, Lee[Veal.Lee@epa.gov]; Wieder, Jessica[Wieder.Jessica@epa.gov]; william.cunningham@nist.gov[william.cunningham@nist.gov]
From: Reyes, Ricardo
Sent: Thur 7/21/2016 9:16:50 PM
Subject: RE: [Non-DoD Source] Re: RE: Interesting PAG question: 'except nuclear war'
removed.txt

I agree with you all.

From a DoD perspective, all recommendations are valid. It is not known what a future nuclear war would be like but is it almost certain that it is not the same as what was envisioned in the 50s and 60s.

DoD doctrine for handling a nuclear detonation has evolved and is very much in line with the multi-government agency approach response plans. DoD has specific guidance for being able to perform in a radiologically contaminated environment post a nuclear detonation and this emanates from their inherent mission to respond if asked by the US Gov. Most of the doctrine is also in linc with NATO.

Commanders will seek the guidance of experts for addressing missions using military doctrine. However, when missions permit and under the advice of the experts, the PAGs can and will likely be implemented.

The PAGs offers the military an opportunity to address not only their active duty personnel but the population they serve in military posts and other locations.

V/R

Ricardo Reyes, Ph.D.

LTC, US Army

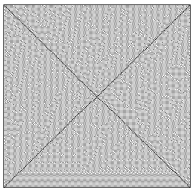
Domestic Nuclear Detection Office

U.S. Department of Homeland Security

Washington, D.C.

Office: 202-254-7167

Mobile: 202-839-1510



(U) Warning: This document is UNCLASSIFIED//FOR OFFICIAL USE ONLY (U//FOUO). It contains information that may be exempt from public release under the Freedom of Information Act (5 U.S.C. 552).

From: Milligan, Patricia [mailto:Patricia.Milligan@nrc.gov]
Sent: Thursday, July 14, 2016 5:02 PM
To: Ansari, Armin (CDC/ONDIEH/NCEH) <asa4@cdc.gov>; Howe, Michael <Michael.Howe@fema.dhs.gov>; MacKinney, John A <john.mackinney@HQ.DHS.GOV>; DeCair, Sara <DeCair.Sara@epa.gov>; Amy Doll <adoll@endyna.com>; Andrew.Wallo@eh.doe.gov; Cacioppo, Ben A Jr CIV DTRA J3-7 (US) <ben.a.cacioppo.civ@mail.mil>; derek.favret@hq.doe.gov; Edward.Regnier@hq.doe.gov; John.Jensen@dm.usda.gov; john.madrid@dtra.mil; Nickel, Lee A CDR USN (US) <lee.a.nickel1@navy.mil>; lodwick.jeffrey@dol.gov; Noska, Michael A (FDA/OC) <Michael.Noska@fda.hhs.gov>; Ward, Paul <Paul.Ward@fema.dhs.gov>; Reyes, Ricardo A LTC USARMY DHA DHSS (US) <ricardo.a.reyes.mil@mail.mil>; siddhanti@endyna.com;

tdkraus@sandia.gov; Veal, Lee <Veal.Lee@epa.gov>; Wieder, Jessica <Wieder.Jessica@epa.gov>; william.cunningham@nist.gov
Subject: [Non-DoD Source] Re: RE: Interesting PAG question: 'except nuclear war'

All active links contained in this email were disabled. Please verify the identity of the sender, and confirm the authenticity of all links contained within the message prior to copying and pasting the address to a Web browser.

All active links contained in this email were disabled. Please verify the identity of the sender, and confirm the authenticity of all links contained within the message prior to copying and pasting the address to a Web browser.

I agree with deletion of the sentence. If we are ever in this situation I think that key decision makers would be grabbing everything at their disposal to make the best decisions possible under the conditions.

From: Ansari, Armin (CDC/ONDIEH/NCEH) <asa4@cdc.gov>
Sent: Thursday, July 14, 2016 4:52 PM
To: 'Howe, Michael'; MacKinney, John A; DeCair, Sara; Amy Doll; Andrew.Wallo@eh.doe.gov; ben.cacioppo@dtra.mil; derek.favret@hq.doe.gov; Edward.Regnier@hq.doe.gov; John.Jensen@dm.usda.gov; john.madrid@dtra.mil; lee.a.nickel1@navy.mil; lodwick.jeffrey@dol.gov; Noska, Michael A (FDA/OC); Milligan, Patricia; Ward, Paul; ricardo.a.reyes@us.army.mil; siddhanti@endyna.com; tdkraus@sandia.gov; Veal, Lee; Wieder, Jessica; william.cunningham@nist.gov
Subject: [External_Sender] RE: Interesting PAG question: 'except nuclear war'

Hi everybody,

I too think deleting the sentence is the better option to avoid confusion.

I think Andy's assessment is correct that the sentence was there to address DoD issues. But

deleting the sentence doesn't harm that. DoD still has the authority to do what they need to do in<u>any area</u> they designate as National Defense Area (NDA). This is obviously not my area of expertise, but I think the concept of NDA is still applicable, not just to nuclear war but also to IND incident:

"E2.1.20. National Defense Area (NDA). An area established on non-Federal lands located within the United States, its possessions or territories for safeguarding classified defense information or protecting DoD equipment and/or material. Establishment of an NDA temporarily places such non-Federal lands under the effective control of the Department of Defense and results only from an emergency event. The OSC or DSR at the scene shall define the boundary, mark it with a physical barrier, and post warning signs. The landowner's consent and cooperation shall be obtained whenever possible; however, military necessity will dictate the final decision regarding location, shape, and size of the NDA."

Above definition comes from this document

Caution-Caution-http://www.au.af.mil/au/awc/awcgate/dod/d523016p.pdf < Caution-Caution-http://www.au.af.mil/au/awc/awcgate/dod/d523016p.pdf >

Armin

From: Howe, Michael [Caution-Caution-mailto:Michael.Howe@fema.dhs.gov]
Sent: Thursday, July 14, 2016 3:13 PM
To: MacKinney, John A <john.mackinney@HQ.DHS.GOV>; DeCair, Sara <DeCair.Sara@epa.gov>; Amy Doll <adoll@endyna.com>; Andrew.Wallo@eh.doe.gov; Ansari, Armin (CDC/ONDIEH/NCEH) <asa4@cdc.gov>; ben.cacioppo@dtra.mil; derek.favret@hq.doe.gov; Edward.Regnier@hq.doe.gov; John.Jensen@dm.usda.gov; john.madrid@dtra.mil; lee.a.nickel1@navy.mil; lodwick.jeffrey@dol.gov; Noska, Michael A (FDA/OC) <Michael.Noska@fda.hhs.gov>; Patricia.Milligan@nrc.gov; Ward, Paul <Paul.Ward@fema.dhs.gov>; ricardo.a.reyes@us.army.mil; siddhanti@endyna.com; tdkraus@sandia.gov; Veal, Lee <Veal.Lee@epa.gov>; Wieder, Jessica <Wieder.Jessica@epa.gov>; william.cunningham@nist.gov
Subject: RE: Interesting PAG question: 'except nuclear war'

I read it the same way. “Nuclear war” is not the same as the IND scenario we plan for today.

Sara’s suggestion is ok, but there is already enough guidance to allow dose assessors and decision makers to concentrate on avoidable dose and make the best choice for a given situation.

The course of action will be the same whether the wording stays or goes. Delete the phrase if it helps avoid confusion.

Michael Howe

M. F. Howe, MS CHP

Health Physicist

Radiological Emergency Preparedness Program

Technological Hazards Division

FEMA/DHS

michael.howe@fema.dhs.gov < Caution-Caution-mailto:michael.howe@dhs.gov >

202 306 5750 (cell)

From: MacKinney, John A
Sent: Thursday, July 14, 2016 2:33 PM
To: DeCair, Sara; Amy Doll; Andrew.Wallo@eh.doe.gov < Caution-Caution-mailto:Andrew.Wallo@eh.doe.gov > ;asa4@cdc.gov < Caution-Caution-mailto:asa4@cdc.gov > ; ben.cacioppo@dtra.mil < Caution-Caution-mailto:ben.cacioppo@dtra.mil > ; derek.favret@hq.doe.gov < Caution-Caution-mailto:derek.favret@hq.doe.gov > ;Edward.Regnier@hq.doe.gov < Caution-Caution-mailto:Edward.Regnier@hq.doe.gov > ; John.Jensen@dm.usda.gov < Caution-Caution-mailto:John.Jensen@dm.usda.gov > ; john.madrid@dtra.mil < Caution-Caution-mailto:john.madrid@dtra.mil > ;lee.a.nickel1@navy.mil < Caution-Caution-mailto:lee.a.nickel1@navy.mil > ; lodwick.jeffrey@dol.gov < Caution-Caution-

mailto:lodwick.jeffrey@dol.gov > ; Howe, Michael; Michael.Noska@fda.hhs.gov < Caution-Caution-mailto:Michael.Noska@fda.hhs.gov > ; Patricia.Milligan@nrc.gov < Caution-Caution-mailto:Patricia.Milligan@nrc.gov > ; Ward, Paul;ricardo.a.reyes@us.army.mil < Caution-Caution-mailto:ricardo.a.reyes@us.army.mil > ; siddhanti@endyna.com < Caution-Caution-mailto:siddhanti@endyna.com > ; tdkraus@sandia.gov < Caution-Caution-mailto:tdkraus@sandia.gov > ; Veal, Lee; Wieder, Jessica;william.cunningham@nist.gov < Caution-Caution-mailto:william.cunningham@nist.gov >
Subject: RE: Interesting PAG question: 'except nuclear war'

I recommend deleting the phrase. It is an historic carve out from another circumstance. Truth is, we would use the PAGs in the downwind areas where implementation is feasible. Also, war is no longer defined as all out nuclear holocaust the way we saw it 20+ years ago. It could be limited. The only question about the use of PAGs following a nuclear strike, whether one or multiple, is feasibility of implementation.

John MacKinney

Director, Nuclear and Radiological Policy

US Department of Homeland Security

(202) 254-6030

SIPR john.mackinney@dhs.sgov.gov < Caution-Caution-mailto:john.mackinney@dhs.sgov.gov >

JWICS jamackinney@dhs.ic.gov < Caution-Caution-mailto:jamackinney@dhs.ic.gov >

From: DeCair, Sara [Caution-Caution-mailto:DeCair.Sara@epa.gov < Caution-Caution-mailto:DeCair.Sara@epa.gov >]
Sent: Thursday, July 14, 2016 2:24 PM
To: Amy Doll; Andrew.Wallo@eh.doe.gov < Caution-Caution-mailto:Andrew.Wallo@eh.doe.gov > ;asa4@cdc.gov < Caution-Caution-mailto:asa4@cdc.gov > ; ben.cacioppo@dtra.mil < Caution-Caution-mailto:ben.cacioppo@dtra.mil > ; derek.favret@hq.doe.gov < Caution-Caution-mailto:derek.favret@hq.doe.gov > ;Edward.Regnier@hq.doe.gov < Caution-Caution-mailto:Edward.Regnier@hq.doe.gov > ; John.Jensen@dm.usda.gov < Caution-Caution-mailto:John.Jensen@dm.usda.gov > ; MacKinney, John A; john.madrid@dtra.mil < Caution-Caution-mailto:john.madrid@dtra.mil > ; lee.a.nickel1@navy.mil < Caution-Caution-mailto:lee.a.nickel1@navy.mil > ;lodwick.jeffrey@dol.gov < Caution-Caution-mailto:lodwick.jeffrey@dol.gov > ; Howe, Michael;Michael.Noska@fda.hhs.gov < Caution-Caution-mailto:Michael.Noska@fda.hhs.gov > ; Patricia.Milligan@nrc.gov < Caution-Caution-mailto:Patricia.Milligan@nrc.gov > ; Ward, Paul; ricardo.a.reyes@us.army.mil < Caution-Caution-

mailto:ricardo.a.reyes@us.army.mil > ; siddhanti@endyna.com < Caution-Caution-mailto:siddhanti@endyna.com > ;tdkraus@sandia.gov < Caution-Caution-mailto:tdkraus@sandia.gov > ; Veal, Lee; Wieder, Jessica;william.cunningham@nist.gov < Caution-Caution-mailto:william.cunningham@nist.gov >
Subject: Interesting PAG question: 'except nuclear war'

PAG Subcommittee;

Hopefully you've had a chance to provide input on the PAG Manual (the rest of the Manual, minus drinking water which is out for comment) which is in OMB review now. An interesting suggestion came up and I wanted to find out if anyone has strong feelings about the caveat, or knowledge of why it's there.

The PAG Manual states, "ThisManualprovides radiologicalprotectioncriteria for applicationto allincidents thatwouldrequire consideration ofprotective actions,withthe exception of nuclearwar."

Comment: In the absence of EPA guidance specific to "nuclear war" it is likely that the PAGs in this Manual would be implemented because there is no other guidance. Recommend adding a sentence similar to, "The PAGs in this Manual may not be appropriate for protecting the public following a nuclear detonation because of the magnitude of the impacts. EPA will work with decision-makers on a case-by-case basis to develop appropriate PAGs following a nuclear detonation."

I might suggest just cutting 'with the exception of nuclear war' and/or adding only the first of two sentences suggested above. This echoes the point that separate guidance for INDs is available, and that in addition to military actions in the case of war, PAGs might indeed be used to inform protective actions. As always, I'm open to suggestions here and the no-action path would be to just leave the language how it is.

Sara D. DeCair

Caution-Caution-http://www.epa.gov/radiation/rert/pags.html < Caution-Caution-http://www.epa.gov/radiation/rert/pags.html >

202-343-9108

Room 1416 B in WJC West

Federal Radiological Preparedness Coordinating Committee (FRPCC) Meeting Executive Summary
June 28, 2016 | 10:00 a.m. – 1:00 p.m.
Department of Energy (DOE) Headquarters, Room 1E-245

I. **Opening Remarks/Introductions** | *Jonathan Hoyes, Director, Technological Hazards Division (THD), Federal Emergency Management Agency (FEMA); Bob Farmer, FEMA, Response Directorate*

- The meeting was opened by Mr. Hoyes and new Co-Chair, Mr. Farmer.

II. **Updates from the Nuclear Regulatory Commission (NRC) Division of Preparedness and Response (DPR)** | *Patricia Milligan, NRC, DPR*

- The Commission has approved rulemaking for Small Modular Reactors (SMRs) with a target publication date of 2020. The NRC is considering a performance-based approach for emergency preparedness and a site boundary emergency planning zone (EPZ) for the SMRs and will be soliciting comments on these options. The NRC will be conducting public meetings later this summer.
- The State-of-the-Art Reactor Consequence Analyses (SOARCA) process that was performed at the Sequoyah Nuclear Plant found that no fatalities were projected to occur in worst case scenarios and that latent cancer risk was very low. The report on this analysis will be available soon and comments on it are due in August 2016.
- Decommissioning regulations are projected to be published in 2019 and are a priority over SMR rulemaking. The regulatory basis will be used as much as possible for SMR rulemaking, as well and will be available for comment in August 2016. Comments should come through the FRPCC.
- Four more plants have announced they will be decommissioning.

III. **Environment, Food and Health Subcommittee Report** | *Mike Noska, Chair, Food and Drug Administration (FDA), U.S. Public Health Service/Advisory Team (A-Team)*

- The charter and concept of operations (CONOPS) for the A-Team have been completed and need to be signed by member agencies. The standard operating procedure (SOP) is in its final form. It will exist as a living document that is updated with lessons learned.
- If a nuclear power plant (NPP) incident occurred today, there would be enough members to support the incident, however if an improvised explosive device (IED) incident occurred, they would be short-staffed, especially in regard to headquarters-level support. This issue is being addressed by bringing in field-level staff from unaffected areas to fill positions at the headquarters-level. Team size and readiness will be reported during the next meeting. Current interagency standards will be used to describe the operational status.

IV. **Protective Action Guides (PAGs) Subcommittee Report** | *Katherine Snead, Environmental Protection Agency (EPA), Radiation Protection Division*

- The Drinking Water PAG is out for public comment until July 27, 2016. There has been a request for a 60-day extension, but that is not likely to be granted. In anticipation of the public having questions about this PAG, a frequently asked question (FAQ) document has been developed. If agencies are receiving questions about the Drinking Water PAG, they should contact EPA for the FAQ document.

- The full PAG Manual has cleared Office of Management and Budget (OMB) and interagency review processes.
- The final package for both the full PAG Manual and Drinking Water PAG should be complete by the end of August 2016.

V. Training and Exercise Subcommittee Report | *Dan Blumenthal, DOE, National Nuclear Security Administration (NNSA); Alan Remick, DOE, NNSA; Bill Eberst, FEMA THD; Alvin Morris, DOE, NNSA; Sean Crawford, Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Office, Response Directorate, FEMA; Jeffrey Blizzard, FEMA Response; Bruce Foreman, FEMA Response*

- The Improvement Plan from Southern Exposure 2015 (SE15) exercise was distributed through the FEMA THD Action Office on June 22, 2016. Agencies that have items in the Improvement Plan need to send in their point of contact as soon as possible.
- RadResponder is being endorsed as the national standard by the EPA and will be incorporated into the Nuclear/Radiological Incident Annex (NRIA). The program will build off the current construct of the National Preparedness System (NPS).
- The Interagency Aerial Radiological Response team participated in the WINGS 16 exercise in New Jersey. It was a full scale exercise that tested CONOPS and SOPs that have been developed. The lessons learned include the need for improved integration of data, more time to collect the data, and greater staffing numbers for the Radiological Nuclear Aerial Coordinator (RNAC). A draft of the after action report (AAR) is targeted for August 1, 2016. The subcommittee plans to finalize CONOPS and SOPs by September and provide drafts for the group to review by the next meeting.
- The Nuclear/Radiological Incident Task Force (NRITF) was given short notice to participate in the Vibrant Response exercise. Some of the lessons learned are that Alert and Notification was a challenge, improved integration of the NRITF into the existing infrastructure is needed, and demand for nuclear/radiological equipment and experts will be high. The lessons learned and other observations from the Eagle Horizon exercise and the raw observations and lessons learned from the Vibrant Response exercise will be provided to the group.
- The Northern Lights exercise is a week-long NPP-based drill taking place in Minnesota. The actual exercise play starts 21 days after a nuclear incident at the plant. The scenario will provide lots of opportunities for labs to participate. Pre-established sample data will be made available to aid exercise play and spiked samples will be provided for the labs to use. The main goal of the exercise is to work through Federal Radiological and Assessment Center (FRMAC) transfer from EPA to DOE supervision. A one-page summary outlining the exercise will be developed and distributed to the group.

VI. American Nuclear Insurers (ANI)-FEMA Meeting Follow-Up and Discussion | *Rachel Cychosz, FEMA Response Policy*

- FEMA met with ANI in March 2016 to discuss coordination of helping the public after an NPP incident. During the meeting it was established that both ANI and FEMA have an obligation to meet the needs of the public after an NPP incident. ANI is prepared to quickly provide for the immediate needs of the public after an incident. Within their statutory purview, FEMA or other federal programs could meet the needs that ANI could not. There are no outstanding assignments associated with this follow-on.

VII. Initiative 5: Nuclear Radiological Incident Annex (NRIA) Revision | *Bruce Foreman, FEMA Response*

- The final NRIA draft, dated March 31, 2016 was submitted for Domestic Resilience Group (DRG) approval on June 23, 2016 and the DRG Principals currently have it for review. Comments are due from the FRPCC membership on the draft by July 11, 2016.

VIII. Animal Monitoring and Decontamination Subcommittee | *Gordon Cleveland, U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS)*

- The subcommittee is currently seeking research-backed methods and products for cleaning radiologically contaminated pets and animals that are not livestock, however funding for the research continues to be a challenge. The subcommittee is considering issuing a standard request for proposal (RFP) since no funding is currently in place. FEMA THD will include this guidance in the FEMA Radiological Emergency Preparedness (REP) Program Manual, once it has been written, just as it has with other federal guidance such as the EPA PAG Manual.

IX. New Initiative #8: Nuclear Radiological Incident Response Task Force (NRITF) | *Bruce Foreman, FEMA Response*

- The focus of the task force is consequence management for all nuclear and radiological incidents. The task force also supports the Weapons of Mass Destruction Strategic Group (WMDSG), Domestic Emergency Support Team (DEST); National Incident Management Assistance Team (IMAT); and Nuclear Incident Response Teams (NIRTs) as appropriate. The lessons learned from the Capstone exercise will be distributed. Any comments on that or on the strategic action plan for the task force should be sent in over the next quarter. Please focus on determining if the goals that have been set for the NRITF are specific, measurable, achievable, realistic, and time-bound (SMART). The task force is targeting the Gotham Shield exercise as an opportunity to demonstrate capability.

X. Strategic Action Plan Administration | *Jim Rogers, FEMA Response*

- The strategic action plan was distributed to the group ahead of the meeting. With the exception of some minor updates based on feedback from the FRPCC Co-Chairs, the document is in its final form. In the future, meetings will start with updates on strategic action plan initiatives, then subcommittee reports, and then any additional items will be added to the end. An outline of the new agenda will be sent around to the group. Those reporting on strategic action plan initiatives at future meetings should provide one slide with an updated quad chart to be displayed during the briefing.

XI. Radiological Advisory Medical Team (RAMT) | *Daniel S. Hamilton, National Registry of Radiation Protection Technologists (NRRPT)*

- The RAMT's mission is to provide radiation safety support, dosimetry, and assessment in response to radiological incidents. It assists and furnishes radiological health hazard guidance to the on-scene commander or other responsible officials at an accident site and the installation's medical authority. The established emergency support function (ESF) 8 and Department of Defense (DOD) mission assignment processes will be used to activate the RAMT.

XII. Personal Contamination Monitoring Criteria | *Adela Salame-Alfie, PhD, Centers for Disease Control and Prevention (CDC), Radiation Studies Branch*

- Current methods for screening and decontamination are dependent on the number of people that need to be screened and decontaminated, how quickly they need to be screened and decontaminated, the number of staff that are trained to perform these activities, how much equipment is available, whether the location has a low or high radiation background, and whether showers and running water are available. While the state radiation control program should be consulted, Dr. Salame-Alfie asks that a white paper or subcommittee be established to focus on the different methods and provide overarching guidance that will outline what to focus on when establishing screening and decontamination procedures and how to set up systems that are flexible and scalable. This should not be federal guidance as the situation requires more flexibility than federal guidance will allow.

XIII. Closing Remarks | *Jonathan Hoyes, Director, FEMA THD; Bob Farmer, FEMA, Response Directorate*

- Mr. Remick announced that this would be his last meeting as he is retiring. The group congratulated and thanked him.
- Mr. Farmer thanked CDR Janis McCarroll, FEMA THD, for facilitating the meeting and thanked everyone for attending.

XIV. Meeting Attendees

Name	Organization	Title	Phone	Email
Morgan Folckomer	FDA	Environmental Health Officer	336-613-7917	Morgan.Folckomer@fda.hhs.gov
Jacqueline Shaver	FDA/USPHS	Environmental Health Officer	250-900-1220	Jacqueline.shaver@fda.hhs.gov
Olin Hale	FEMA THD	Section Chief	202-841-3248	Olin.Hale@fema.dhs.gov
Bruce Foreman	FEMA/CBRNE	Action Officer	202-304-5399	Bruce.Foreman@fema.dhs.gov
Maria Kanevsky	EPA	Intern	571-220-7829	Kanevsky.maria@epa.gov
Daniel Hamilton	DHA/WRNMMC	Health Physics/RAMI	301-295-0034	
Brett Allen	FEMA THD	Attorney Advisor	202-430-5920	Brett.Allen@fema.dhs.gov
Gabriela Cabrera	FEMA THD	Intern	301-925-0080	Gabriela.cabrera@fema.dhs.gov
Jessica Carrington	FEMA THD	Contract Support	571-228-2344	Jessica.carrington@ich.com
Michael Poduguski	FEMA CBRN	Contract Support	202-841-9348	mpoduguski@nwcinc.com
Anthony DeFelice	FEMA THD	Attorney Advisor	202-821-5174	Anthony.Defelice@fema.dhs.gov
Michael Wangler	DOE	Specialist	202-586-7970	Mike.Wangler@cm.doe.gov
Rachel Cychosz	FEMA	Policy	202-445-0914	Rachel.Cychosz@fema.dhs.gov
William Eberst	FEMA THD	THD Policy	202-341-4917	William.Eberst@fema.dhs.gov
Adam Hutter	DHS/S&T	Lab Director	212-620-5570	Adam.hutter@hq.dhs.gov
Jeff Blizzard	FEMA	FM	202-646-3118	Jeffrey.blizzard@fema.dhs.gov
John MacKinney	DHS/Policy	Director	202-254-6030	John.mackinney@dhs.gov
Sean Crawford	FEMA/CBRNE	CBRNE Response Branch Chief	202-646-8269	Sean.Crawford@fema.dhs.gov
Robert Farmer	FEMA/Response	Department Assistant Administrator	202-646-3249	Robert.farmer@fema.dhs.gov
Jonathan Hoyes	FEMA THD	Director	202-507-2294	Jonathan.Hoyes@fema.dhs.gov
Tim Greten	FEMA THD	Deputy Director	202-657-2300	Timothy.Greten@fema.dhs.gov
Lee A. Nickel	Naval Nuclear Propulsion	Director, Emergency Planning	202-781-6107	Lee.a.nickelz@navy.mil
Patricia Milligan	NRC/NSIR	Senior Technical Advisor	301-281-3739	Patricia.milligan@nrc.gov
Marissa Bailey	NRC/NSIR	Division Director	301-281-3778	Marissa.bailey@nrc.gov
Steven Johnson	DOE/NNSA	Regional Response Coordinator RAP Region 2	805-570-9740	Steven.johnson@science.doe.gov
Alan Remick	DOE/NNSA	CM Program	202-586-8312	Alan.Remick@nnsa.doe.gov

FEMA

ED_001057_00022032

Al Morris	DOE	CM/PRMAC	202-295-4944	Alvin.Morris@nnsa.doe.gov
Adela Salame-Alne	CDC	Senior Service Fellow	770-488-3077	asalamealne@cdc.gov
Jan Peter Hadebois	State ISN/NESS	Foreign Affairs Office	202-647-0997	hadeboejp@state.gov
Jim Rogers	FEMA	FM	202-212-2545	James.Rogers@fema.dhs.gov
Janis McCarroll	FEMA	THD	202-074-4507	Janis.McCarroll@fema.dhs.gov
Rick Reyes	DHS/DNDO		240-440-3402	Ricardo.a.reyes@us.army.mil
Robert Whitcomb	HHS/CDC	Branch Chief RSB	770-488-3052	rwhitcomb@cdc.gov
Luis Garcia	FEMA	Planner	202-646-4002	Luis.Garcia@dhs.gov
Jim Williams	DOT			James.Williams@dot.gov
Bernie Bogdan	FBI			Bernard.Bogdan@ic.fbi.gov
Mart Stewart-Smith	Department of State			Stewart-Smithma@state.gov
Dan Blumenthal	DOE/NNSA	CM Manager	202-287-5209	Daniel.Blumenthal@nnsa.doe.gov
Dennis Emmert	OSD/Policy	Senior Military Advisor		dennis.j.emmert.mil@mail.mil
John Sokich	NOAA			John.Sokich@noaa.gov
Celestino Abrego	FEMA CBRN	Contract Support		
Kara Simmons	FEMA CBRN	Contract Support		

FEMA

ED_001057_00022032

To: Edwards, Jonathan[Edwards.Jonathan@epa.gov]; Cherepy, Andrea[Cherepy.Andrea@epa.gov]; Werner, Jacqueline[Werner.Jacqueline@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]; Peake, Tom[Peake.Tom@epa.gov]; Schultheisz, Daniel[Schultheisz.Daniel@epa.gov]; Boyd, Mike[Boyd.Mike@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]; Snead, Kathryn[Snead.Kathryn@epa.gov]; DeCair, Sara[DeCair.Sara@epa.gov]; White, Cindy[White.Cindy@epa.gov]; Poppell, Sam W.[Poppell.Sam@epa.gov]; Johnson, Jeremy[Johnson.Jeremy@epa.gov]; Wilds, Edward[Wilds.Edward@epa.gov]; Stafford, Andrea[Stafford.Andrea@epa.gov]; Griggs, John[Griggs.John@epa.gov]; Clark, Mike S.[Clark.Michael@epa.gov]; Giardina, Paul[Giardina.Paul@epa.gov]; Ferguson, Rafaela[Ferguson.Rafaela@epa.gov]; Rowson, David[Rowson.David@epa.gov]; Smith, Alisa[Smith.Alisa@epa.gov]; Aquino, Marcos[Aquino.Marcos@epa.gov]; BANDROWSKI, MIKE[Bandrowski.Mike@epa.gov]; Barnette, Jack[Barnette.Jack@epa.gov]; Brozowski, George[brozowski.george@epa.gov]; Carew, James[Carew.James@epa.gov]; Cooper, Artra[Cooper.Artra@epa.gov]; Debonis, Michael[Debonis.Michael@epa.gov]; Febbo, carol[febbo.carol@epa.gov]; Freed, Rachel[freed.rachel@epa.gov]; Generette, Lloyd[Generette.Lloyd@epa.gov]; Honnellio, Anthony[Honnellio.Anthony@epa.gov]; Hooper, Charles A.[Hooper.CharlesA@epa.gov]; Jackson, Scott[Jackson.Scott@epa.gov]; Jencius, Michele[jencius.michele@epa.gov]; Koehler, Larainne[Koehler.Larainne@epa.gov]; Merritt, Steven[Merritt.Steven@epa.gov]; Murphy, Michael[murphy.michael@epa.gov]; Povetko, Oleg[Povetko.Oleg@epa.gov]; Richards, Jon M.[Richards.Jon@epa.gov]; Schulingkamp, Cristina[schulingkamp.cristina@epa.gov]; Smith, Lora[Smith.Lora@epa.gov]; Snowbarger, Robert[Snowbarger.Robert@epa.gov]; Tu, Victor[Tu.Victor@epa.gov]; Wagner, Christine[Wagner.Christine@epa.gov]
From: Ferguson, Rafaela
Sent: Tue 6/28/2016 9:13:32 PM
Subject: Radiation Meeting with the Regions Thursday, June 30, 2016
Reg Visit Agenda Radiation 6-30-16.docx
June 30 2016 Regional Radiation Meeting Rad NESHAPs Washington DC Presentation June 26 version 1.3 -pve.pptx
RERT Presentation 6 30 16.pdf

Good Afternoon Everyone,

Attached is the Radiation meeting agenda and two ppt presentations; NESHAP, Paul Giardina; RERT; Jeremy Johnson for our meeting on Thursday. I will open up the conference line by 8:45am EST for those of you that are not able to join us here in DC so that you can hear the updates and participate in the discussion via conference call if you would like. The call-in number and access code are listed at the top of the agenda. Talk to you on Thursday!

Rafie

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: Michael Podguski[mpodguski@hwcinc.com]; Blaz, Christopher[Christopher.Blaz@fema.dhs.gov]; Blumenthal, Daniel[Daniel.Blumenthal@nnsa.doe.gov]; egaull@ara.com[egaull@ara.com]; Gorman, Chad[Chad.Gorman@fema.dhs.gov]; david.s.green@nasa.gov[david.s.green@nasa.gov]; andrew.m.grose.civ@mail.mil[andrew.m.grose.civ@mail.mil]; jeff.kowalczik@nrc.gov[jeff.kowalczik@nrc.gov]; scott.lundgren@noaa.gov[scott.lundgren@noaa.gov]; McRae, William (OGA)[william.mcrae@associates.fema.dhs.gov]; ronald.g.meris.civ@mail.mil[ronald.g.meris.civ@mail.mil]; jnasstrom@llnl.gov[jnasstrom@llnl.gov]; Robert.Shankman@hhs.gov[Robert.Shankman@hhs.gov]; Snead, Kathryn[Snead.Kathryn@epa.gov]; john.sokich@noaa.gov[john.sokich@noaa.gov]; NOAA-LNO[NOAA-LNO@fema.dhs.gov]; Veal, Lee[Veal.Lee@epa.gov]; Wieder, Jessica[Wieder.Jessica@epa.gov]; Philippe Lopez[Plopez@hwcinc.com]; Ted Cowan[TCowan@hwcinc.com]; Christian Howieson[chowieson@hwcinc.com]; Kara Simmons[kara.simmons@schafercorp.com]; Celestino Abrego[celestino.abrego@schafercorp.com]; michelle.laver@nnsa.doe.gov[michelle.laver@nnsa.doe.gov]; Weinberg, Ilisa (CTR)[ilisa.weinberg@associates.fema.dhs.gov]; Diana.Tamayo@nnsa.doe.gov[Diana.Tamayo@nnsa.doe.gov]; chris.wamsley@noaa.gov[chris.wamsley@noaa.gov]
Cc: Rollins, James M COL USARMY (US)[james.m.rollins.mil@mail.mil]; Nasstrom, John S.[nasstrom1@llnl.gov]; Tilden, Jay[Jay.Tilden@nnsa.doe.gov]
From: Ignacio, Joselito
Sent: Tue 6/28/2016 2:12:38 PM
Subject: RE: IMAAC Decision Support Discussion
Attachment B - Capstone_EagleHorizon_GradientAspect_2016_IMAAC_BriefingProducts_FullSet.pdf
Attachment C - ExecutiveBriefingProduct_Example-DRAFT 27June2016.pptx
Briefing Memo 06292016 draft.docx

Good morning, everyone.

Please see the updated read ahead package for tomorrow's discussion.

You can join by phone bridge or attend in person. Please remember to show up at least 25 minutes before the meeting due to the anticipated long lines at our security desk. We will, however, need to start on-time due to time constraints with our FEMA leadership.

Thank you.
V/r
Lito

Joselito Ignacio

JOSELITO IGNACIO, MA, MPH, CIH, CSP, REHS
CBRNE Science Advisor & IMAAC Program Manager
Captain, U.S. Public Health Service
CBRNE Office, Response Directorate, Federal Emergency Management Agency
500 C Street, SW, 2nd Floor, 2NW-2002
Washington, DC 20472
Phone: 202-212-5710
Mt. Weather EOC (Fridays/Telecommute Days): (540) 535-4560

Cell: 202-812-9432
Fax: 202-646-4060
joselito.ignacio@fema.dhs.gov

-----Original Appointment-----
From: Michael Podguski [mailto:mpodguski@hwcinc.com]
Sent: Monday, June 27, 2016 2:20 PM
To: Michael Podguski; Blaz, Christopher; Blumenthal, Daniel; Ignacio, Joselito; egaull@ara.com; Gorman, Chad; david.s.green@nasa.gov; andrew.m.grose.civ@mail.mil; jeff.kowalczik@nrc.gov; scott.lundgren@noaa.gov; McRae, William (OGA); ronald.g.meris.civ@mail.mil; jnasstrom@llnl.gov; robert.shankman@hhs.gov; Snead.Kathryn@epa.gov; john.sokich@noaa.gov; NOAA-LNO; veal.lee@epa.gov; wieder.jessica@epa.gov; Philippe Lopez; Ted Cowan; Christian Howieson; Kara Simmons; Celestino Abrego; michelle.laver@nnsa.doe.gov; Weinberg, Ilisa (CTR); Diana.Tamayo@nnsa.doe.gov; chris.wamsley@noaa.gov
Cc: Rollins, James M COL USARMY (US); Nasstrom, John S.; Tilden, Jay
Subject: IMAAC Decision Support Discussion
When: Wednesday, June 29, 2016 1:00 PM-2:00 PM (UTC-05:00) Eastern Time (US & Canada).
Where: FEMA HQ, 500 C Street, SW, Room 212A (and via teleconference at: 800-320-4330, Conference Code: 511084)

All,

Due to scheduling conflicts for some of the meeting's key personnel, this discussion is being moved to 1 p.m. on Wednesday. We have added a teleconference line for those who cannot attend in person.

Additionally, if you are now able to attend the meeting (and previously could not), **please notify me NLT COB today** so that we can add you to the FEMA visitor system. As with before, if you do not presently hold a FEMA badge, please allow additional time to in-process at the access control desk prior to Wednesday's meeting.

If you have any questions or concerns, please let me know.

V/r,

Michael Podguski

All,

In keeping with our previous discussions regarding the need for refining IMAAC products for decision-makers, please reserve this time on your calendar for a group meeting with Messrs. Corey Gruber, Damon Penn, Bob Farmer, Thomas Breslin, and Joshua Dozer. We will discuss their inputs and ideas for enhancing our existing IMAAC modeling products to meet the needs of strategic-level leadership and the NRCS's information requirements.

Due to the previous issues we had getting everyone through FEMA security in a timely fashion, **we recommend arriving at the FEMA HQ security desk NLT 30 minutes prior to the scheduled start of the meeting**. Additionally, **please confirm your attendance NLT noon 27 June**, so that we can ensure everyone is entered in the FEMA visitor system ahead of time.

If you have any questions, please don't hesitate to let me know!

V/r,

Michael Podguski

To: White, Sharon[White.Sharon@epa.gov]
Cc: Edwards, Jonathan[Edwards.Jonathan@epa.gov]; Cherepy, Andrea[Cherepy.Andrea@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]; Anoma, Valentine[Anoma.Valentine@epa.gov]
From: Hallam, Christopher
Sent: Mon 6/27/2016 8:19:39 PM
Subject: HSCN Budget Initiatives
OAR HSCN Budget Initiatives.docx

Good Afternoon, Sharon –

Please find attached the requested OAR submittal for HSCN budget initiative proposals. Please let me know if you have any questions.

Thank you for your attention and have a great day.

Chris Hallam

Health Physicist

Center for Radiological Emergency Management

Office of Radiation and Indoor Air

Office: 202-343-9308

iPhone: 202-839-2492

hallam.christopher@epa.gov

www.epa.gov/radiation

HSCN Budget Initiatives

Submitted by: OAR

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Standardize Data Quality and Data Management (DQ/DM) Protocols for NIRT

Quality standards and data management protocols vary between NIRT member agencies, resulting in an ongoing challenges for interagency use of data. The disparity in approach to DQ/DM among the NIRT partners has its greatest impact during emergency response activities when the data is needed for time-critical decisions. This project would develop and implement common quality standards for radiological analyses, aerial and monitoring data, data validation, data integrity, and data assessment under the NIRT. It would also develop and implement standardized data management protocols and data sharing practices among NIRT assets.

Intramural Budget: TBD based on discussions with NIRT partnering agencies
Extramural Budget: TBD based on discussions with NIRT partnering agencies

ED_001057_00022061

Submitted by: OAR

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Outreach, training & drills for the revised EPA Protective Action Guides

In the tight-knit radiation emergency preparedness community, EPA ORIA is looked to for expert advice on using the Protective Action Guides (PAG) Manual, a long-awaited revision of which is about to be published. Training on implementation of the changes in it from previous versions is necessary to ensure state radiation and emergency management programs properly update state and local plans with the new PAGs. A critical new element of the revised PAGs will be the drinking water PAGs which constitutes a significant step toward improved preparedness as this is an area which has not been previously addressed in EPA's published guidance for radiation disasters. As a new guidance, the drinking water PAG has not, to date, been well planned for or exercised in the radiation preparedness community. Training and implementation assistance is needed to get local and private sector drinking water providers ready with solid emergency response plans, in close coordination with radiation and emergency management programs. Under this project, training for the revised PAG manual will be made available to planners and responders across the U.S. using a combination of webinars and regional face-to-face workshops.

Intramural Budget: TBD
Extramural Budget: TBD

ED_001057_00022061

HSCN Budget Initiatives

Submitted by: OAR

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Develop training and exercises by RERT to enhance search capabilities and strategies for emerging radiological threats

As the methods to obtain radioactive material needed to construct Radiological Dispersion Devices (RDD) become more sophisticated throughout the United States, the nation must increase its capability to search for this material. When a source is lost not only will officials at the federal, state, and local level be looking for the source but this presents an opportunity for terrorist cells to obtain radioactive material through a non-theft manner. To stay ahead this type of activity, expansion of RERT training to federal, state and local search capabilities must significantly increase in the area of concern during the search for a timely and successful recovery of the material.

There is a need in this type of situations to develop search capabilities for outer areas surrounding the target area. This prevents the duplication of DOE assets that would be sent to the target area and expands the search area by having an increased focus on the outer areas. The expansion of RERT training to enhance the capability to search outer areas significantly enhances the nation's capabilities to locate radioactive material.

Budget:

RERT	FY17	FY18	FY19		
Intramural (FTE)[1]	$180,000	$45,000	$45,000	**$270,000**	
Equipment	$250,000	$5,000	$5,000		
Travel	$30,000	$20,000	$20,000		
Contracts	$30,000	$30,000	$30,000		
Grants	$0	$0	$0		
Extramural Total	$310,000	$55,000	$55,000	**$420,000**	
Total by FY	**$490,000**	**$100,000**	**$100,000**	**$690,000**	**Total Budget**

[1]Assumes multiple part-time personnel; 1 FTE = $180,000 (avg).
[2]Contractors to assist with training development

ED_001057_00022061

Submitted by: OAR

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Closing Capacity and Capability Gaps in Environmental Radiological Laboratories

Background

The demand by decision makers for radiological laboratory results would be unprecedented following multiple Radiological Dispersion Devices (RPD's) attacks in different cities (White House Homeland Security Councils National Planning Scenario #11) or the detonation of an Improvised Nuclear Device (IND) (White House Homeland Security Councils National Scenario #2).

The need to rapidly and defensibly determine the nature and extent of contamination, to evaluate the effectiveness of decontamination activities in a timely manner to support consequence management decisions, and to support final clean-up and clearance will result in radioanalytical demands that greatly exceed current radiological laboratory capacities and capabilities. With the Department of Homeland Security as the lead, the Integrated Consortium of Laboratory Networks (ICLN) was established by a MOU in 2005 through a MOU with the following agencies and departments, DOD, DOE, HHS (CDC), EPA, FDA, DOI, DOJ (FBI), Department of Agriculture and the Department of State.

The mission of the ICLN is to provide for a federally coordinated and interoperable system of federal laboratory networks that provide timely, credible and interpretable data in support of surveillance, early detection and effective consequence managements for biological, chemical, radiological or nuclear incident. Several years ago the ICLN undertook a comprehensive assessment of the federal laboratory networks capability to adequately respond to a number of biological, chemical, radiological and nuclear scenarios. The assessment determined two major laboratory capacity and capability gaps. Radiological laboratory testing was one of the two gaps. While some progress has been made since the assessment, the gap still exists.

The overall national gap in radiological laboratory testing can be broken down into four major areas. These are: 1) lack of protocols and procedures to shift from routine operation to surge capacity mode; 2) lack of capability to analyze for select radionuclides in key matrices like urban materials; 3) declining expertise in radiochemistry; 4) lack of proficiency testing programs for key matrices; particularly urban matrices; and 5) lack of radiological laboratory exercises.

Surge Capacity

The vast majority of radiological laboratories have no experience operating in an incident response mode. In their usual mode of routine operations laboratories negotiate turnaround times for sample results. In the event of a major nuclear or radiological incident, laboratories will be expected to operate in a surge mode, maximum throughput and rapid turnaround. Absent the experience in shifting to a surge capacity mode and lacking the

ED_001057_00022061

necessary procedures and protocols, the majority of laboratories will fall well short of the demands placed upon them. What is needed to improve this transition is training and general protocols for surge capacity operations.

Proposal

- Provide on-site training on transitioning from routine operations to surge capacity operations for 10 environmental radiological laboratories per year.
- Develop general protocols on transitioning from routine operations to surge capacity that can be customized by laboratories.

Inability of Laboratories to Analyze Urban Matrices

Most environmental radiological laboratories have experience in analyzing for radionuclides in environmental matrices such as water, soil, vegetation, etc. However, very few laboratories have any experience or even analytical methods to analyze for radionuclides in urban matrices such as cement, brick, asphalt, etc.

Over the past several years ORIA's National Analytical Radiation Environmental Laboratory (NAREL) has been working in partnership with ORD's National Homeland Security Research Center (NHSRC) to develop rapid radiochemical methods for urban matrices. By the end of FY16, rapid radiochemical methods will be published for brick, cement, asphalt, and asphalt shingles. However much work still needs to be done. ORD's NHSRC did a survey of the urban matrices in 50 of the largest cities in the country and this list can be used to prioritize the development of rapid methods.

Proposal

- Develop and validate two rapid radiochemical methods for urban matrices in partnership with ORD NHSRC per year.
- Conduct workshops at national meetings of laboratory personnel on the rapid radiochemical methods for urban matrices every year.

Declining Expertise in Radiochemistry

In 2012, The National Academies of Science issued a report entitled, *Assuring a Future U.S. – Based Nuclear and Radiochemistry Expertise.* The report emphasized the critical need to support efforts focused on developing the longer-term sustainability of the nuclear workforce including laboratory personnel. Highly - educated and experienced radiochemists are being lost to retirement at a rate that exceeds their rate of replacement. There are few if any training courses in radiochemistry – (both the theory and hands-on training) being offered.

Proposal

- Develop Basis of Radiochemistry, Intermediate Radiochemistry and Advanced Radiochemistry training courses. Each course would be one week long with one offering of each course every year for up to 40 participants.

ED_001057_00022061

- As radiochemistry is highly technique dependent with very little automation, provide on-site hands-on training on radiochemistry techniques to 8 environmental radiological laboratories per year.

Lack of Proficiency Testing for Urban Matrices

While there is proficiency testing currently in place for select radionuclides in traditional environmental matrices, such as water, soil, vegetation, air filters, etc, there are currently no proficiency testing programs for urban matrices such as cement, brick, asphalt, etc. Therefore, EPA has no way of evaluating the ability of laboratories to analyze for radionuclides in urban matrices prior to an RDD or IND incident. During an emergency, laboratories will certainly struggle with urban matrices because of the lack of experience in working with them. This will result in delays of getting data to decision makers and there will also be questions about the validity and accuracy of the data.

Proposal

- Develop and send spiked samples of two types of urban matrices (e.g. cement, brick) to 20 laboratories each year.
- Evaluate the results and send each participating laboratory their results along with recommendations on how to improve their performance as appropriate.

Lack of Radiological Laboratory Exercises

Over the past twenty years there have been a number of large scale multi-agency radiological/nuclear exercises. However in almost every case radiological laboratories played a very small role in the exercises with the samples being either notional or if real, very few in number. Therefore radiological laboratories have not truly been exercised in any way that would come close to what they would experience in a major radiological or nuclear event.

Proposal

- Prepare and send 300 to 400 spiked samples of a variety of environmental and urban matrices to 20 to 30 laboratories each year. The laboratories would be given a scheduled for reporting results in a designated electronic data deliverable.
- Following the laboratory exercise conduct several conference calls to capture "lessons learned" from the exercise. These lessons learned would be compiled in a report and sent to each participating laboratory to assist them in improving their procedures and protocols. In addition each laboratory would receive an individual report evaluating their performance along with customized recommendations on how to improve their procedures, protocols and overall performance.

ED_001057_00022061

HSCN Budget Initiatives

Budget for All Proposals

It should be noted that this is a multi-year proposal given that the gap in the nations' radiological laboratory capacity and capability cannot be significant reduced in one year. Also this budget is easily scalable by reducing the number of laboratories involved each year, reducing the number of samples sent for an exercise, etc.

Close Rad Lab Gaps	FY17	FY18	FY19	FY20		
Intramural (FTE)[1]	$90,000	$90,000	$90,000	$90,000	**$360,000**	
Equipment	$30,000	$30,000	$30,000	$30,000		
Travel	$10,000	$10,000	$10,000	$10,000		
Contracts[2]	$685,000	$685,000	$685,000	$685,000		
Grants	$0	$0	$0	$0		
Extramural Total	$725,000	$725,000	$725,000	$725,000	**$2,900,000**	
Total by FY	**$815,000**	**$815,000**	**$815,000**	**$815,000**	**$3,260,000**	**Total Budget**

[1]Assumes multiple part-time personnel; 1 FTE = $180,000 (avg).
[2]Contractors to conduct training, prep PT samples, evaluate results, and write evaluation reports

ED_001057_00022061

Submitted by: OAR

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Perform a Feasibility Study for incorporating radiological parameters/analyses into air monitoring programs other than RadNet

The EPA RadNet currently has more than 130 radiation air monitors in 50 states collecting near-real-time measurement of gamma radiation. Other, non-radiological, air monitoring programs provide data in a similar fashion; two examples are BioWatch for detection of pathogens in and around more than thirty major U.S. cities, and AIRNow which measures air pollutants across the U.S.. This project would explore the viability of leveraging other air monitoring programs such as BioWatch and AIRNow to collect actionable radiological data in the event of an incident involving radioactive materials. The additional surge monitoring capability and capacity for radioactive constituents potentially afforded by these other programs could significantly increase the amount of data available for decision-making with a limited investment of resources.

As background, EPA, DHS and DOE have been piloting limited radiation screening efforts using the BioWatch network in select cities to support special events in 2016. Attachment 1, Partnership for Mutual use of Detection Systems, provides additional information on the pilot study for the BioWatch network.

This project would expand the pilot effort to make radiation monitoring a more robust and routine option for incorporation into other existing networks by assessing and resolving technical challenges for BioWatch and other programs. The project would also work to develop interagency protocols wherein the option for radiation monitoring could be implemented at these additional locations in an expedited manner.

Intramural Budget: TBD
Extramural Budget: TBD

ED_001057_00022061

PARTNERSHIP FOR MUTUAL USE OF DETECTION SYSTEMS

SUMMARY

The Department of Energy, National Nuclear Security Administration (DOE/NNSA), the Department of Homeland Security, Office of Health Affairs, BioWatch Program Office and the Environmental Protection Agency, Office of Radiation and Indoor Air (EPA/ORIA) have the opportunity to leverage existing detection systems to enable the US Government to provide a more holistic approach to CBRN detection by using existing resources in new ways. We will leverage existing infrastructure for biohazard detection to help characterize environmental releases of radiological material significantly sooner than currently feasible. DOE/NNSA and EPA/ORIA propose to conduct a non-destructive radiation survey of the BioWatch filters as a screening approach to rapidly detect and characterize radiological/nuclear materials released into the environment during special events. This enhancement will lead to earlier public health protective actions and potentially lower radiation doses to the public. The agencies' support of special events in 2016, beginning with the Superbowl, provides an opportunity for proof of concept, as explained more fully below.

BACKGROUND

DHS/OHA

The BioWatch program deploys an extensive collector network around key venues in advance of a special event, establishes collection frequency and field operations schedules and determines the best approach for analyzing the filters, either through surge support at the existing BioWatch laboratory and/or by deploying the Rapidly Deployable Laboratory (RDL). RDL is able to expand or augment existing laboratories for both sample screening and verification, providing the same functionality as a BioWatch lab in a highly mobile/modular setup. The BioWatch program partners with public health laboratories and environmental monitoring agencies to collect and rapidly analyze air filter samples to provide an early indication of a potential biological attack. The BioWatch program operates routinely in a number of cities. Additionally, during special events such as National Special Security Events (NSSEs), the program will expand to provide early detection in designated areas and venues.

The locations of the BioWatch collectors are based on venue and city-specific urban atmospheric modeling analysis performed by the DOE/NNSA national laboratories. The same siting principles for the BioWatch collectors would be also useful for siting radiological detection systems, and collaborating among our agencies provides an opportunity to expand the capabilities to rapidly detect and characterize radiological/nuclear materials released into the environment.

DOE/NNSA

The DOE/NNSA Office of Nuclear Incident Response conducts preventive radiological/nuclear detection (PRND) in support of FBI and US Secret Service (USSS) during NSSEs and designated special events. DOE Radiological Assistance Program (RAP) and Nuclear/Radiological Advisory Team (NRAT) provide expert personnel and PRND systems to screen for radiological material before and during special events around key venues. DOE/NNSA also prepares for potential releases so it can quickly transition to consequence management activities. DOE/NNSA and EPA/ORIA, as the constituents of FEMA's Nuclear Incident Response Team (NIRT), characterize any radiological releases and provide assessments of environmental contamination and potential dose to people, providing critical information to decision makers faced with protective action decisions.

DOE/NNSA has the resources to place a few unattended sensors to support special events, but its system is designed based on a scenario involving a known or planned release location. The BioWatch

ED_001057_00022061

system on the other hand, can be situated (based on extensive modeling) to detect aerosolized biological threat agents with high confidence in a wide variety of environments. Hence, the EPA and DOE want to leverage the BioWatch program's detection capabilities to recognize radiological/nuclear threats. Likewise, the BioWatch Program may benefit from this collaboration by leveraging the radiological emergency preparedness and response protocols and infrastructure, built in the years following the Three Mile Island incident, to inform jurisdictional planning for biological and radiological incident response. This supports integration toward an all-hazard response approach. The three agencies may learn best practices from working with each other. Furthermore, opportunities to collaborate and learn more about each other's assets and operations improve unity of effort and interoperability, improving the federal government's response to the State and local officials.

PROOF OF CONCEPT: SUPERBOWL 50

As an initial effort, the team will pursue how to physically accomplish scanning the BioWatch filters for radioactive material without interfering unduly with the BioWatch operational mission and work flow. We propose to bring the proposed detection equipment and operational documents to our next technical meeting to begin to fully understand what approaches might be possible. Challenges may include:

- Special event monitoring involves multiple entities and authorities at the State, local and federal levels. It is imperative to discuss any approach with these authorities so that appropriate concept(s) of operation documents can be developed. Appropriate response to positive radiation or biological agent detections require a whole-of-government response and we will be sensitive to this requirement.
- BioWatch samples are transported inside a metal filter holder assembly (see attached figures), double bagged and under strict chain of custody requirements and taken to a BSL2/3 laboratory for analysis. It is critical to maintain appropriate chain of custody and to be aware of any limitations to staff entering a biosafety laboratory.
- The BioWatch filter is not removed from the filter holder assembly until it is in a laboratory hood, and then the samples are removed and processed individually to minimize cross-contamination. Options for scanning samples in their holders prior to BioWatch processing, scanning filters as they begin processing, and scanning filters post-analysis are possibilities. Initially, we intend to approach scanning the ¾ filters after their initial filter cutting and sealing inside petri dishes.
- Determine and implement necessary health and safety requirements commensurate with facility and program requirements, such as PPE inside the laboratories and/or dosimetry needs

We propose to use the Super Bowl 50 Special Event to evaluate our concept. The lessons learned from this experience, will inform potential joint operations for the national political conventions. If we succeed in these efforts, we could increase our Program's value without significant additional resources.

Points of Contact:

Daniel Blumenthal, DOE/NNSA, Daniel.blumenthal@nnsa.doe.gov, 202-287-5269
Mike Walter, BioWatch Program, Michael.walter@dhs.gov, 202-254-6082
Lee Ann Veal, EPA/ORIA, veal.lee@epa.gov, 202-343-9448

ED_001057_00022061

To: Michael Podguski[mpodguski@hwcinc.com]; Blaz, Christopher[Christopher.Blaz@fema.dhs.gov]; Blumenthal, Daniel[Daniel.Blumenthal@nnsa.doe.gov]; egaull@ara.com[egaull@ara.com]; Gorman, Chad[Chad.Gorman@fema.dhs.gov]; david.s.green@nasa.gov[david.s.green@nasa.gov]; andrew.m.grose.civ@mail.mil[andrew.m.grose.civ@mail.mil]; jeff.kowalczik@nrc.gov[jeff.kowalczik@nrc.gov]; scott.lundgren@noaa.gov[scott.lundgren@noaa.gov]; McRae, William (OGA)[william.mcrae@associates.fema.dhs.gov]; ronald.g.meris.civ@mail.mil[ronald.g.meris.civ@mail.mil]; jnasstrom@llnl.gov[jnasstrom@llnl.gov]; Robert.Shankman@hhs.gov[Robert.Shankman@hhs.gov]; Snead, Kathryn[Snead.Kathryn@epa.gov]; john.sokich@noaa.gov[john.sokich@noaa.gov]; NOAA-LNO[NOAA-LNO@fema.dhs.gov]; Veal, Lee[Veal.Lee@epa.gov]; Wieder, Jessica[Wieder.Jessica@epa.gov]; Philippe Lopez[Plopez@hwcinc.com]; Ted Cowan[TCowan@hwcinc.com]; Christian Howieson[chowieson@hwcinc.com]; Kara Simmons[kara.simmons@schafercorp.com]; Celestino Abrego[celestino.abrego@schafercorp.com]
Cc: Gorman, Chad[Chad.Gorman@fema.dhs.gov]; Crawford, Sean[Sean.Crawford@fema.dhs.gov]; Foreman, Bruce[Bruce.Foreman@fema.dhs.gov]
From: Ignacio, Joselito
Sent: Fri 6/24/2016 6:01:14 PM
Subject: RE: Discussion of IMAAC Modeling for Strategic-Level Perspectives and Support
Briefing Memo 06292016 draft.docx
Attachment B - Capstone_EagleHorizon_GradientAspect_2016_IMAAC_BriefingProducts_FullSet.pdf

Good afternoon, everyone.

For those attending this SLB discussion on IMAAC modeling, please ensure that you have RSVP with Michael Podguski. I will need to input, for those outside of FEMA, your visitor information. Please again ensure that you show up 20-30 minutes before the 11 am meeting. We will have to start on-time for this meeting.

Attached is the *draft* briefing read-ahead memo with the purpose and agenda for the meeting with associated attachments. If you are attending, please inform Michael so that he can update the Read-ahead memo.

Thank you.
V/r
Lito

Joselito Ignacio

Joselito S. Ignacio, MA, MPH, CIH, CSP, REHS
CBRNE Science Advisor & IMAAC Program Manager
Response Directorate, Federal Emergency Management Agency
Department of Homeland Security
500 C Street, SW, 2SW-615
Washington, DC 20478
(202)254-5710
Mount Weather EOC (Mondays/Fridays) (540)535-4560
Cell: (202) 812-9432

Email: Joselito.Ignacio@fema.dhs.gov

-----Original Appointment-----
From: Michael Podguski [mailto:mpodguski@hwcinc.com]
Sent: Monday, June 13, 2016 5:15 PM
To: Michael Podguski; Blaz, Christopher; Blumenthal, Daniel; Ignacio, Joselito; egaull@ara.com; Gorman, Chad; david.s.green@nasa.gov; andrew.m.grose.civ@mail.mil; jeff.kowalczik@nrc.gov; scott.lundgren@noaa.gov; McRae, William (OGA); ronald.g.meris.civ@mail.mil; jnasstrom@llnl.gov; robert.shankman@hhs.gov; Snead.Kathryn@epa.gov; john.sokich@noaa.gov; NOAA-LNO; veal.lee@epa.gov; wieder.jessica@epa.gov; Philippe Lopez; Ted Cowan; Christian Howieson; Kara Simmons; Celestino Abrego
Subject: Discussion of IMAAC Modeling for Strategic-Level Perspectives and Support
When: Wednesday, June 29, 2016 11:00 AM-12:00 PM (UTC-05:00) Eastern Time (US & Canada).
Where: FEMA HQ, 500 C Street, SW, Room 212A

All,

In keeping with our previous discussions regarding the need for refining IMAAC products for decision-makers, please reserve this time on your calendar for a group meeting with Messrs. Corey Gruber, Damon Penn, Bob Farmer, Thomas Breslin, and Joshua Dozer. We will discuss their inputs and ideas for enhancing our existing IMAAC modeling products to meet the needs of strategic-level leadership and the NRCS's information requirements.

Due to the previous issues we had getting everyone through FEMA security in a timely fashion, **we recommend arriving at the FEMA HQ security desk NLT 30 minutes prior to the scheduled start of the meeting**. Additionally, **please confirm your attendance NLT noon 27 June**, so that we can ensure everyone is entered in the FEMA visitor system ahead of time.

If you have any questions, please don't hesitate to let me know!

V/r,

Michael Podguski

To: Veal, Lee[Veal.Lee@epa.gov]; Mosser, Jennifer[Mosser.Jennifer@epa.gov]; Snead, Kathryn[Snead.Kathryn@epa.gov]; Clark, Ray[Clark.Ray@epa.gov]; Shogren, Angela[Shogren.Angela@epa.gov]; Wieder, Jessica[Wieder.Jessica@epa.gov]
From: DeCair, Sara
Sent: Fri 6/24/2016 4:02:27 PM
Subject: RE: Data Mgmt idea and FEMA mgmt change

Indeed. During the early phase, we'll need to be putting data in various formats for the response, and then we'll inherit the FRMAC data mgmt role at the transfer. We can use these tests to inform the FRMAC transfer data quality requirements that Kathryn is leading…

From: Veal, Lee
Sent: Friday, June 24, 2016 11:57 AM
To: DeCair, Sara <DeCair.Sara@epa.gov>; Mosser, Jennifer <Mosser.Jennifer@epa.gov>; Snead, Kathryn <Snead.Kathryn@epa.gov>; Clark, Ray <Clark.Ray@epa.gov>; Shogren, Angela <Shogren.Angela@epa.gov>; Wieder, Jessica <Wieder.Jessica@epa.gov>
Subject: RE: Data Mgmt idea and FEMA mgmt change

You mean aside from how we might manage FRMAC? That's a biggie.

Lee Ann B. Veal

Acting Deputy Director, Radiation Protection Division

Office of Radiation and Indoor Air

Office: 202-343-9448; Cell: 202-617-4322

www.epa.gov/radiation

From: DeCair, Sara
Sent: Friday, June 24, 2016 11:28 AM
To: Mosser, Jennifer <Mosser.Jennifer@epa.gov>; Snead, Kathryn <Snead.Kathryn@epa.gov>; Veal, Lee <Veal.Lee@epa.gov>; Clark, Ray <Clark.Ray@epa.gov>; Shogren, Angela <Shogren.Angela@epa.gov>; Wieder, Jessica <Wieder.Jessica@epa.gov>
Subject: Data Mgmt idea and FEMA mgmt change

I just spoke with Jeff Blizzard this morning and learned that Chad Gorman is going on a detail for six to nine months and Sean Crawford is going to be Acting for him. That means Jeff will now be the project manager for RadResponder and for NIRT! It will be nice to work with him more.

Prior to Northern Lights '16, we'd like to do some data sharing tests to ensure that in a real event, we can get data to and from RadResponder, RadNet, Scribe, GIS viewers and FRMAC RAMS without too much trouble. Sean wondered if that might be a good NIRT project but now is not the time to be requesting funding, I think, and honestly we can do this on our own dime between now and October.

Do you know if anyone in particular had data-themed activities in the works for NL '16? If not, I'm glad to honcho this one. Thx! S.

Sara D. DeCair

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

202-343-9108

Room 1416 B in WJC West

To: Veal, Lee[Veal.Lee@epa.gov]
From: Perrin, Alan
Sent: Thur 6/23/2016 8:44:31 PM
Subject: FW: lunch, coffee...
RPD_staffing_062316.xlsx
Pre-Brief for June 27 Meeting with NRC.DOCX
Reg Visit Agenda Radiation 6-30-16.docx

FYI

Alan Perrin, Acting Director
Radiation Protection Division, USEPA
ofc (202) 343-9775 | mbl (202) 279-0376

From: Perrin, Alan
Sent: Thursday, June 23, 2016 4:06 PM
To: Werner, Jacqueline <Werner.Jacqueline@epa.gov>
Subject: RE: lunch, coffee...

Jacqueline,

I've attached a one-pager with Center staffing. I've also tried to give you access to my calendar which may help you see what's up-coming. You may want to delegate your calendar to Patricia Holden (RPD's IO NOWCC) – she can then fill you up with standing meetings and help manage your time for the next several months. I'm told your phone, computer, etc., should be good to go…

Here are some of the more prominent items on the calendar for next week:

On Mondays, we have been starting the week with a ½ hour RPD management meeting at 10 am, essentially a quick go around of the 3-5 biggest items folks have on their plate for the coming week or two. It's a timely opportunity to introduce you to the team.

This Monday, we are heading up to NRC in the afternoon (1-3 pm at White Flint) for a general management/staff meeting with their Office of Nuclear Materials Safety and Safeguards (NMSS). We discussed your attendance at our pre-brief yesterday with Jon – completely up to you; good chance for you to meet people at NRC and get briefed out on our agenda items (I've attached a draft backgrounder for the meeting), but we all recognize it may be a bit much for first day and suspect that you might have other on-boarding priorities (there is also another chance to hear most of the updates on Thursday). Just let me know what you would like to do.

On Tuesday, we usually have a standing general (1-2 pm) with the OD & COS. We also have a weekly ORIA management meeting (2-3 pm). Next week, however the ORIA meeting is truncated to a ½ hour Supervisor's forum at 3:30 pm and our general is relocated to a ½ hour at 4:30 pm. Ex. 6 - Personal Privacy

Ex. 6 - Personal Privacy

We also have a standing RPD management meeting on Wed at 10 am for an in-process check and a report down from the ORIA management meeting. This week our Wed management meeting was supposed to be pre-empted by a Division all-hands, but it looks like they both will be pre-empted by an all morning RSC (Response Support Corp) training. The training may be a good thing for you to sit in on.

On Thursday, there will be a number of radiation leads from the regions in town and RPD will be hosting sort of an updates meeting for them most of the morning – another opportunity for you to hear what's going on in the Division from staff. We'll have a short opportunity for a meet and greet in the morning, however, we'll need to juggle it with an ER preparedness brief for the AA, 9:15-10 am (we can figure out how to cover everything at some point next week). In the afternoon, we have another brief for the AA, this one on TENORM (technologically enhanced naturally occurring radioactive materials) & the shale oil & gas industry.

Friday – usually a fairly quiet catch your breath and catch up on your work sort of day; looks that way for next week so far…

OK – before this starts feeling too much like a fire hose, I'll end. Tomorrow 6/24 10 am is fine for a phone chat, if it still works for you – what number is best to reach you?

Welcome aboard, Alan

Alan Perrin, Acting Director
Radiation Protection Division, USEPA
ofc (202) 343-9775 | mbl (202) 279-0376

From: Werner, Jacqueline
Sent: Wednesday, June 22, 2016 4:14 PM
To: Perrin, Alan <Perrin.Alan@epa.gov>
Subject: RE: lunch, coffee...

Hi Alan,

Thanks so much for reaching out. Unfortunately, as you can tell, I was unable to free up time before 3pm today. Friday I'm actually working from home so I'm available for a call but not an in person meeting. I really appreciate the reading/materials though. Very helpful.

So, why don't we talk on Friday? I'm available at 10 am, 1 and 2 pm. Do any of those times work for you? Also, I know you are jammed tomorrow but could you send me a Division contact list which hopefully will include the names of each person in each branch within the division? If it happens to have their series/position, that would be great too. Please don't go to any effort to create this if it's not readily available.

I am really looking forward to working with you and I appreciate your counsel and support. By the way, if you happen to find yourself with some free time tomorrow, please let me know. I am in the office tomorrow.

Thanks,

Jacqueline

Jacqueline Robles Werner

Associate Director

Air Enforcement Division

U.S. Environmental Protection Agency

1200 Pennsylvania Ave., NW

WJCS-1117C (MC-2242A)

Washington, DC 20460

t: 202-564-1036

From: Perrin, Alan
Sent: Wednesday, June 22, 2016 12:26 PM
To: Werner, Jacqueline <Werner.Jacqueline@epa.gov>
Subject: lunch, coffee...

Hi Jacqueline,

You suggested we might get together for lunch or coffee at some point. My schedule is good today up to 3 pm and free all day on Friday. Do either of these options work for you?

Also, FYI on background materials. As Jon said, there is a lot of info on the web site – likely much more than you want if you start diving deep. As a bit of a guide, the Division priorities (those items that the AA or the Administrator expect to see completed this year) include:

PAGs – Protective Action Guides and Planning Guidance for Radiological Incidents (https://www.epa.gov/radiation/protective-action-guides-pags). [This is a guidance document that provides protective action levels for decision makers following a rad emergency. The draft final Manual is currently at OMB in interagency review. This action is complicated somewhat by the potential addition of a drinking water PAG (currently proposed and out for public comment); the full Manual has a place-holder in it for the DW PAG. Ideally, these pieces would come together for final publication this year, but we are prepared to publish a full Manual with the DW place-holder, with the idea of adding the DW PAG as an addendum when it is ready.]

Final rule – 40 CFR 61, Subpart W (https://www.epa.gov/radiation/subpart-w-rulemaking-activity). [This is a radionuclide NESHAPs for radon emissions at operating mill tailing facilities; we are currently incorporating OAR edits on the way to OMB for final interagency review.]

Final rule – 40 CFR 192 (https://www.epa.gov/radiation/health-and-environmental-protection-standards-uranium-and-thorium-mill-tailings-40-cfr). [This is the Uranium Mill Tailings rule under the Uranium Mill Tailings Radiation Control Act. This revision would add a subpart to the rule for groundwater protection at uranium in-situ recovery facilities. Preamble and rule text are in process, we hope to get the draft to OMB for final interagency review in August.]

There are a number of other activities in process that we can talk about, however, these are the primary bigger ticket items that are being tracked closely for completion. Cheers, Alan

Alan Perrin, Acting Director
Radiation Protection Division, USEPA
ofc (202) 343-9775 | mbl (202) 279-0376

To: Veal, Lee[Veal.Lee@epa.gov]
Cc: Perrin, Alan[Perrin.Alan@epa.gov]
From: Hallam, Christopher
Sent: Mon 6/20/2016 8:11:50 PM
Subject: HSCN Budget Initiative - Final Review
OAR HSCN Budget Initiatives Final.docx

Good Afternoon, Lee –

Alan asked that I send the OAR HSCN budget initiatives to you for the final review. I plan to submit these tomorrow morning if you think they look good to go.

A lot has changed since you last saw them. We dropped budget numbers from three of the initiatives (per Jon's request) as we will need additional input from either intra- or interagency partners to work up better numbers. For those three we are just getting the ideas submitted as placeholders.

Please let me know if you have questions.

Thank you for your attention, and have a great day.

Chris Hallam

Health Physicist

Center for Radiological Emergency Management

Office of Radiation and Indoor Air

Office: 202-343-9308

iPhone: 202-839-2492

hallam.christopher@epa.gov

www.epa.gov/radiation

HSCN Budget Initiatives

Submitted by: OAR

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Standardize Data Quality and Data Management (DQ/DM) Protocols for NIRT

Quality standards and data management protocols vary between NIRT member agencies, resulting in an ongoing challenges for interagency use of data. The disparity in approach to DQ/DM among the NIRT partners has its greatest impact during emergency response activities when the data is needed for time-critical decisions. This project would develop and implement common quality standards for radiological analyses, aerial and monitoring data, data validation, data integrity, and data assessment under the NIRT. It would also develop and implement standardized data management protocols and data sharing practices among NIRT assets.

Intramural Budget: TBD based on discussions with NIRT partnering agencies
Extramural Budget: TBD based on discussions with NIRT partnering agencies

ED_001057_00022071

Submitted by: OAR

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Outreach, training & drills for the revised EPA Protective Action Guides

In the tight-knit radiation emergency preparedness community, EPA ORIA is looked to for expert advice on using the Protective Action Guides (PAG) Manual, a long-awaited revision of which is about to be published. Training on implementation of the changes in it from previous versions is necessary to ensure state radiation and emergency management programs properly update state and local plans with the new PAGs. A critical new element of the revised PAGs will be the drinking water PAGs which constitutes a significant step toward improved preparedness as this is an area which has not been previously addressed in EPA's published guidance for radiation disasters. As a new guidance, the drinking water PAG has not, to date, been well planned for or exercised in the radiation preparedness community. Training and implementation assistance is needed to get local and private sector drinking water providers ready with solid emergency response plans, in close coordination with radiation and emergency management programs. Under this project, training for the revised PAG manual will be made available to planners and responders across the U.S. using a combination of webinars and regional face-to-face workshops.

Intramural Budget: TBD
Extramural Budget: TBD

ED_001057_00022071

Submitted by: OAR

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Perform a Feasibility Study for incorporating radiological parameters/analyses into air monitoring programs other than RadNet

The EPA RadNet currently has more than 130 radiation air monitors in 50 states collecting near-real-time measurement of gamma radiation. Other, non-radiological, air monitoring programs provide data in a similar fashion; two examples are BioWatch for detection of pathogens in and around more than thirty major U.S. cities, and AIRNow which measures air pollutants across the U.S.. This project would explore the viability of leveraging other air monitoring programs such as BioWatch and AIRNow to collect actionable radiological data in the event of an incident involving radioactive materials. The additional surge monitoring capability and capacity for radioactive constituents potentially afforded by these other programs could significantly increase the amount of data available for decision-making with a limited investment of resources. This project would require coordination with the agencies supporting the various air monitoring programs.

Intramural Budget: TBD
Extramural Budget: TBD

ED_001057_00022071

HSCN Budget Initiatives

Submitted by: OAR

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Develop training and exercises by RERT to enhance search capabilities and strategies for emerging radiological threats

As the methods to obtain radioactive material needed to construct Radiological Dispersion Devices (RDD) become more sophisticated throughout the United States, the nation must increase its capability to search for this material. When a source is lost not only will officials at the federal, state, and local level be looking for the source but this presents an opportunity for terrorist cells to obtain radioactive material through a non-theft manner. To stay ahead this type of activity, expansion of RERT training to federal, state and local search capabilities must significantly increase in the area of concern during the search for a timely and successful recovery of the material.

There is a need in this type of situations to develop search capabilities for outer areas surrounding the target area. This prevents the duplication of DOE assets that would be sent to the target area and expands the search area by having an increased focus on the outer areas. The expansion of RERT training to enhance the capability to search outer areas significantly enhances the nation's capabilities to locate radioactive material.

Budget:

RERT	FY17	FY18	FY19		
Intramural (FTE)[1]	$180,000	$45,000	$45,000	**$270,000**	
Equipment	$250,000	$5,000	$5,000		
Travel	$30,000	$20,000	$20,000		
Contracts	$30,000	$30,000	$30,000		
Grants	$0	$0	$0		
Extramural Total	$310,000	$55,000	$55,000	**$420,000**	
Total by FY	**$490,000**	**$100,000**	**$100,000**	**$690,000**	**Total Budget**

[1]Assumes multiple part-time personnel; 1 FTE = $180,000 (avg).
[2]Contractors to assist with training development

ED_001057_00022071

HSCN Budget Initiatives

Submitted by: OAR

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Closing Capacity and Capability Gaps in Environmental Radiological Laboratories

Background

The demand by decision makers for radiological laboratory results would be unprecedented following multiple Radiological Dispersion Devices (RPD's) attacks in different cities (White House Homeland Security Councils National Planning Scenario #11) or the detonation of an Improvised Nuclear Device (IND) (White House Homeland Security Councils National Scenario #2).

The need to rapidly and defensibly determine the nature and extent of contamination, to evaluate the effectiveness of decontamination activities in a timely manner to support consequence management decisions, and to support final clean-up and clearance will result in radioanalytical demands that greatly exceed current radiological laboratory capacities and capabilities. With the Department of Homeland Security as the lead, the Integrated Consortium of Laboratory Networks (ICLN) was established by a MOU in 2005 through a MOU with the following agencies and departments, DOD, DOE, HHS (CDC), EPA, FDA, DOI, DOJ (FBI), Department of Agriculture and the Department of State.

The mission of the ICLN is to provide for a federally coordinated and interoperable system of federal laboratory networks that provide timely, credible and interpretable data in support of surveillance, early detection and effective consequence managements for biological, chemical, radiological or nuclear incident. Several years ago the ICLN undertook a comprehensive assessment of the federal laboratory networks capability to adequately respond to a number of biological, chemical, radiological and nuclear scenarios. The assessment determined two major laboratory capacity and capability gaps. Radiological laboratory testing was one of the two gaps. While some progress has been made since the assessment, the gap still exists.

The overall national gap in radiological laboratory testing can be broken down into four major areas. These are: 1) lack of protocols and procedures to shift from routine operation to surge capacity mode; 2) lack of capability to analyze for select radionuclides in key matrices like urban materials; 3) declining expertise in radiochemistry; 4) lack of proficiency testing programs for key matrices; particularly urban matrices; and 5) lack of radiological laboratory exercises.

Surge Capacity

The vast majority of radiological laboratories have no experience operating in an incident response mode. In their usual mode of routine operations laboratories negotiate turnaround times for sample results. In the event of a major nuclear or radiological incident, laboratories will be expected to operate in a surge mode, maximum throughput and rapid turnaround. Absent the experience in shifting to a surge capacity mode and lacking the necessary procedures and protocols, the majority of laboratories will fall well short of the demands placed upon them. What is needed to improve this transition is training and general protocols for surge capacity operations.

Proposal

- Provide on-site training on transitioning from routine operations to surge capacity operations for 10 environmental radiological laboratories per year.
- Develop general protocols on transitioning from routine operations to surge capacity that can be customized by laboratories.

ED_001057_00022071

HSCN Budget Initiatives

Inability of Laboratories to Analyze Urban Matrices

Most environmental radiological laboratories have experience in analyzing for radionuclides in environmental matrices such as water, soil, vegetation, etc. However, very few laboratories have any experience or even analytical methods to analyze for radionuclides in urban matrices such as cement, brick, asphalt, etc.

Over the past several years ORIA's National Analytical Radiation Environmental Laboratory (NAREL) has been working in partnership with ORD's National Homeland Security Research Center (NHSRC) to develop rapid radiochemical methods for urban matrices. By the end of FY16, rapid radiochemical methods will be published for brick, cement, asphalt, and asphalt shingles. However much work still needs to be done. ORD's NHSRC did a survey of the urban matrices in 50 of the largest cities in the country and this list can be used to prioritize the development of rapid methods.

Proposal

- Develop and validate two rapid radiochemical methods for urban matrices in partnership with ORD NHSRC per year.
- Conduct workshops at national meetings of laboratory personnel on the rapid radiochemical methods for urban matrices every year.

Declining Expertise in Radiochemistry

In 2012, The National Academies of Science issued a report entitled, *Assuring a Future U.S. – Based Nuclear and Radiochemistry Expertise.* The report emphasized the critical need to support efforts focused on developing the longer-term sustainability of the nuclear workforce including laboratory personnel. Highly - educated and experienced radiochemists are being lost to retirement at a rate that exceeds their rate of replacement. There are few if any training courses in radiochemistry – (both the theory and hands-on training) being offered.

Proposal

- Develop Basis of Radiochemistry, Intermediate Radiochemistry and Advanced Radiochemistry training courses. Each course would be one week long with one offering of each course every year for up to 40 participants.
- As radiochemistry is highly technique dependent with very little automation, provide on-site hands-on training on radiochemistry techniques to 8 environmental radiological laboratories per year.

Lack of Proficiency Testing for Urban Matrices

While there is proficiency testing currently in place for select radionuclides in traditional environmental matrices, such as water, soil, vegetation, air filters, etc, there are currently no proficiency testing programs for urban matrices such as cement, brick, asphalt, etc. Therefore, EPA has no way of evaluating the ability of laboratories to analyze for radionuclides in urban matrices prior to an RDD or IND incident. During an emergency, laboratories will certainly struggle with urban matrices because of the lack of experience in working with them. This will result in delays of getting data to decision makers and there will also be questions about the validity and accuracy of the data.

Proposal

ED_001057_00022071

- Develop and send spiked samples of two types of urban matrices (e.g. cement, brick) to 20 laboratories each year.
- Evaluate the results and send each participating laboratory their results along with recommendations on how to improve their performance as appropriate.

Lack of Radiological Laboratory Exercises

Over the past twenty years there have been a number of large scale multi-agency radiological/nuclear exercises. However in almost every case radiological laboratories played a very small role in the exercises with the samples being either notional or if real, very few in number. Therefore radiological laboratories have not truly been exercised in any way that would come close to what they would experience in a major radiological or nuclear event.

Proposal

- Prepare and send 300 to 400 spiked samples of a variety of environmental and urban matrices to 20 to 30 laboratories each year. The laboratories would be given a scheduled for reporting results in a designated electronic data deliverable.
- Following the laboratory exercise conduct several conference calls to capture "lessons learned" from the exercise. These lessons learned would be compiled in a report and sent to each participating laboratory to assist them in improving their procedures and protocols. In addition each laboratory would receive an individual report evaluating their performance along with customized recommendations on how to improve their procedures, protocols and overall performance.

Budget for All Proposals

It should be noted that this is a multi-year proposal given that the gap in the nations' radiological laboratory capacity and capability cannot be significant reduced in one year. Also this budget is easily scalable by reducing the number of laboratories involved each year, reducing the number of samples sent for an exercise, etc.

Close Rad Lab Gaps	FY17	FY18	FY19	FY20		
Intramural (FTE)[1]	$90,000	$90,000	$90,000	$90,000	**$360,000**	
Equipment	$30,000	$30,000	$30,000	$30,000		
Travel	$10,000	$10,000	$10,000	$10,000		
Contracts[2]	$685,000	$685,000	$685,000	$685,000		
Grants	$0	$0	$0	$0		
Extramural Total	$725,000	$725,000	$725,000	$725,000	**$2,900,000**	
Total by FY	**$815,000**	**$815,000**	**$815,000**	**$815,000**	**$3,260,000**	**Total Budget**

[1]Assumes multiple part-time personnel; 1 FTE = $180,000 (avg).
[2]Contractors to conduct training, prep PT samples, evaluate results, and write evaluation reports

ED_001057_00022071

To: DeCair, Sara[DeCair.Sara@epa.gov]
Cc: Veal, Lee[Veal.Lee@epa.gov]
From: Perrin, Alan
Sent: Fri 6/17/2016 9:30:41 PM
Subject: PAGs

Sara, FYI

My take-aways from Jon's discussion of his weekly …

Janet will be the reviewer as the PAGs move through OAR. (I think this is good news; she is familiar with the docs and the issues and, I believe, recognizes this as the fastest route forward.)

We are on the correct course preparing to include the DW PAG as part of the full manual and also as an addendum if that is the way we need to go. I.e., priority 1) is to get the full manual published, 2) is to get the DW PAG published along with it if we can get all the pieces to come together for us. 2) is ideal, 1) is a got to do.

Alan Perrin, Acting Director
Radiation Protection Division, USEPA
ofc (202) 343-9775 | mbl (202) 279-0376

To: DeCair, Sara[DeCair.Sara@epa.gov]; Snead, Kathryn[Snead.Kathryn@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]
From: Boyd, Mike
Sent: Fri 6/17/2016 7:25:40 PM
Subject: FW: Interface Sara DeCair and PAGs

HI Sara, Kathryn and Lee,

See the email below. I think Shaheen is making the assumption that the recent discussions about supporting for DCFPAK might translate into some additional opportunities for ORNL to provide support to our ER program.

Shaheen, Michael and Nolan from ORNL will all be here this Thursday morning and will attend ISCORS Thursday afternoon. Sara, would you like to set up a meeting with Shaheen? She is an exceptionally talented scientist.

Let me know what you decide. Thanks.

Mike

From: Dewji, Shaheen A. [mailto:dewjisa@ornl.gov]
Sent: Thursday, June 16, 2016 10:01 PM
To: Boyd, Mike <Boyd.Mike@epa.gov>
Cc: Nolan Hertel <nolan.hertel@me.gatech.edu>; Dewji, Shaheen A. <dewjisa@ornl.gov>
Subject: Interface Sara DeCair and PAGs
Importance: High

Mike,

I am looking forward to meeting you at ISCORS! I understand that Sara DeCair will be interfacing more with the CRPK in the future. Michael has been handling the FGR work well with the FGR team. I understand Sara has been active with the development of PAGs. I have a background in emergency response from my work in Canada and have conducted work previously to support the CDC on RDD triage screening with Nolan. Given my background in this work, I would like to expand this capability for the CRPK and was hoping you could provide an introduction for Nolan and I to Sara to see

if we have any scope for supporting the PAGs for radiological incidents further.

Please also feel free to forward her this email and it would be great of we could setup a meeting for you, Nolan and I with Sara to discuss any supporting activities in this area.

Best Regards,

Shaheen A. Dewji, Ph.D.

Center for Radiation Protection Knowledge

Environmental Sciences Division
Oak Ridge National Laboratory
dewjisa@ornl.gov
Office: 865-576-9348

To: Cherepy, Andrea[Cherepy.Andrea@epa.gov]
Cc: Edwards, Jonathan[Edwards.Jonathan@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]; Griggs, John[Griggs.John@epa.gov]; Poppell, Sam W.[Poppell.Sam@epa.gov]; Johnson, Jeremy[Johnson.Jeremy@epa.gov]
From: Snead, Kathryn
Sent: Wed 6/15/2016 7:10:52 PM
Subject: Revised ER Preparedness Brief (with and without notes sections)
erpreparednessbrief061516.pptx
erpreparednessbrief_notes061516.pptx

Andrea,

As requested, please find attached revised versions of the ER Preparedness Brief with and without notes sections for the briefing for Janet tomorrow. Let me know if you have any questions or last-minute changes. Thanks!

Kathryn Snead

Center for Radiological Emergency Management

Office of Radiation and Indoor Air

Environmental Protection Agency

1200 Pennsylvania Ave., NW

Washington, DC 20460

202-343-9228 (W)

202-536-7896 (C)

To: White, Rick[White.Rick@epa.gov]; Ferguson, Rafaela[Ferguson.Rafaela@epa.gov]
Cc: Veal, Lee[Veal.Lee@epa.gov]; Snead, Kathryn[Snead.Kathryn@epa.gov]; Wieder, Jessica[Wieder.Jessica@epa.gov]
From: Perrin, Alan
Sent: Wed 6/15/2016 6:08:31 PM
Subject: RE: ACTION - Emergency Response toolkit
RadiationEmergencyResponseMessagingLW.DOCX

Thanks, Rick. Suggest a Rad focus, unless there are egregious elements to the other fact sheets that you feel need comment. Please also note the request for additional material and links to additional material – I suspect we have a lot to offer here.

Jess, just FYI to you.

Alan Perrin, Acting Director
Radiation Protection Division, USEPA
ofc (202) 343-9775 | mbl (202) 279-0376

From: White, Rick
Sent: Wednesday, June 15, 2016 1:57 PM
To: Ferguson, Rafaela <Ferguson.Rafaela@epa.gov>
Cc: Veal, Lee <Veal.Lee@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; Snead, Kathryn <Snead.Kathryn@epa.gov>
Subject: RE: ACTION - Emergency Response toolkit

Rafie-

Christie sent us the Rad fact sheet to review separately which we are doing and should be able to get back to her next week. Are we being asked to review the Chemical ad Anthrax one too (those were the ones attached)?

From: Ferguson, Rafaela
Sent: Wednesday, June 15, 2016 1:43 PM
To: White, Rick <White.Rick@epa.gov>

Cc: Veal, Lee <Veal.Lee@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; Snead, Kathryn <Snead.Kathryn@epa.gov>
Subject: FW: ACTION - Emergency Response toolkit
Importance: High

Rick,

Would you please have CRIO PIOs review this info and, especially the rad fact sheet and let me know what changes we want to send forward tomorrow, if possible. Comments are due back on Monday.already see ERAMS reference needs to be updated to RadNet or edit reference to say RadNet formerly known as ERAMS. Thanks!

Rafie

From: Rowson, David
Sent: Wednesday, June 15, 2016 12:00 PM
To: Cherepy, Andrea <Cherepy.Andrea@epa.gov>; Edwards, Jonathan <Edwards.Jonathan@epa.gov>
Cc: Durkin, Kim <Durkin.Kim@epa.gov>; Smith, Alisa <Smith.Alisa@epa.gov>; Kolb, Laura <Kolb.Laura@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; Veal, Lee <Veal.Lee@epa.gov>; Ferguson, Rafaela <Ferguson.Rafaela@epa.gov>
Subject: FW: ACTION - Emergency Response toolkit

Andrea and Jon,

Lou Witt and Laureen burton were included in an email from OPA this morning saying the Agency is overhauling its emergency preparedness communications and as part of that, developing a toolkit for press officers and program comms leads. (There's additional background in the email chain below.)

OPA has asked for review/comment and we noticed there is a rad fact sheet and that no RPD folks were in the distribution list. Laura is reaching out to Alan, Rafie and Lee so RPD can review the rad and any other fact sheets of interest. Depending on whether we have any significant feedback, this may come back through you. If you have any further guidance, please let us know.

Dave

David Rowson, Director

Indoor Environments Division

US Environmental Protection Agency

202-343-9449

From: Kolb, Laura
Sent: Wednesday, June 15, 2016 10:04 AM
To: Jalbert, Philip <Jalbert.Philip@epa.gov>; Rowson, David <Rowson.David@epa.gov>; Smith, Alisa <Smith.Alisa@epa.gov>
Subject: FW: ACTION - Emergency Response toolkit

Perhaps a topic for MT mtg?

From: Burton, Laureen
Sent: Wednesday, June 15, 2016 10:01 AM
To: Kolb, Laura <Kolb.Laura@epa.gov>
Subject: Fwd: ACTION - Emergency Response toolkit

I don't know how or if Lou is sharing this info for review within IED but as you are such a big part of our ER/EP work thought you and maybe others should review. I will review as well.

Laureen

Sent from iPhone. Please forgive me and the 'auto spell check' for any typos.

Begin forwarded message:

From: "StClair, Christie" <StClair.Christie@epa.gov>
Date: June 14, 2016 at 3:33:47 PM CDT
To: "Cohen, Nancy" <Cohen.Nancy@epa.gov>, "Lowery, Brigid" <Lowery.Brigid@epa.gov>, "Deitz, Randy" <Deitz.Randy@epa.gov>, "Colip, Matthew" <colip.matthew@epa.gov>, "Wells,

Suzanne" <Wells.Suzanne@epa.gov>, "Gartner, Lois" <Gartner.Lois@epa.gov>, "Fitz-James, Schatzi" <Fitz-James.Schatzi@epa.gov>, "Siedschlag, Gregory" <Siedschlag.Gregory@epa.gov>, "Zaragoza, Larry" <Zaragoza.Larry@epa.gov>, "Loop, Travis" <Loop.Travis@epa.gov>, "Fuld, John" <Fuld.John@epa.gov>, "Davis, Alison" <Davis.Alison@epa.gov>, "Mattas-Curry, Lahne" <Mattas-Curry.Lahne@epa.gov>, "Millett, John" <Millett.John@epa.gov>, "Drinkard, Andrea" <Drinkard.Andrea@epa.gov>, "McMichael, Nate" <McMichael.Nate@epa.gov>, "Canino, Richard" <Canino.Richard@epa.gov>, "Riggs, Rebecca" <Riggs.Rebecca@epa.gov>, "Witt, Lou" <Witt.Lou@epa.gov>, "Burton, Laureen" <Burton.Laureen@epa.gov>, "Oh, Peter" <Oh.Peter@epa.gov>, "Runge, Roberta" <Runge.Roberta@epa.gov>, "Irizarry, Gilberto" <Irizarry.Gilberto@epa.gov>, "Wall, Tom" <Wall.Tom@epa.gov>, "Strauss, Linda" <Strauss.Linda@epa.gov>, "Maguire, Megan" <Maguire.Megan@epa.gov>, "Linkins, Samantha" <Linkins.Samantha@epa.gov>, "Hubbard, Carolyn" <Hubbard.Carolyn@epa.gov>
Cc: "Kluesner, Dave" <kluesner.dave@epa.gov>, "Hull, George" <Hull.George@epa.gov>, "Wodarski, Lauren" <wodarski.lauren@epa.gov>, "Scheps, Adam" <scheps.adam@epa.gov>, "Georges, Thomas" <Georges.Thomas@epa.gov>, "Burch, Julia" <Burch.Julia@epa.gov>
Subject: ACTION - Emergency Response toolkit

All,

EPA is overhauling our emergency communications preparedness. One part of the project is a "PIO Toolkit" for press officers and program comms leads. When complete, we'll have a library of grab-and-go resources we can access quickly, no matter what the crisis.

Each incident "chapter" will have messaging, press releases, social media, fact sheets and infographics.

We need your help with two things:

1. Please review the draft messaging documents, attached, that relate to your office. All I'm asking now is for your top-line feedback:

- Will it be useful to your comms team and the PIOs in the immediate aftermath?

- Do you know of any other resources we can pull from?

- How can we make these more useful?

2. Please send additional materials:

- ☐☐☐☐☐☐☐☐ Links to info, checklists, messaging, FAQs from EPA or other federal agencies
- ☐☐☐☐☐☐☐☐ Press releases, infographics, fact sheets from previous real-life responses
- ☐☐☐☐☐☐☐☐ Message maps created for these types of incidents
- ☐☐☐☐☐☐☐☐ Infographics or fact sheets from the EPA website
- ☐☐☐☐☐☐☐☐ Draft social media or social media used for previous responses
- ☐☐☐☐☐☐☐☐ Briefly describe on your program's role during this type of response

Please forward this email to any additional staff or programs who might have helpful input or materials.

Email your feedback to me directly **by COB Monday, June 20.** Our goal is to circulate the draft PIO Toolkit by June 30.

Call me anytime if you have questions or want to discuss.

Thank you very much!

Christie

Christie St. Clair

Office of Public Affairs

Environmental Protection Agency

Washington, DC

o: 202-564-2880

m: 202-768-5780

Radiation Emergency Response Messaging

Source: FEMA, DHS, EPA, CDC
Date: June 2016

Main Source link: http://www.fema.gov/media-library-data/20130726-1919-25045-1433/communicating_during_and_after__npp_incident___june_2013__secure_.pdf

Main Source link: https://www.epa.gov/sites/production/files/2015-05/documents/rerp-1-00.pdf
https://radiation.zendesk.com/hc/en-us/sections/202407177

EPA's role: EPA develops science-based guidance for cleaning up sites that are contaminated with radioactive materials, including Superfund Program sites. The Agency works cooperatively with other federal agencies to ensure that consistent site investigation and laboratory methods are used throughout the federal government.

Other relevant agencies: Dept. of Agriculture, Commerce, Defense, Energy, Health and Human Services, Labor, Transportation, Veterans Affairs, Nuclear Regulatory Commission, NASA, and the American Red Cross.

Relevant program office: Office of Air and Radiation; EPA's National Center for Radiation Field Operations (https://www.epa.gov/aboutepa/forms/contact-us-about-epas-national-center-radiation-field-operations-ncrfo)

Relevant web content: The following is a link to the EPA's information regarding what to do in the event of a radiation-related emergency (https://www.epa.gov/radiation). EPA Rdiation Factsheet: https://www.epa.gov/sites/production/files/2015-05/documents/402-k-10-008.pdf

Past EPA Responses

Social Media Guide

EPA responsibilities after a radiation emergency:
**Below are EPA responsibilities which could require press releases or the production of information for the public following an emergency.*

- **Prepare health and safety advice and information for the public.**
  - **Analyze risk and recommend protective actions and other radiation protection measures.**
  - **Recommend acceptable emergency radiation levels in the environment.**
  - **Determine routes of exposure and estimate effects of radioactive releases on human health and environment.**
- Provide nationwide environmental monitoring data from Environmental Radiation Ambient

Monitoring Systems (**ERAMS**) for assessing the national impact of a release.

- Direct and conduct environmental monitoring activities and assess the environmental consequences of radioactivity releases.
- Access response contractors, the Emergency Response Team, strike forces, RERT, and other special forces of the National Response System.
- Assist in the preparation of long-term monitoring and area restoration plans; and recommend cleanup criteria.

Messaging FAQs:

All wording taken from FEMA and EPA response packets linked above.

Public Health and Safety Information

1. Is there an immediate danger?

People are being told to evacuate or stay inside (shelter-in-place) because exposure to the radioactive material outside is potentially dangerous. If you were instructed to stay inside, remain inside until you are told otherwise by local authorities. Walls, brick, concrete or soil between yourself and the source of radiation can help reduce radiation dose. If you were instructed to evacuate, please do so immediately, following instructions of emergency officials.

Click here for more information about protecting yourself from radiation:
https://www.epa.gov/radiation/protecting-yourself-radiation
Click here for more information about radiation health effects:
https://www.epa.gov/radiation/radiation-health-effects
Click here for radiation dose calculator:
https://www.epa.gov/radiation/calculate-your-radiation-dose

3. Who should evacuate and who should go inside and stay inside?

As stated by [insert official], people in [area/location] should evacuate and people in [area/location] should go inside and stay inside. These decisions are based on radiation science and other important factors such as direction of the wind, amount and type of radioactive material released, and how quickly radiation levels decrease. Individuals who are sheltering-in-place will be instructed to leave the area as soon as the risk from exposure decreases.

4. Is my food and water safe?

If you are concerned about the safety of your food:
o Wash your hands with soap and water before handling food. This will help remove any radioactive material that might be on your hands, limiting its spread to your food.
o Use a damp towel or cloth to clean all cans, bottles, packaged foods, counters, plates, pots, and utensils before using them.
o Seal these towels or cleaning cloths in a plastic bag and place them away from people and animals.

o Food in sealed containers and any unspoiled food in your refrigerator or freezer is safe to eat.
o Consumers can call the toll-free USDA Meat and Poultry Hotline 24 hours a day at 1-888-MPHotline (1-888-674-6854); for the hearing impaired (TTY) 1-800-256-7072.

Until we have drinking water test results, only bottled water is certain to be free of contamination. You can safely drink water, juices or other drinks in sealed containers or in your refrigerator or freezer. If a sealed container was exposed to radioactive dust outside, use a clean towel to wipe off the bottle to remove any radioactive material before opening it. The risk from having radioactive material on your body or consuming radioactive material on your food is significantly reduced by washing, even if the water itself is contaminated. Boiling tap water does not get rid of radioactive material.

5. Is the air safe to breathe?

The radioactive material released in the air can give a radiation dose. Covering your mouth and nose with a protective layer – like a mask, cloth, or towel – can help reduce the amount of particles you breathe. If you have been instructed to stay inside, it is because walls can provide protection from the radioactive material outside. If possible, close windows/shut off HVAC that brings in outdoor air until the plume has passed.

6. When will it be safe for people to return to their homes and businesses?

A long, difficult cleanup may await us and the most important goal of the cleanup is to protect public health. This radioactive material release has created areas where radiation could be dangerously high. It may be months or years before the most contaminated areas are reoccupied.

Radiation FAQs

7. What is radiation?

Radiation is the release of energy from unstable atoms in the form of particles or waves. Everything is made of atoms. Some atoms are unstable and release energy to become stable, these atoms are radioactive. Radiation can be detected using special equipment. People cannot see, smell, hear, feel, or taste radiation. With the correct instruments, radiation is easily detectable. Radiation affects people by depositing energy in body tissue. When an incident occurs, scientists can predict how much radiation energy a person might absorb. There is a direct relationship between how much radiation energy a person absorbs (dose), how fast they absorb it (dose rate), and potential health effects.

8. What's the difference between alpha, beta, and gamma radiation? How do these types of radiation affect people?

• Alpha radiation (also called alpha particles): Alpha particles cannot penetrate most matter. A piece of paper, clothing, or the outer layers of skin is sufficient to stop alpha particles. Radioactive material that emits alpha particles (alpha emitters) can give a radiation dose when inhaled, swallowed, or absorbed into the blood stream through wounds.
• Beta radiation (also called beta particles): Beta particles can be stopped by a layer of clothing or by a few millimeters of a substance such as aluminum. Beta particles are capable of penetrating the skin and causing cutaneous radiation injury, but this is not likely to occur from an NPP incident. As with alpha emitters, beta emitters can produce a radiation dose when they are inhaled or swallowed or absorbed into the blood stream through wounds.
• Gamma radiation (or gamma rays): Gamma rays are essentially the same as X-rays. They are a type of penetrating radiation. Denser and thicker materials stop them better. Several feet of concrete or a few inches of lead are required to stop most of them. Gamma rays are a radiation hazard for the entire body.

9. What is potassium iodide (KI)?

Potassium iodide is a salt, similar to table salt. It is often referred to as KI, which is its chemical symbol. Potassium iodide, if taken in time and at the appropriate dosage, blocks radioactive iodine from being absorbed by the thyroid gland. This could reduce the risk of thyroid cancers and diseases that might otherwise be caused by exposure to radioactive iodine that could be dispersed in a severe nuclear accident. KI only protects the thyroid gland from radioactive iodine exposure. To protect your whole body, follow the instructions of local officials. KI is a reasonable, prudent, and inexpensive supplement to other protective actions.

10. How do you monitor/detect radiation?

Specialized instruments are used to detect radiation. No one detector can accurately measure all types of radiation. Specialized emergency responders are trained and skilled in using these instruments.

11. How much radiation is safe? How much is considered low risk?

According to radiation safety experts, radiation exposure between 5–10 rem usually results in little to no harmful health effects. Infants, the elderly and pregnant women are more sensitive to radiation exposure than healthy adults. It takes a large dose of radiation—more than 75 rem—in a short amount of time (usually minutes) to cause immediate health effects like acute radiation sickness.

12. Does radiation cause cancer?

Radiation from natural background and other man-made sources is a minor contributor to our overall cancer risk. According to radiation safety experts, radiation exposure between 5–10 rem usually results in little to no harmful health effects. Radiation sickness occurs only when a

person is exposed to very high levels of radiation (more than 75 rem).

Click here for more information:
https://www.epa.gov/sites/production/files/2015-05/documents/402-r-99-001.pdf

13. Are NPPs safe?

NPPs are designed and built to rigorous standards of safety. Safety standards are set by the NRC. Operating licenses are granted only to plants that meet all the safety requirements. NPPs are constantly inspected to ensure compliance. NPPs in the U.S. have a very strong record of safely producing power.

14. How much radioactive material has been released from the NPP?

The release is still under way [or the release has been stopped]. We won't have specific information until we do monitoring and analysis, both on the ground and via aerial surveillance. But based on what we know of the plant's operations we can state that the plant is likely to have emitted [_____].

Emergency Response and Cleanup

16. What is being done in response to the release of radioactive material?

The [unit/plant] has been shut down and, as it cools, the source of the radiation will diminish. Highly skilled teams are at the plant working to shut off the path of the release to the environment. Federal, State, local, and tribal responders are coordinating closely to respond as effectively as possible.

18. Can the contaminated areas ever be cleaned up and returned to their former use?

Right now we are focused on assuring the health and safety of all those affected, and making sure they are kept out of harm's way. Affected areas are being cordoned off until we determine the locations and the levels of radiation. As soon as the immediate emergency is over and the plant is fully stabilized, we will carefully assess the extent of the contamination. It is probable that contaminated land will be returned to its former use. However, areas will not be returned to their former use until we are sure they do not pose a risk.

Click Here for EPA radioactive soil clean-up plan:
https://www.epa.gov/sites/production/files/2015-05/documents/402-r-96-011a_intro.pdf

EPA Specific Role

20. What is EPA's role in emergency response?

Under the NCP, EPA is the lead response agency for releases of hazardous substances, including radionuclides, in the Inland Zone of the US, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 "**CERCLA**" (Superfund), and excluding certain releases of radiological materials from Nuclear Regulatory Commission (**NRCom**) licensed nuclear reactors and from uranium mill tailing sites. The responsibility for EPA's national preparedness to respond to environmental incidents and emergencies is divided up among three headquarters organizations and the 10 EPA Regions. Radiological emergency preparedness is a primary responsibility of ORIA, whereas preparedness for oil and hazardous substance emergencies is the responsibility of the Chemical Emergency Planning and Prevention Office (CEPPO) and Office of Emergency and Remedial Response (OERR), and their regional program counterparts. The EPA Regions may operate autonomously and somewhat independently of headquarters; however, they collaborate with headquarters during many of the emergency response preparedness and operations. Both headquarters and regional offices maintain a mutual core of responsibilities augmenting one another in time of need.

Click here for more information on EPA Incident Responses:
https://www.epa.gov/radiation/incident-guides
Click here for more information on EPA Protective Action Guidelines:
https://www.epa.gov/radiation/protective-action-guides-pags

20. What are the environmental effects of a radioactive material release?

Responders are collecting environmental samples to get a complete picture of the extent of the environmental impacts. Right now we are gathering information that has a direct impact on public safety, such as levels of contamination, while taking into account the need to protect our field teams and responders. Monitoring will be ongoing for some period of time.

21. What are exposure limits? Who sets them?

The NRC requires that users of radioactive materials, including NPPs, keep radiation exposures within the NRC's specified dose limits and as low as reasonably achievable. The EPA has developed a series of PAGs that suggest precautions. PAGs provide guidance only, but typically are incorporated into offsite response plans and are used as the basis for determining protective actions. The National Council on Radiation Protection and Measurements (NCRP) estimates that an average person in the United States receives a total annual dose of about 0.62 rem (620 millirem) from all radiation sources, natural and man-made.

21. What can EPA do to assist financially?

In most EPA Regions, the OSC may approve the use of Superfund in the amount of $200K in an emergency, or $50K for non-emergency removal response and a Superfund account number will be established for travel and other response costs requested by the OSC.

22. What is EPA's role if this was a terrorist attack?

EPA's traditional response capabilities are well suited to responding to terrorist-related radiological incidents. EPA's traditional consequence management activities, were coordinated with the FEMA-led response, as in other radiological emergencies warranting FRERP response.

Past EPA Responses

2011 Japanese Fukushima Nuclear Incident
List of all press releases by date: https://www.epa.gov/radnet/2011-japanese-nuclear-incident-epa-news-releases-date

Main Press Releases:
Initial Statement - https://www.epa.gov/sites/production/files/2014-11/documents/epa_statement_on_air_monitoring_effort_3-15-11.pdf
Confirmation that no concerning radiation levels had reached the U.S. - https://www.epa.gov/sites/production/files/2014-11/documents/3-28-11.pdf
Fact Sheet on Seafood Safety - https://www.epa.gov/sites/production/files/2014-11/documents/seafoodsafetyfactsheet_03may2011.pdf
Return to Routine Operations - https://www.epa.gov/sites/production/files/2014-11/documents/may3rdstatement.pdf

Social Media Guide and Examples

Facebook Initial Message – Non Emergency
"As a result of the incident with the ___ nuclear plant in ___, several EPA air monitors have detected very low levels of radioactive material in the United States consistent with estimates form the damaged nuclear reactors. These detections were expected and the levels detected are far below levels of public-health concern.

Facebook Fukushima Examples:
"Our website is the best way to get the latest information and data on our radiation monitoring efforts: http://www.epa.gov/japan2011. You should send your technical questions to radiation.questions@epa.gov as we have a team of experts answering these questions. We're doing our best to respond to general questions here, and we'll share other information as it's developed by our experts. Thanks for your patience."

"Drinking water from Boise, ID and Richland, WA showed trace amounts of Iodine-131, about 0.2 picocuries per liter. Even an infant would have to drink almost 7,000 liters of this water to receive a radiation dose equivalent to a day's worth of natural background radiation exposure. We expected to find results such as these in some samples, and similar findings are to be

expected in the coming weeks."

Twitter Initial Message – Non Emergency Example
"Following incident in ___, EPA has detected expected low levels of radiation which pose no public health concern."

Facebook Initial Message (General) – Emergency
The EPA is working with federal, state and local authorities to provide information as quickly and as accurately as possible. Please listen to all local law enforcement and emergency response instructions and check the EPA website for the most up to date notifications.

Twitter Initial Message (General) – Emergency
"EPA responding to emergency in ___. Working with fed, state and local authorities to provide information as it becomes available."

To: White, Rick[White.Rick@epa.gov]
Cc: Veal, Lee[Veal.Lee@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]; Snead, Kathryn[Snead.Kathryn@epa.gov]
From: Ferguson, Rafaela
Sent: Wed 6/15/2016 5:43:11 PM
Subject: FW: ACTION - Emergency Response toolkit
Anthrax Emergency Response MessagingLW.docx
ATT00001.htm
Chemical Release Emergency Response MessagingLW.docx
ATT00002.htm
Water Emergency Response MessagingLW.docx
ATT00003.htm
EarthquakeEmergencyResponseMessagingLW.docx
ATT00004.htm
RadiationEmergencyResponseMessagingLW.docx
ATT00005.htm
WaterWeatherEmergencyResponseMessagingLW.docx
ATT00006.htm
Oil Spill Messaging.docx
ATT00007.htm

Rick,

Would you please have CRIO PIOs review this info and, especially the rad fact sheet and let me know what changes we want to send forward tomorrow, if possible. Comments are due back on Monday.already see ERAMS reference needs to be updated to RadNet or edit reference to say RadNet formerly known as ERAMS. Thanks!

Rafie

From: Rowson, David
Sent: Wednesday, June 15, 2016 12:00 PM
To: Cherepy, Andrea <Cherepy.Andrea@epa.gov>; Edwards, Jonathan <Edwards.Jonathan@epa.gov>
Cc: Durkin, Kim <Durkin.Kim@epa.gov>; Smith, Alisa <Smith.Alisa@epa.gov>; Kolb, Laura <Kolb.Laura@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; Veal, Lee <Veal.Lee@epa.gov>; Ferguson, Rafaela <Ferguson.Rafaela@epa.gov>
Subject: FW: ACTION - Emergency Response toolkit

Andrea and Jon,

Lou Witt and Laureen burton were included in an email from OPA this morning saying the Agency is overhauling its emergency preparedness communications and as part of that,

developing a toolkit for press officers and program comms leads. (There's additional background in the email chain below.)

OPA has asked for review/comment and we noticed there is a rad fact sheet and that no RPD folks were in the distribution list. Laura is reaching out to Alan, Rafie and Lee so RPD can review the rad and any other fact sheets of interest. Depending on whether we have any significant feedback, this may come back through you. If you have any further guidance, please let us know.

Dave

David Rowson, Director

Indoor Environments Division

US Environmental Protection Agency

202-343-9449

From: Kolb, Laura
Sent: Wednesday, June 15, 2016 10:04 AM
To: Jalbert, Philip <Jalbert.Philip@epa.gov>; Rowson, David <Rowson.David@epa.gov>; Smith, Alisa <Smith.Alisa@epa.gov>
Subject: FW: ACTION - Emergency Response toolkit

Perhaps a topic for MT mtg?

From: Burton, Laureen
Sent: Wednesday, June 15, 2016 10:01 AM
To: Kolb, Laura <Kolb.Laura@epa.gov>
Subject: Fwd: ACTION - Emergency Response toolkit

I don't know how or if Lou is sharing this info for review within IED but as you are such a big part of our ER/EP work thought you and maybe others should review. I will review as well.

Laureen

Sent from iPhone. Please forgive me and the 'auto spell check' for any typos.

Begin forwarded message:

From: "StClair, Christie" <StClair.Christie@epa.gov>
Date: June 14, 2016 at 3:33:47 PM CDT
To: "Cohen, Nancy" <Cohen.Nancy@epa.gov>, "Lowery, Brigid" <Lowery.Brigid@epa.gov>, "Deitz, Randy" <Deitz.Randy@epa.gov>, "Colip, Matthew" <colip.matthew@epa.gov>, "Wells, Suzanne" <Wells.Suzanne@epa.gov>, "Gartner, Lois" <Gartner.Lois@epa.gov>, "Fitz-James, Schatzi" <Fitz-James.Schatzi@epa.gov>, "Siedschlag, Gregory" <Siedschlag.Gregory@epa.gov>, "Zaragoza, Larry" <Zaragoza.Larry@epa.gov>, "Loop, Travis" <Loop.Travis@epa.gov>, "Fuld, John" <Fuld.John@epa.gov>, "Davis, Alison" <Davis.Alison@epa.gov>, "Mattas-Curry, Lahne" <Mattas-Curry.Lahne@epa.gov>, "Millett, John" <Millett.John@epa.gov>, "Drinkard, Andrea" <Drinkard.Andrea@epa.gov>, "McMichael, Nate" <McMichael.Nate@epa.gov>, "Canino, Richard" <Canino.Richard@epa.gov>, "Riggs, Rebecca" <Riggs.Rebecca@epa.gov>, "Witt, Lou" <Witt.Lou@epa.gov>, "Burton, Laureen" <Burton.Laureen@epa.gov>, "Oh, Peter" <Oh.Peter@epa.gov>, "Runge, Roberta" <Runge.Roberta@epa.gov>, "Irizarry, Gilberto" <Irizarry.Gilberto@epa.gov>, "Wall, Tom" <Wall.Tom@epa.gov>, "Strauss, Linda" <Strauss.Linda@epa.gov>, "Maguire, Megan" <Maguire.Megan@epa.gov>, "Linkins, Samantha" <Linkins.Samantha@epa.gov>, "Hubbard, Carolyn" <Hubbard.Carolyn@epa.gov>
Cc: "Kluesner, Dave" <kluesner.dave@epa.gov>, "Hull, George" <Hull.George@epa.gov>, "Wodarski, Lauren" <wodarski.lauren@epa.gov>, "Scheps, Adam" <scheps.adam@epa.gov>, "Georges, Thomas" <Georges.Thomas@epa.gov>, "Burch, Julia" <Burch.Julia@epa.gov>
Subject: ACTION - Emergency Response toolkit

All,

EPA is overhauling our emergency communications preparedness. One part of the project is a "PIO Toolkit" for press officers and program comms leads. When complete, we'll have a library of grab-and-go resources we can access quickly, no matter what the crisis.

Each incident "chapter" will have messaging, press releases, social media, fact sheets and infographics.

We need your help with two things:

1. Please review the draft messaging documents, attached, that relate to your office. All I'm asking now is for your top-line feedback:

- ☐☐☐☐☐☐☐☐ Will it be useful to your comms team and the PIOs in the immediate aftermath?
- ☐☐☐☐☐☐☐☐ Do you know of any other resources we can pull from?
- ☐☐☐☐☐☐☐☐ How can we make these more useful?

2. Please send additional materials:

- ☐☐☐☐☐☐☐☐ Links to info, checklists, messaging, FAQs from EPA or other federal agencies
- ☐☐☐☐☐☐☐☐ Press releases, infographics, fact sheets from previous real-life responses
- ☐☐☐☐☐☐☐☐ Message maps created for these types of incidents
- ☐☐☐☐☐☐☐☐ Infographics or fact sheets from the EPA website
- ☐☐☐☐☐☐☐☐ Draft social media or social media used for previous responses
- ☐☐☐☐☐☐☐☐ Briefly describe on your program's role during this type of response

Please forward this email to any additional staff or programs who might have helpful input or materials.

Email your feedback to me directly **by COB Monday, June 20.** Our goal is to circulate the draft PIO Toolkit by June 30.

Call me anytime if you have questions or want to discuss.

Thank you very much!

Christie

Christie St. Clair

Office of Public Affairs

Environmental Protection Agency

Washington, DC

o: 202-564-2880

m: 202-768-5780

Anthrax Emergency Response Messaging

Source: FEMA, DHS, EPA, CDC
Date: June 2016

Main Source link: https://www.epa.gov/sites/production/files/2014-10/documents/sam_2012_07162012.pdf

Main Source link: https://www.fema.gov/pdf/emergency/nrf/nrf_BiologicalIncidentAnnex.pdf

EPA's role: EPA develops science-based guidance for cleaning up buildings and other sites that are contaminated with chemical or biological agents, including Superfund Program sites. The Agency works cooperatively with other federal agencies and disaster organizations to ensure that consistent site investigation and laboratory methods are used throughout the federal government.

Other relevant agencies: Department of Health and Human Services, Department of Agriculture, Department of Commerce, Department of Defense, Department of Energy, Department of Homeland Security, Department of the Interior, Department of Justice, Department of Labor, Department of State, Department of Transportation, Department of Veterans Affairs, General Services Administration, U.S. Agency for International Development, U.S. Postal Service, American Red Cross

Relevant program office: Office of Emergency Management (OEM)

Past EPA Responses

Social Media Guide

Relevant web content: The following link is an EPA published webpage on mail irradiation: https://www3.epa.gov/radtown/mail-irradiation.html. The EPA Office of Homeland Security is also helpful: https://www.epa.gov/aboutepa/about-office-homeland-security-ohs

EPA responsibilities after an anthrax emergency:
**Below are EPA responsibilities which could require press releases or the production of information for the public following an emergency.*

- **Prepare health and safety advice and information for the public.**
  - **Analyze risk and recommend protective actions and other protection measures.**
- Direct and conduct detection and protective measures, as well as environmental monitoring activities and assess the environmental consequences of chemical and biological releases.
- Identify chemical or biological agent
- Designation of Superfund sites

- Access response contractors, the Emergency Response Team, strike forces, RERT, and other special forces of the National Response System.
- Assist in the preparation of long-term cleanup and area restoration plans

Messaging FAQs:

Public Health and Safety Information

1. Is there an immediate danger?

Often anthrax attacks are contained within in an office or building. In this case, follow law enforcement and emergency responder instructions on evacuation protocol. In the case of a widespread, outdoor chemical contamination, people may be told to evacuate or stay inside (shelter-in-place) because exposure to the material outside is potentially dangerous. If you were instructed to stay inside, remain inside until you are told otherwise by local authorities. Walls, brick, concrete or soil between yourself and the source of radiation can help reduce radiation dose. If you were instructed to evacuate, please do so immediately, following instructions of emergency officials.

Is anthrax exposure contagious?

Inhalation anthrax occurs when bacterial spores are inhaled, and may be fatal without treatment. The most common form of anthrax infection is cutaneous though. Approximately 95% of skin infections occur when bacteria enters via cut on the skin upon handling contaminated objects; 20% of untreated cases are fatal. Consumption of poorly cooked contaminated meat can also be infections. Anthrax is a bacterial infection and is not contagious, but people who may be contaminated should be properly cleaned and dispose of infected clothes.

Symptoms of anthrax poisoning include inhalation anthrax: Fever, malaise, fatigue, cough, chest discomfort, stridor (noisy breathing), respiratory distress, dyspnea (shortness of breath), and cyanosis (bluish discoloration of the skin). Cutaneous anthrax symptoms include: Raised itchy bump to vesicle which progresses to painless ulcer (1-3cm) with black area in the center. Swollen lymph nodes and flu-like symptoms. Ingested anthrax: Flu-like symptoms, nausea, loss of appetite, vomiting, fever, abdominal pain, and severe diarrhea. Seek medical help immediately should you experience any of these symptoms.

Click here for CDC basic anthrax information: http://www.cdc.gov/anthrax/basics/

Is anthrax exposure lethal?

Inhalation anthrax is highly lethal. Given the uncertainties regarding published infective doses

for bioagents, it is important to examine what the infectivity numbers represent, including the routes of exposure and the animal species used for the lab studies. Responders should not assume that an infective dose estimate represents a safe level. In the absence of data on infectious dose, the LD50 (the dose of spores in animal experiments which results in the death of 50% of the animals) can be used in its place. Clearly, a dose that could potentially kill 50% of the people exposed is not to be considered safe.

What do I do to protect myself in case of a chemical or biological contamination?

Under ICS, the appointed Health and Safety Officer will determine PPE, Medical Surveillance, and Safety Plans.

Click here for CDC prevention guidelines: http://www.cdc.gov/anthrax/medical-care/prevention.html

What do I do if I have been exposed to anthrax?

Decontaminate skin with warm soapy water (10% bleach solution may irritate skin) for 10-15 minutes. Antibiotics (Ciprofloxacin, Doxycycline) and vaccination can help prevent infection with exposure to spores. With respect to specifics (e.g., value of mechanical scrubbing, contact time of decon solution, and need to rinse completely) citizens should check with the EPA National Decon Team Subject Matter Experts at 513-487-2420 (after hours call 24-hour pager at 1-800-329-1841).

For exposed persons, CDC currently recommends 60 days of antibiotic prophylaxis after exposure. Because experimental data indicate that viable spores may persist in the lungs for 100 days after exposure,

Click here for CDC treatment guidelines: http://www.cdc.gov/anthrax/medical-care/treatment.html

Anthrax FAQs

How is anthrax identified?

Since there is no definitive/reliable field test for biological agents of concern, all potential bioterrorism samples are transported to an LRN laboratory, where expert analysis is conducted using established Federal protocols/reagents. The following actions occur if a positive result is obtained by an LRN on an environmental sample submitted by the FBI or other designated law enforcement personnel: The LRN immediately notifies the local FBI of the positive test result and informs the appropriate public health officials. HHS, EPA, and cooperating agencies support the determination of the contaminated area. EPA will provide data to support the determination of the contaminated area and to assist with decisions regarding whether to shelter-in-place. EPA will also play a role in the decontamination of facilities and outdoor areas.

Click here for an anthrax fact sheet:
https://yosemite.epa.gov/sab/sabproduct.nsf/5AC43A81439F12A1852574D6004FC77C/$File/HSAC+Anthrax+12+20.pdf

How is anthrax contained/cleaned?

In response to 2001 bioterror attacks in a federal office building, EPA has found that biocides for anthrax spore decontamination can include:

- Bleach
- Chlorine Dioxide
- Ethylene Oxide
- Hydrogen Peroxide and Peroxyacetic Acid
- Methyl Bromide
- Paraformaldehyde
- Vaporized Hydrogen Peroxide

How long does it take to clean an Anthrax site?

This may vary depending on the size and scope of the contamination. An outdoor incident is much harder to fully clean since the spores can spread over a wide area. An indoor contamination will only be deemed clean when there is "no evidence of spores". This could take weeks, and decontamination processes can ruin some pictures, canvases and porous materials.

Emergency Response and Cleanup

How does EPA assist indoor contamination cleanup?

The clearance goal of "no detection of viable spores" as confirmed with sampling methods compatible with culture-based analysis should generally be used. In order to increase confidence in the data from targeted sampling, EPA and CDC recommend that trained field responders should use surface sample collection methods for which there are available validated laboratory processing methods. Sample collection methods for field responders that are based on validated laboratory processing methods can be accessed at:
http://www.cdc.gov/niosh/topics/emres/surface-sampling-bacillus-anthracis.html

EPA and CDC recognize that not all analytical methods are validated and that the existing validated methods may not work in all circumstances. Notably, they are limited at present to use on smooth, non-porous surfaces. The IC/UC and the EPA will develop a site specific plan for clean up with a preference for targeted sampling during the characterization and clearance phases. EPA has determined from experience and studies that fumigation is the best decontamination methodology for large facilities with *B. anthracis* contamination. However, decisions regarding decontamination technology and strategy should be made on a site- and situation-specific basis, including considerations such as decontamination technology capacity and availability, building use, and type and extent of contamination. EPA intends to select or

recommend the most cost effective and efficacious decontamination technology based on these considerations.

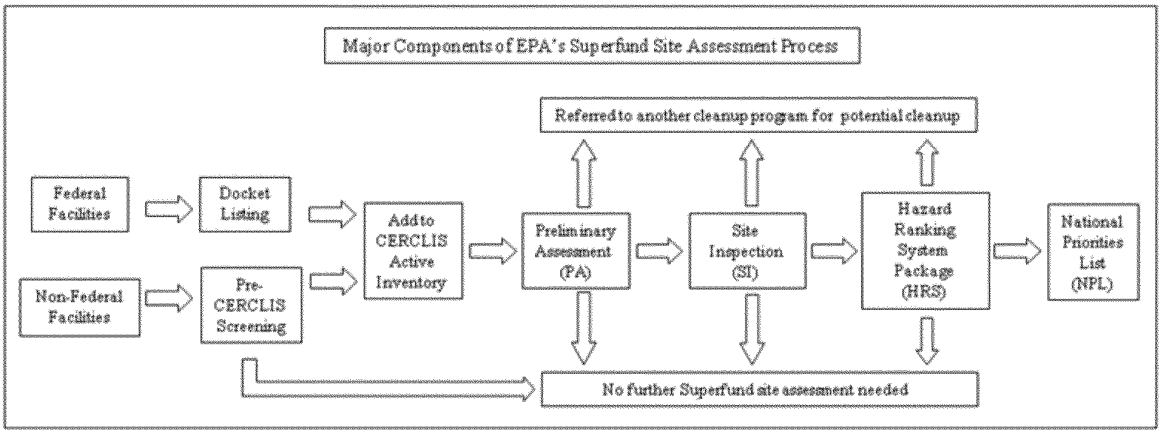
How does EPA assist outdoor contamination cleanup?

The ability to assess the extent of contamination, knowledge of spore fate and transport, historical experience and efficacy of decontamination technology will likely be more limited for an outdoor setting. Therefore, a modified approach to meeting the clearance goal is recommended for outdoor environments. However, the public health and environmental aims to reduce the exposure risk through a reduction in spore load remain the same as the indoor environment. As in the indoor setting, the IC/UC should develop a site-specific sampling plan with a preference for targeted sampling during the remediation phase. The clearance goal of "no detection of viable spores" as confirmed with air sampling methods compatible with culture-based analysis should be used.

What are the prerequisites for designating an area a Superfund site?

The Superfund site assessment process begins with site discovery or notification of a release or potential release into the environment. EPA may be notified of hazardous waste activity by citizens, states, tribes or other environmental programs.

Following notification, non-federal sites undergo pre-screening to determine whether the Superfund site assessment process is appropriate. At the conclusion of each assessment, the HRS model is applied to derive a preliminary site HRS score. Sites with preliminary HRS scores below 28.5 generally require no further Superfund remedial interest and are assigned a NFRAP decision. The NFRAP decision can also be made at sites with preliminary HRS scores of 28.5 or higher if EPA determines the site would receive a "no action" Record of Decision (ROD) if placed on the NPL. Most sites assessed for potential NPL listing screen out of the program.



Click here for more information on Superfund sites: https://www.epa.gov/superfund/superfund-site-assessment-process

EPA Specific Role

What is EPA's role in site cleanup?

If a *B. anthracis* incident occurs in the United States or within its territories, the public health and environmental response communities must work collaboratively during the response to most effectively address the risks posed by the incident. The ultimate goal is to effectively and efficiently remediate the environment so that the local or state public health officials or private building owners can make follow-on decisions. The EPA is ultimately responsible for the coordination of cleanup efforts. The remediation phase of a response includes characterization, decontamination, and clearance as defined in the Office of Science and Technology Policy (OSTP) draft document, *Planning Guidance for Recovery Following Biological Incidents*. (OSTP, 2009)

Click here for more information on planning for the recovery from a biological emergency: http://www.fema.gov/media-library-data/20130726-1910-25045-1918/20_rrkp_key_planning_factors_biological_incident.pdf

Past EPA Responses

Danbury, Conn. Anthrax Clean Up - https://www3.epa.gov/region1/removal-sites/DanburyConnAnthraxCleanUp.html

Social Media Guide

Chemical Release Emergency Response Messaging

Source: FEMA, DHS, EPA, CDC, American Red Cross
Date: June 2016

Main Source link:
https://www.epa.gov/sites/production/files/documents/tri_in_action_final_report_july_2013.pdf

Main Source link: https://www.epa.gov/sites/production/files/2015-07/documents/state_tribal_local_guide_factsheet_7-10-2015_2.pdf

EPA's role: EPA develops science-based guidance for cleaning up buildings and other sites that are contaminated with chemical or biological agents, including Superfund Program sites. The Agency works cooperatively with other federal agencies and disaster organizations to ensure that consistent site investigation and laboratory methods are used throughout the federal government. EPA also maintains a database e of

Other relevant agencies: American Red Cross, Federal Emergency Management Agency, Center for Disease Control, Internal Revenue Service, Department of Homeland Security, Department of Health and Human Services

Relevant program office: Office of Solid Waste and Emergency Response; U.S. EPA: Office of Pollution Prevention and Toxics: Pollution Prevention Division; U.S. EPA: Office of Air and Radiation

Relevant web content: Homeland Security Chemical Attack Fact Sheet:
https://www.dhs.gov/xlibrary/assets/prep_chemical_fact_sheet.pdf

Past EPA Responses

Social Media Guide

EPA responsibilities after a chemical release emergency:
**Below are EPA responsibilities which could require press releases or the production of information for the public following an emergency.*

- **Prepare health and safety advice and information for the public.**
  - **Analyze risk and recommend protective actions and other protection measures.**
- Direct and conduct detection and protective measures, as well as environmental monitoring activities and assess the environmental consequences of chemical and biological releases.
- Identify chemical agent and present information to the public
- Designation of Superfund sites

- Access response contractors, the Emergency Response Team, strike forces, RERT, and other special forces of the National Response System.
- Assist in the preparation of long-term cleanup and area restoration plans

Public Health and Safety Information

What do I do in case of a chemical attack?

Quickly try to define the impacted area or where the chemical is coming from, if possible, take immediate action to get away. If the chemical is inside a building where you are, get out of the building without passing through the contaminated area, if possible. If you can't get out of the building or find clean air without passing through the area where you see signs of a chemical attack, it may be better to move as far away as possible and shelter-in-place. If you are instructed to remain in your home or office building, you should: Close doors and windows and turn off all ventilation, including furnaces, air conditioners, vents, and fans; Seek shelter in an internal room and take your disaster supplies kit; Seal the room with duct tape and plastic sheeting; Listen to your radio for instructions from authorities. If you are caught in or near a contaminated area, you should: Move away immediately in a direction upwind of the source; Find shelter as quickly as possible. If you are outside, quickly decide what is the fastest way to find clean air. Consider if you can get out of the area or if you should go inside the closest building and shelter-in-place.

Click here for more in-depth guides on chemical threats and hazardous materials threats:
https://www.ready.gov/chemical-threats
https://www.ready.gov/hazardous-materials-incidents

Is there an immediate danger?

People are being told to evacuate or stay inside (shelter-in-place) because exposure to the radioactive material outside is potentially dangerous. If you were instructed to stay inside, remain inside until you are told otherwise by local authorities. If you were instructed to evacuate, please do so immediately, following instructions of emergency officials.

What can I do to prepare for a chemical attack?

Build an Emergency Supply Kit, which includes items like non-perishable food, water, a battery-powered or hand-crank radio, extra flashlights and batteries. Also include: A roll of duct tape and scissors, plastic for doors, windows, and vents for the room in which you will shelter in place. To save critical time during an emergency, pre-measure and cut the plastic sheeting for each opening.

Click here for link to an Emergency Supply Kit list: https://www.ready.gov/build-a-kit

What do I do if I have been exposed to a chemical contaminant?

Decontamination is needed within minutes of exposure to minimize health consequences. Do not leave the safety of a shelter to go outdoors to help others until authorities announce it is safe to do so. A person affected by a chemical agent requires immediate medical attention from a professional. If medical help is not immediately available, decontaminate yourself and assist in decontaminating others.

Decontamination guidelines are as follows:
•Use extreme caution when helping others who have been exposed to chemical agents.
•Remove all clothing and other items in contact with the body. Contaminated clothing normally removed over the head should be cut off to avoid contact with the eyes, nose and mouth. Put contaminated clothing and items into a plastic bag and seal it. Decontaminate hands using soap and water. Remove eyeglasses or contact lenses. Put glasses in a pan of household bleach to decontaminate them and then rinse and dry.
•Flush eyes with water.
•Gently wash face and hair with soap and water before thoroughly rinsing with water.
•Decontaminate other body areas likely to have been contaminated. Blot (do not swab or scrape) with a cloth soaked in soapy water and rinse with clear water.
•Change into uncontaminated clothes. Clothing stored in drawers or closets is likely to be uncontaminated.
•Proceed to a medical facility for screening and professional treatment.

Chemical Contaminant FAQs

What is a chemical attack?

Chemical agents are poisonous vapors, aerosols, liquids and solids that have toxic effects on people, animals or plants. They can be released by bombs or sprayed from aircraft, boats and vehicles. They can be used as a liquid to create a hazard to people and the environment. Some chemical agents may be odorless and tasteless. They can have an immediate effect (a few seconds to a few minutes) or a delayed effect (2 to 48 hours). While potentially lethal, chemical agents are difficult to deliver in lethal concentrations. Outdoors, the agents often dissipate rapidly. Chemical agents also are difficult to produce. A chemical attack could come without warning. Signs of a chemical release include people having difficulty breathing; experiencing eye irritation; losing coordination; becoming nauseated; or having a burning sensation in the nose, throat and lungs. Also, the presence of many dead insects or birds may indicate a chemical agent release.

Emergency Response and Cleanup

What is being done in response to the release of the chemical material?

Federal, State, local, and tribal responders are coordinating closely to respond as effectively as possible.

***

What can my community do to help?
Click here for a community level guide to dealing with chemical emergencies:
https://www.epa.gov/sites/production/files/2015-07/documents/state_tribal_local_guide_factsheet_7-10-2015_2.pdf

EPA Specific Role

What is EPA's role in cleaning chemical attacks?

The EPA communicates with state, local and tribal officials to coordinate clean-up efforts. EPA is charged with enforcing government set chemical safety standards and operations. In addition, to prepare for such an attack, and to support response and remediation teams, EPA chemists have been developing methods for detecting extremely low concentrations of nerve agents, such as sarin, VX, soman and cyclohexyl sarin, and the blister agent sulfur mustard. EPA homeland security researchers have worked with the Agency's Office of Emergency Management and the U.S. Army and Department of Energy to arrange for the Environmental Response Laboratory Network (ERLN) to obtain and use "ultra-dilute" (10 parts per million) quantities of CWAs. These standard samples are safely and securely stored on site. This laboratory continues to research new ways to protect citizens against chemical attacks, and will provide health and safety input during clean-ups.

What other measures has EPA taken to keep us safe?

Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) created the TRI (Toxic Release Inventory) Program. Under the requirements of EPCRA, all U.S. facilities that meet TRI reporting criteria must submit TRI data to EPA and the states in which they are located by July 1 of each year. EPCRA Section 313 compliance resources include inspectors and attorneys in each of EPA's 10 regional offices and at EPA headquarters. EPA investigates cases of EPCRA non-compliance and may issue civil penalties, including monetary fines, and may also require correction of the violation.
The Toxic Release Inventory allows the EPA to gather up to date information on the location and amount of toxins being released into our environment, and can give us valuable information in a time of emergency.

With approximately 400,000 facilities reporting under Section 311 and 312, the chemical information provided by these facilities offers a wealth of additional information that can be useful to first responders, LEPCs, and TEPCs in the local planning process. LEPCs and TEPCs should use information received under Sections 311, 312, and 302 to develop, implement, and update the emergency response plan. It is critically important that first responder organizations

make full use of the chemical hazard information for appropriate training and to minimize the risks to fire-fighters, medics and hazmat teams when responding to an emergency.
The Tier II form under Section 312 requires specific information on facilities that handle hazardous chemicals. Beyond the requirements for specific information about the facility (e.g., the address of the location where hazardous chemicals are stored, latitude and longitude, maximum number of occupants, and whether the facility is manned or unmanned), the form now requires facilities to provide contact information for the facility emergency coordinator.

Click Here for Toxic Release Homepage: https://www.epa.gov/toxics-release-inventory-tri-program

Click Here for EPA's "Computer Aided Management of Emergency Operations" online tool for managing chemical emergencies: https://www.epa.gov/cameo

Past EPA Responses

N/A?

Social Media Guide

Facebook Initial Message – Non Emergency
"As a result of the incident _____, several EPA air monitors have detected very low levels of chemicals in the ___. The levels detected are far below levels of public-health concern.

"We're sharing data with local and state officials and the community as part of our response to ___. See the most recent information." (link to EPA disaster specific website/URL)

Twitter Initial Message – Non Emergency Example
"Following incident in ___, EPA has detected expected low levels of chemical contamination which pose no public health concern."

Water Chemical Contamination: ___

Air Chemical Contamination: ___

Facebook Initial Message (General) – Emergency
The EPA is working with federal, state and local authorities to provide information as quickly and as accurately as possible. Please listen to all local law enforcement and emergency response instructions and check the EPA website for the most up to date notifications.

Twitter Initial Message (General) – Emergency
"EPA responding to emergency in ___. Working with fed, state and local authorities to provide information as it becomes available."

Earthquake Emergency Response Messaging

Source: FEMA, DHS, EPA, CDC
Date: June 2016

Main Source link: http://www.fema.gov/media-library-data/1421937886237-e683b4975c2c324b18967ead20336b2f/FEMAB526_2014.pdf

Main Source link: https://www.epa.gov/sites/production/files/2015-06/documents/earthquake_1.pdf

EPA's role: EPA develops science-based guidance for cleaning up sites damaged by natural disasters. The Agency works cooperatively with other federal agencies to ensure that consistent site investigation and laboratory methods are used throughout the federal government.

Other relevant agencies: FEMA, Center for Disease Control, National Response Center, Department of Homeland Security

Relevant program office: Office of Water, Office of Land and Emergency Management, Office of Air and Radiation

Relevant web content: https://www.epa.gov/natural-disasters/earthquakes
https://www3.epa.gov/wastes/conserve/imr/cdm/pubs/disaster.htm

Past EPA Responses

Social Media Guide

EPA responsibilities after an earthquake emergency:
**Below are EPA responsibilities which could require press releases or the production of information for the public following an emergency.*

- **Prepare health and safety advice and information for the public.**
  - **Analyze risk and recommend protective actions**
- Direct and conduct environmental monitoring activities and assess the environmental consequences of earthquake and any resulting damage which could lead to environmental safety concerns
- Access response contractors, the Emergency Response Team, strike forces, RERT, and other special forces of the National Response System.
- Assist in the preparation of long-term monitoring and area restoration plans; and recommend cleanup criteria.

Messaging FAQs:
****All wording taken from FEMA and EPA response packets linked above.***

Public Health and Safety Information

What can I do to prepare for an Earthquake?

Drinking water and food: Earthquakes strike suddenly, violently and usually without warning. Identifying potential hazards ahead of time and advance planning can reduce the dangers of serious injury or loss of life from an earthquake.

- Make a kit of supplies. Keep at least a 3-day water supply per person -and don't forget pets. What you can do to protect your household well.

- Prepare food supplies for an emergency. Get a fridge thermometer to be sure of safe storage temperatures if you lose electricity. Freeze extra containers of water ahead of time. Use ice chests in case power is out for more than four hours.

Click here for Earthquake early warning system: http://earthquake.usgs.gov/research/earlywarning/

Is there an immediate danger?

After an earthquake, expect aftershocks. Stay away from damaged areas. Clean up spilled medicines, bleaches, gasoline, or other flammable liquids immediately. Get out of unstable buildings and away from structures which may fall. One threat is carbon monoxide poisoning due to damaged generators. People get sick or die each year from carbon monoxide or "CO" poisoning due to unsafe use of generators. Broken gas lines greatly increase the risk of fire, explosion, or poor air quality. If you smell gas, open windows and shut off the main gas line. Notify the utility or other authorities.

- **ALERT: Generator exhaust is toxic.** Always put generators outside well away from doors, windows, and vents. Never use a generator inside homes, garages, crawlspaces, sheds, or similar areas. Carbon monoxide (CO) is deadly, can build up quickly, and linger for hours. More information.
- **Listen:** Public Service Announcement about carbon monoxide (also en español)

What do I do during an Earthquake?

Earthquake mitigation and safe practices are advised to help protect you and your property and businesses. Earthquake mitigation is any action taken to reduce damages or losses to your business, employees, building, and building contents should an earthquake occur. In addition to basic preparedness activities such as creating and exercising disaster plans, preparing disaster supply kits, and knowing how to “Drop, Cover, Hold on,” the private sector must complement these activities by implementing mitigation actions to reduce earthquake risks and further minimize disruptions, damages, and losses.

What about my children?

Many schools have shelter in place policies, so listen to local authorties and emergency officials before attempting to collect your children. Talk to your children’s school beforehand to make sure you understand their emergency protocol.

Is the water safe to drink?

The strong ground motion of earthquakes has the potential to cause a great deal of damage to drinking water and wastewater utilities, particularly since most utility components are constructed from inflexible materials (e.g., concrete, metal pipes). Earthquakes create many cascading and secondary. Impacts that may include, but are not limited to:
•Structural damage to facility infrastructure and equipment• Water tank damage or collapse• Water source transmission line realignment or damage• Damage to distribution lines due to shifting ground and soil liquefaction, resulting in potential water loss, water service interruptions, low pressure, contamination and sinkhole sand/or large pools of water throughout the service area• Loss of power and communication infrastructure• Restricted access to facilities due to debris and damage to roadways.

Keep bottled water as part of your household emergency preparedness kit.

Click here for suggested activities to help facilities prepare: https://www.epa.gov/waterutilityresponse
Please note, the linked information is written for hurricane preparedness but much of it will still apply to earthquake preparedness activities.

Earthquake FAQs

What is an Earthquake? What other problems is this Earthquake likely to cause?

An earthquake is ground shaking caused by a sudden movement of rock in the Earth's crust. Such movements usually occur along faults, which are thin zones of crushed rock separating blocks of crust. When one block suddenly slips and moves relative to the other along a fault, the energy released creates vibrations called seismic waves that radiate up through the crust to the Earth's surface, causing the ground to shake. Earthquakes may last only a few seconds or may continue for up to several minutes. They can occur at any time of the day or night and at any time of the year.

Earthquakes are caused by stress that builds up over time as blocks of crust attempt to move but are held in place by friction along a fault. (The Earth's crust is divided into large plates that continually move over, under, alongside, or apart from one another atop the partly molten outer layer of the Earth's core.) When the pressure to move becomes stronger than the friction holding them together, adjoining blocks of crust can suddenly slip, rupturing the fault, and creating an earthquake. In addition to ground shaking, earthquakes can also generate secondary hazards such as landslides, avalanches, surface faulting, tsunamis, liquefaction and flash floods.

Emergency Response and Cleanup

How do I clean up?

Lead-safe work: By law, contractors need to use lead-safe work practices on emergency renovations on homes or buildings built before 1978. Activities such as sanding, cutting, and demolition can create lead-based paint hazards. Lead-contaminated dust is harmful to adults, particularly pregnant women, and children.

- Important information about post-disaster renovations and lead-based paint
- Ways to protect against lead-based paint hazards

Asbestos: Anyone working on demolition, removal, and cleanup of building debris needs be aware of any asbestos and to handle asbestos materials properly. People exposed to asbestos dust can develop serious lung health problems including asbestosis, lung cancer and mesothelioma. Although the use of asbestos has dramatically decreased in recent years, it is still found in many residential and commercial buildings and can pose a serious health risk.

- More about the dangers of exposure to asbestos
- Asbestos Standard for the Construction Industry, from OSHA

Can the damaged areas ever be cleaned up and returned to their former use?

Disasters can generate tons of debris, including building rubble, soil and sediments, green waste (e.g., trees and shrubs), personal property, ash, and charred wood. How a community manages disaster debris depends on the debris generated and the waste management options available. Burying or burning is no longer acceptable, except when permission or a waiver has been granted, because of the side effects of smoke and fire from burning, and potential water and soil contamination from burial. Typical methods of recycling and solid waste disposal in sanitary landfills often cannot be applied to disaster debris because of the large volume of waste and reluctance to overburden existing disposal capacity. More about handling disaster debris.

Clean up may take a long time, but many areas can eventually be returned to their former use.

EPA Specific Role

What is EPA's role in emergency response?

EPA is the primary agency responsible for emergency support related to hazardous materials. EPA responds to releases of hazardous materials and provides technical assistance for environmental monitoring needs. EPA regional offices also can provide technical assistance on municipal solid waste issues. EPA is responsible for monitoring the response to the cleanup and containment of these environmental hazards, as well as assisting state and local authorities.

What are the environmental effects?

Earthquakes can bring down buildings and bridges in a localized area and damage buildings and other structures in a far wider area. Secondary damage from fires, explosions, and localized flooding from broken water pipes can increase the amount of debris. Earthquake debris includes building materials, personal property, and sediment from landslides. Earthquakes can also damage and contaminate water lines and demolition can lead to contact with asbestos.

What can EPA do to assist financially?

EPA, in connection with FEMA, handle some of the reimbursement of disaster debris management costs. Some states reimburse some costs even if the disaster does not qualify for federal reimbursement funds. Discuss recordkeeping requirements with your state emergency planning agency. Your community, particularly if it is small, might benefit from identifying in advance people who have experience in obtaining reimbursement.

Past EPA Responses

Social Media Guide

Facebook Initial Message – Non Emergency
"As a result of the earthquake near ___

Twitter Initial Message – Non Emergency Example
"Following incident in ___,

Facebook Initial Message (General) – Emergency
The EPA is working with federal, state and local authorities to provide information as quickly and as accurately as possible. Please listen to all local law enforcement and emergency response instructions and check the EPA website for the most up to date notifications.

Twitter Initial Message (General) – Emergency
"EPA responding to emergency in ___. Working with fed, state and local authorities to provide information as it becomes available."

Water Contamination Emergency Response Messaging

Source: FEMA, DHS, EPA, CDC
Date: June 2016

Main Source link: https://www.epa.gov/dwreginfo

EPA's role: EPA sets legal limits on over 90 contaminants in drinking water. The legal limit for a contaminant reflects the level that protects human health and that water systems can achieve using the best available technology. EPA rules also set water-testing schedules and methods that water systems must follow.

The Safe Drinking Water Act (SDWA) gives individual states the opportunity to set and enforce their own drinking water standards if the standards are at a minimum as stringent as EPA's national standards.

Other relevant agencies: American Red Cross, FEMA, Center for Disease Control, Agency for Toxic Substances and Disease Registry

Relevant program office: Office of Water

Relevant web content: https://www.epa.gov/flint/flint-drinking-water-faqs
https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#hh2

Past EPA Responses

Social Media Guide

EPA responsibilities after a radiation emergency:
**Below are EPA responsibilities which could require press releases or the production of information for the public following an emergency.*

- **Prepare health and safety advice and information for the public.**
- Provide nationwide environmental monitoring data from Environmental Radiation Ambient Monitoring Systems (**ERAMS**) for assessing the national impact of a release.
- Direct and conduct environmental monitoring activities and assess the environmental consequences.
- Access response contractors, the Emergency Response Team, strike forces, RERT, and other special forces of the National Response System.
- Assist in the preparation of long-term monitoring and area restoration plans; and recommend cleanup criteria.

Messaging FAQs:
****All wording taken from EPA Flint response papers linked above.***

Public Health and Safety Information

Is it safe for adults to shower or bathe with lead-contaminated water? Can babies be bathed in tap water?

Yes. Your skin does not absorb lead in water. If plain tap water has too much lead, bathing and showering is still safe for children and adults. It is safe even if the skin has minor cuts or scrapes. Never drink bathwater, and do not allow babies and children to drink bathwater. Rashes have many causes, but

no medical link between rashes and unfiltered water has been found. If you have concerns, call your primary care doctor and call 2-1-1.

If water is contaminated with other chemical substances, officials may advise you to stop bathing in the water until its safety can be assured.

Is it safe to wash dishes and do laundry with unfiltered water that has tested positive for lead?

Yes, but dry them after. Wash dishes, bottles, and toys with unfiltered soapy water. Dry before use. Lead in water will not be absorbed by porcelain, metal, or glass. Clothes washed in plain tap water will not contain enough lead to cause harm.

Will water contaminated with lead hurt me or my children?

Lead exposure can affect nearly every system in the body. It may not have obvious symptoms, so people might not realize they have too much lead in their bodies. For young children, exposure to lead can cause behavior problems and learning disabilities. The only way to know if you have lead in your body is to get tested.

Children
Even low levels of lead in the blood of children can result in:

- Behavior and learning problems
- Lower IQ and hyperactivity
- Slowed growth
- Hearing problems
- Anemia

In rare cases, ingestion of lead can cause seizures, coma and even death.
Pregnant Women
Lead can accumulate in our bodies over time, where it is stored in bones along with calcium. During pregnancy, lead is released from bones as maternal calcium and is used to help form the bones of the fetus. This is particularly true if a woman does not have enough dietary calcium. Lead can also cross the placental barrier exposing the fetus to lead. This can result in serious effects to the mother and her developing fetus, including:

- Reduced growth of the fetus
- Premature birth

Find out more about lead's effects on pregnancy:

- Lead and Your Baby (March of Dimes)
- Effects of Workplace Hazards on Female Reproductive Health (National Institute for Occupational Safety and Health)

Lead can also be transmitted through breast milk. Read more on lead exposure in pregnancy and lactating women (PDF)
Adults
Lead is also harmful to adults. Adults exposed to lead can suffer from:

- Cardiovascular effects, increased blood pressure and incidence of hypertension
- Decreased kidney function
- Reproductive problems (in both men and women)

What other chemicals can water be contaminated with?

- Aldrin and Dieldrin
- Boron
- Dacthal and its Degradates
- 1,1,-dichloro-2,2,-bis(p-chlorophenyl)ethylene (DDE)
- 1,3 dichloropropene (Telone)

- S-Ethyl Dipropylthiocarbamate (EPTC)
- Fonofos
- Hexachlorobutadiene
- Manganese
- Metribuzin
- Naphthalene
- Terbacil
- 1,1,2,2-tetrachloroethane
- Brominated Trihalomethanes

Click here for more information about other sicknesses related to contaminated water:

Legionella: https://www.epa.gov/sites/production/files/2015-10/documents/legionella-report.pdf

Giardia: https://www.epa.gov/sites/production/files/2015-10/documents/giardia-report.pdf

Mycobacteria: https://www.epa.gov/sites/production/files/2015-10/documents/mycobacteria-report.pdf

We (residents) have been getting information on how to use water safely from many different organizations, and sometimes that information is conflicting. Who should we listen to?

EPA is coordinating with the city, state, and other federal agencies to respond to all of the issues with Flint's water. Until further notice, EPA advises that residents should always use a water filter. Use only bottled water for water, food and formula given to babies under 1 year old. Bottled water is the safest choice for pregnant or breastfeeding women and kids under 6 years of age.

FAQs

I had the water in my home tested and the result came back with low/no detectable lead. Can I stop drinking filtered or bottled water?

No. Your low lead test result is encouraging, but the results are from a specific sample showing a snapshot in time. So it doesn't mean that your water is always safe to drink. There is still a citywide water emergency in Flint and everyone, including pets, should drink filtered or bottled water until further notice.

Bottled water is the safest choice for pregnant and breastfeeding women and children under 6. Bottled water should be used for drinking and preparing food and formula for infants under 1 year old.

What is being done to make sure everyone is getting the information and resources including minority, immigrant, and other at-risk communities?

Many federal and state agencies in the response are going to community meetings, speaking to the media, and distributing information as they sample water on where you may pick up a filter or bottled water. EPA also provides translation of information to Spanish, Chinese, and Arabic for residents and has community involvement coordinators regularly contacting residents and community groups.

How long will it take to get my results once EPA samples my water?

A. EPA will call residents with their preliminary sampling results before posting it to the interactive maps. It is estimated that preliminary data will be available about 14 days after sample collection. Final data which has been through EPA's quality assurance checks is estimated to be available 20 days after sample collection.

How can we recycle used water bottles?

Empty water bottles can be taken to any of the recycling stations that have been set up around the city or where you picked up bottled water. The city and state can make arrangements to pick them up from the disabled by calling 2-1-1. More information is available at www.michigan.gov/flintwater

Emergency Response and Cleanup

When will the water be safe to drink?

EPA advises residents to continue using water filters or bottled water until EPA makes a determination that the corrosion control treatment has been optimized.

You should continue to use filters in the meantime. Any water treatment filter used should be NSF-53 certified to remove lead and should be located at the end of the plumbing right before the tap, so that all water that flows through home plumbing is treated.

What other chemicals are being tested in the water? I've heard there is more that we need to be concerned with than lead.

EPA is testing the water in Flint for many different chemical contaminants and is also conducting other water quality testing to comprehensively evaluate the overall safety of the water from lead, copper, microbes, disinfection byproducts and other heavy metals.

EPA Specific Role

How does EPA test if water is contaminated?

First, EPA consults the drinking water Contaminate Candidate List. The drinking water CCL is a list of contaminants that are currently not subject to any proposed or promulgated national primary drinking water regulations, but are known or anticipated to occur in public water systems. Contaminants listed on the CCL may require future regulation under the Safe Drinking Water Act (SDWA). SDWA requires EPA to publish the CCL every five years. SDWA directs the Agency to consider the health effects and occurrence information for unregulated contaminants as the Agency makes decisions to place contaminants on the list. SDWA further specifies that the Agency place those contaminants on the list that present the greatest public health concern related to exposure from drinking water. EPA uses the CCL to identify priority contaminants for regulatory decision making and information collection.

What is a regulatory determination?

A regulatory determination is a formal decision on whether EPA should initiate a process to develop a national primary drinking water regulation for a specific contaminant. The law requires EPA to make regulatory determinations for at least five contaminants from the most recent CCL within five years after the completion of the previous round of regulatory determinations. To see the list of regulatory determinations for the previous CCLs, please go to:

- The regulatory determination for the CCL 1
- The regulatory determination for the CCL 2
- The regulatory determination for the CCL 3

It is important to note that EPA is not limited to making regulatory determinations for only those contaminants on the CCL. The agency can also decide to regulate other unregulated contaminants if information becomes available showing that a specific contaminant presents a public health risk in drinking water.

What criteria does EPA consider to make a regulatory determination?

When making a "determination" to regulate a contaminant in drinking water, the law requires that EPA determine whether it meets the following three criteria:
•The contaminant may have an adverse effect on the health of persons;
•The contaminant is known to occur or there is substantial likelihood the contaminant will occur in public water systems with a frequency and at levels of public health concern;
•In the sole judgment of the Administrator, regulation of the contaminant presents a meaningful opportunity for health risk reductions for persons served by public water systems.

What can EPA do to assist financially?

Two significant sources of potential funding from EPA programs are the Drinking Water State Revolving Fund (DWSRF) and the Clean Water Act State Revolving Fund (CWSRF).

Fortunately, broad-based funding can mean broad-based support for protection activities. Actions that protect sources of drinking water can help federal programs, states, and communities meet other environmental and social goals.

Click here to learn more about funding opportunities for source water protection and cleanup:
https://www.epa.gov/sourcewaterprotection/funding-source-water-protection

Water contamination can also be address through Brownfields:
http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1009IXT.txt

Why is EPA conducting water sampling in a municipality?

As part of an interagency effort being led by the U.S. Department of Health and Human Services (HHS), EPA has deployed a response team to conduct sampling and analysis that will help state and local leaders identify the scope of contamination and design and execute a plan for mitigation.

How are sampling sites chosen?

EPA is choosing water quality sampling sites based on a variety of factors, including but not limited to:

•information about sites that are suspected or confirmed to have lead plumbing,

•households where lead-levels are known to be elevated,

•locations where water may lie stagnant before use,

•and other information about areas that may pose a higher risk or concern to the community.

How long will EPA's response team be sampling the water?

EPA is committed to providing water quality information to support the restoration of safe drinking water. EPA will continue its response efforts as part of the broader Federal interagency team, and in collaboration with state and local governments until the job is done.

Draft Messages for Specific Incidents

Excerpted from **"Effective Risk and Crisis Communication during Water Security Emergencies"**

https://www.epa.gov/sites/production/files/2015-08/documents/effective_risk_and_crisis_communication_during_water_security_emergencies.pdf

This report includes ample messaging for six hypothetical situations involving community water supplies. They include anticipated questions and sample responses that will be useful for these situations.

- Hypothetical Credible Threat Involving Chemical Contamination of a Reservoir (p. 3-2)
- Hypothetical Physical Attack – Bomb explosion (p. 3-6)
- Hypothetical Credible Threat to a Water System (p. 3-12)
- Hypothetical Power Loss Incident (p. 3-17)
- Hypothetical Pesticide Contamination Incident (3. 3-23)
- Hypothetical Intentional Biological Contamination Incident

Anticipating Public Questions to a Water Crisis
https://www.epa.gov/sites/production/files/2015-08/documents/anticipating_public_questions_5.pdf

Pesticide Scenario

We have confirmed the presence of a pesticide in the drinking water.
■ The pesticide is [insert name of pesticide], which is used for [insert use
■ Levels of the pesticide are above recommended drinking water standards.
■ The drinking water in the following locations has been affected [insert locations].

An investigation is underway to determine the source and amount of the pesticide.
■ We are taking samples and conducting tests throughout the system.
■ Public health and hospitals are tracking and treating those who are ill.
■ Law enforcement is investigating the cause. Effective immediately, people should not use the water.
■ People and pets should not drink the water.
■ People should not use the water to bathe, shower, or wash.
■ Alternative sources of drinking water will be made available at the following locations [insert locations and show map].

We are testing water quality throughout the system.
■ We are taking samples at various locations.
■ [Insert laboratory name] is testing those samples.
■ The results of these tests will determine our next steps. We have begun recovery operations.
■ Our recovery operations are being coordinated with local, state, and federal agencies.
■ The CDC and other public health experts are advising us on potential health effects.
■ The US Environmental Protection Agency and other experts are advising us on how to clean the system.

Effective immediately, people should not use the water.
■ People should not drink the water.
■ People should not use the water to bathe, shower, or wash.
■ Alternative sources of drinking water will be made available at the following locations [insert locations].

We are assessing the number of people who might be affected.
■ Health officials are tracking calls and complaints.
■ Samples have been sent to state laboratories for testing.
■ Results of the tests will help us better determine affected areas. We are working closely with local hospitals.

We are working closely with local hospitals
■ Hospitals are prepared to provide treatment.
■ Hospitals are also providing medical advice.
■ The CDC is providing advice to us and the hospitals. We are coordinating our response efforts with other organizations.

We are coordinating our response efforts with other organizations

■ In special cases, we will make door-to-door visits.
■ Hospitals and nursing homes will receive priority attention.
■ Other communities have offered resources and support.

Symptoms depend on exposure.
■ Because of the unusual smell and taste, most people will not drink the water.
■ Because of the small amounts of pesticide involved, most people will not breathe amounts large enough to cause harm.
■ Skin penetration is unlikely unless there has been prolonged contact with the water. The pesticide can enter the body through drinking, breathing, or skin contact.

The pesticide can enter the body through drinking, breathing, or skin contact.
■ Exposure is typically not life threatening.
■ Most people who have been exposed and have symptoms will fully recover.
■ The biggest concern is exposure by drinking a large amount of contaminated water. There are many symptoms.

There are many symptoms.
■ People who drank more than a quart of the water may experience nausea, an upset stomach, and vomiting.
■ People who are experiencing symptoms should not be encouraged to vomit.
■ Call 911 immediately or go to an emergency room if you have symptoms.

Children and the elderly need special protection.
■ Children and the elderly are more vulnerable to illness than other populations.
■ Children are more vulnerable because they have less developed body defenses.
■ The elderly are more vulnerable because they may have weakened immune systems.

Children and the elderly should be especially careful not to contact the water.
■ Children and the elderly should not bathe using the water.
■ Children and the elderly should not swim in the water.
■ Children and the elderly should not wash dishes using the water or use dishes washed in the water.
Children and the elderly should be especially careful not to drink the water.
■ Children and elderly should drink only bottled water.
■ Children and the elderly should not drink beverages prepared with the water.
■ Parents should not prepare infant formula using the water.

Our primary concern is the pesticide entering the body through drinking.
■ People should not drink the water or cook with it. Boiling does not remove a pesticide.
■ People should not drink beverages prepared with the water or make infant formula.
■ People should keep children and pets away from the water.

People can water their plants, gardens, and lawns with the water.
■ People should wear gloves to prevent skin contact with the water when using a hose.
■ Avoid breathing aerosolized water from sprinklers.
■ Avoid creating run-off that could contaminate the sewer system.

Skin contact should be avoided, especially if contact is prolonged.
■ People should not use the water for washing dishes.
■ People should not use the water to take baths or showers.
■ It is okay to flush toilets.

At this time, people should not use the water.
■ People should not drink the water.
■ People should not use the water to bathe, shower, or wash.

■ Boiling the water will not make it safe.

We will provide regular updates on our testing.
■ Updates are available on our Web site [insert Web site].
■ Updates will be broadcast through local radio and TV.
■ Updates are available from our information line at [insert number].

People from affected areas should drink only bottled water.
■ Free bottled water will be available at the following locations [insert location] at [insert times].
■ Bottled water should be used for cooking and other uses.
■ Bottled water should be used for pets.

Testing will confirm the absence of harmful levels.
■ We will collect water samples at multiple locations along the distribution system.
■ Samples will be tested for [insert pesticide name] at laboratories.
■ The tests are highly accurate in detecting the pesticide.

Federal and state agencies determine what level is considered safe.
■ The water system will not be put back into service until the contamination is reduced below this level.
■ This cleanup level is based on protecting human health against long-term effects for all age groups. ■ The public health department will verify that levels are safe.

We will continue testing to ensure that levels remain safe.
■ We will monitor for elevated levels of the pesticide.
■ We will report any problems and take necessary actions.
■ Water users should report any unusual odors, coloration, or other problems by calling our hotline at [insert number].

Terrorist Scenario

Terrorists contaminated part of the water system with [insert biological agent].
■ People have reported gastrointestinal illness.
■ [Insert biological agent] causes nausea, vomiting, and diarrhea, but it is generally not life threatening. ■ If you are experiencing symptoms, please seek immediate medical attention.

We have contained the contamination [insert map showing system and indicating affected area].
■ The affected area has been isolated from the rest of the water system.
■ Sampling for additional contaminants is currently being performed.
■ Additional public announcements will be made as more information becomes available.

We recommend people living in this area [insert boundaries] boil their water.
■ Bring your water to a rolling boil for [insert number] minutes and let cool before drinking.
■ Fact sheets and other information are available on the following Web site [insert Web site] or at our toll-free telephone line [insert telephone number].
■ Alternative drinking water is available at [insert address of location].

There has been an intentional contamination of the water system.
■ We are currently working with local law enforcement and the FBI in response to this event.
■ We know the location of the point of introduction [insert location], and are currently working to define the area affected.
■ We are also working to sample our entire system for indication of other areas that may be contaminated.

Most people infected with this bacterium will have mild to moderate illness.

■ [Insert biological agent] infection can cause diarrhea and vomiting.
■ The very young and old, and people with weakened immune systems are typically most at risk.
■ If people are having symptoms, they should consult their physicians.

We have issued a “do not use” notice in response.
■ “Do Not Use” means do not use the water for drinking, bathing, or cooking. It is safe to flush toilets. ■ We are recommending the use of alternative sources (such as bottled water) until we lift the “do not use” notice.
■ We are working to contain and clean up this contamination and will provide more information as soon as it becomes available.

We know the source of the contamination.
■ The police and FBI have identified a location in the [insert name] neighborhood where the contaminant was introduced.
■ The police are currently treating this contamination event as an act of terrorism.
■ Evidence collected at the scene confirms that the source of the water contamination came from this location.

We are currently working to clearly define the area affected.
■ We are sampling and analyzing the water system around that location.
■ We are looking at the water distribution system to specifically define the affected area.
■ Sample results can be expected from the laboratory within 48 hours.

At this time, illness has been reported only in this area [insert boundaries].
■ In addition to the localized sampling, we are sampling throughout the system for evidence of contamination.
■ Preliminary water quality testing indicates that this contamination has not spread throughout the system.
■ If you have questions as to whether or not you may be affected by this event, please call our 24 hour hotline at [insert number].

RODS – our public health surveillance system – showed a higher than normal number of illnesses in the community.
■ The Real-time Outbreak Disease Surveillance (RODS) system examines emergency department data from area hospitals and over-the-counter drug sales.
■ Recent RODS data has shown an increase in the number of emergency room patients with diarrhea and GI symptoms.
■ RODS data has also shown an increase in the sale of over-the-counter anti-diarrheal medications from local drug stores.

Water samples were collected by the water utility.
■ Samples were collected within the impacted areas.
■ Samples were collected throughout the distribution system.
■ Additional sampling and analysis will be conducted as needed.

Further investigation indicates that the public water system is the likely source.
■ The health department interviewed patients to investigate the cause of their illness.
■ Clinical laboratory tests supported the diagnosis.
■ The health department worked with the water department to verify the cases occurred within the water department’s service area.

If you live in the affected area (see map), your water may still contain [insert biological agent].
■ This bacterium can cause illness when people come in direct contact with it.
■ The “do not use” notice is based on taking a conservative stance to protect against any resulting

illness.
■ The protection of public health and safety is the basis for all aspects of this advisory and response.

This should not affect fire fighting.
■ The fire department has informed us that they will continue to use this water as needed to fight fires.
■ Bacteriological contamination of this type does not prohibit its use for firefighting purposes.
■ Fire protection will continue during the emergency.

People should avoid direct contact with this water at this time.
■ People in this area are advised to not drink, cook, bathe, give to pets, or otherwise use the water where personal contact may occur.
■ We are working as quickly as possible to resolve this issue and restore full use of the drinking water system in the affected areas.
■ We will inform you of any change in the use advisory

[Insert agent] is a bacteria that affects the gastrointestinal system.
■ Frequent hand washing will help control the spread of [insert agent].
■ The water utility has treated the water with higher but safe levels of chlorine to kill the [insert agent]. ■ Use alcohol-based hand cleaners until the water is safe to drink.

Symptoms will generally last for 7 – 10 days.
■ Primary symptoms include nausea, vomiting, and diarrhea.
■ People with symptoms should contact their health care providers for treatment information.
■ People can call the public health hotline at [insert number] for more information about [insert biological contaminant].

[Insert agent] does not typically cause long-term health effects.
■ [Insert agent] is generally not life threatening.
■ The most vulnerable groups include small children, the elderly, and people with weak immune systems.
■ [Insert biological contaminant] infection is treatable by [insert treatment]

Hospital reports from [insert names of hospitals] indicate higher numbers of cases of ill patients than normal.
■ [Insert number] hospitals have reported a total of [insert number] cases during a [insert number]-day period.
■ The number of hospital patients with gastrointestinal symptoms is well above normal.
■ The reports were provided to the health department as part of the community's medical tracking system.

The health department identified [insert biological contaminant] in the water system as the cause.
■ The health department conducted interviews with ill patients to determine the cause.
■ The health department's investigation also included laboratory tests.
■ The health department contacted the water authorities and indicated there may be a waterborne problem.

The water utility reports [insert biological contaminant] in samples collected from the water system.
■ The water utility initiated testing after notification from the health department.
■ The water utility is identifying impacted areas.

Water is being made available to households in the affected area [insert boundaries].
■ The city is setting up distribution centers for the affected area.
■ We are able to distribute [insert number] gallons of water per person.
■ Disabled or other individuals who cannot get to a distribution center should call [insert number] for

assistance.

Hospitals in the affected area will have supplies of safe drinking water.
■ The water utility has arranged for the provision of water treatment units for the hospital system. ■ People should not go to a hospital for their household's supply of emergency water.
■ Health clinics in the area are also receiving supplies of emergency drinking water.

Please follow the "do not use" drinking water order.
■ People are not to use the water for cooking, bathing, or any other personal contact uses, including for pets.
■ Ongoing samples of the water system are being taken.
■ We will let you know when the water is again safe to use.

Past EPA Responses

Flint Lead in Water Crisis

- List of all published documents on Flint Drinking Water: https://www.epa.gov/flint/flint-drinking-water-documents
- Informational Website: https://www.epa.gov/flint
- Pipe Flushing Guidelines: https://www.epa.gov/sites/production/files/2016-05/documents/5_flint_flush_letter3.pdf
    - Public Information was distributed through videos linked below
        - https://www.youtube.com/watch?v=-MotSosxd28&feature=player_embedded
        - https://www.youtube.com/watch?v=Qi7uMOtVA1o&feature=player_embedded
        - https://www.youtube.com/watch?v=adoHpxK62Lo&feature=player_embedded
- Drinking Water Task Force: https://www.epa.gov/flint/flint-safe-drinking-water-task-force

Dorado Groundwater Contamination

Press Release: https://www.epa.gov/newsreleases/statement-epa-dorado-groundwater-contamination-site

Gold King Mine

- List of all published documents on Gold King Mine Water Contamination: https://www.epa.gov/goldkingmine/press-releases-and-updates-gold-king-mine-response
- Action Memo: https://www.epa.gov/goldkingmine/press-releases-and-updates-gold-king-mine-response

Social Media Guide and Examples

Facebook Initial Message (General) – Emergency
The EPA is working with federal, state and local authorities to provide information as quickly and as accurately as possible. Please listen to all local law enforcement and emergency response instructions and check the EPA website for the most up to date notifications.

Twitter Initial Message (General) – Emergency
"EPA responding to emergency in ___. Working with fed, state and local authorities to provide information as it becomes available."

Water/Weather Emergency Response Messaging

Source: FEMA, DHS, EPA, CDC
Date: June 2016

EPA's role:

Other relevant agencies: FEMA, Center for Disease Control, Department of Health and Human Services, Center for Disease Control, American Red Cross, U.S. Coast Guard, Department of Agriculture, Department of the Interior, U.S. Geological Services

EPA responsibilities after a Water/Weather emergency:
**Below are EPA responsibilities which could require press releases or the production of information for the public following an emergency.*

Water/Weather Emergencies include hurricanes, drought, extreme heat, snow and ice, tornadoes, tsunamis, and wildfires

- **Prepare health and safety advice and information for the public.**
- Provide nationwide environmental monitoring data from Environmental Radiation Ambient Monitoring Systems (**ERAMS**) for assessing the national impact of a release.
- Direct and conduct environmental monitoring activities and assess the environmental consequences.
- Access response contractors, the Emergency Response Team, strike forces, RERT, and other special forces of the National Response System.
- Assist in the preparation of long-term monitoring and area restoration plans; and recommend cleanup criteria.

Contents of this Document

General FAQs Messaging
Flood Messaging
Tsunami Messaging
Tornado Messaging
Hurricane Messaging
Landslide Messaging
Water Contamination via Natural Disaster Messaging

General FAQs

Public Health and Safety Information

What can I do to prepare for a natural disaster?
Drinking water and food: Many natural disasters strike suddenly, violently and usually without warning. Identifying potential hazards ahead of time and advance planning can reduce the dangers of serious injury or loss of life from an earthquake.

- Make a kit of supplies. Keep at least a 3-day water supply per person -and don't forget pets. What you can do to protect your household well.
- Prepare food supplies for an emergency. Get a fridge thermometer to be sure of safe storage temperatures if you lose electricity. Freeze extra containers of water ahead of time. Use ice chests in case power is out for more than four hours.

Click here for help making an emergency plan: https://www.ready.gov/make-a-plan

What about my children?

Many schools have shelter in place policies, so listen to local authorties and emergency officials before attempting to collect your children. Talk to your children's school beforehand to make sure you understand their emergency protocol.

Natural Disaster FAQs

Is global warming to blame for this natural disaster?

EPA scientists attest that global warming has caused and will continue to cause an increases in the frequency or severity of some extreme weather events, such as extreme precipitation, flooding, droughts, and storms, threaten the health of people during and after the event. The people most at risk include young children, older adults, people with disabilities or medical conditions, and the poor. Extreme events can affect human health in a number of ways by

Emergency Response and Cleanup

How do I clean up after a water/weather emergency?

Lead-safe work: By law, contractors need to use lead-safe work practices on emergency renovations on homes or buildings built before 1978. Activities such as sanding, cutting, and demolition can create lead-based paint hazards. Lead-contaminated dust is harmful to adults, particularly pregnant women, and children.

- Important information about post-disaster renovations and lead-based paint
- Ways to protect against lead-based paint hazards

Asbestos: Anyone working on demolition, removal, and cleanup of building debris needs be aware of any asbestos and to handle asbestos materials properly. People exposed to asbestos dust can develop serious lung health problems including asbestosis, lung cancer and mesothelioma. Although the use of asbestos has dramatically decreased in recent years, it is still found in many residential and commercial buildings and can pose a serious health risk.

- More about the dangers of exposure to asbestos
- Asbestos Standard for the Construction Industry, from OSHA

Mold: Mold can cause serious health problems. The key to mold control is moisture control. After the flood, remove standing water and dry indoor areas. Remove and discard anything that has been wet for more than 24-48 hours.

- More about mold cleanup
- Mold health FAQs

Can the damaged areas ever be cleaned up and returned to their former use?

Disasters can generate tons of debris, including building rubble, soil and sediments, green waste (e.g., trees and shrubs), personal property, ash, and charred wood. How a community manages disaster debris depends on the debris generated and the waste management options available. Burying or burning is no longer acceptable, except when permission or a waiver has been granted, because of the side effects of smoke and fire from burning, and potential water and soil contamination from burial. Typical methods of recycling and solid waste disposal in sanitary landfills often cannot be applied to disaster debris because of the large volume of waste and reluctance to overburden existing disposal capacity. More about handling disaster debris.

Clean up may take a long time, but many areas can eventually be returned to their former use.

EPA Specific Role

What is EPA's role in emergency response?

EPA is the primary agency responsible for emergency support related to hazardous materials. EPA responds to releases of hazardous materials and provides technical assistance for environmental monitoring needs. EPA regional offices also can provide technical assistance on municipal solid waste

issues. EPA is responsible for monitoring the response to the cleanup and containment of these environmental hazards, as well as assisting state and local authorities.

What can EPA do to assist financially?

EPA, in connection with FEMA, handle some of the reimbursement of disaster debris management costs. Some states reimburse some costs even if the disaster does not qualify for federal reimbursement funds. Discuss recordkeeping requirements with your state emergency planning agency. Your community, particularly if it is small, might benefit from identifying in advance people who have experience in obtaining reimbursement.

General Social Media Guide and Examples

Facebook Initial Message (General) – Emergency
The EPA is working with federal, state and local authorities to provide information as quickly and as accurately as possible. Please listen to all local law enforcement and emergency response instructions and check the EPA website for the most up to date notifications.

Twitter Initial Message (General) – Emergency
"EPA responding to emergency in ___. Working with fed, state and local authorities to provide information as it becomes available."

Flood Specific Messaging

Relevant program office: Office of Water, Office of Land and Emergency Management

Relevant Web Content: http://emergency.cdc.gov/disasters/floods/index.asp
http://www.fema.gov/media-library-data/20130726-1446-20490-0539/FEMA511-complete.pdf

FAQs
Public Health and Safety Information

Is exposure to flood water safe?

Limit contact with flood water. Flood water may have high levels of raw sewage or other hazardous substances. Early symptoms from exposure to contaminated flood water may include upset stomach, intestinal problems, headache and other flu-like discomfort. Anyone experiencing these and any other problems should immediately seek medical attention.

What are the health risks associated with flooding?

Flood waters and standing waters pose various risks, including infectious diseases, chemical hazards, and injuries.

Infectious Diseases
Diarrheal Diseases
Eating or drinking anything contaminated by flood water can cause diarrheal disease. To protect yourself and your family:

- Practice good hygiene (handwashing) after contact with flood waters.
- Do not allow children to play in flood water areas.
- Wash children's hands frequently (always before meals).
- Do not allow children to play with toys that have been contaminated by flood water and have not been disinfected.
- For information on disinfecting certain nonporous toys, visit CDC Healthy Water's Cleaning and

Sanitizing with Bleach section.

Wound Infections
Open wounds and rashes exposed to flood waters can become infected. To protect yourself and your family:

- Avoid exposure to flood waters if you have an open wound.
- Cover open wounds with a waterproof bandage.
- Keep open wounds as clean as possible by washing well with soap and clean water.
- If a wound develops redness, swelling, or drainage, seek immediate medical attention.

For more information, visit CDC's Emergency Wound Care After a Natural Disaster .

Injuries
Drowning
Flood water poses drowning risks for everyone, regardless of their ability to swim. Swiftly moving shallow water can be deadly, and even shallow standing water can be dangerous for small children.
Vehicles do not provide adequate protection from flood waters. They can be swept away or may stall in moving water.
Animal and Insect Bites
Flood waters can displace animals, insects, and reptiles. To protect yourself and your family, be alert and avoid contact.

- Protect Yourself from Animal- and Insect-Related Hazards After a Disaster
- Wildlife in Disasters [FEMA]

Wounds
Flood waters may contain sharp objects, such as glass or metal fragments, that can cause injury and lead to infection.

- Emergency Wound Care After a Natural Disaster

Electrocution
Avoid downed power lines.

- Protect Yourself and Others From Electrical Hazards After a Disaster

Are there contamination hazards after a flood?

Be aware of potential chemical hazards during floods. Flood waters may have moved hazardous chemical containers of solvents or other industrial chemicals from their normal storage places.

- Protect Yourself From Chemicals Released During a Natural Disaster
- Chemical Emergencies

Flood FAQs

How do I reduce flood damage?

Click here for more information and a community plan: http://www.fema.gov/media-library-data/20130726-1446-20490-0539/FEMA511-complete.pdf

Emergency Response and Cleanup

What do I do to clean up after a flood?
When returning to a home that's been flooded after natural disasters such as hurricanes, tornadoes, and floods, be aware that your house may be contaminated with mold or sewage, which can cause health risks for your family.

When You First Reenter Your Home

- If you have standing water in your home and can turn off the main power from a dry location, then go ahead and turn off the power, even if it delays cleaning. If you must enter standing water to

access the main power switch, then call an electrician to turn it off. **NEVER turn power on or off yourself or use an electric tool or appliance while standing in water.**

- Have an electrician check the house's electrical system before turning the power on again.
- If the house has been closed up for several days, enter briefly to open doors and windows to let the house air out for at least 30 minutes before you stay for any length of time.
- If your home has been flooded and has been closed up for several days, presume your home has been contaminated with mold. See Protect Yourself from Mold.
- If your home has been flooded, it also may be contaminated with sewage. See Flood Water After a Disaster or Emergency.
- After completing the cleanup, wash your hands with soap and warm water. Use water that has been boiled for 1 minute (allow the water to cool before washing your hands).
    - Or you may use water that has been disinfected for personal hygiene use (solution of $\frac{1}{8}$ teaspoon [~0.75 milliliters] of household bleach per 1 gallon of water). Let it stand for 30 minutes. If the water is cloudy, use a solution of ¼ teaspoon (~1.5 milliliters) of household bleach per 1 gallon of water.
- Wash all clothes worn during the cleanup in hot water and detergent. These clothes should be washed separately from uncontaminated clothes and linens.
- Wash clothes contaminated with flood or sewage water in hot water and detergent. It is recommended that a laundromat be used for washing large quantities of clothes and linens until your onsite waste-water system has been professionally inspected and serviced.
- Seek immediate medical attention if you become injured or ill.

Dry Out Your House

If flood or storm water has entered your home, dry it out as soon as possible. Follow these steps:

- If you have electricity and an electrician has determined that it's safe to turn it on, use a "wet-dry" shop vacuum (or the vacuum function of a carpet steam cleaner), an electric-powered water transfer pump, or sump pump to remove standing water. If you are operating equipment in wet areas, be sure to wear rubber boots.
- If you do not have electricity, or it is not safe to turn it on, you can use a portable generator to power equipment to remove standing water. **Note: If you must use a gasoline-powered pump, generator, pressure washer, or any other gasoline-powered tools to clean your home, never operate the gasoline engine inside a home, basement, garage, carport, porch, or other enclosed or partially enclosed structures, even if the windows and doors are open. Such improper use can create dangerously high levels of carbon monoxide and cause carbon monoxide poisoning.**
- If weather permits, open windows and doors of the house to aid in the drying-out process.
- Use fans and dehumidifiers to remove excess moisture. Fans should be placed at a window or door to blow the air outwards rather than inwards, so not to spread the mold.
    - Have your home heating, ventilating, and air-conditioning (HVAC) system checked and cleaned by a maintenance or service professional who is experienced in mold clean-up **before you turn it on**. If the HVAC system was flooded with water, turning on the mold-contaminated HVAC will spread mold throughout the house. Professional cleaning will kill the mold and prevent later mold growth. When the service determines that your system is clean and if it is safe to do so, you can turn it on and use it to help remove excess moisture from your home.
    - Prevent water outdoors from reentering your home. For example, rain water from gutters or the roof should drain away from the house; the ground around the house should slope away from the house to keep basements and crawl spaces dry.
    - Ensure that crawl spaces in basements have proper drainage to limit water seepage. Ventilate to allow the area to dry out.

Outside the Home

- Keep children and pets out of the affected area until cleanup has been completed.
- Wear rubber boots, rubber gloves, and goggles during cleanup of affected area.
- Have your onsite waste-water system professionally inspected and serviced if you suspect damage.

- Wash all clothes worn during the cleanup in hot water and detergent. These clothes should be washed separately from uncontaminated clothes and linens.
- After completing the cleanup, wash your hands with soap and warm water. Use water that has been boiled for 1 minute (allow the water to cool before washing your hands).
    - Or you may use water that has been disinfected for personal hygiene use (solution of $\frac{1}{8}$ teaspoon [~0.75 milliliters] of household bleach per 1 gallon of water). Let it stand for 30 minutes. If the water is cloudy, use solution of ¼ teaspoon (~1.5 milliliters) of household bleach per 1 gallon of water.
- Seek immediate medical attention if you become injured or ill.

Click here for more information: http://emergency.cdc.gov/disasters/mold/reenter.asp

EPA Specific Role

Click here for more information on EPA's commitment to improving green infrastructure for climate resiliency: https://www.epa.gov/green-infrastructure

Past EPA Response

Tsunami Messaging

Relevant program office: Office of Water, Office of Land and Emergency Management

Relevant Web Content: http://emergency.cdc.gov/disasters/tsunamis/index.asp

FAQs
Public Health and Safety Information

What are the health concerns associated with Tsunamis?

Immediate health concerns
- After the rescue of survivors, the primary public health concerns are clean drinking water, food, shelter, and medical care for injuries.
- Flood waters can pose health risks such as contaminated water and food supplies.
- Loss of shelter leaves people vulnerable to insect exposure, heat, and other environmental hazards.
- The majority of deaths associated with tsunamis are related to drownings, but traumatic injuries are also a primary concern. Injuries such as broken limbs and head injuries are caused by the physical impact of people being washed into debris such as houses, trees, and other stationary items. As the water recedes, the strong suction of debris being pulled into large populated areas can further cause injuries and undermine buildings and services.
- Medical care is critical in areas where little medical care exists.

Secondary effects
- Natural disasters do not necessarily cause an increase in infectious disease outbreaks. However, contaminated water and food supplies as well as the lack of shelter and medical care may have a secondary effect of worsening illnesses that already exist in the affected region.
    - Decaying bodies create very little risk of major disease outbreaks.
        - The people most at risk are those who handle the bodies or prepare them for burial.

Long-lasting effects
The effects of a disaster last a long time. The greater need for financial and material assistance is in the

months after a disaster, including

- surveying and monitoring for infectious and water- or insect-transmitted diseases;
- diverting medical supplies from non-affected areas to meet the needs of the affected regions;
- restoring normal primary health services, water systems, housing, and employment; and

assisting the community to recover mentally and socially when the crisis has subsided.

Is my food safe to eat?

To prevent foodborne diseases, wash your hands with clean water and soap before and after you eat or prepare food and after you use the latrine or bathroom. If you do not have clean water, use waterless hand sanitizers until clean water is available for washing.
Do not eat any food that has not been sealed in waterproof containers (commercially canned or sealed plastic containers) and that may have come in contact with untreated water, such as seawater, floodwater, river water, or pond water. Throw away any food not in nonsealed, nonwaterproof containers that has come in contact with untreated water. Undamaged commercially canned foods can be saved. Remove the can labels, wash the outsides of the cans with soapy water, and thoroughly disinfect the cans using a solution of 1 cup (8 ounces; approximately 0.25 liters) of household bleach (5.25%) in 5 gallons (approximately 19 liters) of treated drinking-quality water. Use a marker to note the contents and expiration date on the cans. If opened food containers have screw caps, snap lids, crimped caps (soda pop bottles), twist caps, or flip tops, or if they have been home canned, throw them away if they have come in contact with untreated water. They cannot be disinfected.

Feeding Infants
If you are not breastfeeding, use **only** pre-prepared canned baby formula that requires no added water.

Keeping Foods Cold
If available, dry ice can be used to keep foods cold—25 pounds (approximately 11.5 kg) of dry ice will keep a 10-cubic-foot (283-liter) freezer below freezing for 3 to 4 days. Be careful when handling dry ice, because it freezes everything it touches. Wear dry, heavy gloves to avoid injury. As dry ice melts, it changes from a solid into a gas. Ventilate (air out) vehicles or rooms when transporting, storing, or using dry ice. Without good ventilation, gas from melting dry ice can build up and cause harmful effects, including unconsciousness and death.

Deciding About Thawed Food
Thawed food can usually be eaten or refrozen if it is still "refrigerator cold" or if it still contains ice crystals. To be safe, remember, "When in doubt, throw it out." Discard any food that has been at room temperature for 2 hours or more, and any food that has an unusual odor, color, or texture. A food thermometer can be used to check food temperature.

Is the water safe to drink?

A tsunami creates a surge of ocean water that can sometimes engulf large geographic areas. As the ocean water comes ashore, drinking water wells can become submerged and potentially contaminated with microorganisms (bacteria, viruses, parasites) and chemicals that can adversely affect human health. The sea salts associated with saltwater flooding of coastal drinking water supplies are not an immediate health threat. Because of the unpleasant taste of saltwater, most people will not ingest (swallow) a large enough amount to cause immediate health problems. However, disease-causing microorganisms spread by the flood do not normally produce a strong taste. If water containing disease-causing microorganisms is ingested, even in small amounts, it may cause immediate, life-threatening health problems such as chronic diarrhea, cholera, and serious infections. Using contaminated water to clean small cuts and open wounds also poses a danger of serious infections. Additionally, chemical contaminants often found in floodwater can easily contaminate wells. Chemical contaminants can include fuel products from overturned fuel tanks, or pesticides that may have been stored in flooded areas. Ingesting water containing these types of chemical contaminants may result in threats to life and health.

After wells have been properly cleaned out and they begin to refill with water from the aquifer, much of the increase in salinity (saltiness) should subside. Shallow wells may be more affected than deeper wells because of the higher loading of saltwater in the upper layer of soil. Although recovery of shallow wells may be slower than that of deeper wells, the salinity of shallow wells should lessen over time.
After a tsunami, people in affected areas should listen for public announcements on the safety of the water supply. Flooded private wells will need to be tested and disinfected after flood waters recede. If odor, taste, unusual discoloration, or the results of preliminary water testing lead people to suspect that area wells are contaminated by fuel, pesticides, or other chemicals, a chemical analysis of drinking water is strongly recommended. Questions about testing should be directed to local authorities.

Water for Drinking, Cooking, and Personal Hygiene
Safe water for drinking, cooking, and personal hygiene includes bottled, boiled, or treated water. After a tsunami, water sources may be contaminated with saltwater. Your local authorities can make specific recommendations for boiling or treating water in your area.
Learn more about making water safe after a disaster.

Click here for related information

- WHO South-East Asia Earthquake and Tsunami Web Site: Household Water Treatment and Safe Storage Following Emergencies and Disasters
- WHO: The International Network to Promote Household Water Treatment and Safe Storage
- U.S. Environmental Protection Agency Advice on Flooded Wells

Tsunami FAQs

What is a Tsunami?

Tsunamis, also known as seismic sea waves, are a series of enormous waves created by an underwater disturbance such as an earthquake, landslide, volcanic eruption, or meteorite. A tsunami can strike anywhere along most of the U.S. coastline. Learn more about tsunamis and get information about health concerns after a tsunami including food and water safety.

Emergency Response and Cleanup

See general clean up answers

Past EPA Responses

Tornado Messaging

Relevant program office: Office of Water, Office of Air, Office of Land and Emergency Management

Relevant Web Content: http://emergency.cdc.gov/disasters/tornadoes/index.asp

FAQs
Public Health and Safety Information

How can I prepare for a Tornado?

When there are thunderstorms in your area, turn on your radio or TV to get the latest emergency information from local authorities. Because tornadoes often accompany thunderstorms, pay close attention to changing weather conditions when there is a severe thunderstorm watch or warning.
A ***severe thunderstorm watch*** means severe thunderstorms are possible in your area.
A ***severe thunderstorm warning*** means severe thunderstorms are occurring in your area.
Keep fresh batteries and a battery-powered radio or TV on hand. Electrical power is often interrupted

during thunderstorms--just when information about weather warnings is most needed. Listen for announcements of a tornado watch or tornado warning. Learn about the tornado warning system of your county or locality. Most tornado-prone areas have a siren system. Know how to distinguish between the siren's warnings for a tornado *watch* and a tornado *warning*. A **tornado watch** is issued when weather conditions favor the formation of tornadoes, for example, during a severe thunderstorm.
During a tornado **watch**,

- Stay tuned to local radio and TV stations or a National Oceanographic and Atmospheric Administration (NOAA) Weather Radio for further weather information.
- Watch the weather and be prepared to take shelter immediately if conditions worsen.

A **tornado warning** is issued when a tornado funnel is sighted or indicated by weather radar.
You should take shelter immediately.

What supplies do I need to be prepared?

Store the following documents in a fire- and water-proof safe:

- Birth certificates
- Ownership certificates (autos, boats, etc.)
- Social security cards
- Insurance policies
- Will
- Household inventory
  - List of contents of household; include serial numbers, if applicable
  - Photographs or videotape of contents of every room
  - Photographs of items of high values, such as jewelry, paintings, collection items

First aid supplies like drugs, medications, disinfectant, Aspirin tablets, eye drops, and bandages.

How can I secure my house from tornado damage?

No home is completely safe in a tornado. However, attention to construction details can reduce damage and provide better protection for you and your family if a tornado should strike your house. If an inspection using the "Home Inspection Checklist" reveals a possible hazard in the way your home is constructed, contact your local city or county building inspectors for more information about structural safety. They may also offer suggestions on finding a qualified contractor to do any needed work for you. Shut off gas before a tornado to ensure there are no gas leaks. Shut off electricity and water mains after a disaster strikes to help save house from further damage.

Identify top-heavy, free-standing furniture, such as bookcases and china cabinets that could topple over. Secure your furniture by using one of two methods. "L" brackets, corner brackets, or aluminum molding, to attach tall or top-heavy furniture to the wall. Eyebolts, to secure items located a short distance from the wall.

Tornado FAQs

What does a Tornado look like?

Some tornadoes strike rapidly, without time for a tornado warning, and sometimes without a thunderstorm in the vicinity. When you are watching for rapidly emerging tornadoes, it is important to know that you cannot depend on seeing a funnel: clouds or rain may block your view. The following weather signs may mean that a tornado is approaching:

- A dark or green-colored sky
- A large, dark, low-lying cloud
- Large hail
- A loud roar that sounds like a freight train

If you notice any of these weather conditions, take cover immediately, and keep tuned to local radio and TV stations or to a NOAA weather radio.

If you see a funnel cloud nearby, take shelter immediately (see the following section for instructions on shelter). However, if you spot a tornado that is far away, help alert others to the hazard by reporting it to the newsroom of a local radio or TV station before taking shelter as described later. Use common sense and exercise caution: if you believe that you might be in danger, seek shelter immediately.

Where do I shelter from a Tornado?

The key to surviving a tornado and reducing the risk of injury lies in planning, preparing, and practicing what you and your family will do if a tornado strikes. Flying debris causes most deaths and injuries during a tornado. Although there is no *completely* safe place during a tornado, some locations are much safer than others. At home, pick a place in the home where family members can gather if a tornado is headed your way. One basic rule is *AVOID WINDOWS*. An exploding window can injure or kill.
The safest place in the home is the interior part of a basement. If there is no basement, go to an inside room, without windows, on the lowest floor. Mobile homes can turn over during strong winds. Even mobile homes with a tie-down system cannot withstand the force of tornado winds. Plan ahead. If you live in a mobile home, go to a nearby building, preferably one with a basement. If there is no shelter nearby, lie flat in the nearest ditch, ravine, or culvert and shield your head with your hands. Do the following if you are caught outside during a tornado and there is no adequate shelter immediately available:

- Avoid areas with many trees.
- Protect your head with an object or with your arms.

Emergency Response and Clean Up

How do I clean up after a Tornado?

Wear sturdy shoes or boots, long sleeves, and gloves. Learn proper safety procedures and operating instructions before operating any gas-powered or electric-powered saws or tools. Clean up spilled medicines, drugs, flammable liquids, and other potentially hazardous materials.

Past EPA Response

Hurricane Messaging

Relevant program office: Office of Water, Office of Land and Emergency Management

Relevant web content: http://emergency.cdc.gov/disasters/hurricanes/index.asp

FAQs
Public Health and Safety Information

See answers on flood water, debris clean up, safe water management, and planning

Landslide Messaging

Relevant program office: Office of Land and Emergency Management

Relevant web content: http://emergency.cdc.gov/disasters/landslides.asp

FAQs
Public Health and Safety Information

How do I protect myself from a landslide?

Before intense storms and rainfall, assume that steep slopes and areas burned by wildfires are vulnerable to landslides and debris flows. Learn whether landslides or debris flows have occurred previously in your area by contacting local authorities, a county geologist or the county planning department, state geological surveys or departments of natural resources, or university departments of geology. Develop emergency and evacuation plans for your family and business. Develop an emergency communication plan in case family members are separated. During intense storms and rainfall, listen to the radio or watch TV for warnings about intense rainfall or for information and instructions from local officials. Be aware of any sudden increase or decrease in water level on a stream or creek that might indicate debris flow upstream. A trickle of flowing mud may precede a larger flow. Look for tilted trees, telephone poles, fences, or walls, and for new holes or bare spots on hillsides. Listen for rumbling sounds that might indicate an approaching landslide or mudflow. Be alert when driving. Roads may become blocked or closed due to collapsed pavement or debris. If landslide or debris flow danger is imminent, quickly move away from the path of the slide. Getting out of the path of a debris flow is your best protection. Move to the nearest high ground in a direction away from the path. If rocks and debris are approaching, run for the nearest shelter and take cover (if possible, under a desk, table, or other piece of sturdy furniture).

Click here for more information on landslides and mudflow safety in the U.S.: http://pubs.usgs.gov/fs/fs-0071-00/fs-0071-00.pdf

Landslide FAQs

What is a landslide?

Landslides occur when masses of rock, earth, or debris move down a slope. **Debris flows**, also known as **mudslides**, are a common type of fast-moving landslide that tends to flow in channels. Landslides are caused by disturbances in the natural stability of a slope. They can accompany heavy rains or follow droughts, earthquakes, or volcanic eruptions. Mudslides develop when water rapidly accumulates in the ground and results in a surge of water-saturated rock, earth, and debris. Mudslides usually start on steep slopes and can be activated by natural disasters. Areas where wildfires or human modification of the land have destroyed vegetation on slopes are particularly vulnerable to landslides during and after heavy rains.

Click here for more information on landslides and mudflows in the U.S.: http://pubs.usgs.gov/circ/c1244/
http://www.ngdc.noaa.gov/nndc/struts/results?eq_1=39&t=101634&s=0&d=4&d=44

Emergency Response and Clean Up

See general clean-up guidelines

Past EPA Response

Emergency Response for Drinking Water and Wastewater Utilities Messaging

Relevant program office: Office of Water

Relevant web content: Emergency Response for Drinking Water and Wastewater Utilities - https://www.epa.gov/waterutilityresponse
Click here for more information on contaminated water: https://www.epa.gov/sites/production/files/2015-06/documents/comntainmentanddisposal.pdf
Anticipating Public Questions to a Water Crisis
https://www.epa.gov/sites/production/files/2015-08/documents/anticipating_public_questions_5.pdf
Incident Action Checklists for Water Utilities: https://www.epa.gov/waterutilityresponse/access-incident-action-checklists-water-utilities
On the go app: https://watersgeo.epa.gov/responseotg/

FAQs

Public Health and Safety Information

Is the water safe to drink?

Limit contact with flood water. Natural disasters have the potential to cause a great deal of damage to drinking water and wastewater utilities, particularly since most utility components are constructed from inflexible materials (e.g., concrete, metal pipes). Impacts that may include, but are not limited to: •Structural damage to facility infrastructure and equipment• Water tank damage or collapse• Water source transmission line realignment or damage• Damage to distribution lines due to shifting ground and soil liquefaction, resulting in potential water loss, water service interruptions, low pressure, contamination and sinkhole sand/or large pools of water throughout the service area• Loss of power and communication infrastructure• Restricted access to facilities due to debris and damage to roadways.

Keep bottled water as part of your household emergency preparedness kit. Water that you suspect to be contaminated should be boiled to kill all major water-borne bacterial pathogens. Boil water for 1 minute, and for 3 minutes at elevations above 5280 ft. **Boiling water information ;** Getting and disinfecting drinking water.

Click here for suggested activities to help facilities prepare: https://www.epa.gov/waterutilityresponse Please note, the linked information is written for hurricane preparedness but much of it will still apply to earthquake preparedness activities.

In addition: Do not drink your well water until it is tested and safe. Do not use (flush) the sewage system until water in the soil absorption field is lower than the water level around the house. If you have a small business and your septic system has received chemicals, take extra precautions to prevent contact with water or inhaling fumes. Proper clean-up depends on the kinds of chemicals in the wastewater. Read more about flooded wells.

Click here for more information: https://www.epa.gov/privatewells/what-do-your-private-well-after-flood

Emergency Response and Clean Up

What is decontamination?
Decontamination is the inactivation or reduction of contaminants from surfaces by physical, chemical, or other methods to meet a cleanup goal. Decontamination does not include the treatment of contaminated water or wastewater. Decontamination happens after confirming the contamination and before returning the system to service. Decontamination is part of "Remediation and Cleanup" following an incident.

What do I do with my home septic system after a flood?

Do not drink your *well water* until it is tested and safe. Do not use (flush) the sewage system until water in the soil absorption field is lower than the water level around the house. If you have a **small business** and your septic system has received chemicals, take extra precautions to prevent contact with water or inhaling fumes. Proper clean-up depends on the kinds of chemicals in the wastewater.
Protect your well water after a flood. Stay away from the well pump while flooded to avoid electric shock. Do not drink or wash from the flooded well to avoid becoming sick. Get assistance from a well or pump contractor to clean and disinfect your well before turning on the pump. After the pump is turned back on, pump the well until the water runs clear to rid the well of flood water. If the water does not run clear, get advice from the county or state health department or extension service.

How do I handle water contaminated due to a natural disaster?

Contamination emergencies at utilities may occur naturally or by man-made causes. Manmade causes

may be accidental or intentional. During a contamination incident, utilities will have to handle contaminated water properly. This may include: Isolating and treating contaminated water; Storing treated water and decontaminated infrastructure components

Social Media Guide

Drinking Water Advisory Communication Toolbox

The toolbox provides information on how to plan for, develop, implement, and evaluate drinking water advisories. It includes instructions on how to prepare before an event, what to do during an event, templates and tools to use, and recommendations for follow-up actions and assessments after an event to enable water systems to communicate effectively with partners and the public in order to protect public health.

Online: http://www.cdc.gov/healthywater/emergency/dwa-comm-toolbox/
PDF: http://www.cdc.gov/healthywater/pdf/emergency/drinking-water-advisory-communication-toolbox.pdf

To: Griggs, John[Griggs.John@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]; Wilds, Edward[Wilds.Edward@epa.gov]; Edwards, Jonathan[Edwards.Jonathan@epa.gov]; Wilds, Edward[Wilds.Edward@epa.gov]; Snead, Kathryn[Snead.Kathryn@epa.gov]; Anoma, Valentine[Anoma.Valentine@epa.gov]; DeCair, Sara[DeCair.Sara@epa.gov]; Mosser, Jennifer[Mosser.Jennifer@epa.gov]; Cherepy, Andrea[Cherepy.Andrea@epa.gov]
From: Hallam, Christopher
Sent: Wed 6/15/2016 3:22:57 PM
Subject: HSCN Budget
HSCN Budget Initiatives 20160615.docx

Please see attached update.

Chris Hallam

Health Physicist

Center for Radiological Emergency Management

Office of Radiation and Indoor Air

Office: 202-343-9308

iPhone: 202-839-2492

hallam.christopher@epa.gov

www.epa.gov/radiation

Submitted by: OAR (Mosser)

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Standardize Quality and Data Management Protocols for NIRT

Current quality standards and data management protocols vary between NIRT member agencies, which results in challenges for interagency use of data. Data used in decision-making may have to be re-evaluated by another agency to ensure standards are met, thereby duplicating effort and slowing the production of viable data/data assessments for critical decision-making. This project would develop and implement common quality standards for radiological analyses, aerial and monitoring data, data validation, data integrity, and data assessment under the NIRT. It would also develop and implement standardized data management protocols and data sharing practices among NIRT assets.

Budget:

Quality & Data Management	FY17	FY18	FY19	FY20		
Intramural	$400,000	$400,000	$300,000	$200,000		
Equipment	$10,000	$5,000	$5,000	$5,000		
Travel	$30,000	$30,000	$18,000	$18,000		
Contracts	$220,000	$170,000	$162,000	$112,000		
Grants	$0	$0	$0	$0		
Total	$660,000	$605,000	$485,000	$335,000	**$2,085,000**	**Grand Total**

Intramural assumes a fully burdened FTE of $200k/yr; Years 1 & 2 = one FTE; year 3 = 0.75 FTE; year 4 = 0.5 FTE
Equipment – dedicated laptops, specialized software, etc in first year; upgrades, replacement and licensing fees for remaining years
Travel year one and two: assumes 5 meetings with FRMAC x 3 pax for EPA @ $2k per pax = $30k/y
Travel years three and four assume 3 meetings x 3 epa pax @ $2k per pax = $18k/y
Contracts – includes same travel for 2 contractor pax as shown above

Submitted by: OAR (Anoma)

Theme: Nationwide preparedness

Proposed Project: Database of Radioactive Sources located within U.S. Colleges, universities, scrap yards and other sources

The Environmental Protection Agency as the primary institution concerned with the preservation of human health and the environment, would like to continue work previously started with Minority Academic Institutions (HBCU/MAIs) to create a database for radioactive sources in the U.S. academic institutions. The purpose of the database would be to enable personnel at these institutions to recognize and to safely secure radioactive sources as a preventive measure. This database would help to establish a quick and effective identification, removal and disposal of radioactive sources (orphaned and non-orphaned) which if undetected could present a health hazard and cost the public and industry millions of dollars in lost production and decontamination expenses. These sources if found in the wrong hands could be used for terrorist related activities.

Budget:

Source Database	FY17	FY18	FY19	FY20		
Intramural	$150,000	$150,000	$0	$0		
Equipment	$0	$0	$0	$0		
Travel	$5,000	$5,000	$0	$0		
Contracts	$0	$0	$0	$0		
Grants	$75,000	$75,000	$0	$0		
Total	$230,000	$230,000	$0	$0	$460,000	Grand Total

Submitted by: OAR (DeCair)

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Outreach, training & drills with new water PAGs

EPA's primary Critical Infrastructure/Key Resources mission is to ensure safe drinking water is available for all Americans. In a radiation disaster, EPA Regions and HQ will be pressed for protective actions and public information beyond the existing capability of local water utilities. The new drinking water PAG, issued for public comment in early June 2016, is a step toward improved preparedness. Training and implementation assistance is needed to get local and private sector drinking water providers ready with solid emergency response plans. Workshops in all 50 states are proposed.

Budget:

Water PAGs	FY17	FY18	FY19	FY20		
Intramural	$120,000	$80,000	$20,000	$0		
Equipment	$5,000	$0	$0	$0		
Travel	$60,000	$60,000	$10,000	$0		
Contracts	$150,000	$100,000	$15,000	$0		
Grants	$0	$0	$0	$0		
Total	$335,000	$240,000	$45,000	$0	**$620,000**	**Grand Total**

Submitted by: OAR (Veal)

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Perform a Feasibility Study for incorporating radiological parameters/analyses into the BioWatch program

The EPA RadNet currently has more than 130 radiation air monitors in 50 states collecting near-real-time measurement of gamma radiation 24/7/365. The addition of BioWatch monitoring locations as data collection points that can also serve for radiation detection/sampling would provide a significant increase in capability and capacity in the assessment of radiological threats. The current BioWatch system will present some technical challenges for radiological data collection and analysis which need to be overcome. The first step to overcoming these challenges is the conduct of a feasibility study with some bench scale testing to determine if the expanded use of the BioWatch program for radiation detection/sampling is viable.

Budget:

Rad FS for BioWatch	FY17	FY18	FY19	FY20		
Intramural	$200,000	$150,000	$0	$0		
Equipment	$100,000	$100,000	$0	$0		
Travel	$30,000	$30,000	$0	$0		
Contracts	$120,000	$120,000	$0	$0		
Grants	$0	$0	$0	$0		
Total	$450,000	$400,000	$0	$0	$850,000	Grand Total

Submitted by: OAR (Wilds)

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Develop RERT search capabilities and strategies for emerging radiological threats

As the methods to obtain radioactive material needed to construct Radiological Dispersion Devices (RDD) become more sophisticated throughout the United States, the RERT must increase its capability to search for this material. When a source is lost not only will officials at the federal, state, and local level be looking for the source but this presents an opportunity for terrorist cells to obtain radioactive material through a non-theft manner. To stay ahead this type of activity, expansion of RERT search capabilities can provide a significant increase in the area covered during the search for a timely and successful recovery of the material.

There are two potential paths that may be used to involve the RERT. First, it is possible that the RERT may be called directly early during an incident to help locate the radioactive material sources. Second, as part of the Federal Radiological Monitoring and Assessment Center, RERT may be called in to assist with the search. In both situations the RERT should develop search capabilities for outer areas surrounding the target area. This prevents the duplication of DOE assets that would be sent to the target area and expands the search area by having RERT focus on the outer areas. The expansion of RERT capability to search outer areas significantly enhances the federal government's capabilities to locate radioactive material.

Budget:

RERT Search	FY17	FY18	FY19	FY20		
Intramural	$200,000	$150,000	$100,000	$0		
Equipment	$300,000	$100,000	$0	$0		
Travel	$40,000	$60,000	$10,000	$0		
Contracts	$50,000	$25,000	$0	$0		
Grants	$0	$0	$0	$0		
Total	$590,000	$335,000	$110,000	$0	**$1,035,000**	**Grand Total**

Submitted by: OAR (Griggs)

Theme: Enhanced Threat Agent (CBR) Capability and Capacity

Proposed Project: Closing Capacity and Capability Gaps in Environmental Radiological Laboratories

Background:

The demand by decision makers for radiological laboratory results would be unprecedented following multiple Radiological Dispersion Devices (RPD's) attacks in different cities (White House Homeland Security Councils National Planning Scenario #11) or the detonation of an Improvised Nuclear Device (IND) (White House Homeland Security Councils National Scenario #2).

The need to rapidly and defensibly determine the nature and extent of contamination, to evaluate the effectiveness of decontamination activities in a timely manner to support consequence management decisions, and to support final clean-up and clearance will result in radioanalytical demands that greatly exceed current radiological laboratory capacities and capabilities. With the Department of Homeland Security as the lead, the Integrated Consortium of Laboratory Networks (ICLN) was established by a MOU in 2005 through a MOU with the following agencies and departments, DOD, DOE, HHS (CDC), EPA, FDA, DOI, DOJ (FBI), Department of Agriculture and the Department of State.

The mission of the ICLN is to provide for a federally coordinated and interoperable system of federal laboratory networks that provide timely, credible and interpretable data in support of surveillance, early detection and effective consequence managements for biological, chemical, radiological or nuclear incident. Several years ago the ICLN undertook a comprehensive assessment of the federal laboratory networks capability to adequately respond to a number of biological, chemical, radiological and nuclear scenarios. The assessment determined two major laboratory capacity and capability gaps. Radiological laboratory testing was one of the two gaps. While some progress has been made since the assessment, the gap still exists.

The overall national gap in radiological laboratory testing can be broken down into four major areas. These are: 1) lack of protocols and procedures to shift from routine operation to surge capacity mode; 2) lack of capability to analyze for select radionuclides in key matrices like urban materials; 3) declining expertise in radiochemistry; 4) lack of proficiency testing programs for key matrices; particularly urban matrices; and 5) lack of radiological laboratory exercises.

Surge Capacity

The vast majority of radiological laboratories have no experience operating in an incident response mode. In their usual mode of routine operations laboratories negotiate turnaround times for sample results. In the event of a major nuclear or radiological incident, laboratories will be expected to operate in a surge mode, maximum throughput and rapid turnaround. Absent the experience in shifting to a surge capacity mode and lacking the necessary procedures and protocols, the majority of laboratories will fall well short of the demands placed upon them. What is needed to improve this transition is training and general protocols for surge capacity operations.

Proposal

- Provide on-site training on transitioning from routine operations to surge capacity operations for 10 environmental radiological laboratories per year.
- Develop general protocols on transitioning from routine operations to surge capacity that can be customized by laboratories.

Inability of Laboratories to Analyze Urban Matrices

Most environmental radiological laboratories have experience in analyzing for radionuclides in environmental matrices such as water, soil, vegetation, etc. However, very few laboratories have any experience or even analytical methods to analyze for radionuclides in urban matrices such as cement, brick, asphalt, etc.

Over the past several years ORIA's National Analytical Radiation Environmental Laboratory (NAREL) has been working in partnership with ORD's National Homeland Security Research Center (NHSRC) to develop rapid radiochemical methods for urban matrices. By the end of FY16, rapid radiochemical methods will be published for brick, cement, asphalt, and asphalt shingles. However much work still needs to be done. ORD's NHSRC did a survey of the urban matrices in 50 of the largest cities in the country and this list can be used to prioritize the development of rapid methods.

Proposal

- Develop and validate two rapid radiochemical methods for urban matrices in partnership with ORD NHSRC per year.
- Conduct workshops at national meetings of laboratory personnel on the rapid radiochemical methods for urban matrices every year.

Declining Expertise in Radiochemistry

In 2012, The National Academies of Science issued a report entitled, *Assuring a Future U.S. – Based Nuclear and Radiochemistry Expertise.* The report emphasized the critical need to support efforts focused on developing the longer-term sustainability of the nuclear workforce including laboratory personnel. Highly - educated and experienced radiochemists are being lost to retirement at a rate that exceeds their rate of replacement. There are few if any training courses in radiochemistry – (both the theory and hands-on training) being offered.

Proposal

- Develop Basis of Radiochemistry, Intermediate Radiochemistry and Advanced Radiochemistry training courses. Each course would be one week long with one offering of each course every year for up to 40 participants.
- As radiochemistry is highly technique dependent with very little automation, provide on-site hands-on training on radiochemistry techniques to 8 environmental radiological laboratories per year.

Lack of Proficiency Testing for Urban Matrices

While there is proficiency testing currently in place for select radionuclides in traditional environmental matrices, such as water, soil, vegetation, air filters, etc, there are currently no proficiency testing programs for urban matrices such as cement, brick, asphalt, etc. Therefore, EPA has no way of evaluating the ability of laboratories to analyze for radionuclides in urban matrices prior to an RDD or IND incident. During an emergency, laboratories will certainly struggle with urban matrices because of the lack of experience in working with them. This will result in delays of getting data to decision makers and there will also be questions about the validity and accuracy of the data.

Proposal

- Develop and send spiked samples of two types of urban matrices (e.g. cement, brick) to 20 laboratories each year.

- Evaluate the results and send each participating laboratory their results along with recommendations on how to improve their performance as appropriate.

Lack of Radiological Laboratory Exercises

Over the past twenty years there have been a number of large scale multi-agency radiological/nuclear exercises. However in almost every case radiological laboratories played a very small role in the exercises with the samples being either notional or if real, very few in number. Therefore radiological laboratories have not truly been exercised in any way that would come close to what they would experience in a major radiological or nuclear event.

Proposal

- Prepare and send 300 to 400 spiked samples of a variety of environmental and urban matrices to 20 to 30 laboratories each year. The laboratories would be given a scheduled for reporting results in a designated electronic data deliverable.
- Following the laboratory exercise conduct several conference calls to capture "lessons learned" from the exercise. These lessons learned would be compiled in a report and sent to each participating laboratory to assist them in improving their procedures and protocols. In addition each laboratory would receive an individual report evaluating their performance along with customized recommendations on how to improve their procedures, protocols and overall performance.

Budget

For all proposals

It should be noted that this is a multi-year proposal given that the gap in the nations' radiological laboratory capacity and capability cannot be significant reduced in one year. Also this budget is easily scalable by reducing the number of laboratories involved each year, reducing the number of samples sent for an exercise, etc.

Capacity & Capability Rad Lab Gap	FY17	FY18	FY19	FY20		
Intramural	$100,000	$100,000	$100,000	$100,000		
Equipment / Supplies	$30,000	$30,000	$30,000	$30,000		
Travel	$10,000	$10,000	$10,000	$10,000		
Contracts	$685,000	$685,000	$685,000	$685,000		
Grants	$0	$0	$0	$0		
Total	$825,000	$825,000	$825,000	$825,000	**$3,300,000**	**Grand Total**

Proposed budget to close capacity and capability gaps in environmental radiological laboratories

Intramural assumes a 1/2 burdened FTE at $200k/y; assumes multiple personnel working partial FTEs.

Equipment / Supplies Laboratory equipment and radiological standard reference materials

Contracts – contractors will conduct training, prepare PT samples, evaluate results, write evaluation reports.

To: Hutter, Adam[adam.hutter@HQ.DHS.GOV]; Remick, Alan[alan.remick@nnsa.doe.gov]; Scott, Andrew[andrew.scott@hq.dhs.gov]; Armin Ansari[asa4@cdc.gov]; Barbara Stunder[Barbara.Stunder@noaa.gov]; Ben Cacioppo[Ben.Cacioppo@dtra.mil]; Stevenson, Benjamin[Benjamin.Stevenson@hq.dhs.gov]; Bernard Bogdan[bernard.bogdan@ic.fbi.gov]; Webb, Bill[Bill.Webb@fema.dhs.gov]; Blizzard, Jeffrey[jeffrey.blizzard@fema.dhs.gov]; Blumenthal, Daniel[Daniel.Blumenthal@nnsa.doe.gov]; Bruce Young[Bruce.Young@med.va.gov]; byw3@cdc.gov[byw3@cdc.gov]; Gorman, Chad[Chad.Gorman@fema.dhs.gov]; Wood, Chad[chad.wood@HQ.DHS.GOV]; Christine Martin[MartinCR@state.gov]; Gregg, Chuck[Chuck.Gregg@fema.dhs.gov]; Burnside, Conrad[Conrad.Burnside@fema.dhs.gov]; Crawford, Sean[Sean.Crawford@fema.dhs.gov]; Cullen, William R[William.Cullen@fema.dhs.gov]; Dean McCauley[Dean.McCauley@gsa.gov]; Dennis Emmert (dennis.j.emmert.mil@mail.mil)[dennis.j.emmert.mil@mail.mil]; Eberst, William[William.Eberst@fema.dhs.gov]; Elaine Bond[Elaine_Bond@ios.doi.gov]; Farmer, Robert[Robert.Farmer2@fema.dhs.gov]; Feighert, Dan[Dan.Feighert@fema.dhs.gov]; THD-RAC Chairs[THD-RACChairs@fema.dhs.gov]; FladeboeJP@state.gov[FladeboeJP@state.gov]; Foreman, Bruce[Bruce.Foreman@fema.dhs.gov]; Fox, Kathleen (Katie) M[Kathleen.Fox@fema.dhs.gov]; Garcia, Luis[Luis.Garcia2@fema.dhs.gov]; Gardner, Patricia[Patricia.Gardner2@fema.dhs.gov]; Gordon Cleveland[Gordon.S.Cleveland@aphis.usda.gov]; Greten, Timothy[Timothy.Greten@fema.dhs.gov]; Hammond, Lisa[Lisa.Hammond@fema.dhs.gov]; Sherwood, Harry[Harry.Sherwood@fema.dhs.gov]; Heath, Stanley[stanley.heath@HQ.DHS.GOV]; Hoyes, Jonathan[jonathan.hoyes@fema.dhs.gov]; Jacqueline.mann@nist.gov[Jacqueline.mann@nist.gov]; James Williams[James.Williams@dot.gov]; Jeffery Albanus[jeffery.albanus@navy.mil]; Jeffrey Sincek[jeffrey.sincek@fda.hhs.gov]; 'Jensen, John (USDA)'[john.jensen@dm.usda.gov]; Jim Stahlman (James.e.stahlman.civ@mail.mil)[James.e.stahlman.civ@mail.mil]; John F. Koerner (John.Koerner@hhs.gov)[John.Koerner@hhs.gov]; John Madrid[john.madrid@dtra.mil]; MacKinney, John A[john.mackinney@HQ.DHS.GOV]; John.Sokich@noaa.gov[John.Sokich@noaa.gov]; Brinsfield, Kathryn[kathryn.brinsfield@hq.dhs.gov]; Kennedy, Beth D CTR OSD OUSD POLICY (US)[beth.d.kennedy.ctr@mail.mil]; McDaniel, Kenneth L CIV[Kenneth.L.McDaniel@uscg.mil]; Kgeiss@ostp.eop.gov[Kgeiss@ostp.eop.gov]; Veal, Lee[Veal.Lee@epa.gov]; Lee.a.nickel1@navy.mil[Lee.a.nickel1@navy.mil]; lodwick.jeffrey@dol.gov[lodwick.jeffrey@dol.gov]; Marissa Bailey[Bailey@nrc.gov]; McCarroll, Janis[Janis.McCarroll@fema.dhs.gov]; michael.noska@fda.hhs.gov[michael.noska@fda.hhs.gov]; Mike.Wangler@em.doe.gov[Mike.Wangler@em.doe.gov]; Monchek, Rafaela[Rafaela.Monchek@fema.dhs.gov]; Monchek, Rafaela[Rafaela_Monchek@nss.eop.gov]; Musick, David[David.Musick@fema.dhs.gov]; OLeary, Sean[Sean.OLeary@fema.dhs.gov]; Hale, Olin[olin.hale@fema.dhs.gov]; Paul Cross[pcross@usgs.gov]; pxm@nrc.gov[pxm@nrc.gov]; Grundstrom, Richard[Richard.Grundstrom@fema.dhs.gov]; Robert Whitcomb[robert.whitcomb@cdc.hhs.gov]; Washington, Russell[Russell.Washington@fema.dhs.gov]; Sally Billings[sally.billings@nrc.gov]; DeCair, Sara[DeCair.Sara@epa.gov]; Scardino, Thomas[thomas.scardino@fema.dhs.gov]; Overby, Stacey[stacey.c.overby@nasa.gov]; Stephanie Coffin, NRC[Stephanie.coffin@nrc.gov]; Colman, Steve[Steve.Colman@fema.dhs.gov]; steven.fine@noaa.gov[steven.fine@noaa.gov]; THD-RAC Chairs[THD-RACChairs@fema.dhs.gov]; Quinn, Vanessa[Vanessa.Quinn@fema.dhs.gov]; Vanhorne-Sealy, Jama[jama.vanhorne-sealy@hq.dhs.gov]; Wieder, Jessica[Wieder.Jessica@epa.gov]; Billado, William[William.Billado@hq.dhs.gov]; Alexis Gearing[alexis.gearing@icfi.com]; Alvin Morris[alvin.morris@nnsa.doe.gov]; Andrew Wallo[andrew.wallo@hq.doe.gov]; Bennett, Gerilee[Gerilee.Bennett@fema.dhs.gov]; Blunt, Kenyetta[Kenyetta.Blunt@fema.dhs.gov]; Bobbitt, Sharon[sharon.bobbitt@fema.dhs.gov]; Schlieger, Brian[schlieger.brian@epa.gov]; Carrington, Jessica[Jessica.Carrington@icfi.com]; Chacko, Betsie[betsie.chacko@HQ.DHS.GOV]; Chase, Stephen[Stephen.Chase@fema.dhs.gov]; Coleman-Hansberry, Brenda[Brenda.Coleman-Hansberry@fema.dhs.gov]; Collins, Richard[Richard.Collins@fema.dhs.gov]; Coons, Albert[Albert.Coons@fema.dhs.gov]; Cychosz, Rachel[Rachel.Cychosz@fema.dhs.gov]; DeFelice, Anthony[Anthony.DeFelice@fema.dhs.gov]; Dozor, Joshua[Joshua.Dozor@fema.dhs.gov]; Echevarria, Sharon[Sharon.Echevarria@fema.dhs.gov]; Fiore, Craig[Craig.Fiore@fema.dhs.gov]; Harris III, Timothy[timothy.harrisiii@fema.dhs.gov]; Hart, Hampton[Hampton.Hart@fema.dhs.gov]; Howe, Michael[Michael.Howe@fema.dhs.gov]; Jackson, Liz[Liz.Jackson@fema.dhs.gov]; Jason.kozal@nrc.gov[Jason.kozal@nrc.gov]; Snead, Kathryn[Snead.Kathryn@epa.gov]; Ken

Lauziere[Ken.Lauziere@cabezon.com]; Kenneth Inn[kenneth.inn@nist.gov]; Laurence Broun[laurence.broun@ios.doi.gov]; Lisa Karam[lisa.karam@nist.gov]; Nanko, Lisa[Nanko.Lisa@epa.gov]; Mark Russo[mark.russo@fda.hhs.gov]; Michael Podguski[mpodguski@hwcinc.com]; Ward, Paul[Paul.Ward@fema.dhs.gov]; Perry, April[April.Perry@fema.dhs.gov]; Pesapane, Robert[Robert.Pesapane@fema.dhs.gov]; Ricardo Reyes[ricardo.a.reyes@us.army.mil]; Collins, Richard[Richard.Collins@fema.dhs.gov]; Robert Prins[robert.prins@dtra.mil]; Sabata, Andrew[andrew.sabata@fema.dhs.gov]; Stewart-Smith, Mart A (Stewart-SmithMA@state.gov)[Stewart-SmithMA@state.gov]; Tagliento, Marc[Marc.Tagliento@fema.dhs.gov]; Tony Nesk[nesk.tony@epa.gov]
Cc: Rogers, James D[James.Rogers3@fema.dhs.gov]; Blizzard, Jeffrey[jeffrey.blizzard@fema.dhs.gov]
From: Hale, Olin
Sent: Thur 6/9/2016 11:31:08 AM
Subject: Publication of EPA Drinking Water Protective Action Guide (PAG).

Good Morning FRPCC Colleagues,

The Environmental Protection Agency would like to share with the FRPCC news about the upcoming Federal Register publication of a Drinking Water PAG proposal. EPA expects a Federal Register publication in the next few days.

Pre-publication versions of the "Draft Protective Guide (PAG) for Drinking Water" and the " Notice of Availability" are available on the EPA website now:

https://www.epa.gov/radiation/protective-action-guides-pags

EPA will be seeking comment on the Proposed Drinking Water Protective Action Guide (PAG) and Planning Guidance For Radiological Incidents. Public comments will be due 45 days after publication in the Federal Register.

Once Notice of Availability is published in the Federal Register, pre-publication versions will be replaced with links to the Federal Register and Docket.

Please let me know if I may provide any additional information.

Very Best Regards,

Olin

Olin T. Hale, PPS

FRPCC Secretariat

Professional Services and Integration
Technological Hazards Division
Federal Emergency Management Agency
U.S. Department of Homeland Security
202.341.8643

email: olin.hale@fema.dhs.gov

To: BANDROWSKI, MIKE[Bandrowski.Mike@epa.gov]; Berry, Mark[Berry.Mark@epa.gov]; Bhesania, Amy[Bhesania.Amy@epa.gov]; Carroll, Craig[Carroll.Craig@epa.gov]; Cherepy, Andrea[Cherepy.Andrea@epa.gov]; Clark, Mike S.[Clark.Michael@epa.gov]; Davis, Amber[Davis.Amber@epa.gov]; Dossett, Donald[Dossett.Donald@epa.gov]; Durkin, Kim[Durkin.Kim@epa.gov]; Edwards, Jonathan[Edwards.Jonathan@epa.gov]; Febbo, carol[febbo.carol@epa.gov]; Ferguson, Rafaela[Ferguson.Rafaela@epa.gov]; Freeman, Alison[Freeman.Alison@epa.gov]; Giardina, Paul[Giardina.Paul@epa.gov]; Griggs, John[Griggs.John@epa.gov]; Honnellio, Anthony[Honnellio.Anthony@epa.gov]; Jackson, Scott[Jackson.Scott@epa.gov]; Jalbert, Philip[Jalbert.Philip@epa.gov]; Jay, Michael[Jay.Michael@epa.gov]; Jencius, Michele[jencius.michele@epa.gov]; Kolb, Laura[Kolb.Laura@epa.gov]; Kral, Katrin[Kral.Katrin@epa.gov]; McDonnell, Ida[McDonnell.Ida@epa.gov]; McTigue, Erin[McTigue.Erin@epa.gov]; Peake, Tom[Peake.Tom@epa.gov]; Rowson, David[Rowson.David@epa.gov]; Schultheisz, Daniel[Schultheisz.Daniel@epa.gov]; Shimek, Susie[Shimek.Susie@epa.gov]; Smith, Alisa[Smith.Alisa@epa.gov]; Snowbarger, Robert[Snowbarger.Robert@epa.gov]; Stafford, Andrea[Stafford.Andrea@epa.gov]; Vargo, Steve[Vargo.Steve@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]; Wilds, Edward[Wilds.Edward@epa.gov]; Wilson, Wenona[Wilson.Wenona@epa.gov]; Worley, Gregg[Worley.Gregg@epa.gov]; Aquino, Marcos[Aquino.Marcos@epa.gov]; Barnette, Jack[Barnette.Jack@epa.gov]; Brozowski, George[brozowski.george@epa.gov]; Cooper, Artra[Cooper.Artra@epa.gov]; Debonis, Michael[Debonis.Michael@epa.gov]; DeCair, Sara[DeCair.Sara@epa.gov]; Freed, Rachel[freed.rachel@epa.gov]; Generette, Lloyd[Generette.Lloyd@epa.gov]; Hooper, Charles A.[Hooper.CharlesA@epa.gov]; Johnson, Jeremy[Johnson.Jeremy@epa.gov]; Koehler, Larainne[Koehler.Larainne@epa.gov]; Mosser, Jennifer[Mosser.Jennifer@epa.gov]; Murphy, Michael[murphy.michael@epa.gov]; Poppell, Sam W.[Poppell.Sam@epa.gov]; Povetko, Oleg[Povetko.Oleg@epa.gov]; Richards, Jon M.[Richards.Jon@epa.gov]; Schulingkamp, Cristina[schulingkamp.cristina@epa.gov]; Sells, Mark D.[Sells.Mark@epa.gov]; Zhen, Davis[Zhen.Davis@epa.gov]
Cc: Durant, Jennah[Durant.Jennah@epa.gov]; Hubbard, Joseph[Hubbard.Joseph@epa.gov]; Nesky, Anthony[Nesky.Tony@epa.gov]; Shogren, Angela[Shogren.Angela@epa.gov]
From: Brozowski, George
Sent: Thur 6/9/2016 10:59:41 AM
Subject: Handling Press Response Regarding New Water PAG

Good morning! The Office of Water is the lead office for the new water PAGs. Reporters should go through your regional press office or HQ Press Office and they can arrange a discussion with a senior drinking water official.

The HQ Press Office Contact for drinking water issues is Julia Valentine:

Desk: (202) 564-2663

Cell: (202) 740-1336

valentine.julia@epa.gov

George P. Brozowski

Regional Health Physicist/Radon Coordinator

US EPA – R6

1445 Ross Avenue

Mail Stop - 6MM-XU

Dallas, TX 75202

214-665-8541 o

214-755-1530 c

To: Chan, Imei[Chan.Imei@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]
From: Edwards, Jonathan
Sent: Wed 6/8/2016 7:53:49 PM
Subject: FW: Santa Sussanna Tribute to Gregg Dempsey and RERT Training

FYI

From: Douglas Sharp [mailto:douglas.sharp@unlv.edu]
Sent: Wednesday, June 08, 2016 7:04 AM
To: Johnson, Jeremy <Johnson.Jeremy@epa.gov>
Cc: Edwards, Jonathan <Edwards.Jonathan@epa.gov>; Wilds, Edward <Wilds.Edward@epa.gov>; Stafford, Andrea <Stafford.Andrea@epa.gov>; Sharp, Douglas C. <Sharp.Douglas@epa.gov>
Subject: Santa Sussanna Tribute to Gregg Dempsey and RERT Training

Jeremy,

I found the tribute to Gregg Dempsey in the link attached below while researching radiation topics of interest to me. It really shows what a positive impact Gregg had on the Santa Sussanna project and I was thinking it might be good to show it to everybody at an ORIA all hands meeting.

I also found a motherlode of youtube videos on the history of Santa Sussanna and EPA involvement that CPT could use as a means to train all staff for a wide variety of RERT mission objectives. There are plenty of videos on Fukushima as well. I believe great value to RERT training efforts may be obtained through focused research into lessons learned from these and other examples. While I have your attention, we could also devote some time to understanding the controversial new draft PAGs for immediate phase drinking water standards that just came out for public comment. I have a suspicion that expert guidance concerning drinking water issues during a radiological emergency and over the course of a long-term recovery could be in short supply inside any given incident command post that we could be attached to. Perhaps it would be in EPA's interests to develop some of our NCRFO scientists to become proficient in interpreting the drinking water PAGs in anticipation of their being assigned to serve in an Envionmental Unit under the ICS. Sandra Elkouz, for example, has a master of science in chemistry and she used to work in a local government drinking water lab before she came to us.

https://www.youtube.com/watch?v=_60E0mdKtcc

V/r,

Doug Sharp

Physical Scientist

NCRFO CPT

Douglas C. Sharp, M.S., CEM, CSP

Adjunct Professor

Executive Master of Science in Crisis and Emergency Management

University of Nevada, Las Vegas

School of Environmental and Public Affairs

Greenspun College of Urban Affairs

Cell: 702.533.9108

To: Veal, Lee[Veal.Lee@epa.gov]
From: Nesky, Anthony
Sent: Tue 6/7/2016 7:26:12 PM
Subject: FW: EPA Seeks Comment on Proposed Drinking Water Protective Action Guide (PAG) and Planning Guidance For Radiological Incidents

This message was sent to NARR.

Tony Nesky

Center for Radiation Information and Outreach

Tel: 202-343-9597

nesky.tony@epa.gov

From: White, Rick
Sent: Tuesday, June 07, 2016 11:45 AM
Subject: EPA Seeks Comment on Proposed Drinking Water Protective Action Guide (PAG) and Planning Guidance For Radiological Incidents

Good Morning-

You are receiving this e-mail because you have previously expressed interest in this topic-

EPA will be seeking comment on the Proposed Drinking Water Protective Action Guide (PAG) and Planning Guidance For Radiological Incidents. Public comments will be due 45 days after publication in the Federal Register.

Pre-publication versions of the "Draft Protective Guide (PAG) for Drinking Water" and the " Notice of Availability" are available on our website now.

https://www.epa.gov/radiation/protective-action-guides-pags

Once Notice of Availability is published in the Federal Register, pre-publication versions will be replaced with links to the Federal Register and Docket.

Rick White

Acting Director, Center for Radiation Information and Outreach

Environmental Protection Agency

Office of Radiation and Indoor Air (ORIA)

To: Veal, Lee[Veal.Lee@epa.gov]; Poppell, Sam W.[Poppell.Sam@epa.gov]; Johnson, Jeremy[Johnson.Jeremy@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]
From: Snead, Kathryn
Sent: Tue 6/7/2016 7:18:52 PM
Subject: Updated ER Preparedness Brief for Your Consideration
erpreparednessbrief060616.pptx

Lee, Alan, Sam, and Jeremy,

Based on the feedback you've given me, I've made several changes to the attached ER Preparedness Brief, which is currently scheduled for Janet McCabe on June 15, 2016. First, I've attempted to frame the Brief more as a coherent story that we want to share with Janet with a take-away message at the end. Second, I've included a lot of details that Jeremy and Sam were able to share with me about their programs and their current and upcoming projects. I'm interesting in hearing whether I've gotten closer to the mark with this updated version.

I'd like to suggest that it's time to bring this to John and Ed, and also to share this with Jon Edwards. Does anyone object to my scheduling a time to discuss this brief with them?

Kathryn Snead

Center for Radiological Emergency Management

Office of Radiation and Indoor Air

Environmental Protection Agency

1200 Pennsylvania Ave., NW

Washington, DC 20460

202-343-9228 (W)

202-536-7896 (C)

ORIA's Emergency Response Preparedness

Brief for Janet McCabe
June 15, 2016

ED_001057_00022132

Emergency Response Preparedness

- ER Preparedness
  - Mission
  - Current State
  - Goals
- Current Actions to Improve Readiness
- Planned Actions to Improve Readiness

ED_001057_00022132

ED_001057_00022132

Mission

To protect human health and the environment from unnecessary exposure to ionizing radiation during radiation emergencies by:

- Providing technical advice and assistance to prevent or minimize threats to public health and the environment;
- Providing advice on protective measures to ensure public health and safety;
- Providing assessments of dose and impact of any release on public health and the environment;
- Performing monitoring, sampling, laboratory analyses and data assessments to assess and characterize environmental impacts, and;
- Providing technical advice and assistance for containment, cleanup, restoration, and recovery following a radiological incident.

Scenarios

- EPA On-Scene Coordinator-led Event
- Domestic Response to Foreign Nuclear Incident
- Nuclear Power Plant Response

ED_001057_00022132

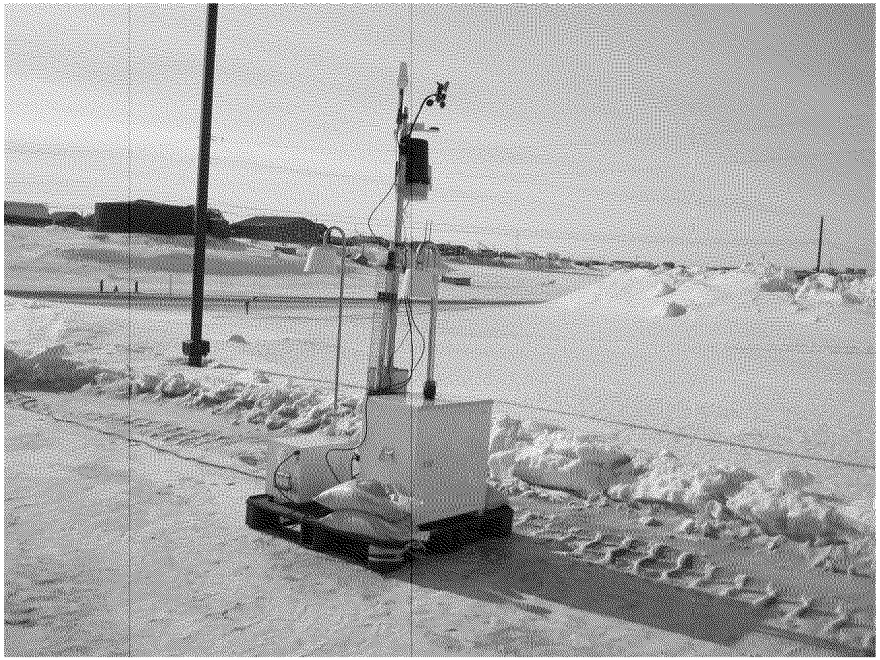
EPA OSC-led Event

This is the incident that ORIA would be most prepared for because it is a smaller event; for example, Boise, Idaho & Safety Light (PA).

ED_001057_00022132

Foreign Nuclear Incident

ORIA, with our regional & internal partners, can provide a meaningful response to an Foreign Nuclear Incident of similar impact as Fukushima, Chernobyl, and taking additional steps for an improved response.



ED_001057_00022132

Nuclear Power Plant Response

This scenario is the biggest vulnerability and would bring intense pressure on the agency

- Large impact/concern for public health
- Expecting the need for two-shifts and a sustained long-term response

ED_001057_00022132

ORIA's Current State Readiness

Function	OSC-led	FNI	NPP
RadNet	■	▒	■
Field support	▒	▒	■
Analytical support	■	◪	■
Public Information Officers	■	◪	■
Data Management	▒	◪	■
Science Team	■	◪	■

ED_001057_00022132

ED_001057_00022132

Goals

- Maintain current capabilities
  - Keep “green” functions ready to go
- Improve readiness in challenged areas
  - Upgrade “yellow” functions to “green”
- Achieve full readiness for first two scenarios
  - EPA OSC-led Response
  - Foreign Nuclear Incident
- Achieve partial readiness for NPP scenario

Current Actions to Improve Readiness

- Reorganized into Centers of Excellence
- Developed Response Niche – Focus on Expert Advice
- Gaining Practical Experience at Superfund Sites
- Improving RadNet

ED_001057_00022132

Current Actions to Improve Readiness

- Improving Radiation Expertise
- Increasing Exercise Participation
- Revising Key Guidance
- Developing Just-in-Time Training for Field Personnel

ED_001057_00022132

ED_001057_00022132

Planned Actions to Improve Readiness

Near-term Projects

- Increase Field Training
- Train Radiation Task Force Leaders
- Train Public Information Officers in Radiation
- Increase Flexibility through Contract Support

Planned Actions to Improve Readiness

Longer-term Projects

- Develop Strategic Training Plans
- Build Technical Expertise
- Manage Data

ED_001057_00022132

ED_001057_00022132

Summary

Radiation Emergency Response Program will

- accomplish its mission
- via a series of current and planned actions to improve readiness
- to meet specific scenario-based emergency response preparedness goals.

To: Veal, Lee[Veal.Lee@epa.gov]
From: Nesky, Anthony
Sent: Tue 6/7/2016 4:40:31 PM
Subject: RE: Question Press Inquiry
PressInquiry-6-7-16.docx

Here is a draft. I'll be right over.

Tony Nesky

Center for Radiation Information and Outreach

Tel: 202-343-9597

nesky.tony@epa.gov

From: Veal, Lee
Sent: Tuesday, June 07, 2016 12:34 PM
To: Hernandez-Quinones, Samuel <Hernandez.Samuel@epa.gov>
Cc: DeCair, Sara <DeCair.Sara@epa.gov>; Christ, Lisa <Christ.Lisa@epa.gov>; Nesky, Anthony <Nesky.Tony@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>
Subject: RE: Question Press Inquiry

Sam,

I'm adding in Tony and Alan. Tony is preparing some draft language that will help.

We think it is important to point out that we are not proposing a rule, rather it is a guide, and that we're not proposing a standard. That would be the SDWA MCL.

Then we can answer the question by saying that EPA has not proposed a drinking water PAG before, although our 1992 document includes a placeholder. We then need to emphasize that the 2013 publication did solicit comment on a drinking water PAG, which we did receive, digest and incorporate into a proposal.

There is the matter of the DHS 2008 Federal Register notice with an IND/RDD PAG guide. That guide is noted/referenced in the 2013 EPA proposed guide.

Lee

Lee Ann B. Veal

Acting Deputy Director, Radiation Protection Division

Office of Radiation and Indoor Air

Office: 202-343-9448; Cell: 202-617-4322

www.epa.gov/radiation

From: Hernandez-Quinones, Samuel
Sent: Tuesday, June 07, 2016 11:41 AM
To: Veal, Lee <Veal.Lee@epa.gov>
Cc: DeCair, Sara <DeCair.Sara@epa.gov>; Christ, Lisa <Christ.Lisa@epa.gov>
Subject: RE: Question Press Inquiry

Do you think our proposed response is appropriate?

This is our proposed response:

The previous PAG Manual, entitled "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (EPA-400-R-92-001, May 1992), was published by the U.S. EPA in 1992. This did not include a value for drinking water. **In XXXX, EPA considered establishing a drinking water PAG, it however was never released publicly. Most recently, in** March 2013, EPA published an updated version of the document which EPA received significant comment. The current FRN represents EPA's proposal for the drinking water portion of that 2013 PAG.

Sam

From: Veal, Lee
Sent: Tuesday, June 07, 2016 11:39 AM
To: Hernandez-Quinones, Samuel <Hernandez.Samuel@epa.gov>
Cc: DeCair, Sara <DeCair.Sara@epa.gov>
Subject: Re: Question Press Inquiry

The 2008 manual with a DW PAG did clear OMB and was held up with the new Administration's request to examine release able materials in early 2009.

Lee Ann B Veal

Acting Deputy Director, Radiation Protection Division

Office 202-343-9448

Cell 202-617-4322

On Jun 7, 2016, at 11:13 AM, Hernandez-Quinones, Samuel <Hernandez.Samuel@epa.gov> wrote:

> Hi Lee,
>
> We had a question and I wanted to share with you to make sure the response was accurate.
>
> So I believe they are asking about a 2008 PAG effort. My understanding is that EPA developed a DW PAG proposal but it was not cleared to be released by OMB on 2009, am I correct? Please see below and let me know your thoughts.
>
> Thanks

Sam

This is the question:

We got a call from a source who says EPA is apparently publishing a rule that will increase the level of radiation allowed in drinking water. Supposedly the new rule is similar to a proposal the Bush administration made.

He's asking what the limit used to be. He said he's hearing that what we're proposing for comment is similar to a proposal under the Bush Administration, which was eventually abandoned.

This is our proposed response:

The previous PAG Manual, entitled "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (EPA-400-R-92-001, May 1992), was published by the U.S. EPA in 1992. This did not include a value for drinking water. **In XXXX, EPA considered establishing a drinking water PAG, it however was never released publicly. Most recently, in** March 2013, EPA published an updated version of the document which EPA received significant comment. The current FRN represents EPA's proposal for the drinking water portion of that 2013 PAG.

==========

Samuel Hernández Quiñones, P.E.
Environmental Engineer
Office of Water

Environmental Protection Agency
1200 Pennsylvania Ave. NW
Washington, DC 20460
202-564-1735

"USEPA Protecting Human Health and the Environment"

This is the question:

We got a call from a source who says EPA is apparently publishing a rule that will increase the level of radiation allowed in drinking water. Supposedly the new rule is similar to a proposal the Bush administration made.

He's asking what the limit used to be. He said he's hearing that what we're proposing for comment is similar to a proposal under the Bush Administration, which was eventually abandoned.

DRAFT ANSWER

EPA is not proposing a drinking water rule or any changes to drinking water standards. EPA is proposing non-regulatory guidance that authorities can use to protect residents from experiencing the harmful effects from radiation in drinking water following a radiological emergency. EPA is seeking public comment on the proposed drinking water Protective Action Guide (PAG) for up to 45 days following publication in the Federal Register.

In May 1992, EPA published the Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (EPA-400-R-92-001, May 1992) (known as the PAG Manual). This did not include a value for drinking water, but did include a placeholder for_____ In March 2013, EPA proposed an updated version of the document which did not contain a drinking water PAG. EPA received comment. The current FRN represents EPA's proposal for the drinking water portion of that 2013 PAG.Manual.

For more information about the proposal, see:

https://www.epa.gov/radiation/protective-action-guides-pags

To: Veal, Lee[Veal.Lee@epa.gov]
From: Hale, Olin
Sent: Tue 6/7/2016 4:00:59 PM
Subject: RE: EPA PAG Update to the FRPCC Strategic Plan

Good Morning Lee,

Just checking in to see if you have any good news!

Very Best,

Olin

Olin T. Hale|– DHS - FEMA
1800 S. Bell St, Arlington, VA| 202-341-8643 **Cell** |

olin.hale@fema.dhs.gov

From: Veal, Lee [mailto:Veal.Lee@epa.gov]
Sent: Monday, June 06, 2016 2:49 PM
To: Hale, Olin
Subject: RE: EPA PAG Update to the FRPCC Strategic Plan

Hi Olin,

Sara is still out on leave. Good for her!

This language is correct. I will have one addition after today. I'm told that we may have news!

Ask me again in the morning if you would.

Lee

Lee Ann B. Veal

Acting Deputy Director, Radiation Protection Division

Office of Radiation and Indoor Air

Office: 202-343-9448; Cell: 202-617-4322

www.epa.gov/radiation

From: Hale, Olin [mailto:olin.hale@fema.dhs.gov]
Sent: Monday, June 06, 2016 2:20 PM
To: Veal, Lee <Veal.Lee@epa.gov>
Subject: EPA PAG Update to the FRPCC Strategic Plan

Good Afternoon Lee,

If you don't mind we would like to update the EPA PAG project for the 2016 FRPCC Strategic Plan and wondered (if you had time) to look over the information we have below?

I hope it is no bother: I also didn't want to pester Sara as I wasn't sure if she was back to work yet.

It was great working with you on The Mountain, I look forward to doing so again!

Best Regards,

Olin

Initiative #3: Protective Action Guides (PAGs) Implementation.

-

Purpose:

- Implement the revised PAGs, including key items such as dosimetry guidance, FDA guidelines, late-phase recovery guidance, and a general update of current information through an inter-agency collaborative effort.

Goals/Objectives:

- Assist public officials in planning the emergency response to radiological incidents; and

- Provide radiological protection criteria for application to all incidents that would require consideration of protective actions.

-

Performance Metrics:

- The metrics for the project include: Federal Register Notice (FRN) comment adjudication, and final PAG Manual with outreach and training. Publication and implementation of the revised PAGs constitutes performance goal achievement.

-

Key Milestones/Timeline:

- Due to the collaborative nature of such a large partnership process, timelines are approximate. The current best estimate is for a November 2016 final FRN for the final revised PAGs.

-

Lead FRPCC Subcommittee: Protective Action Guides

-

Subcommittee Chair Agency: Environmental Protection Agency (EPA)

Subcommittee Member Agencies: DHHS/ASPR, CDC, Department of Defense (DoD), DOE/NNSA, FEMA, FDA, NRC, Occupational Safety and Health Administration (OSHA), USDA

Olin

Olin T. Hale, PPS

Professional Services and Integration
Technological Hazards Division
Federal Emergency Management Agency
U.S. Department of Homeland Security
202.341.8643

email: olin.hale@fema.dhs.gov

To: Perrin, Alan[Perrin.Alan@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]; Snead, Kathryn[Snead.Kathryn@epa.gov]; Ferguson, Rafaela[Ferguson.Rafaela@epa.gov]; Nesky, Anthony[Nesky.Tony@epa.gov]
Cc: Aquino, Marcos[Aquino.Marcos@epa.gov]; BANDROWSKI, MIKE[Bandrowski.Mike@epa.gov]; Barnette, Jack[Barnette.Jack@epa.gov]; Brozowski, George[brozowski.george@epa.gov]; Cooper, Artra[Cooper.Artra@epa.gov]; Debonis, Michael[Debonis.Michael@epa.gov]; DeCair, Sara[DeCair.Sara@epa.gov]; Freed, Rachel[freed.rachel@epa.gov]; Generette, Lloyd[Generette.Lloyd@epa.gov]; Giardina, Paul[Giardina.Paul@epa.gov]; Honnellio, Anthony[Honnellio.Anthony@epa.gov]; Hooper, Charles A.[Hooper.CharlesA@epa.gov]; Johnson, Jeremy[Johnson.Jeremy@epa.gov]; Koehler, Larainne[Koehler.Larainne@epa.gov]; Mosser, Jennifer[Mosser.Jennifer@epa.gov]; Murphy, Michael[murphy.michael@epa.gov]; Poppell, Sam W.[Poppell.Sam@epa.gov]; Povetko, Oleg[Povetko.Oleg@epa.gov]; Richards, Jon M.[Richards.Jon@epa.gov]; Schulingkamp, Cristina[schulingkamp.cristina@epa.gov]; Sells, Mark D.[Sells.Mark@epa.gov]; Zhen, Davis[Zhen.Davis@epa.gov]
From: Brozowski, George
Sent: Mon 6/6/2016 9:24:49 PM
Subject: Planned Announcement Monday Proposed Radiation PAG
2016-0603 Water PAGS Announcement.docx

Good afternoon, and on behalf of Sara DeCair, we would like to share the good news of the release of the water PAGs.

Check out the information below along with the attached document.

Thanks and take care!

George P. Brozowski

Regional Health Physicist/Radon Coordinator

US EPA – R6

1445 Ross Avenue

Mail Stop - 6MM-XU

Dallas, TX 75202

214-665-8541 o

214-755-1530 c

From: Eric Burneson – 6/3/16 5:17 PM

To: Regions

Cc:

Subject: Planned Announcement Monday Proposed Radiation PAG

On Monday, June 6 EPA will be "rolling out" our proposed Drinking Water Protective

Action Guide for Radiologic Incidents. During a radiological emergency, radioactive material could be released into the rivers, lakes, and streams used by public water suppliers. EPA is proposing non-regulatory guidance that authorities can use to protect residents from experiencing the harmful effects from radiation in drinking water following an emergency. EPA will be seeking public comment on the proposed Protective Action Guide (PAG) for Radiological Incidents for up to 45 days following publication in the Federal Register.

The purpose of EPA's Protective Active Guide (PAG) for Radiological Incidents is to guide the first year of planning and decision-making efforts by local and state officials. It is not intended for long-term or everyday use. The proposed PAG does not affect EPA's drinking water standards for radionuclides. Therefore, affected public water systems are expected to take actions to return to compliance with drinking water standards after a radiological emergency as soon as practicable.

Attached for your information is the "rollout document" that will guide our communications with the public on this proposal. Please note that the attached document is not for external distribution.

The pre-Federal Register version of the proposed water PAG is live on our website. The link, which appears in the Federal Register, is:

https://www.epa.gov/radiation/protective-action-guides-pags

Please contact Tony Nesky - Center for Radiation Information and Outreach – if you have any questions. His phone number is 202-343-9597 and email nesky.tony@epa.gov

PROTECTIVE ACTION GUIDES AND PLANNING GUIDANCE FOR RADIOLOGICAL INCIDENTS

ANTICIPATED RELEASE DATE: Monday, June 6

ACTION: EPA is seeking public comment on a proposed protective action guide (PAG) for drinking water following a radiological incident. The drinking water PAG is an addition to the revised draft 2013 PAG Manual – *Protective Action Guides and Planning Guidance for Radiological Incidents*.

ANTICIPATED REACTION

In response to a previous proposal, anti-nuclear and environmental groups publicized misleading comparisons of derived water PAG concentrations alongside MCL concentrations. For some radionuclides, the resulting difference in concentration was several thousand times higher, and there were accusations that the SDWA was being weakened. This tactic is likely to be repeated or even intensified.

State radiation control programs, nuclear power plant response communities, and the American Water Works Association (AWWA) have asked EPA for a drinking water PAG for emergencies. Comments submitted on the 2013 PAG Manual from many states, the AWWA, Health Physics Society, Nuclear Energy Institute and Conference of Radiation Control Program Directors specifically request a drinking water PAG.

MATERIALS

- Desk statement
- Fact sheet
- Roll Out Schedule
- Stakeholder notification list
- Social media
- Internal question and answer
- External question and answer

DESK STATEMENT

EPA Seeks Public Comment on Proposed Protective Action Guides and Planning Guidance for Radiological Incidents

During a radiological emergency, radioactive material could be released into the rivers, lakes, and streams used by public water suppliers. EPA is proposing non-regulatory guidance that authorities can use to protect residents from experiencing the harmful effects from radiation in drinking water following an emergency. EPA is seeking public comment on the proposed *Protective Action Guide (PAG) for Radiological Incidents* for up to 45 days following publication in the Federal Register.

Additional Background:
The purpose of EPA's Protective Active Guide (PAG) for Radiological Incidents is to guide the first year of planning and decision-making efforts by local and state officials. It is not intended for long-term or everyday use. The proposed PAG does not affect EPA's drinking water standards for radionuclides. Therefore, affected public water systems are expected to take actions to return to compliance with drinking water standards after a radiological emergency as soon as practicable.

EPA is proposing a two-tiered approach to address the people at the most sensitive life stage and to address the general population. The tiered approach may help officials prioritize potentially scarce water resources for those most at risk in a disaster response.

ED_001057_00022137

The proposed PAGs are developed for up to one year of exposure. In comparison, the Maximum Contaminant Levels (MCL) were developed assuming 70 years of continuous exposure. The PAGs are intended to 1) prevent short-term health effects, 2) balance protection with other important factors that may arise during an emergency (ensuring the actions result in more benefit than harm) and 3) reduce the potential for longer-term health effects. In considering these key principles, the EPA is proposing drinking water PAGs of:

- 500 mrem projected dose, for one year, to the general population
- 100 mrem projected, for one year, to the most sensitive populations (e.g. infants, children, pregnant women and nursing women)

More information on proposed action and how to submit public comments:
http://www.epa.gov/radiation/protective-action-guides-pags.

BACKGROUND

The U.S. EPA published the previous PAG Manual, entitled "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (EPA-400-R-92-001, May 1992), in 1992. In March 2013, EPA published an updated version of the document.

During Fukushima nuclear power plant incident, the Agency had to develop drinking water guidance for U.S. citizens who might have been exposed to contamination from the incident. Since then, EPA has identified an emergency drinking water PAG as a priority. EPA recognized that a short-term emergency drinking water guide may be useful for public health protection and sought the public's input on the appropriateness of, and possible values for, an intermediate phase emergency drinking water PAG.

EPA is proposing a two-tiered drinking water PAG of 500 mrem-projected dose in the first year for the general population, and a stricter limit for people at more sensitive life stages -- 100 mrem projected dose in the first year for infants, children, pregnant women and nursing mothers. During the early Fukushima response, Japan used a very similar set of guides: about 100 mrem for infants on formula and about 400 mrem for everyone else. This helped Japanese officials prioritize the distribution of bottled water.

The proposed drinking water PAG was developed in consideration of several key factors, including existing radiation protection standards, the drinking water MCLs for radionuclides, excess health risks associated with the radiation doses identified in the draft 2013 PAG Manual, and standards that have been set in response to previous radiological incidents. The proposed adult drinking water PAG of 500 mrem is consistent with both the FDA food PAG of 500 mrem and the 500-mrem one-year whole body dose guide for drinking water established by the Department of Homeland Security.

ROLLOUT SCHEDULE

-2 Days prior to Release

- Email to Regional branch chiefs and relevant regional staff

-1 Day prior of Release

- Congressional notifications (Confirm with Cathy Davis)

ED_001057_00022137

Day Of	
Morning	Phone calls and email to stakeholders (Stakeholder Notification List below)
12:30 p.m.	Web content goes live
1:00 p.m.	Post social media
	Broad stakeholder notification via Water Headlines

STAKEHOLDER NOTIFICATION LIST

Communication by: Peter Grevatt, Director of Office of Ground Water and Drinking Water

- Michael Deane, Director, National Association of Water Companies
- Tracy Mehan, Government Affairs Director, American Water Works Association (AWWA)
- Mike Paque, Executive Director, Groundwater Protection Council
- Jim Taft, Executive Director, Association of State Drinking Water Administrators (ASDWA)
- Lynn Thorp, National Campaigns Director, Clean Water Action
- Diane Van de Hei, Executive Director, Association of Metropolitan Water Agencies
- Sam Wade, Executive Director, National Rural Water Association
- Mae Wu, Natural Resources Defense Council (NRDC)

Communication by: Office of Air and Radiation

- Nuclear Energy Institute (NEI)
- Committee to Bridge the Gap
- National Alliance for Radiation Readiness (NARR)

SOCIAL MEDIA

WATER HEADLINES

EPA Proposes Protective Action Guide for Drinking Water Following a Radiological Incident

During a radiological emergency, such as an accident at a nuclear power plant, radioactive material can be released into the environment. This radioactive material could get into rivers, lakes and streams that are used by public water suppliers to deliver drinking water to residents of towns and cities. EPA is proposing a non-regulatory Protective Action Guide (PAG) to help officials determine the best way to prevent the public from experiencing the harmful effects from radiation in drinking water during an emergency. Read more

TWITTER

EPA is seeking public comment on a proposed Protective Action Guide for drinking water following a radiological incident. Read more.

INTERNAL QUESTIONS & ANSWERS

Why is there a need for a drinking water PAG when EPA already has regulations for radionuclides in drinking water?

Under the Safe Drinking Water Act (SDWA), the Agency established a dose-based Maximum Contaminant Level (MCL) for beta particle and photon (gamma) radioactivity of 4 mrem/yr; based on lifetime exposure criteria, which assume 70 years of continued exposure to contaminants in drinking water.

The Agency determined that it may not be possible to base response measures during short-term emergency incidents on lifetime exposure criteria. While the SDWA framework is appropriate for normal operations, it does not provide the necessary tools to assist emergency responders with determining the need for an immediate

ED_001057_00022137

protective action (e.g., do not drink orders). The goal is to prioritize potentially scarce water resources for those most at risk in a disaster response.

Regardless of the cause of an incident, EPA expects that any drinking water system impacted during a radiation incident will take action as soon as practicable to return to compliance with the SDWA levels as soon as practical.

Will the drinking water PAG weaken EPA's regulations for radionuclides in drinking water?
No. The drinking water PAG is non-regulatory guidance for emergencies only. Public water systems must comply with EPA's National Primary Drinking Water Regulations for Radionuclides. Water systems are expected to take corrective measures to meet radionuclide standards as soon as practicable.

Why is there a different guidance for pregnant women and children versus adults?
EPA proposes a lower dose threshold for sensitive ages because fetuses, infants, and children are at greater risk from radiological exposures than adults. This is due to two reasons. First, their cells in their growing bodies develop at such a rapid pace, making them more sensitive to the potential harmful effects of radiation. Second, they have more time to be affected by longer-lived radionuclides that clear slowly from the body; a newborn that ingests radioactive material in water might be subject to the effects of that radiation for a longer period of time than an adult.

Did EPA consider any information from other countries when developing the drinking water PAG?
Yes. Japan used a very similar set of guides for infants on formula (near 100 mrem) and near 400 mrem for everyone else. This helped them prioritize the use of bottled water for the most sensitive population.

FDA already mentions water in their Food PAG guidance. Why did EPA just propose a new drinking water guidance?
EPA's authorities are separate from FDA's. Whereas the FDA food PAG is relevant for food, EPA's drinking water PAG accounts for possible contamination in the drinking water supply. The water and food ingestion routes are inherently related because water may be used in the preparation of some food products and radionuclides in water will affect crops and ultimately enter the food supply. However, a strict delineation between the water and food ingestion routes is not straightforward and there are inherent differences in how the food and water supplies are protected. As a result, the intervention/response levels for water and food differ. Once an event occurs and the actual contamination levels are known, incident-specific factors might be used.

A main difference between the FDA Food PAG and EPA's Drinking Water PAG is in the technical approach, in that the EPA PAG is based on newer definitions of dosimetry. There is no difference in protection because the underlying objective for both PAGs is to assure individuals will have no significant health risk from ingesting radioactive contamination.

In addition, because drinking water is usually locally controlled and food is frequently shipped in from distant locations, different and separate interdiction approaches would be appropriate. Finally, as explained in the revised interim PAG manual (2013), the various PAGs are designed to work in concert, allowing emergency responders to choose the exposure reduction strategies that match the exposure scenario, community needs, and resources available in the particular emergency.

Since FDA and EPA each has a PAG of 500 mrem, is it possible for someone to get 500 mrem from food AND 500 mrem from water?

ED_001057_00022137

It is unlikely that someone would get 500 mrem from food and 500 mrem from drinking water. Two PAGs were established because FDA's and EPA's authorities are separate but the two Agencies work closely in radiological response and recovery planning. Therefore, the 500 mrem PAG is not anticipated to be reached whether via food, water, or both.

Why is there a big difference in guidance for 15-year olds compared to 16-year olds? If my child just turned 16, I can't understand why he would be different from a 15-year old.
EPA evaluated risk to adults and risks to the most sensitive populations resulting from exposure to radiation from drinking water. EPA evaluated six different age groups, including infants, 1, 5, 10, 15-year olds and adults. The adult age group is representative of organ size and intake rates for people from age 16 up. While the difference in actual incurred dose between people age 15 to age 16 are minimal, it is important to identify a clear life stage for risk communication and risk management purposes

The PAGs provide guidance using the best science available but the PAGs also give local responders the flexibility to decide whether protective actions should be extended to age groups other than those prescribed in the proposed drinking water PAG. Decisions to extend the protective actions to anyone under age 18 or apply a single number to an entire population, would be based on the particular conditions of each incident and would also consider how such actions are implemented by local responders.

I am pregnant and I don't feel like my unborn baby should be placed in the same category as a child at age 15. Did EPA consider a separate guidance for pregnant women?
Yes. EPA evaluated the different age groups for the radionuclides most likely to be released in a radiation incident and selected the most limiting concentration that would result in a 100 mrem annual dose. This lower tier PAG applies to pregnant women to protect the fetus. This approach is conservative and protective of all sensitive populations (i.e., infants, 1, 5, and 10 year olds). In fact, the most sensitive age group based on our evaluation is often the 5 year old or the 15 year old, depending on the nuclide. This is primarily because of intake rates.

What about nursing mothers?
To protect nursing infants and young children, the lower tier PAG applies to nursing mothers as well.

Why wouldn't my water department give me bottled water immediately following a radiation event?
The EPA drinking water PAG is non-regulatory guidance to assist emergency management officials when making response plans. Options available to your water department for providing an alternate source of drinking water could include: bottled water, altering the source water (such as switching to ground water), interconnection between systems, or a combination of these actions.

How does the EPA drinking water PAG for adults and infants compare to the drinking water emergency standards for adults and infants established by the Japanese government?
The Japanese adult drinking water emergency standard of 300 Bq/L corresponds to a dose of about 1 mrem/day, or 365 mrem over the course of a year (on the same order of magnitude as EPA's proposed PAG for the adult population), assuming a high-end default water ingestion rate of 2 L/day. Using the Japanese infant drinking water emergency standard of 100 Bq/L, from birth until the age of 1, and an infant consumes an average of 0.2 L/day over the course of the year, the projected dose is 134 mrem in a year.

What about the total dose I might incur if this water PAG is established? Or, what happens from a cumulative risk perspective?

ED_001057_00022137

In developing the drinking water PAG, we did consider the potential for cumulative exposure. PAGs do not represent "acceptable" routine exposures in the way that environmental standards such as MCLs do. PAGs are guidance levels to support emergency decision making by response authorities to avoid unnecessary radiation exposure. Development and implementation of PAGs are always guided by three basic principles: Avoid acute effects, minimize cancer risk, and ensure the actions taken are not more dangerous than the risk being avoided. While the PAGs for various media/pathways are separate, emergency management officials must consider all exposure routes when making protective action decisions in an emergency.

Local decision makers will need to determine the appropriate PAGs depending on projected risk. For the PAGs, exposure routes are divided up by time and circumstance to allow the many different potential protective actions to be tailored to the specific risks that must be addressed. The full PAG Manual addresses all of the other pathways (plume inhalation, immersion, ground shine, skin and thyroid doses in particular, long term exposure to contamination, reentry and return to complete cleanup work, etc.) but always within parameters appropriate to a corresponding PAG.

Did any of the public commenters suggest the Agency go with more MCL or CERCLA type levels? Did any states comment and what were their comments?

EPA received a broad range of comments on the drinking water PAG. All of the comments are available on Regulations.Gov. Several States did comment (CA, OH, PA, MN, WA, IL, KS, NH), as well as two local boards (located in CA and OH) and multi-state organizations (Conference of Radiation Control Program Officers and Association of State and Territorial Solid Waste Management Officials). Two of the State/governmental board comments supported using the NPDWR 4 mrem/year standard and the remaining 10 State/governmental organization commenters supported establishing a separate drinking water PAG (various approaches). The two commenters who indicated a preference for using the NPDWR MCL were the CA Office of Emergency Services and the San Onofre Nuclear Generating Station Interjurisdictional Planning Committee. It is important to note that PAGs do not in any way change the applicability of the NPDWR for radionuclides to drinking water utilities. Any exceedance of the maximum contaminant level, even in an emergency, is a violation and utilities must return to compliance with the NPDWR MCLs as soon as practical. In addition, the utility must notify customers that they are in violation. Those provisions are not impacted by establishing a drinking water PAG.

Did EPA use the same methodology to derive childrens values for a radionuclides PAG and for the cyanotoxin Health Advisories?

No, radionuclides are different from most other toxins in that they may cause damage (cancer) by delivering a dose of radiation when they decay in the body as opposed to chemical reaction with the body's tissue. Therefore, EPA does not use standard risk characterization methodologies such as those used for the cyanotoxin Health Advisories. Instead, EPA in 1999 developed a special methodology for evaluating cancer risks entitled EPA's Federal Guidance Report 13, Cancer Risk Coefficients for Environmental Exposures to Radionuclides (EPA 402-C-99-001, Rev. 1). EPA used FGR 13 methodology to estimate the concentration of various radionuclides that would deliver a radiation dose of 100 mrem. EPA also used FGR 13 to determine which age groups require the lowest concentration of radionuclides to limit their dose to less than 100 mrem and concluded that children age 15 and younger required lower concentrations than older age groups.

ED_001057_00022137

EXTERNAL QUESTIONS & ANSWERS (for use on EPA's website or a fact sheet)

ALL AUDIENCES

What is a drinking water PAG?
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.

How can I submit comments on this proposal?
EPA welcomes written comments on the proposed drinking water PAG. The public will have 45 days to submit comments on this proposal starting the day of its publication in the Federal Register. Be sure to identify your submission by Docket ID Number. EPA-HQ-OAR-2008-0268. You can submit comments on-line, by email, by regular mail, or in–person. Detailed instructions for submission of comments are in the Federal Register notice.

How does the drinking water PAG work with EPA's existing Safe Drinking Water Act regulations?
The drinking water PAG is non-regulatory guidance for emergency situations only. Immediately following a radiological incident, community water systems must return to compliance with EPA's Radionuclides Rule[1]. Public water suppliers will be required to take corrective measures to meet radionuclide standards as soon as practicable.

CONSUMERS

How will my children and I be protected during a radiological emergency?

- Emergency responders, state and local authorities have emergency plans in place to protect public health by helping individuals avoid doses of radiation.
- State or local government officials will take reasonable precautionary measures to protect water supplies as soon as they are aware of the radiological incident.
- Public water suppliers are expected to be in close communication with their state/local officials.
- The drinking water PAG can be used to inform decisions about continued use of contaminated water for drinking purposes and to inform decisions to provide alternative drinking water for the affected community.

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 emgergincy. The 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

[1] For more information about EPA's regulations for radionuclides in drinking water, refer to the Radionuclides Rule: A Quick Reference Guide: http://water.epa.gov/lawsregs/rulesregs/sdwa/radionuclides/upload/2009_04_16_radionuclides_qrg_radionuclides.pdf

ED_001057_00022137

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 bottled water to the community.

INDUSTRY

What actions could water systems take to protect the public from contaminated water?
Before an emergency occurs, develop a radiological emergency operations plan that is utility-specific. Advance planning can provide clarity and facilitate the decision-making process. Guidance on developing emergency drinking water supplies[2] is available from EPA.
During an emergency, public drinking water systems can:

- Treat contaminated water
- Establish interconnections to neighboring systems
- Blend water sources
- Work with state or local government authorities to provide water in tanker trucks and/or bottled water

During an emergency, when and how should water systems sample for radionuclides?
After a radiological release, drinking water systems should collect samples for analysis as soon as it is safe to do so and for several weeks following the event, as needed. EPA has rapid analytical methods[3] (non-regulatory) for detecting particular radionuclides in water. EPA approved methods must be used for analysis when complying with the NPDWRs for radionuclides.

What are the radionuclides that are likely to be detected in drinking water following a radiological incident?
The radionuclides that could contaminate water will depend on the type of incident. There are specific radionuclides, such as cesium-137, iodine-131, yttrium-90 and strontium-90, which are of particular interest for radiological releases from nuclear power plants. Different radionuclides can be associated with other incidents that involve a radiological dispersal device (RDD) or improvised nuclear device (IND). For additional information on the types of radionuclides associated with various types of radiological incidents please visit: http://www.remm.nlm.gov/typesofevents.htm.

[2] Refer to EPA. *Planning for an Emergency Drinking Water Supply,* EPA 600/R-11/054, June 2011
[3] The rapid analysis methods can be located at http://www.epa.gov/narel/rapid_methods.html

ED_001057_00022137

To: Veal, Lee[Veal.Lee@epa.gov]
From: Nesky, Anthony
Sent: Mon 6/6/2016 7:36:37 PM
Subject: Note to Stakeholders on Water PAG

Dear Lee:

What do you think of the following note to the stakeholders:

SUBJECT: EPA to seek comment on proposed Protective Action Guide (PAG) for Drinking Water

EPA Seeks Comment on Proposed Drinking Water Protective Action Guide (PAG) and Planning Guidance for Radiological Incidents
Public comments will be due 45 days after publication in the Federal Register.

During a radiological emergency, radioactive material could be released into the rivers, lakes, and streams used by public water suppliers. EPA is proposing non-regulatory guidance that authorities can use to protect residents from experiencing the harmful effects from radiation in drinking water following an emergency. EPA is seeking public comment on the proposed drinking water *Protective Action Guide (PAG) for Radiological Incidents* for up to 45 days following publication in the Federal Register.

The purpose of EPA's Protective Active Guide (PAG) for Radiological Incidents is to guide planning and decision-making efforts by local and state officials. It is not intended for long-term or everyday use. The proposed PAG does not affect EPA's drinking water standards for radionuclides. Therefore, affected public water systems are expected to take actions to return to compliance with drinking water standards after a radiological emergency as soon as practicable.

Pre-publication versions of the "Draft Protective Guide (PAG) for Drinking Water" and the "Notice of Availability" are available on our website now.

https://www.epa.gov/radiation/protective-action-guides-pags

Once the official version of this document is published in the Federal Register pre-publication versions will be removed from the Internet and replaced with a link to the official versions.

Tony Nesky

Center for Radiation Information and Outreach

Tel: 202-343-9597

nesky.tony@epa.gov

To: Veal, Lee[Veal.Lee@epa.gov]
From: Hale, Olin
Sent: Mon 6/6/2016 7:14:08 PM
Subject: RE: EPA PAG Update to the FRPCC Strategic Plan

Good Afternoon Lee,

Ex. 6 - Personal Privacy

I will drop you a note in the morning, thank you so much for your quick reply.

Olin

Olin T. Hale|– DHS - FEMA
1800 S. Bell St, Arlington, VA| 202-341-8643 **Cell** |

olin.hale@fema.dhs.gov

From: Veal, Lee [mailto:Veal.Lee@epa.gov]
Sent: Monday, June 06, 2016 2:49 PM
To: Hale, Olin
Subject: RE: EPA PAG Update to the FRPCC Strategic Plan

Hi Olin,

Ex. 6 - Personal Privacy

This language is correct. I will have one addition after today. I'm told that we may have news!

Ask me again in the morning if you would.

Lee

Lee Ann B. Veal

Acting Deputy Director, Radiation Protection Division

Office of Radiation and Indoor Air

Office: 202-343-9448; Cell: 202-617-4322

www.epa.gov/radiation

From: Hale, Olin [mailto:olin.hale@fema.dhs.gov]
Sent: Monday, June 06, 2016 2:20 PM
To: Veal, Lee <Veal.Lee@epa.gov>
Subject: EPA PAG Update to the FRPCC Strategic Plan

Good Afternoon Lee,

If you don't mind we would like to update the EPA PAG project for the 2016 FRPCC Strategic Plan and wondered (if you had time) to look over the information we have below?

I hope it is no bother: I also didn't want to pester Sara as I wasn't sure if she was back to work yet.

It was great working with you on The Mountain, I look forward to doing so again!

Best Regards,

Olin

Initiative #3: Protective Action Guides (PAGs) Implementation.

-

Purpose:

- Implement the revised PAGs, including key items such as dosimetry guidance, FDA guidelines, late-phase recovery guidance, and a general update of current information through an inter-agency collaborative effort.

Goals/Objectives:

- Assist public officials in planning the emergency response to radiological incidents; and

- Provide radiological protection criteria for application to all incidents that would require consideration of protective actions.

-

Performance Metrics:

- The metrics for the project include: Federal Register Notice (FRN) comment adjudication, and final PAG Manual with outreach and training. Publication and implementation of the revised PAGs constitutes performance goal achievement.

-

Key Milestones/Timeline:

- Due to the collaborative nature of such a large partnership process, timelines are approximate. The current best estimate is for a November 2016 final FRN for the final revised PAGs.

-

Lead FRPCC Subcommittee: Protective Action Guides

-

Subcommittee Chair Agency: Environmental Protection Agency (EPA)

Subcommittee Member Agencies: DHHS/ASPR, CDC, Department of Defense (DoD), DOE/NNSA, FEMA, FDA, NRC, Occupational Safety and Health Administration (OSHA), USDA

Olin

Olin T. Hale, PPS

Professional Services and Integration
Technological Hazards Division
Federal Emergency Management Agency
U.S. Department of Homeland Security
202.341.8643

email: olin.hale@fema.dhs.gov

To: Hill, Glynis[Hill.Glynis@epa.gov]
Cc: Veal, Lee[Veal.Lee@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]
From: DeCair, Sara
Sent: Mon 5/23/2016 2:14:42 PM
Subject: OMB: full PAG Manual

Link below is the full Manual, rec'd on 5/19. The link doesn't tell us much about the Interagency review. I can ask Trish at NRC if they've seen it go out from Vlad.

S.

From: Hill, Glynis
Sent: Monday, May 23, 2016 10:00 AM
To: DeCair, Sara
Subject: RE: Briefing on full PAG Manual

http://www.reginfo.gov/public/do/eoDetails?rrid=126354 This is the link to the document that appears; however Im not sure if this the DW one or the Full Manual.

Pending EO 12866 Regulatory Review - reginfo.gov

Glynis Hill – Environmental Scientist | Office of the Administrator | Office of Policy | Office of Regulatory Policy & Management

(202) 564-1139 | 3512V WJC North | Mail Code 1803 | 1200 Pennsylvania Avenue, NW | Washington, DC 20460

From: DeCair, Sara
Sent: Monday, May 23, 2016 9:52 AM
To: Hill, Glynis <Hill.Glynis@epa.gov>
Subject: Re: Briefing on full PAG Manual

Help? I'm not sure where to look.

From: Hill, Glynis
Sent: Monday, May 23, 2016 9:48 AM
To: Veal, Lee; DeCair, Sara
Cc: Perrin, Alan
Subject: RE: Briefing on full PAG Manual

You can check the OMB website to see if the documents were sent out to Federal agencies.

Glynis Hill – Environmental Scientist | Office of the Administrator | Office of Policy | Office of Regulatory Policy & Management

(202) 564-1139 | 3512V WJC North | Mail Code 1803 | 1200 Pennsylvania Avenue, NW | Washington, DC 20460

From: Veal, Lee
Sent: Monday, May 23, 2016 9:37 AM
To: DeCair, Sara <DeCair.Sara@epa.gov>; Hill, Glynis <Hill.Glynis@epa.gov>
Cc: Perrin, Alan <Perrin.Alan@epa.gov>
Subject: RE: Briefing on full PAG Manual

Good morning,

Ex. 5 - Deliberative Process

Lee

Lee Ann B. Veal

Acting Deputy Director, Radiation Protection Division

Office of Radiation and Indoor Air

Office: 202-343-9448; Cell: 202-617-4322

www.epa.gov/radiation

From: DeCair, Sara
Sent: Thursday, May 19, 2016 5:03 PM
To: Dorjets, Vlad <Vladik_Dorjets@omb.eop.gov>
Cc: Hill, Glynis <Hill.Glynis@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; Veal, Lee <Veal.Lee@epa.gov>
Subject: RE: Briefing on full PAG Manual

That seems odd, here is a copy.

From: Dorjets, Vlad [mailto:Vladik_Dorjets@omb.eop.gov]
Sent: Thursday, May 19, 2016 4:51 PM
To: DeCair, Sara <DeCair.Sara@epa.gov>
Cc: Hill, Glynis <Hill.Glynis@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; Veal, Lee <Veal.Lee@epa.gov>
Subject: RE: Briefing on full PAG Manual

Ex. 5 - Deliberative Process

From: DeCair, Sara [mailto:DeCair.Sara@epa.gov]
Sent: Thursday, May 19, 2016 4:30 PM
To: Dorjets, Vlad <Vladik_Dorjets@omb.eop.gov>
Cc: Hill, Glynis <Hill.Glynis@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; Veal, Lee <Veal.Lee@epa.gov>
Subject: RE: Briefing on full PAG Manual

Vlad, here is a brief summary:

Ex. 5 - Deliberative Process

Thanks,

Sara

From: Dorjets, Vlad [mailto:Vladik_Dorjets@omb.eop.gov]
Sent: Thursday, May 19, 2016 3:10 PM
To: DeCair, Sara <DeCair.Sara@epa.gov>
Cc: Hill, Glynis <Hill.Glynis@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; Veal, Lee <Veal.Lee@epa.gov>
Subject: RE: Briefing on full PAG Manual
Importance: High

Sara,

Ex. 5 - Deliberative Process

Vlad

From: DeCair, Sara [mailto:DeCair.Sara@epa.gov]
Sent: Thursday, May 19, 2016 2:21 PM
To: Dorjets, Vlad <Vladik_Dorjets@omb.eop.gov>
Cc: Hill, Glynis <Hill.Glynis@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; Veal, Lee <Veal.Lee@epa.gov>
Subject: RE: Briefing on full PAG Manual

Vlad,

No worries. We have availability between 8:30 and 11:00 am, or between 3:30 and 5:30 pm on Tuesday, May 31st. Just let us know,

Sara

From: Dorjets, Vlad [mailto:Vladik_Dorjets@omb.eop.gov]
Sent: Thursday, May 19, 2016 12:13 PM
To: DeCair, Sara <DeCair.Sara@epa.gov>
Cc: Hill, Glynis <Hill.Glynis@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; Veal, Lee <Veal.Lee@epa.gov>
Subject: RE: Briefing on full PAG Manual

Sara,

Thanks for agreeing to provide a briefing. I imagine that it would not only be very informative but also yield a much more efficient review. Unfortunately, I'll be out of town on training all of next week (an EPA NPDES Permit Writing Workshop) so would prefer to push the briefing to the following week. Could you let me know if any days and times work that week?

Thanks,

Vlad

From: DeCair, Sara [mailto:DeCair.Sara@epa.gov]
Sent: Thursday, May 19, 2016 11:48 AM
To: Dorjets, Vlad <Vladik_Dorjets@omb.eop.gov>
Cc: Hill, Glynis <Hill.Glynis@epa.gov>; Perrin, Alan <Perrin.Alan@epa.gov>; Veal, Lee <Veal.Lee@epa.gov>
Subject: Briefing on full PAG Manual

Vlad,

Glynis tells me that you'd like a briefing on the full PAG Manual, since you weren't involved with the process of getting it out for comment in 2013. We would suggest a phone briefing where I can walk through the changes we made based on public comments, and show you how much of the Manual has stayed the same. It can be organized as a front to back walk through of the chapters as we have them laid out now.

I can set up a conference line for us once you let us know which of the dates/times here might work best. I anticipate that my Division Director, Alan, and also Glynis would want to participate as well. Will you let me know if any of the times below would work for you? Thank you!

May 24th, Tuesday: 9 am, 10 am or 4 pm.

May 25th, Wednesday: 8 or 9 am.

May 26th, Thursday: 4 pm.

Sara D. DeCair

>>>http://www.epa.gov/radiation/rert/pags.html<<<;;

202-343-9108

Room 1416 B in WJC West

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

This page intentionally left blank.

ED_001057_00022178

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.

ED_001057_00022178

This page intentionally left blank.

ED_001057_00022178

TABLE OF CONTENTS

LIMITS ON SCOPE iii

TABLE OF CONTENTS v

LIST OF TABLES viii

LIST OF FIGURES ix

CHAPTER 1. OVERVIEW 10

1.1 PLANNING GUIDANCE AND PROTECTIVE ACTION GUIDES 10
1.2 APPLICABILITY 10
1.3 BACKGROUND ON THE UPDATED PAGS 11
1.3.1 Legal Basis 11
1.3.2 Interaction with Federal Radiation Council (FRC) Reports No. 5 and 7 12
1.3.3 Technical Basis 12
1.3.4 Changes in Scenarios since the Issuance of the 1992 PAG Manual 12
1.3.5 Key Changes to PAGs in this Updated Manual 13
1.4 RADIOLOGICAL INCIDENT PHASES AND APPLICABILITY OF PROTECTIVE ACTIONS 14
1.4.1 Implementation of Protective Action Guides and Protective Actions 16
1.4.2 Early Phase Protective Action Guides and Protective Actions 16
1.4.3 Intermediate Phase Protective Action Guides and Protective Actions 17
1.4.4 Late Phase 18
1.4.5 Conservatism built into the PAGs 19
KEY POINTS IN CHAPTER 1 – OVERVIEW 20

CHAPTER 2. EARLY PHASE PROTECTIVE ACTION GUIDES 21

2.1 EXPOSURE PATHWAYS DURING THE EARLY PHASE 21
2.1.1 Exposure Pathways from Airborne Releases 21
2.1.2 Establishment of Exposure Patterns 22
2.2 THE PROTECTIVE ACTION GUIDES AND PROTECTIVE ACTIONS FOR THE EARLY PHASE: EVACUATION, SHELTERING-IN-PLACE AND ADMINISTRATION OF POTASSIUM IODIDE 23
2.2.1 Thyroid Based Evacuation 23
2.2.2 Evacuation vs. Sheltering-in-Place 24
2.2.3 Considerations for Potassium Iodide (KI) 28
2.2.4 PAGs and Nuclear Facilities Emergency Planning Zones (EPZ) 30
2.3 DOSE PROJECTIONS 31
2.3.1 Dose Projection during the Early Phase 31
2.3.2 Duration of Exposure 32
2.3.3 Derived Response Levels and Dose Parameters 33
2.3.4 Higher PAGs for Special Circumstances 33
2.4 CONTAMINATION LEVELS AND MONITORING OF THE ENVIRONMENT AND POPULATIONS 34
2.4.1 Surface Contamination Control 34
2.4.2 Priorities for Control of Contaminated Areas 35
2.4.3 Recommendations for Emergency Screening in Areas Not Qualifying as Low Background Areas 36

ED_001057_00022178

2.4.4 Recommendations for Screening in Low Background Areas 36
2.5 BASIS FOR EARLY PHASE PAGS 37
KEY POINTS IN CHAPTER 2 – EARLY PHASE 40

CHAPTER 3. EMERGENCY WORKER PROTECTION 41
3.1 CONTROLLING OCCUPATIONAL EXPOSURE AND DOSES TO EMERGENCY WORKERS 41
3.1.1 Maintaining the ALARA Principle 42
3.1.2 Understanding Dose and Risk Relationships 42
3.2 OCCUPATIONAL SAFETY REGULATIONS FOR RADIOLOGICAL EMERGENCY RESPONSE 45
KEY POINTS IN CHAPTER 3 – EMERGENCY WORKER PROTECTION 47

CHAPTER 4. INTERMEDIATE PHASE PROTECTIVE ACTION GUIDES 48
4.1 EXPOSURE PATHWAYS DURING THE INTERMEDIATE PHASE 48
4.2 THE PROTECTIVE ACTION GUIDES AND PROTECTIVE ACTIONS FOR THE INTERMEDIATE PHASE: RELOCATION AND DOSE REDUCTION 49
4.2.1 Removal of the 50 Year Relocation PAG 50
4.2.2 The Population Affected 51
4.2.3 Areas Involved 51
4.2.4 Priorities 53
4.3 SEQUENCE OF EVENTS 53
4.3.1 Establishment of Isodose-Rate Lines 54
4.3.2 Dose Projections 54
4.3.3 Projected External Gamma Dose 56
4.3.4 Exposure Limits for People Reentering the Relocation Area 56
4.4 PROTECTIVE ACTION GUIDANCE FOR FOOD AND DRINKING WATER 56
4.5 LONGER-TERM OBJECTIVES OF THE PROTECTIVE ACTION GUIDES FOR THE INTERMEDIATE PHASE 57
4.6 REENTRY MATRIX FOLLOWING A RADIOLOGICAL INCIDENT OR ACCIDENT 57
4.7 BASIS FOR INTERMEDIATE PHASE PAGs 61
KEY POINTS IN CHAPTER 4 – INTERMEDIATE PHASE 62

CHAPTER 5. PLANNING GUIDANCE FOR THE LATE PHASE 63
5.1 LATE PHASE CLEANUP PROCESS 63
5.1.1 Transitioning from Intermediate to Late Phase Cleanup 63
5.1.2 Characterization and Stabilization 64
5.1.3 Goals and Strategies 64
5.1.4 Implementation and Reoccupancy 66
5.1.5 Stakeholder Involvement 66
5.1.6 Cleanup Process Implementation and Organization: An Example 67
5.2 DISPOSAL OF LARGE VOLUMES OF RADIOLOGICAL WASTE 71
5.2.1 Potential Waste Volumes and Existing Waste Disposal Options 72
5.2.2 Integrated Disposal Options 73
5.2.3 Planning and Coordination among Federal and State Entities 76
5.2.4 Other Potential Options and Considerations 76
5.2.5 Potential Federal Actions to Develop New Disposal Capacity 78
KEY POINTS IN CHAPTER 5 – LATE PHASE 80

ED_001057_00022178

APPENDIX A – REFERENCES.....81
APPENDIX B – GLOSSARY.....85
APPENDIX C – LIST OF ACRONYMS.....89

ED_001057_00022178

LIST OF TABLES

Table 1-1. Summary Table for PAGs, Guidelines, and Planning Guidance for Radiological Incidents.....15

Table 2-1. PAGs and Protective Actions for the Early Phase of a Radiological Incident.....24

Table 2-2. Threshold Thyroid Radioactive Exposures and Recommended Doses of KI for Different Risk Groups.....29

Table 3-1. Emergency Worker Guidelines.....43

Table 3-2. Acute Radiation Syndrome.....44

Table 3-3. Regulations for Worker Protection.....46

Table 4-1. PAGs and Protective Actions for Exposure to Deposited Radioactivity during the Intermediate Phase of a Radiological Incident..... 50

Table 4-2. Reentry Matrix: Quick Reference to Operational Guidelines.....58

ED_001057_00022178

LIST OF FIGURES

Figure 2-1. Exposure Reduction from External Radiation from Nuclear Fallout as a function of Building Type and Location..... 27

Figure 4-1. Generalized Protective Action Areas for NPP Incident..... 52

ED_001057_00022178

ED_001057_00022178

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

ED_001057_00022178

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.

ED_001057_00022178

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.

ED_001057_00022178

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.

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.

ED_001057_00022178

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.

ED_001057_00022178

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.

ED_001057_00022178

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.

- 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).

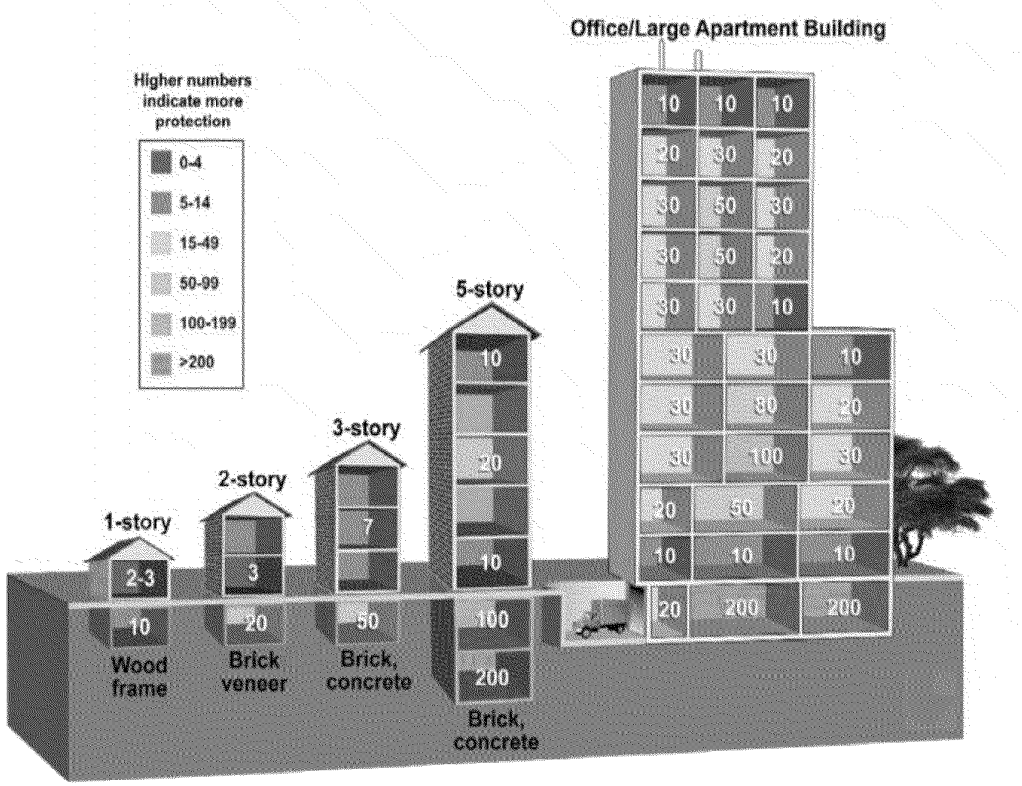
In a study of 230 mass evacuations in the U.S. ("Identification and Analysis of Factors Affecting Emergency Evacuations" NUREG/CR-6484, 2004) only six cases involved deaths from the hazard itself, and of these six, only one case involved deaths during the evacuation itself. Only two cases involved injuries 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]

---

[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.

ED_001057_00022178

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.

ED_001057_00022178

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.

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)

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.

ED_001057_00022178

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.

ED_001057_00022178

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).

ED_001057_00022178

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.

ED_001057_00022178

	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).

ED_001057_00022178

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

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,

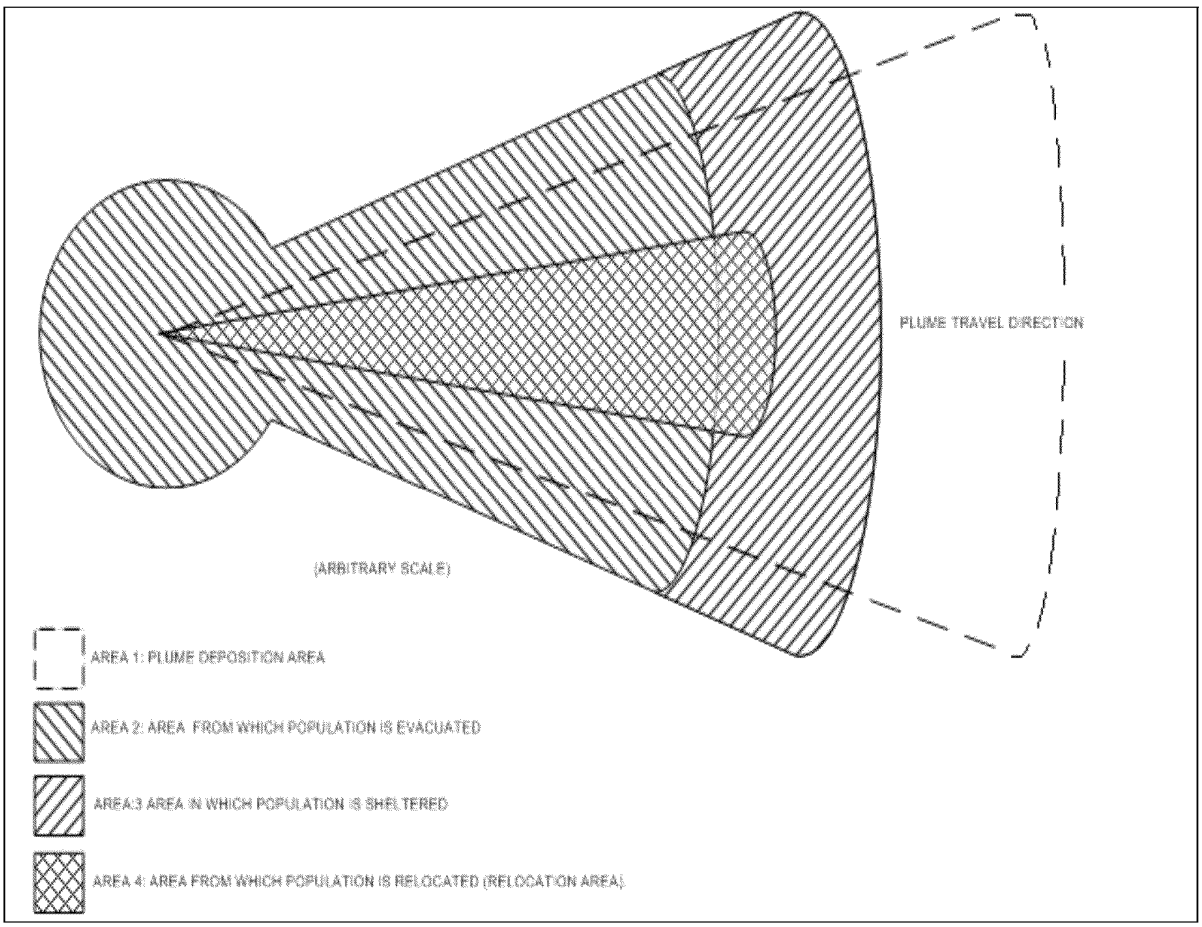
because of mobility constraints for their evacuation, had remained sheltered-in-place during plume passage.

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



ED_001057_00022178

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.

ED_001057_00022178

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.

ED_001057_00022178

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)

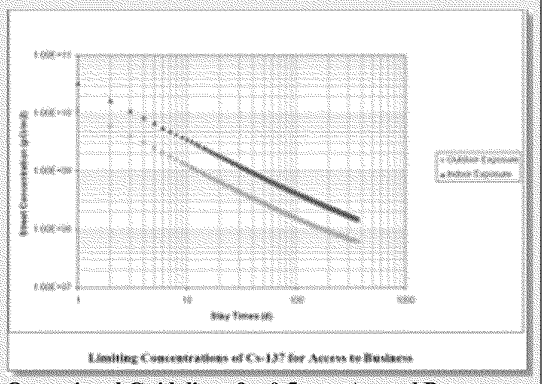
ED_001057_00022178

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.

ED_001057_00022178

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;

ED_001057_00022178

- 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

ED_001057_00022178

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

ED_001057_00022178

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

ED_001057_00022178

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.

ED_001057_00022178

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.

- 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

Aaberg 1989 — Aaberg, R. Evaluation of Skin and Ingestion Exposure Pathways. EPA 520/1-89-016. U.S. Environmental Protection Agency, Washington, D.C., (1989).

CDC 2014 — Centers for Disease Control and Prevention, Department of Health and Human Services [CDC/HHS]. Population monitoring in radiation emergencies: A guide for state and local public health planners. Second edition. Centers for Disease Control and Prevention, Department of Health and Human Services. Atlanta, GA, (2014).

DHS 2008 — Federal Emergency Management Agency, Department of Homeland Security [FEMA/DHS]. Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents. Federal Register, 70, 45029; August 1, 2008.

DOE 1988 — Department of Energy [DOE]. External Dose-Rate Conversion Factors for Calculation of Dose to the Public. DOEIEH-0070, U.S. Department of Energy, Washington, D.C., (1988).

DOE 1990 — Department of Energy [DOE]. Effectiveness of Sheltering-in-place in Buildings and Vehicles for Plutonium. DOE/EH-0 159, U.S. Department of Energy, Washington, D.C., (1990).

DOE 2009 — Department of Energy [DOE]. Preliminary Report on Operational Guidelines Developed for Use in Emergency Preparedness and Response to a Radiological Dispersal Device Incident. DOE/HS-0001; ANL/EVS/TM/09-1. U.S. Department of Energy, Washington, D.C. (2009).

DOE 2010 — Department of Energy [DOE]. Federal Radiological Monitoring and Assessment Center (FRMAC) Assessment Manual, Volume 2: Pre-Assessed Default Scenarios. SAND2010-2575P, Federal Radiological Monitoring and Assessment Center, U.S. Department of Energy, Washington, D.C., (2010).

DOE 2012 — Department of Energy [DOE]. Radiological Emergency Response Health and Safety Manual. DOE/NV/11718--440, Federal Radiological Monitoring and Assessment Center, U.S. Department of Energy, Washington, D.C., (2012).

DOE 2015 — Department of Energy [DOE]. Federal Radiological Monitoring and Assessment Center (FRMAC) Assessment Manual, Volume 1: Overview and Methods. SAND2013-0184P, Federal Radiological Monitoring and Assessment Center, U.S. Department of Energy, Washington, D.C., (2012).

DoD 2003 — Military Medical Operations, Armed Forces Radiobiology Research Institute [AFRRI/DOD]. Medical Management of Radiological Casualties, Second Edition. Armed Forces Radiobiology Research Institute, Department of Defense. Bethesda, MD, (2003).

ED_001057_00022178

DOT 2004 Department of Transportation [DOT]. Traffic Safety Facts 2004: A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System. DOT HS 809 919. U.S. Department of Transportation, National Highway Traffic Safety Administration. Washington, D.C. (2004).

EPA 1978a Environmental Protection Agency [EPA]. Protective Action Evaluation Part I: The Effectiveness of Sheltering-in-Place as a Protective Action Against Nuclear Accidents Involving Gaseous Releases. EPA 52011-78-001A, U.S. Environmental Protection Agency, Washington, D.C., (1978).

EPA 1978b Environmental Protection Agency [EPA]. Protective Action Evaluation Part II - Evacuation and Sheltering-in-place as Protective Actions Against Nuclear Accidents Involving Gaseous Releases. 52011-78-001B, U.S. Environmental Protection Agency, Washington, D.C., (1978).

EPA 1987 Environmental Protection Agency [EPA]. Radiation Protection Guidance to Federal Agencies for Occupational Exposure. Federal Register, 52, 2822-2834; 1987.

EPA 1992a Environmental Protection Agency [EPA]. Implementing Protective Actions for Radiological Incidents at Other Than Nuclear Power Reactors. EPA 402-R-92-001. U.S. Environmental Protection Agency, Washington, D.C., (1992).

EPA 1992b Environmental Protection Agency [EPA]. Manual of Protective Action Guides and Protective Actions for Nuclear Incidents. EPA 400-R-92-001 U.S. Environmental Protection Agency, Washington, D.C., (1992).

EPA 1997 Environmental Protection Agency [EPA]. Health Effects Assessment Summary Tables, FY 1997 Update. EPA 540-R-97-036. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation, Washington, D.C., (1997).

EPA 1999 Environmental Protection Agency [EPA]. Cancer Risk Coefficients for Environmental Exposure to Radionuclides, Federal Guidance Report #13. EPA 402-R-99-001. U.S. Environmental Protection Agency, Office of Air and Radiation, Washington, D.C., (1999).

FEMA 2008a Federal Emergency Management Agency [FEMA]. National Response Framework. U.S. Federal Emergency Management Agency, Washington, D.C., (2008).

FEMA 2008b Federal Emergency Management Agency [FEMA]. National Response Framework, Nuclear/Radiological Incident Annex. U.S. Federal Emergency Management Agency, Washington, D.C., (2008).

FDA 1998 Food and Drug Administration [FDA]. Accidental Radioactive Contamination of Human Food and Animal Feeds: Recommendations for State and Local Agencies. U.S. Food and Drug Administration, Center for Devices and Radiological Health. Rockville, MD, (1998).

FDA 2001 Food and Drug Administration [FDA]. Notice: Guidance Potassium Iodide as a Thyroid Blocking Agent in Radiation Emergencies. Federal Register, 66, 64046; 2001.

FDA 2002 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).

FRC 1964 Federal Radiation Council [FRC]. Background Material for the Development of Radiation Protection Standards, Staff Report of the FRC, Report No. 5. Washington, DC, (1964).

FRC 1965 Federal Radiation Council [FRC]. Background Material for the Development of Radiation Protection Standards, Protective Action Guides for Strontium-89, Strontium-90 and Cesium-137, Report No. 7. Washington, DC, (1965).

Hans et al. 1975 Hans, J.M. Jr. and Sell, T.C. Evacuation Risks -An Evaluation. EPA-520/6-74- 002, U.S. Environmental Protection Agency, Washington, D.C., (1975).

IAEA 2002 International Atomic Energy Agency. Preparedness and Response for a Nuclear or Radiological Emergency. Safety Series GS_R_2, International Atomic Energy Agency, Vienna, Austria, (2002).

IAEA 1991 International Atomic Energy Agency. Principles for Establishing Intervention Levels for the Protection of the Public in the Event of a Nuclear Accident or Radiological Emergency. Safety Series No. 72, Revision 1, International Atomic Energy Agency, Vienna, Austria, (1991).

ICRP 1991 International Commission on Radiological Protection. 1990 Recommendations of the International Commission on Radiological Protection. ICRP Publication 60, Annals of the ICRP 21(1-3), Pergamon Press, Oxford (1991).

NCRP 2001 National Council on Radiation Protection and Measurements. Management of Terrorist Events Involving Radioactive Material, NCRP Report No. 138. National Council on Radiation Protection and Measurements, Bethesda, MD, (2001).

NCRP 2010 National Council on Radiation Protection and Measurements. Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers, NCRP Report No. 165, National Council on Radiation Protection and Measurements, Bethesda, MD, (2010).

NRC 1975 Nuclear Regulatory Commission [NRC]. Reactor Safety Study. An Assessment of Accident Risks in U. S. Commercial Nuclear Power Plants. WASH-1400, NUREG-751014, U.S. Nuclear Regulatory Commission, Washington, D.C., (1975).

NRC 1978 Nuclear Regulatory Commission (US)[NRC]. Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans in Support of Light Water Nuclear Power Plants, NUREG-0396, U.S. Nuclear Regulatory Commission, Washington, D.C., (1978).

ED_001057_00022178

NRC 1980 Nuclear Regulatory Commission [NRC]. Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants. NUREG-0654, FEMA-REP-1, Rev. 1., U.S. Nuclear Regulatory Commission, Washington, D.C., (1980).

NRC 1988 Nuclear Regulatory Commission [NRC]. A Regulatory Analysis on Emergency Preparedness for Fuel Cycle and Other Radioactive Material Licensees. NUREG-1140, U.S. Nuclear Regulatory Commission, Washington, D.C., (1988).

NRC and EPA 1978 Nuclear Regulatory Commission [NRC] and Environmental Protection Agency [EPA]. Task Force Report. Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans in Support of Light Water Nuclear Power Plants. NUREG-0396 or EPA-52011-78-016, U.S. Environmental Protection Agency, Washington D.C., (1978).

NRC 2005 Nuclear Regulatory Commission [NRC]. Identification and Analysis of Factors Affecting Emergency Evacuations. NUREG/CR-6864. U.S. Nuclear Regulatory Commission, Washington, D.C., (2005).

NRC 2008 Nuclear Regulatory Commission [NRC]. Assessment of Emergency Response Planning and Implementation for Large Scale Evacuations. NUREG/CR-6981. U.S. Nuclear Regulatory Commission, Washington, D.C., (2008).

NSS 2010 National Security Staff [NSS], Interagency Policy Coordination Subcommittee for Preparedness and Response to Radiological and Nuclear Threats. Planning Guidance for Response to a Nuclear Detonation. Second Edition. Interagency Policy Coordination Subcommittee for Preparedness and Response to Radiological and Nuclear Threats, Washington, D.C., (2010).

Pasquill, 1961 Pasquill, F. The estimation of the dispersion of windborne material. Meteorology Magazine. 90, 33-49, (1961).

SNL 1982 Sandia National Laboratory [SNL]. Technical Guidance for Siting Criteria Development. NUREG/CR-2239. U.S. Nuclear Regulatory Commission, Washington, D.C., (1982).

ED_001057_00022178

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.

ED_001057_00022178

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: Boyd, Mike[Boyd.Mike@epa.gov]; Gillam, Connie[Gillam.Connie@epa.gov]
Cc: Puskin, Jerome[Puskin.Jerome@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]
From: Rosnick, Reid
Sent: Wed 7/9/2014 5:03:03 PM
Subject: RE: REMINDER: Items for the RPD Weekly Are Due by COB Today (eom)

Mike,

Thanks. I would add the following (in red)

Reid

From: Boyd, Mike
Sent: Wednesday, July 09, 2014 1:00 PM
To: Gillam, Connie
Cc: Puskin, Jerome; Veal, Lee; Rosnick, Reid
Subject: RE: REMINDER: Items for the RPD Weekly Are Due by COB Today (eom)

Lee, Jerry, and Reid,

Please look over and make sure you agree with this summary. Reid, did I cover your activity accurately?

RPD staff will be attending the 59th annual meeting of the Health Physics Society (HPS) in Baltimore, Maryland, from July 13-17. HPS is an organization for radiation protection professionals in the U.S. and several RPD staff are active members. This year's meeting features a highlighted lunchtime debate on Monday between RPD's Jerry Puskin and retired Washington State University professor Antone Brooks on the topic, "Is there a dose of radiation that Is not dangerous?," with Jerry arguing the position that there is no completely safe dose. Sara DeCair will be giving a presentation on the 2013 Revision of the Protective Action Guides Manual. Mike Boyd is the Chair of the HPS International Collaboration Committee (ICC), which will meet in Baltimore on Tuesday, and has taken the lead in planning an all-day ICC special technical session on the topic "Recovery from Large Scale Nuclear Contamination - What Have We Learned?" Mike will also give a presentation on how nuclear power plant accident recovery

has changed between the accidents at Three Mile Island and Fukushima. Reid Rosnick will give a lecture during the Wednesday afternoon special NESHAPS session where he will introduce the CAP88 version 4 code for evaluating compliance with radionuclide NESHAPS. He will also co-present a PEP class on Thursday on CAP88 version 4. Other RPD staff attending the HPS meeting include Phil Egidi, Jennifer Mosser, and David Pawel.

From: Gillam, Connie
Sent: Wednesday, July 09, 2014 10:11 AM
To: OAR-ORIA-RPD
Subject: REMINDER: Items for the RPD Weekly Are Due by COB Today (eom)

To: Veal, Lee[Veal.Lee@epa.gov]; Forinash, Betsy[Forinash.Betsy@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]; Edwards, Jonathan[Edwards.Jonathan@epa.gov]
From: DeCair, Sara
Sent: Tue 6/17/2014 3:11:43 PM
Subject: Updated PAG Project Plan
PAG Project Planning 6-17-2014.docx

I also left a short writeup with a suggested rationale for Sam in your mailboxes. Let me know if you need anything more for your general with Mike tomorrow at 2. Thanks!

S.

Sara D. DeCair

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

202-343-9108

Resolution of Comments: The PAG Subcommittee prepared written internal "Resolution" decisions with the following current status:

- Evacuation -- done
- 2X Background Tables -- done
- Relocation -- done
- Dose assessment – pending Subcmte evaluation of impacts to age groups/gender – in progress
- KI and/or thyroid-based evacuation – pending analysis by NRC and DOE – in progress
- Water – OGWDW, in progress
- Worker Protection -- done
- Combined Intermediate Phase PAG -- or decision on addressing drinking water issues – pending justification from Navy Nuke *or a water PAG*
- **Cleanup – no substantive changes needed**
- **Waste Management – no substantive changes needed**
- General – done, pending 3rd version of one-pager on "What We Heard" – Betsy is editing this
- Process/Administrative – closely related to General comments that we can address in one-pager, above
- Anti-Weblink (e.g., comments to include all tables into document) – done
- Miscellaneous – done
- Editorial – in progress

Dosimetry symposium: To answer the technical policy question of how to properly implement ICRP 60 series dosimetry with age-specific dose conversions, an interagency symposium was held at 1310 L Street to discuss in particular, what reference individual(s) to project doses to in our Evacuation recommendations. The summary was presented to the PAG Subcommittee for decision on recommendations, which will be described in PAG Manual language for users.

Three months of PAG Manual editing and refinement (through June 2014): With contractor support and interagency key staff help, we'll incorporate all the suggestions according to the comment spreadsheet decisions and create a single redline/strikeout version for review. Rather than frequent PAG Subcommittee meetings, the group will be asked to review subsections of edited Manual text. Focus now is on explaining how to project doses to sensitive subpopulations and reiterating the risk-benefit basis behind the PAG levels.

Addressing Drinking Water: OGWDW is developing an approach for addressing drinking water using tiered risk levels and several precautionary action options. See the updated PAGs schedule below that focuses on getting the water proposal out.

Summary of next steps and the future:

- Ongoing through June 2014: Staff and contractor draft revisions to manual, product is single redline/strikeout document for review.
- June – August 2014: Draft FR Notice language and PAG Manual water language – Sam is drafting, and we will suggest a technical basis starting from the principles of radiation protection.
- July – August 2014: Brief AAs, DA as appropriate
- August – September 2014: Brief multi-agency PAGs Subcommittee & get concurrence on proposal, concurrently have updated Water proposal reviewed by OSWER, OHS and OGC.
- September – October 2014: Develop Water proposal *Federal Register* package
- October – November 2014: OPEI review and facilitation

ED_001057_00023596

- November – February 2014: OMB 90-day Review
- Finalize edited FR Notice and Water proposal **(OMB release + 14 days)**
- Complete *Federal Register* Workflow for Water proposal **(OMB release + 30 days)**
- Compile and adjudicate comments from public review **(OMB release + 60 days)**
- Finalize entire PAG Manual including Water **(OMB release + 90 days) (Apr. 2015?)**

Final Manual: When announced in the Federal Register, we should describe a twelve-month implementation timeframe during which response organizations can update plans, procedures and training to start using the new, final PAG Manual.

Ideas for streamlining intra- and inter-agency reviews:

- Start briefings in June with top leadership to keep the feedback at a strategic level. Include enough details to explain all changes in Early & Intermediate Phase chapters, and that no changes were needed in Late Phase chapter.
- Brief Bob Perciasepe if and when he is interested.
- Brief the interagency PAG Subcommittee on the water proposed approach.
- Consider using OHS as a conduit for intra-agency reviews.
- Engage with OGC early.
- Talk with OMB about process and FR Notice of water proposal, then final Manual.

Variables that could impact this timeline:

- Method and timeframe for communicating the water proposal to stakeholders.
- Internal agency review demands.
- OMB priorities and required review period.
- Complexity of comments returned from interagency review.

ED_001057_00023596

To: DeCair, Sara[DeCair.Sara@epa.gov]; Forinash, Betsy[Forinash.Betsy@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]
From: Schultheisz, Daniel
Sent: Thur 6/5/2014 8:37:21 PM
Subject: RE: Quick - PAGs talk Betsy gave for Japanese del?
Japan Meeting 051314.ppt

Attached.

From: DeCair, Sara
Sent: Thursday, June 05, 2014 4:31 PM
To: Forinash, Betsy; Veal, Lee; Schultheisz, Daniel
Subject: Quick - PAGs talk Betsy gave for Japanese del?

I am talking with Peter Jutro at 5 pm and what he has in front of him is the talk Betsy gave at the Japanese delegation meeting recently – I don't think I have a copy of that. Just if you have a chance in the next half hour, would you send it to me? Thanks much! I can wing it if not – he mostly wants to ask questions, I think. S.

Sara D. DeCair

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

202-343-9108

Overview of EPA Radiation Protection Program

May 13, 2014

Presented By:
U.S. Environmental Protection Agency
Office of Radiation and Indoor Air
Radiation Protection Division

Presented To:
Delegation from Fukushima Prefecture
and Aizo University
Meeting with USEPA
Washington, DC

ED_001057_00023612

Outline of Presentation

EPA Organization and Roles

Radiation Standards and Guidelines

Protective Actions for Radiological Emergencies

Radiation Monitoring

Radioactive Waste Management

ED_001057_00023612

EPA Organizational Framework

ED_001057_00023612

EPA's Role in Radiation Protection

EPA responsibilities include

- Issue standards to limit environmental release/exposure
- Measure radiation in the environment and assess effects
- Inform the public about risks and avoiding exposure

EPA has a unique set of expertise for dealing with radiation in the environment

- Homeland security and emergency response
- Regulatory and policy development and implementation
- Science and technical information and studies
- Public education and outreach
- Radioanalytical, field, and policy support to other Agency offices

ED_001057_00023612

Radiation Standards & Guidelines

ED_001057_00023612

Radiation Protection Standards

EPA issues standards under various laws:

- Uranium fuel cycle (Atomic Energy Act of 1954)
- Spent nuclear fuel, high-level and transuranic waste
  - Nuclear Waste Policy Act of 1982
  - Energy Policy Act of 1992
  - Waste Isolation Pilot Plant (WIPP) Land Withdrawal Act
- Uranium/thorium mill tailings
  - Uranium Mill Tailings Radiation Control Act of 1978
- Air emissions from various activities (Clean Air Act)
- Drinking water (Safe Drinking Water Act)

EPA target is to limit lifetime cancer risk to between 10^{-4} and 10^{-6}

ED_001057_00023612

Radiation Protection Guidelines

EPA issues several types of guidance

- Federal/Presidential Guidance
  - Guidance for other federal agencies
    - Often more widely adopted
  - Includes public/worker protection, risk/dose conversions
- Other radiation protection guidelines
  - Protective Action Guides (PAG) Manual
  - Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)
- Cleanup guidance
  - Primarily under the Superfund program
- Guidance often developed with other agencies
  - Disposal of large volumes under consideration

ED_001057_00023612

EPA's Protective Action Guides (PAGs) Manual

ED_001057_00023612

What are Protective Action Guides?

Guidance on interventions--protective actions--to protect the public from unnecessary exposure in a radiological incident.

- **Planning and response tool** for emergency conditions.
- **Numerical guide**: projected individual dose at which a specific protective action is recommended to reduce or avoid that dose.
- **Not legally binding**: must take into account incident-specific factors, weigh other risks.
- Reasonable actions to reduce dose are encouraged.

Decisions on protective actions are made by local or regional authorities.

ED_001057_00023612

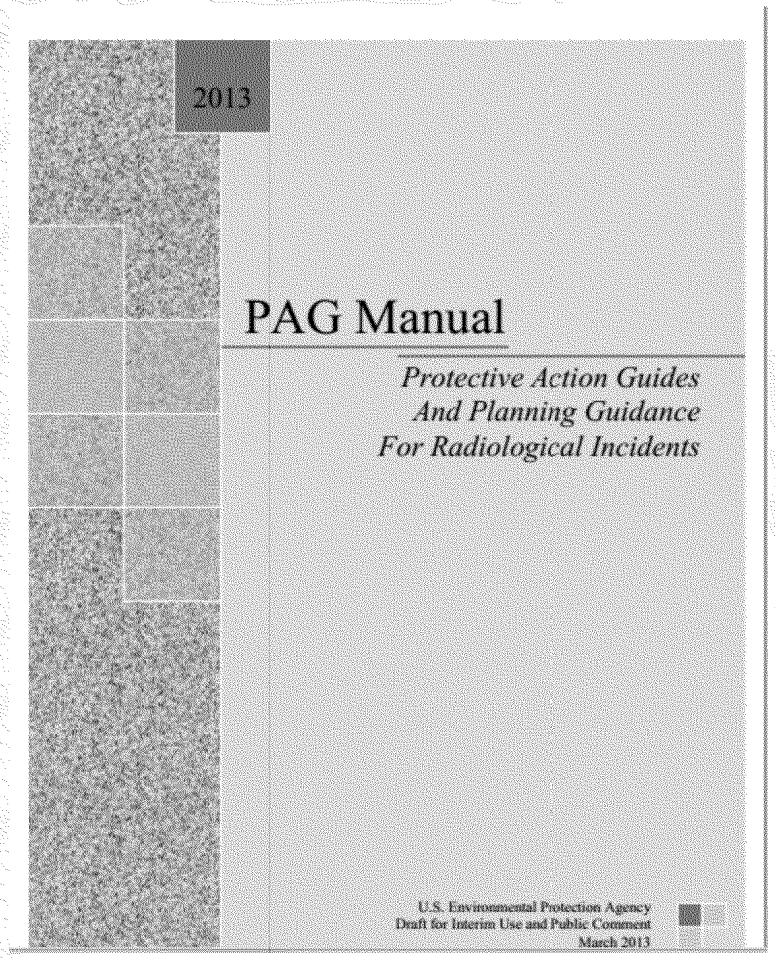
What are PAGs? (2)

Updated *draft* PAGs manual issued spring 2013.

- Replaces 1992 document.
- Updated dosimetry, broader applicability, alignment with more recent approaches.

Available for interim use in planning and response.

Final guide expected in 2014.



ED_001057_00023612

Technical basis for PAGs

Three principles guide selection of dose level:

- Prevent acute effects.
- Reduce risk of chronic effects.
- Balance protection with other important factors and ensure that actions result in more benefit than harm.

Represent consensus from relevant national agencies with emergency response roles in public health, food safety, agriculture, and radiation protection for workers and public.

PAGs are pre-determined for broad application, without regard to magnitude or type of release (no assessment of source terms).

ED_001057_00023612

When Do PAGs Apply (and not)?

To **emergency situations**, with exposures for a relatively short time.

- But NOT to: nonemergency conditions; chronic exposures; clean-up of contaminated sites

To **all types of incidents** that may require protection actions:

- Accidental or deliberate (i.e., terrorist) release of radioactivity
- Fixed facilities or moveable material
- But NOT to nuclear war

To **all phases** of incident response:

- Early or emergency phase
- Intermediate phase
- Late or recovery phase

ED_001057_00023612

Early Phase

Early phase:

- Beginning of emergency.
- Information may be limited or unsure.
- May last from hours to days.

Protective actions and PAGs are meant to minimize external exposure and inhalation from plume.

- Sheltering-in-place.
- Evacuation.
- Administration of stable potassium iodide (KI).
- Other measures without PAGs: personal decontamination, ad hoc respiratory protection.

ED_001057_00023612

Intermediate Phase

Intermediate phase:

- Source and releases under control (not growing).
- Reliable environmental measurements are available as a basis for making decisions.
- May last from weeks to months, may overlap with early and late phases.

Protective actions and PAGs are intended to reduce or avoid dose to public and workers, to control contamination, to prepare for cleanup.

- Relocation.
- Food interdiction.
- Limits on worker exposure, re-entry to perform vital services.

Other actions may be warranted to reduce doses: targeted decontamination, focused cleanup, restricted land access

Waste disposal and the availability of capacity must be considered.

ED_001057_00023612

Late Phase

Late phase:

- Actions designed to reduce radiation levels in the environment begin.
- More time and information allows for better data collection, stakeholder involvement, and analysis of options.
- May extend from months to years.

Actions are meant to reduce long-term exposures and improve living conditions.

- A PAG level, or dose to avoid, is not appropriate for long-term cleanup.
- Manual describes important aspects of process and participants in decision making on clean-up goals, technology, land use and approaches.

ED_001057_00023612

Additional Background Information

PAGs Summary Tables

ED_001057_00023612

Summary of PAGs

Phase	Protective Action Recommendation	Protective Action Guide or Planning Guide
Early (Chapter 2)	Sheltering-in-place or evacuation of the public[a]	1 to 5 rem (10 mSv to 50 mSv) projected dose/4 days[b]
	Administration of prophylactic drugs KI[c]	5 rem (50 mSv) projected child thyroid dose[d] from radioactive iodine
	Limit emergency worker exposure	5 rem (50 mSv)/year (or greater under exceptional circumstances)[e]
Intermediate (Chapter 3)	Relocation of the public	2 rem (20 mSv) projected dose first year[b] Subsequent years, 0.5 rem (5 mSv)/year projected dose
	Food interdiction[f]	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[b]
	Reentry	Operational Guidelines[g] (Stay times and concentrations) for specific activities (see Section 3.7)
Late (Chapter 4)	Cleanup	Brief description of planning process
	Waste Disposal	Brief description of planning process

ED_001057_00023612

Although it's not always so simple…

[a] 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.

[b] 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.

[c] Provides thyroid protection from internal exposure to radioactive iodines only. For other information on 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

[d] Thyroid equivalent dose. For more information, refer to http://www.fda.gov/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness/ucm072265.htm.

[e] 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.

[f] 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

[g] 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)

ED_001057_00023612

Monitoring Radiation Levels

EPA's RadNet System

ED_001057_00023612

What is RadNet?

RadNet is EPA's national radiation monitoring system.

RadNet is designed to measure:

- ambient levels of radiation in the environment to establish baseline levels and identify trends.
- large-scale atmospheric releases of radiation (in the U.S. and from foreign sources) impacting large parts of the country and major population centers.

RadNet is not designed to measure impacts in the immediate vicinity ("ground zero") of a nuclear incident.

ED_001057_00023612

What do we monitor?

The RadNet network includes several different types of monitoring:

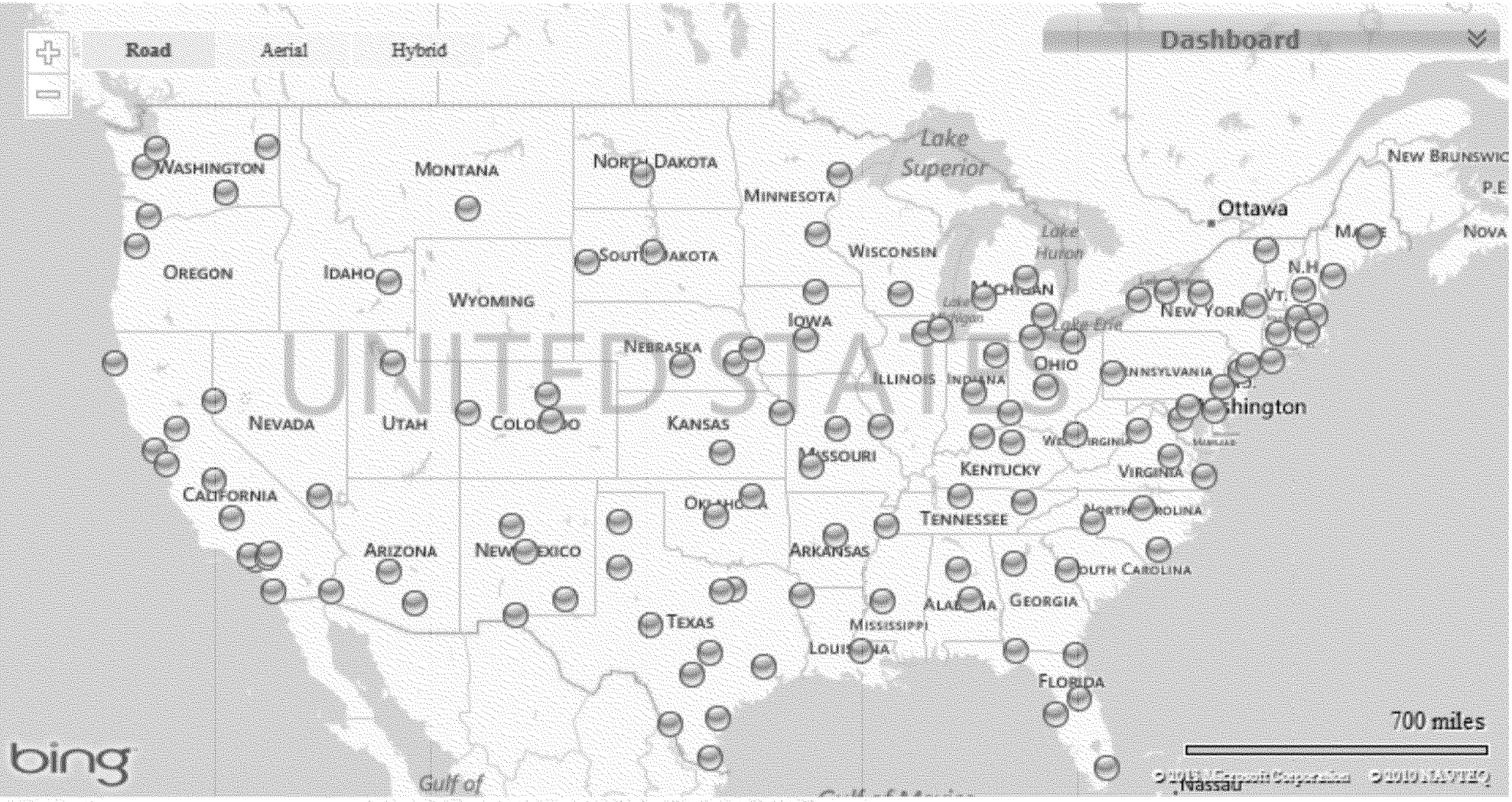
- Air monitoring (particulates): 137 stationary and 40 deployable high-volume air samplers in the continental US, Alaska, Hawaii and Puerto Rico.
- Additional samples (precipitation, drinking water, and milk) are also collected on a limited basis.

All data is posted on EPA's public web site.

- Some gamma exposure rate data is available in real-time.
- Results of filter analysis are typically available ~1 month after collection (can be shorted during emergency operations).

ED_001057_00023612

RadNet Locations (Continental U.S.)



ED_001057_00023612

What monitoring capabilities does EPA have for emergencies?

Aerial survey capability

- Airborne Spectral Photometric Environmental Collection Technology (ASPECT)
- Real-time radiological detection and mapping

Mobile radioanalytic laboratory (and sample preparation)

- Mobile environmental response laboratory (MERL)

“Scanner van” provides ground-level mapping capability.

Hand-held instrumentation for site surveys and personnel monitoring.

ED_001057_00023612

What other monitoring data is available in emergencies?

Regional and state monitoring systems and survey data

Industry monitoring at or near nuclear power plants

Other federal agencies

- Defense and civilian agencies have capabilities
- In emergency situations, all federal monitoring plans, data and modelling are coordinated.

International monitoring system (IMS)

Issues:

- Access to data
- Confirmation of quality assurance
- Compatibility of data formats and platforms

ED_001057_00023612

Additional Background Information

RadNet Data

ED_001057_00023612

What data do we get?

Stationary air monitors

- Real-time gamma data (counts per minute) with qualitative information on specific isotopes.
- Gamma spectroscopy is conducted if pre-set gamma screening levels are exceeded.
- Filter analysis is conducted for gross-beta, with additional alpha, beta and gamma analysis if pre-set screening levels are exceeded.

Deployable air monitors

- Real-time gamma exposure rate data.
- Options for high- and low- volume sampling.

Precipitation is sampled quarterly and published on an annual basis.

ED_001057_00023612

Radioactive Waste Management in the U.S.

ED_001057_00023612

Overview of Radioactive Waste in the U.S.

As defined by law*, radioactive waste in the United States falls into different categories, with different requirements for management and disposal:

- Spent nuclear fuel
- High-level radioactive waste
- Transuranic radioactive waste (long-lived intermediate level waste)
- Uranium or thorium mill tailings
- Low-level radioactive waste (LLRW) (radioactive waste that is <u>not</u> any of the above)
- Categories are comparable, but not identical, to definitions by IAEA (in 2009 General Safety Guide GSG-1)
- Naturally-occurring radioactive materials (NORM) do not generally fall under these statutory definitions of radioactive waste

* The primary statute is the Atomic Energy Act of 1954, as amended (United States Code, Title 42, Chapter 23)

ED_001057_00023612

Responsibilities for Radioactive Waste

Three Federal agencies have authorities to regulate/manage radioactive waste:

- Nuclear Regulatory Commission (NRC) regulates nuclear power plants and users of radioactive material
- Department of Energy (DOE) regulates its own research and defense uses of radioactive material
- Environmental Protection Agency (EPA) establishes regulatory standards and addresses certain cleanups
- State agencies and EPA have authority to regulate naturally-occurring radioactive materials (NORM)

ED_001057_00023612

Radioactive Waste Disposal in the U.S.

Two primary methods of disposal are used:

- Geologic disposal is specified for:
  - Spent fuel/high-level waste (Yucca Mountain, DOE/NRC)
  - Transuranic defense waste (WIPP, DOE/EPA)
- Near-surface land disposal is used for:
  - Uranium/thorium mill tailings (NRC/DOE)
  - Most non-DOE low-level radioactive waste (NRC)

NRC further defines LLRW in 10 CFR part 61

- Three classes of waste (A, B, C) based on concentration and half-life (DOE does not use A,B,C)
- Greater-Than-Class C not generally suitable for near-surface disposal (DOE has responsibility under law)

ED_001057_00023612

State Responsibilities for LLRW Disposal

Low-Level Radioactive Waste Policy Act of 1980 and 1985 Amendments require states to provide disposal capacity for non-DOE LLRW

- Allows states to form "regional compacts"
  - Compact designates a "host state" for facility
  - Can exclude waste from out-of-compact states
  - 10 compacts include 42 states
  - Many legal issues have resulted from compact system, but only one disposal facility has been developed
  - See www.llwforum.org for more information

ED_001057_00023612

Low-Level Radioactive Waste Disposal

Four facilities are licensed to dispose of LLRW:

- Barnwell, South Carolina (Classes A, B, C)
  - Atlantic Compact (3 states)
- Richland, Washington (Classes A, B, C)
  - Northwest (8 states) and Rocky Mountain (3 states) Compacts
- Clive, Utah (Class A only) (non-compact facility)
- Andrews, Texas (Classes A, B, C, and DOE waste)
  - Texas Compact (2 states) (Also includes a Federal disposal cell)
  - Most states now have access to the Texas facility

DOE has disposal capability at several of its sites

NORM and exempt waste has used solid/haz landfills

ED_001057_00023612

Current Issues in LLRW Management

NRC is considering actions to address several issues:

- Disposal of large quantities of depleted uranium
  - Not considered in original evaluation for 10 CFR part 61
  - New enrichment plants licensed or proposed
  - DOE is “deconverting” uranium hexafluoride
- “Risk-informing” 10 CFR part 61 (issued in 1982)
  - May involve revision of waste classification system
  - More explicit consideration of long-lived radionuclides
- Revision of “concentration averaging” technical position

DOE is also revising internal LLRW Orders

Safety and security of disused sealed sources (multi-agency)

ED_001057_00023612

Radioactive Waste Transportation

Depending on whose waste is involved, transportation by road, rail, or barge is regulated by NRC, DOE, and the Department of Transportation (DOT)

- Approval of shipping containers
  - Range from 55-gallon drum to highly engineered
- Manifesting of waste to disposal facility
- Labeling/placarding requirements
- Radiation emanation rates at surface

ED_001057_00023612

Responding to a Radiological Incident

- Draft PAG Manual proposes planning guidance focused on options for disposal (complex issues)
  - Licensed LLRW disposal facilities
  - RCRA solid and hazardous waste landfills
    - Local disposal highly sensitive and controversial
  - Federal facilities/sites
  - Newly developed disposal capacity
  - Appropriate for level of hazard
  - Waste volumes will drive decision-making
    - Could overwhelm existing disposal capacity
    - Need to be considered in early planning
    - Early waste characterization is extremely important

ED_001057_00023612

Resolution of Comments: The PAG Subcommittee prepared written internal "Resolution" decisions with the following current status:

- Evacuation -- done
- 2X Background Tables -- done
- Relocation -- done
- Dose assessment – pending Subcmte evaluation of impacts to age groups/gender – in progress
- KI and/or thyroid-based evacuation – pending analysis by NRC and DOE – in progress
- Water – OGWDW, in progress
- Worker Protection -- done
- Combined Intermediate Phase PAG -- or decision on addressing drinking water issues – pending justification from Navy Nuke *or a water PAG*
- **Cleanup – no substantive changes needed**
- **Waste Management – no substantive changes needed**
- General – done, pending 3rd version of one-pager on "What We Heard" – Betsy is editing this
- Process/Administrative – closely related to General comments that we can address in one-pager, above
- Anti-Weblink (e.g., comments to include all tables into document) – done
- Miscellaneous – done
- Editorial – in progress

Dosimetry symposium: To answer the technical policy question of how to properly implement ICRP 60 series dosimetry with age-specific dose conversions, an interagency symposium was held at 1310 L Street to discuss in particular, what reference individual(s) to project doses to in our Evacuation recommendations. The summary was presented to the PAG Subcommittee for decision on recommendations, which will be described in PAG Manual language for users.

Three months of PAG Manual editing and refinement (through June 2014): With contractor support and interagency key staff help, we'll incorporate all the suggestions according to the comment spreadsheet decisions and create a single redline/strikeout version for review. Rather than frequent PAG Subcommittee meetings, the group will be asked to review subsections of edited Manual text. Focus now is on explaining how to project doses to sensitive subpopulations and reiterating the risk-benefit basis behind the PAG levels.

Addressing Drinking Water: OGWDW is developing an approach for addressing drinking water using tiered risk levels and several precautionary action options. See the updated PAGs schedule below that focuses on getting the water proposal out.

Summary of next steps and the future:

- Ongoing through May 2014: Staff and contractor draft revisions to manual, product is single redline/strikeout document for review.
- May 20, 2014: Brief ODs on drinking water products to decide on approach.
- June – August 2014: Draft FR Notice language and PAG Manual water language – Sam is drafting, and we will suggest a technical basis starting from the principles of radiation protection.
- July – August 2014: Brief AAs, DA as appropriate
- August – September 2014: Brief multi-agency PAGs Subcommittee & get concurrence on proposal, concurrently have updated Water proposal reviewed by OSWER, OHS and OGC.
- September – October 2014: Develop Water proposal *Federal Register* package
- October – November 2014: OPEI review and facilitation

ED_001057_00023626

- November – February 2014: OMB 90-day Review
- Finalize edited FR Notice and Water proposal **(OMB release + 14 days)**
- Complete *Federal Register* Workflow for Water proposal **(OMB release + 30 days)**
- Compile and adjudicate comments from public review **(OMB release + 60 days)**
- Finalize entire PAG Manual including Water **(OMB release + 90 days) (Apr. 2015?)**

Final Manual: When announced in the Federal Register, we should describe a twelve-month implementation timeframe during which response organizations can update plans, procedures and training to start using the new, final PAG Manual.

Ideas for streamlining intra- and inter-agency reviews:

- Start briefings in June with top leadership to keep the feedback at a strategic level. Include enough details to explain all changes in Early & Intermediate Phase chapters, and that no changes were needed in Late Phase chapter.
- Brief Bob Perciasepe if and when he is interested.
- Brief the interagency PAG Subcommittee on the water proposed approach.

Consider using OHS as a conduit for intra-agency reviews.

- Engage with OGC early.
- Talk with OMB about process and FR Notice of water proposal, then final Manual.

Variables that could impact this timeline:

- Method and timeframe for communicating the water proposal to stakeholders.
- Internal agency review demands.
- OMB priorities and required review period.
- Complexity of comments returned from interagency review.

ED_001057_00023626

To: Veal, Lee[Veal.Lee@epa.gov]
From: DeCair, Sara
Sent: Wed 5/21/2014 5:50:18 PM
Subject: Water studies supporting PAG development
Analysis in Support of PAG for Drinking Water.PDF
Cost of Providing Alternate Drinking Water.PDF
Exposure Pathways for Water.PDF
Transport of Deposited Radioactivity to Surfacewater.PDF

Lee,

Would you pass these studies on to Eric, Lisa and Sam? I am sure the content will ring a bell with Eric and Sam once they see them again.

Thanks so much, I'm heading back in to the session but will have my Blackberry if you need anything,

Sara

What We Heard

We received 5,000 comments from members of the public, state and local emergency response and health organizations, national and international radiation protection organizations. We adjudicated the comments with our interagency PAGs Subcommittee of the FRPCC and are finalizing the PAG Manual revision for publication, we hope, in late 2014.

Significant changes we made:

- Clarification on planning considerations related to the lower FDA KI (supplemental) PAG in combination with deleting the thyroid-based evacuation threshold
- Additional language on implementing the FRMAC tables of derived values
- A water PAG was added.
- Maintained the removal of the Relocation PAG of 5 rem over 50 years to avoid confusion with long-term cleanup goals

Concern: The PAG Manual is a way to weaken environmental 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 emergency guidance and do not overturn or affect the stringency or enforcement of any standards or laws to the situations in which they apply. The PAG levels are used only in an emergency when radiation levels have already exceeded environmental standards and could be high enough to cause health effects unless something is done. The PAG levels trigger public safety measures to minimize or avoid radiation exposure during an emergency.

Concern: The fact that the PAGs are higher than existing radiation protection regulations means that EPA is allowing more the public to get more radiation exposure.

PAGs are guidance for use only in an emergency. The increased risk for cancer from radiation exposure at the PAG levels is approximately 0.12% or 12 additional cancers out of 10,000 people. If used early in an emergency, the PAG Guidance could trigger safety actions to prevent the public from getting any additional exposure at all—they could be evacuated before the arrival of a radioactive plume. The PAG safety actions can be triggered by projected doses—officials do not have to wait for radiation measurements to order public safety measures if they have any reason to suspect that the radiation could approach the PAG levels.

Concern: The PAG Manual is not necessary. You should just base your emergency responses on existing environmental standards instead of the higher PAG triggers.

The PAGs are designed to prevent health effects by triggering public safety measures, such as evacuation. The PAG levels are higher than legal standards because they are based on the risk of health effects from radiation is that is high enough to warrant having people evacuate or stay indoors for extended periods.. The additional risk from a slight increase over legal limits is not worth the known risks of evacuation or sheltering in place; traffic accidents, trips and falls, anxiety from separation of family

members, etc. The PAGs are set at a level where the health risk from radiation exposure outweighs the risk from the safety measures. Although higher than legal standards, the PAG levels are still highly protective, and the guidance in the PAG Manual is designed to prevent the public from ever being exposed to radiation at the PAG levels.

Emergency preparedness starts with radioactive materials regulation, nuclear facility siting and minimizing risks of industrial needs of the population. Preventing accidents by ensuring safety redundancies and training local responders to take quick actions will save people from disasters. PAGs are focused on making the best prompt actions when bad things are happening.

Concern: The PAG Manual is a "back door" that permits industry to give the public to get a higher dose of radiation than legal standards.

The PAG Manual provides guidance for emergency situations only. No one is permitting a radiological accident or terrorist event. As long there are nuclear materials in the world, we have the responsibility to plan responses to protect the public from potential releases. The PAG Manual is emergency guidance, not a legal standard, and cannot be used to set cleanup levels.

Concern: The doses in the PAG Manual set a precedent for EPA to weaken its radiation protection regulations.

The PAG Manual is a non-binding guidance document to help officials plan safety measures in the event of a radiological emergency. Standards are legally enforceable limits on radioactive emissions. The PAG Manual has no bearing on the interpretation, enforcement, or setting of standards. The PAG Manual was first issued in 1975, and has no effect on environmental regulations.

Concern: The cleanup guidance in the PAG Manual allows too much radiation.

The PAG Manual is non-binding guidance for emergency situations and cannot be used to set cleanup levels. Chapter 4 of the PAG Manual provides a list of considerations for planning and initiating a cleanup process after the emergency is brought under control, but does not prescribe cleanup levels. Cleanup may take a long time and some safety measures may be necessary for years. For instance, some restrictions on use of certain areas may be in place for a long time.

Where cleanup goals don't achieve background levels, land use might have to be restricted. Superfund, for instance, balances reduced exposure with practical requirements of removing the contamination.

A cleanup level will be decided by decision makers along with community members to balance the goals with their needs. Jobs, homes, social, practical and technical factors will inform the cleanup goals set. How long the cleanup takes will directly impact people's ability to work and live in an area. This process can be sped up with additional funding, workers, equipment, technology and the collaboration with local residents helping out.

To: Veal, Lee[Veal.Lee@epa.gov]
From: DeCair, Sara
Sent: Mon 5/19/2014 5:24:14 PM
Subject: An idea for you to think about...
Idea for May 20 2014.docx

Lee,

See attached for what I got from Sam, and some ideas I had to ensure our basis is solid. I'm not sure if I should call Sam and get him thinking about this, maybe, or mention it tomorrow -- and I can definitely read the Codex to understand it better.

Getting on a call soon, then I can discuss if you like. Thanks for thoughts!

Sara

To: Veal, Lee[Veal.Lee@epa.gov]; Edwards, Jonathan[Edwards.Jonathan@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]; Hernandez-Quinones, Samuel[Hernandez.Samuel@epa.gov]; Gillam, Connie[Gillam.Connie@epa.gov]
From: DeCair, Sara
Sent: Fri 5/16/2014 7:08:46 PM
Subject: Final: H2O briefing for 5/20 ODs briefing
Joint Briefing PGrevatt-Flynn May-16 SHQ.docx

All, we have agreed on a final briefing paper for the ODs meeting on Tuesday afternoon, May 20th. Thank you, Sam!

- Sara

From: Hernandez-Quinones, Samuel
Sent: Friday, May 16, 2014 2:34 PM
To: DeCair, Sara
Subject: RE: Edited H2O briefing

Hi Sara,

I have revised the briefing document. I incorporated most of your changes but at this time we want to keep the "do not drink" label on the recomendations. This could be discussed during the meeting.

I moved up the timeline for the development of the FR action as you suggested, but since there is so much uncertainty over at what level the decision will be made with respect to the water part that I am including a range of dates that I feel more confident in which we could provide input. Also this is something we can discuss during the meeting.

Thank You

Sam

==========

Samuel Hernández Quiñones, P.E.
Environmental Engineer
Environmental Protection Agency
Office of Water
1200 Pennsylvania Ave. NW
Washington, DC 20460
202-564-1735
"USEPA Protecting Human Health and the Environment"

To: Shih-Yew Chen[schen32@iit.edu]; Irwin, William[william.irwin@state.vt.us]; Kosti, Ourania[OKosti@nas.edu]; Ruffo, Robyn[robyn.ruffo@fema.dhs.gov]; Mauldin, Deborah[Deborah.Mauldin@fema.dhs.gov]; Bennett, Gerilee (Gerilee.Bennett@fema.dhs.gov)[Gerilee.Bennett@fema.dhs.gov]; asa01@health.state.ny.us[asa01@health.state.ny.us]; Linet, Martha (NIH/NCI) [E] (linetm@exchange.nih.gov)[linetm@exchange.nih.gov]
Cc: Schultheisz, Daniel[Schultheisz.Daniel@epa.gov]; Nesky, Anthony[Nesky.Tony@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]; Forinash, Betsy[Forinash.Betsy@epa.gov]
From: DeCair, Sara
Sent: Wed 5/7/2014 4:53:12 PM
Subject: DeCair slides: NAS Symposium on the Science of Response to a Nuclear Accident: Evacuations and resettlement
NAS Beebe PAGs to Recovery DeCair 5-6-2014.pptx

Good afternoon all;

I hope it's not too, too late for you to take a glance through my slides before they are due to NAS on Friday. If you see anything that could use clarifying or editing, please let me know. Thanks, and see you next week!

Sara

202-343-9108

From: Shih-Yew Chen [mailto:schen32@iit.edu]
Sent: Friday, May 02, 2014 2:31 PM
To: Irwin, William
Cc: Kosti, Ourania; DeCair, Sara; Ruffo, Robyn; Mauldin, Deborah; Bennett, Gerilee (Gerilee.Bennett@fema.dhs.gov); asa01@health.state.ny.us; Linet, Martha (NIH/NCI) [E] (linetm@exchange.nih.gov)
Subject: Re: NAS Symposium on the Science of Response to a Nuclear Accident: Evacuations and resettlement

Bill,

It's a pleasure. Look forward to a great session.

Thanks.

S.Y.

IIT

On Friday, May 2, 2014, Irwin, William <william.irwin@state.vt.us> wrote:

Dear Dr. Chen,

I appreciate the quality and information in your presentation. I did not read it before completing mine, but our two presentations seem to work well together. I must take care not to dwell long on any of my slides, though with but ten minutes to speak.

Thank you for sharing your work with us.

Bill

William Irwin, ScD, CHP | Radiological & Toxicological Sciences Chief |802-863-7238 (O)| 802-316-0119 (M) | 802-250-3592 (P)

From: Shih-Yew Chen [mailto:schen32@iit.edu]
Sent: Thursday, May 01, 2014 1:30 PM
To: Kosti, Ourania
Cc: DeCair, Sara; Ruffo, Robyn; Mauldin, Deborah; Irwin, William; Bennett, Gerilee (Gerilee.Bennett@fema.dhs.gov); asa01@health.state.ny.us; Linet, Martha (NIH/NCI) [E] (linetm@exchange.nih.gov)
Subject: Re: NAS Symposium on the Science of Response to a Nuclear Accident: Evacuations and resettlement

Hi All,

Here is my slides to share. Welcome any comment. I will limit my time to within 10 min. as required.

S.Y.

On Thu, May 1, 2014 at 11:58 AM, Kosti, Ourania <OKosti@nas.edu> wrote:

Dear Panel participants,

At your conference call earlier this month you indicated that it would be beneficial to circulate your presentations within the group to ensure consistency and coverage of important topics related to Post Emergency Transition to Recovery. I encourage you to do so. As a reminder your **final presentations are due to me Friday, May 9**.

Thanks,

Rania

From: Kosti, Ourania
Sent: Tuesday, April 15, 2014 2:38 PM
To: 'DeCair, Sara'; 'Ruffo, Robyn'; 'Mauldin, Deborah'; 'Irwin, William'; 'Shih-Yew Chen'; Bennett, Gerilee (Gerilee.Bennett@fema.dhs.gov)
Cc: 'asa01@health.state.ny.us'; 'Linet, Martha (NIH/NCI) [E] (linetm@exchange.nih.gov)'; Kosti, Ourania

Subject: RE: NAS Symposium on the Science of Response to a Nuclear Accident: Evacuations and resettlement

All:

Thank you for a productive conference call. Following our discussions, your session title and order of presentations has been revised to:

Post Emergency Transition to Recovery

William Irwin, Vermont Department of Health

Gerilee Bennett, Federal Emergency Management Agency

Sara D. DeCair, Environmental Protection Agency

S.Y. Chen, Illinois Institute of Technology

Also, as we discussed:

- The focus of the session has switched to intermediate and late phases of the response to a nuclear reactor accident

- The NAS staff authored White Paper will include a description of the emergency response to nuclear reactor accident event progression<

To: Veal, Lee[Veal.Lee@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]; Edwards, Jonathan[Edwards.Jonathan@epa.gov]
From: DeCair, Sara
Sent: Mon 4/28/2014 3:42:06 PM
Subject: PAG Manual and Water project plans
PAG Project Planning 4-21-2014.docx
Water PAG proposal timeline 4-24-2014.docx

Still doing redline edits of the Manual, so the Manual project plan hasn't changed. But the Water timeline is updated with some pretty optimistic AA and DA steps added. Let me know if you have any suggestions, and we'll be sure to talk about this at the call I've set up with Lisa Christ on Thursday.

Thanks!

Sara

Six months of PAG Subcommittee meetings (until March 2014): The PAG Subcommittee meets approximately every two weeks to discuss and adjudicate comments. The 4,993 comments have been binned into categories and we've prepared written internal "Resolution" decisions with the PAG Subcommittee with the following current status:

- Evacuation -- done
- 2X Background Tables -- done
- Relocation -- done
- Dose assessment – pending a March 5 Symposium on projecting dose to age groups/gender
- KI and/or thyroid-based evacuation – pending analysis by NRC and DOE
- Water – OW, in progress
- Worker Protection -- done
- Combined Intermediate Phase PAG -- or decision on addressing drinking water issues – pending justification from Navy Nuke *or a water PAG*
- **Cleanup – no substantive changes needed** title change to "Planning Guidance …" & all incidents are unique
- **Waste Management – no substantive changes needed**
- General – done, pending 3rd version of one-pager on "What We Heard"
- Process/Administrative – closely related to General comments that we can address in one-pager, above
- Anti-Weblink (e.g., comments to include all tables into document) – done
- Miscellaneous – done
- Editorial – in progress

Addressing Drinking Water: OGWDW is developing a potential approach for addressing drinking water using tiered risk levels and several precautionary action options. This potential approach was briefed to ODs on Mar. 19 and next steps decided. Decision briefing: May 20, 2014. A separate project plan/timeline is attached. See pros & cons for issuing water guide with or without the full PAG Manual.

Dosimetry symposium: To answer the technical policy question of how to properly implement ICRP 60 series dosimetry with age- and gender-specific dose conversions, an interagency symposium will be held at 1310 L Street to discuss in particular, what reference individual(s) to project doses to in our Evacuation recommendations. Discussion summary will be presented at PAG Subcommittee meeting for decision on recommendations, which should then be captured in PAG Manual language for users.

Three months of PAG Manual editing and refinement (through <u>May 2014</u>): With contractor support and interagency key staff help, we'll incorporate all the suggestions according to the comment spreadsheet decisions and create a single redline/strikeout version for review. Started Mar. 7 with 'easy' edits and many items needing follow up are next. Key ORIA staff who usually assist are: Scott Telofski, Lowell Ralston, Wes Boyd. Additional volunteers will be recruited! Rather than frequent PAG Subcommittee meetings, the group will be asked to review subsections of edited Manual text.

Summary of next steps and the future:

- <u>March 19, 2014:</u> Briefing with OGWDW and ORIA OD on drinking water approaches.
- <u>Ongoing through May 2014:</u> Staff and contractor draft revisions to manual, product is single redline/strikeout document for review.
- <u>May 20, 2014:</u> Brief ODs on drinking water products to decide on approach.
- <u>June – July 2014:</u> Interoffice OD level briefings and reviews, in particular on Water, Cleanup and Waste sections. Time frame may vary depending upon level of engagement from other offices. Finalize PAG Manual for delivery to OPEI and OMB by August.

ED_001057_00023669

- August 2014: FRPCC (interagency) presentation of draft (should be quick, since those same individuals staff the Subcommittee).
- August 2014: OPEI & OMB discussions begin. Time estimates for this review will be driven by OMB priorities and history tells us that this could require 12 weeks or 12 months.
- Estimate November 2014: OMB interagency review is complete and package is returned to EPA for publication.
- Estimate December 2014: Final Manual to be announced in the Federal Register. That announcement should describe a twelve-month implementation timeframe during which response organizations can update plans, procedures and training to start using the new, final PAG Manual.

Ideas for streamlining intra- and inter-agency reviews:

- Start briefings in June with top leadership to keep the feedback at a strategic level. Include enough details to explain all changes in Early & Intermediate Phase chapters, and that no changes were needed in Late Phase chapter.
- Brief the interagency PAG Subcommittee on the water proposed approach.
- Brief Bob Perciasepe if and when he is interested.
- Consider using OHS as a conduit for intra-agency reviews.
- Engage with OGC early.
- Talk with OMB about process and FR Notice of Final Manual, water proposal.

Variables that could impact this timeline:

- Method and timeframe for communicating the water proposal to stakeholders.
- Internal agency review demands.
- OMB priorities and required review period.
- Complexity of comments returned from interagency review.

ED_001057_00023669

Water PAG Proposal Timeline Apr. 24, 2014

(dates listed below are estimated completion targets, subject to change)

- Brief ODs of ORIA and OGWDW on proposed approach to gather advice on process. **(Mar. 19)** *completed*
- Prepare this internal Communications Plan to guide our steps and a one-page paper describing our approach for our multi-agency partners. **(Mar. 21)** *completed*
- Meeting between ORIA and OGWDW staff **(Mar. 26)** *completed*
  - ✓ Finalize this timeline per management input
- Draft language to support risk/age group/nuclide concentration tables **(Apr. 30)**
  - ✓ Optional actions couched as precautionary actions or planning guidance
  - ✓ Upper level (dose or risk) tied to a 'do not drink' action
- Brief ODs on PAG recommendation and precautionary actions/planning guidance **(May 20)**
  - ✓ Decision on PAG and optional actions to use, risk groups
  - ✓ Decision on issuing FR notice for water separately or with Manual (see pros & cons ↓)
  - ✓ Ask ODs to contact their counterparts in OGC, OSWER and OHS
  - ✓ Ask ODs for process steps needed with AAs, DA so we can start scheduling
- Draft FR Notice language and PAG Manual water language **(May 20)**
  - ✓ Regardless of separate or combined with final Manual, need to describe proposal
- Have updated Water proposal reviewed by OSWER, OHS and OGC. **(starting Jun. 2)**
  - ✓ Assuming ORIA, OGWDW reviews done
  - ✓ WLO and ARLO review concurrently
  - ✓ Staff level and OD-level conversations to discuss feedback
- Brief multi-agency PAGs Subcommittee & get concurrence on FR Notice, Water proposal **(Jun. 16)**
  - ✓ More broadly too, through FRPCC & National Response Team
  - ✓ Set timeframe and focus on showstoppers only
  - ✓ Schedule a couple of conference calls to discuss
  - ✓ Adjudicate feedback
- Discuss how risk and dose coefficients are developed with Jerry & Lowell (**mid-June)**
- Expand internal review: NHSRC, OHS, SHEMD, OECA, Regional Radiation Programs **(Jun. 24)**
  - ✓ Describe the nature of the approach and this review
  - ✓ Set a timeframe for the review
- Brief AAs, DA as appropriate **(July 1-14)**
- Brief ORIA Labs, Regions, Special Teams on approach **(Jun. 30)**
- Spread word about the proposal to key external audiences **(Jul. 14)**
  - ✓ AWWA
  - ✓ HPS, CRCPD, NARR
- Develop Water proposal *Federal Register* package, which will include the following: **(Aug. 1)**
  - Federal Register Notice,

- Water section of PAG Manual,
- Memorandum from ORIA Office Director to OAR Assistant Administrator,
- Action Memo from OAR Assistant Administrator to EPA Administrator,
- Communications material: Desk statement, key messages.

- OPEI review and facilitation **(Aug. 1-20)**
  - ✓ Identify correct timeframe to engage OPEI
  - ✓ Identify correct timeframe to engage OMB
- OMB 90-day Review (**Aug. 20 ---- _____**)
  - ✓ FR package from AA to OPEI
  - ✓ Initial meeting with OMB desk officer and technical staff
  - ✓ Interagency review through Regulatory Policy Officers
- Finalize edited FR Notice and PAGs Manual **(OMB release + 14 days)**
  - ✓ Incorporate OMB and multi-agency suggestions
  - ✓ Brief EPA's upper management
- Complete *Federal Register* Workflow, including: **(OMB release + 30 days)**
  - ✓ The Federal Register package goes from OPEI to OEX.
  - ✓ Conduct briefings as needed.
  - ✓ The Federal Register package goes from OEX to the Immediate Office of the Administrator for signature.
  - ✓ After signature, the Federal Register package is returned to OEX. OEX delivers the signed package to OPEI.
  - ✓ OPEI forwards the package to the Federal Register for publication.
- Compile and adjudicate comments from public review **(OMB release + 60 days)**
- Finalize Water section and fold in to PAG Manual **(OMB release + 90 days) (Feb. 2015?)**
-
- [PAG Manual finalization and issuance process described in Sara's project plan]
-
- Provide easy access to information on PAGs Manual update and FR notice
  - ✓ Link to FR notice from RPD homepage: www.epa.gov/radiation
  - ✓ Provide link to FR Notice and more details on the update in PAGs webpage http://www.epa.gov/radiation/rert/pags.html.
  - ✓ Encourage feedback through FR; email updates to list of all information requestors
- Conduct specific outreach to emergency response communities/organizations such as CRCPD, HPS, etc. during the public comment period
- Finalize PAGs Manual and Response to Comments for publication in FR **(Spring 2015)**
- Publish Frequently Asked Questions on the web page **(Spring 2015)**
  - Provide training, participation in exercises, and outreach information to aid implementation…

~~~
~~~

Pros and Cons for Separate or Combined FR Issuance

Separate prior issuance of water proposal:

Pros:

- ✓ More transparent and sincere solicitation of input
- ✓ Avoids confusion of interim final, proposal, and final Manual
- ✓ Allows time to do more refinements and improvements in final PAG Manual

Cons:

- ✓ Delays issuance of final PAG Manual
- ✓ Potentially pushes finalization into election cycle delays at OMB
- ✓ May confuse users about status of interim 2013 PAG Manual

Combined issuance of water proposal within final PAG Manual:

Pros:

- ✓ Provides final PAG Manual sooner to users
- ✓ Avoids additional delays in OMB review
- ✓ Allows interim use of water proposal in case of an incident

Cons:

- ✓ Agency may appear less willing to take input and revise/reissue final Manual
- ✓ Still requires another round of comment adjudication and finalization if changes needed

To: Veal, Lee[Veal.Lee@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]
From: DeCair, Sara
Sent: Mon 4/21/2014 1:29:49 PM
Subject: updated PAG & Water project plans
PAG Project Planning 4-21-2014.docx
Water PAG proposal timeline 4-21-2014.docx

Lee, Alan,

The attached updated project plans reflect what we talked about last week. Bottom line: The redline edits are taking a little longer than my optimistic estimates. Not a shocker! And Water is going a little more slowly than I would have liked, but I've set up pre-meetings with Jerry and Sam, and then will set manager meetings prior to the ODs decision brief (May 20) so we can be on the same page.

I adjusted timeframes in the Water project plan, and it paints the separate issuance scenario picture. I didn't yet do a combined issuance timeline. See the pros and cons (same as before) which we agree should be the focus on the ODs discussion/decision.

Let me know if I can change or adjust anything for your meeting with Mike tomorrow, and get this to Jon as well. Thanks!!

S.

Six months of PAG Subcommittee meetings (until March 2014): The PAG Subcommittee meets approximately every two weeks to discuss and adjudicate comments. The 4,993 comments have been binned into categories and we've prepared written internal "Resolution" decisions with the PAG Subcommittee with the following current status:

- Evacuation -- done
- 2X Background Tables -- done
- Relocation -- done
- Dose assessment – pending a March 5 Symposium on projecting dose to age groups/gender
- KI and/or thyroid-based evacuation – pending analysis by NRC and DOE
- Water – OW, in progress
- Worker Protection -- done
- Combined Intermediate Phase PAG -- or decision on addressing drinking water issues – pending justification from Navy Nuke *or a water PAG*
- **Cleanup – no substantive changes needed** title change to "Planning Guidance …" & all incidents are unique
- **Waste Management – no substantive changes needed**
- General – done, pending 3rd version of one-pager on "What We Heard"
- Process/Administrative – closely related to General comments that we can address in one-pager, above
- Anti-Weblink (e.g., comments to include all tables into document) – done
- Miscellaneous – done
- Editorial – in progress

Addressing Drinking Water: OGWDW is developing a potential approach for addressing drinking water using tiered risk levels and several precautionary action options. This potential approach was briefed to ODs on Mar. 19 and next steps decided. Decision briefing: May 20, 2014. A separate project plan/timeline is attached. See pros & cons for issuing water guide with or without the full PAG Manual.

Dosimetry symposium: To answer the technical policy question of how to properly implement ICRP 60 series dosimetry with age- and gender-specific dose conversions, an interagency symposium will be held at 1310 L Street to discuss in particular, what reference individual(s) to project doses to in our Evacuation recommendations. Discussion summary will be presented at PAG Subcommittee meeting for decision on recommendations, which should then be captured in PAG Manual language for users.

Three months of PAG Manual editing and refinement (through <u>May 2014</u>): With contractor support and interagency key staff help, we'll incorporate all the suggestions according to the comment spreadsheet decisions and create a single redline/strikeout version for review. Started Mar. 7 with 'easy' edits and many items needing follow up are next. Key ORIA staff who usually assist are: Scott Telofski, Lowell Ralston, Wes Boyd. Additional volunteers will be recruited! Rather than frequent PAG Subcommittee meetings, the group will be asked to review subsections of edited Manual text.

Summary of next steps and the future:

- <u>March 19, 2014:</u> Briefing with OGWDW and ORIA OD on drinking water approaches.
- <u>Ongoing through May 2014:</u> Staff and contractor draft revisions to manual, product is single redline/strikeout document for review.
- <u>May 20, 2014:</u> Brief ODs on drinking water products to decide on approach.
- <u>June – July 2014:</u> Interoffice OD level briefings and reviews, in particular on Water, Cleanup and Waste sections. Time frame may vary depending upon level of engagement from other offices. Finalize PAG Manual for delivery to OPEI and OMB by August.

ED_001057_00023676

- August 2014: FRPCC (interagency) presentation of draft (should be quick, since those same individuals staff the Subcommittee.)
- August 2014: OPEI & OMB discussions begin. Time estimates for this review will be driven by OMB priorities and history tells us that this could require 12 weeks or 12 months.
- Estimate November 2014: OMB interagency review is complete and package is returned to EPA for publication.
- Estimate December 2014: Final Manual to be announced in the Federal Register. That announcement should describe a twelve-month implementation timeframe during which response organizations can update plans, procedures and training to start using the new, final PAG Manual.

Ideas for streamlining intra- and inter-agency reviews:

- Start briefings in June with top leadership to keep the feedback at a strategic level. Include enough details to explain all changes in Early & Intermediate Phase chapters, and that no changes were needed in Late Phase chapter.
- Brief the interagency PAG Subcommittee on the water proposed approach.
- Brief Bob Perciasepe if and when he is interested.
- Consider using OHS as a conduit for intra-agency reviews.
- Engage with OGC early.
- Talk with OMB about process and FR Notice of Final Manual, water proposal.

Variables that could impact this timeline:

- Method and timeframe for communicating the water proposal to stakeholders.
- Internal agency review demands.
- OMB priorities and required review period.
- Complexity of comments returned from interagency review.

ED_001057_00023676

Water PAG Proposal Timeline Apr. 21, 2014

(dates listed below are estimated completion targets, subject to change)

- Brief ODs of ORIA and OGWDW on proposed approach to gather advice on process. **(Mar. 19)** *completed*
- Prepare this internal Communications Plan to guide our steps and a one-page paper describing our approach for our multi-agency partners. **(Mar. 21)** *completed*
- Meeting between ORIA and OGWDW staff **(Mar. 26)** *completed*
  - ✓ Finalize this timeline per management input
- Discuss how risk and dose coefficients are developed with Jerry & Lowell (**Apr. 24)**
- Draft language to support risk/age group/nuclide concentration tables **(Apr. 30)**
  - ✓ Optional actions couched as precautionary actions or planning guidance
  - ✓ Upper level (dose or risk) tied to a 'do not drink' action
- Brief ODs on risk tables and precautionary actions/planning guidance **(May 20)**
  - ✓ Decision on PAG and optional actions to use, risk groups
  - ✓ Decision on issuing FR notice for water separately or with Manual (see pros & cons ↓)
  - ✓ Ask ODs to contact their counterparts in OGC, OSWER and OHS
- Draft FR Notice language to announce and describe the proposed approach **(May 20)**
  - ✓ Regardless of separate or combined with final Manual, need to describe proposal
- Have updated Water proposal reviewed by OSWER, OHS and OGC. **(starting Jun. 2)**
  - ✓ ORIA, OGWDW reviews done
  - ✓ WLO and ARLO review concurrently
  - ✓ Staff level and OD-level conversations to discuss feedback
- Begin multi-agency PAGs Subcommittee review of FR Notice, Water proposal **(Jun. 16)**
  - ✓ More broadly into interagency through FRPCC, National Response Team
  - ✓ Set timeframe and focus on showstoppers only
  - ✓ Schedule a couple of conference calls to discuss
  - ✓ Conduct comment adjudication
- Engage multi-agency PAGs Subcommittee to obtain concurrence on the approach: DOE, NRC, HHS (FDA and CDC), DOL-OSHA, DOD, DHS, FEMA, and USDA, others... **(Jun. 30)**
  - ✓ Gauge DHS's reaction *3 key DHS offices on board*
  - ✓ Brief management, if needed
  - ✓ Set a call with PAGs Subcommittee (NRT as well?)
- Expand internal review: NHSRC, OHS, SHEMD, OECA, Regional Radiation Programs **(Jun. 24)**
  - ✓ Describe the nature of the approach and this review
  - ✓ Set a timeframe for the review
- Brief ORIA Labs, Regions on approach, by phone (**Jun. 30)**
- Get new approach message to Special Teams **(Jun. 30)**
- Spread word about the proposal to key external audiences **(Jul. 14)**

- ✓ AWWA
- ✓ HPS, CRCPD, NARR

- Develop Water proposal *Federal Register* package, which will include the following: **(Aug. 1)**
  - Federal Register Notice,
  - Water section of PAG Manual,
  - Memorandum from ORIA Office Director to OAR Assistant Administrator,
  - Action Memo from OAR Assistant Administrator to EPA Administrator,
  - Communications material: Desk statement, key messages.
- OPEI review and facilitation **(Aug. 1-20)**
  - ✓ Identify correct timeframe to engage OPEI
  - ✓ Identify correct timeframe to engage OMB
- OMB 90-day Review (**Aug. 20 ---- _____**)
  - ✓ FR package from AA to OPEI
  - ✓ Initial meeting with OMB desk officer and technical staff
  - ✓ Interagency review through Regulatory Policy Officers
- Finalize edited FR Notice and PAGs Manual **(OMB release + 14 days)**
  - ✓ Incorporate OMB and multi-agency suggestions
  - ✓ Brief EPA's upper management
- Complete *Federal Register* Workflow, including: **(OMB release + 30 days)**
  - ✓ The Federal Register package goes from OPEI to OEX.
  - ✓ Conduct briefings as needed.
  - ✓ The Federal Register package goes from OEX to the Immediate Office of the Administrator for signature.
  - ✓ After signature, the Federal Register package is returned to OEX. OEX delivers the signed package to OPEI.
  - ✓ OPEI forwards the package to the Federal Register for publication.
- Compile and adjudicate comments from public review
- Finalize Water section and fold in to PAG Manual
-
- [PAG Manual finalization and issuance process described in Sara's project plan]
-
- Provide easy access to information on PAGs Manual update and FR notice
  - ✓ Link to FR notice from RPD homepage: www.epa.gov/radiation
  - ✓ Provide link to FR Notice and more details on the update in PAGs webpage http://www.epa.gov/radiation/rert/pags.html.
  - ✓ Encourage feedback through FR; email updates to list of all information requestors
- Conduct specific outreach to emergency response communities/organizations such as CRCPD, HPS, etc. during the public comment period
- Finalize PAGs Manual and Response to Comments for publication in FR **(Spring 2015)**
  - ✓ Convene PAGs Subcommittee to respond to and incorporate comments

- Publish Frequently Asked Questions on the web page **(Spring 2015)**
  - Provide training, participation in exercises, and outreach information to aid implementation…

~~~

Pros and Cons for Separate or Combined FR Issuance

Separate prior issuance of water proposal:

Pros:

- ✓ More transparent and sincere solicitation of input
- ✓ Avoids confusion of interim final, proposal, and final Manual
- ✓ Allows time to do more refinements and improvements in final PAG Manual

Cons:

- ✓ Delays issuance of final PAG Manual
- ✓ Potentially pushes finalization into election cycle delays at OMB
- ✓ May confuse users about status of interim 2013 PAG Manual

Combined issuance of water proposal within final PAG Manual:

Pros:

- ✓ Provides final PAG Manual sooner to users
- ✓ Avoids additional delays in OMB review
- ✓ Allows interim use of water proposal in case of an incident

Cons:

- ✓ Agency may appear less willing to take input and revise/reissue final Manual
- ✓ Still requires another round of comment adjudication and finalization if changes needed
~~~

To: Schultheisz, Daniel[Schultheisz.Daniel@epa.gov]; Forinash, Betsy[Forinash.Betsy@epa.gov]; Nesky, Anthony[Nesky.Tony@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]
From: DeCair, Sara
Sent: Thur 4/17/2014 7:09:02 PM
Subject: What We Heard (on PAGs) for your review
PAGs-What We Heard 4-17-2014.docx

Tony and I did a new version of this, and you'll see a new "concerns" format. We don't want to fall into the trap of stating a misperception and lending it credence, but this is just an idea of how to organize it. Please send comments or additions to Tony and I by Monday, April 28th. Thank so much!

Sara D. DeCair

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

202-343-9108

What We Heard

We received 5,000 comments from members of the public, state and local response organizations, national and international radiation protection organizations. We adjudicated the comments with our interagency PAGs Subcommittee of the FRPCC and are finalizing the PAG Manual revision for publication, we hope, in late 2014.

Significant changes we made:

- Clarification on planning considerations related to the lower FDA KI (supplemental) PAG in combination with deleting the thyroid-based evacuation threshold
- Additional language on implementing the FRMAC tables of derived values
- A water PAG is provided for
- Maintained the removal of the Relocation PAG of 5 rem over 50 years to avoid confusion with long-term cleanup goals

Concern: The PAG Manual is way to weaken environmental regulations.

Environmental standards are legal limits designed to prevent health effects from everyday exposure to low levels of radiation over a human lifetime. The PAG levels are emergency guidance, not legal guidance, and do not overturn or weaken any standards or laws. The PAG levels are only used in an emergency when radiation levels have already exceeded environmental standards and could be high enough to cause health effects unless something is done. The PAG levels trigger public safety measures to minimize or avoid radiation exposure during an emergency.

Concern: The fact that the PAGs are higher than legal standards means that EPA is allowing more the public to get more radiation exposure.

PAGs are guidance for use only in an emergency. The increased risk for cancer from radiation exposure at the PAG levels is approximately 0.12% or 12 additional cancers out of 10,000 people. If used early in an emergency, the PAG Guidance could trigger safety actions to prevent the public from getting any additional exposure at all—they could be evacuated before the arrival of a radioactive plume. The PAG safety actions can be triggered by projected doses—officials do not have to wait for radiation measurements to order public safety measures if they have any reason to suspect that the radiation could approach the PAG levels.

Concern: The PAG Manual is not necessary. You should just base your emergency responses on existing environmental standards instead of the higher PAG triggers.

The PAGs are designed to prevent health effects by triggering public safety measures, such as evacuation. The PAG levels are higher than legal standards because they are based on the risk of health effects from radiation is that is high enough to warrant having people evacuate or stay indoors for extended periods.. The additional risk from a slight increase over legal limits is not worth the known risks of evacuation or sheltering in place; traffic accidents, trips and falls, anxiety from separation of family members, etc. The PAGs are set at a level where the health risk from radiation exposure outweighs the

risk from the safety measures. Although higher than legal standards, the PAG levels are still highly protective, and the guidance in the PAG Manual is designed to prevent the public from ever being exposed to radiation at the PAG levels.

Emergency preparedness starts with radioactive materials regulation, nuclear facility siting and minimizing risks of industrial needs of the population. Preventing accidents by ensuring safety redundancies and training local responders to take quick actions will save people from disasters. PAGs are focused on making the best prompt actions when bad things are happening.

Concern: The PAG Manual is a "back door" that permits industry to give the public to get a higher dose of radiation than legal standards.

The PAG Manual provides guidance for emergency situations only. No one is permitting a radiological accident or terrorist event. As long there are nuclear materials in the world, we have the responsibility to plan responses to protect the public from potential releases. The PAG Manual is emergency guidance, not a legal standard, and cannot be used to set cleanup levels.

Concern: The doses in the PAG Manual set a precedent for EPA to weaken its radiation protection regulations.

The PAG Manual is a non-binding guidance document to help officials plan safety measures in the event of a radiological emergency. Standards are legally enforceable limits on radioactive emissions. The PAG Manual has no bearing on the interpretation, enforcement, or setting of standards. The PAG Manual was first issued in 1975, and has no effect on environmental regulations.

Concern: The cleanup guidance in the PAG Manual allows too much radiation.

The PAG Manual is non-binding guidance for emergency situations and cannot be used to set cleanup levels. Chapter 4 of the PAG Manual provides a list of considerations for planning and initiating a cleanup process after the emergency is brought under control, but does not prescribe cleanup levels. Cleanup may take a long time and some safety measures may be necessary for years. For instance, some restrictions on use of certain areas may be in place for a long time.

Where cleanup goals don't achieve background levels, land use might have to be restricted. Superfund, for instance, balances reduced exposure with practical requirements of removing the contamination.

A cleanup level will be decided by decision makers along with community members to balance the goals with their needs. Jobs, homes, social, practical and technical factors will inform the cleanup goals set. How long the cleanup takes will directly impact people's ability to work and live in an area. This process can be sped up with additional funding, workers, equipment, technology and the collaboration with local residents helping out.

To: 'Edward"<Edward.Regnier@hq.doe.gov> "Regnier'[Edward.Regnier@hq.doe.gov]; Edwards, Jonathan[Edwards.Jonathan@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]; Boyd, Mike[Boyd.Mike@epa.gov]; 'Kraus, Terrence D'[tdkraus@sandia.gov]; 'Carlos.Corredor@Hq.Doe.Gov'[Carlos.Corredor@Hq.Doe.Gov]; 'Favret, Derek'[Derek.Favret@Hq.Doe.Gov]; 'Patricia.Milligan@nrc.gov'[Patricia.Milligan@nrc.gov]; 'michael.howe@fema.dhs.gov'[michael.howe@fema.dhs.gov]; 'paul.ward@fema.dhs.gov'[paul.ward@fema.dhs.gov]; 'Michael.Noska@fda.hhs.gov'[Michael.Noska@fda.hhs.gov]; 'Whitcomb, Robert (CDC)'[byw3@CDC.GOV]; 'nolan.hertel@me.gatech.edu'[nolan.hertel@me.gatech.edu]; 'kfe@ornl.gov'[kfe@ornl.gov]; 'Kowalczik, Jeff'[Jeff.Kowalczik@nrc.gov]; 'donald.cool@nrc.gov'[donald.cool@nrc.gov]; 'Jensen, John'[john.jensen@usda.gov]; Boyd, Wesley L.[Boyd.Wesley@epa.gov]; 'Andrew.Wallo@hq.doe.gov'[Andrew.Wallo@hq.doe.gov]; 'Dixon, John E. (CDC)'[gyf7@CDC.GOV]; 'Jensen, JohnT'[John.Jensen@dm.usda.gov]; Mosser, Jennifer[Mosser.Jennifer@epa.gov]; 'anthony.huffert@nrc.gov'[anthony.huffert@nrc.gov]
From: DeCair, Sara
Sent: Wed 4/2/2014 12:38:38 PM
Subject: Improved Summary & Next Steps: ICRP 60+ Symposium for Emergency Response
Summary 4-2-2014.docx

An improved version of the Summary is attached. Thanks!

From: DeCair, Sara
Sent: Tuesday, April 01, 2014 5:28 PM
To: 'Edward"<Edward.Regnier@hq.doe.gov> "Regnier'; Edwards, Jonathan; Veal, Lee; Perrin, Alan; Boyd, Mike; 'Kraus, Terrence D'; 'Carlos.Corredor@Hq.Doe.Gov'; 'Favret, Derek'; 'Patricia.Milligan@nrc.gov'; 'michael.howe@fema.dhs.gov'; 'paul.ward@fema.dhs.gov'; 'Michael.Noska@fda.hhs.gov'; 'Whitcomb, Robert (CDC)'; 'nolan.hertel@me.gatech.edu'; 'kfe@ornl.gov'; 'Kowalczik, Jeff'; 'donald.cool@nrc.gov'; 'Jensen, John'; Boyd, Wesley L.; 'Andrew.Wallo@hq.doe.gov'; 'Dixon, John E. (CDC)'; 'Jensen, JohnT'; Mosser, Jennifer; 'anthony.huffert@nrc.gov'
Subject: Summary & Next Steps: ICRP 60+ Symposium for Emergency Response

Thank you, everyone, for participating in the Symposium we hosted on March 5th. It was a productive conversation that will well inform the PAG Subcommittee's next steps. Please see attached a brief summary of the Symposium, and do let me know if you have any questions.

<< File: Summary 4-1-2014.docx >>

Sara D. DeCair
http://www.epa.gov/radiation/rert/pags.html
202-343-9108

To: 'Edward"<Edward.Regnier@hq.doe.gov> "Regnier'[Edward.Regnier@hq.doe.gov]; Edwards, Jonathan[Edwards.Jonathan@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]; Boyd, Mike[Boyd.Mike@epa.gov]; 'Kraus, Terrence D'[tdkraus@sandia.gov]; 'Carlos.Corredor@Hq.Doe.Gov'[Carlos.Corredor@Hq.Doe.Gov]; 'Favret, Derek'[Derek.Favret@Hq.Doe.Gov]; 'Patricia.Milligan@nrc.gov'[Patricia.Milligan@nrc.gov]; 'michael.howe@fema.dhs.gov'[michael.howe@fema.dhs.gov]; 'paul.ward@fema.dhs.gov'[paul.ward@fema.dhs.gov]; 'Michael.Noska@fda.hhs.gov'[Michael.Noska@fda.hhs.gov]; 'Whitcomb, Robert (CDC)'[byw3@CDC.GOV]; 'nolan.hertel@me.gatech.edu'[nolan.hertel@me.gatech.edu]; 'kfe@ornl.gov'[kfe@ornl.gov]; 'Kowalczik, Jeff'[Jeff.Kowalczik@nrc.gov]; 'donald.cool@nrc.gov'[donald.cool@nrc.gov]; 'Jensen, John'[john.jensen@usda.gov]; Boyd, Wesley L.[Boyd.Wesley@epa.gov]; 'Andrew.Wallo@hq.doe.gov'[Andrew.Wallo@hq.doe.gov]; 'Dixon, John E. (CDC)'[gyf7@CDC.GOV]; 'Jensen, JohnT'[John.Jensen@dm.usda.gov]; Mosser, Jennifer[Mosser.Jennifer@epa.gov]; 'anthony.huffert@nrc.gov'[anthony.huffert@nrc.gov]
From: DeCair, Sara
Sent: Tue 4/1/2014 9:28:30 PM
Subject: Summary & Next Steps: ICRP 60+ Symposium for Emergency Response
Summary 4-1-2014.docx

Thank you, everyone, for participating in the Symposium we hosted on March 5th. It was a productive conversation that will well inform the PAG Subcommittee's next steps. Please see attached a brief summary of the Symposium, and do let me know if you have any questions.

Sara D. DeCair
http://www.epa.gov/radiation/rert/pags.html
202-343-9108

Summary and Next Steps

Symposium: Using ICRP 60+ Dosimetry for Emergency Response Dose Projections on March 5, 2014

- *Participants*: Jon Edwards, Sara DeCair, Wes Boyd, Mike Boyd, Jen Mosser (EPA), Don Cool, Trish Milligan, Tony Huffert (NRC), Andy Wallo, Terry Kraus, Ed Regnier, Carlos Corredor, Derek Favret (DOE), Mike Noska (FDA), Paul Ward (FEMA), and John Jensen (USDA)
- *Primary question: How should updated dosimetry (ICRP 60 series including age- and gender-specific factors) be used for emergency response dose assessment, particularly early (four day) and intermediate phase (one year) projections? Discuss how each organization is implementing updated dosimetry in the various programs represented.*

- Sara DeCair on the EPA PAGs
  - ✓ In the 1992 PAG Manual, adult dosimetry was all that was available
  - ✓ Setting the PAG levels did include consideration of higher risks for fetus and those more difficult to move, so conservatism was built in
  - ✓ Making age group specific dose calculations adds complexity to managing the early phase that may not be warranted (except in the case of radioiodines)
  - ✓ Being too conservative can result in the population being exposed to more risk from protective actions than the risk from radiation exposure, or avoiding less dose than intended, per ICRP 63
- Andy Wallo on DOE Health, Safety & Security using ICRP 60+
  - ✓ DOE is demonstrating compliance using an age and gender weighted person
  - ✓ Inhalation dose for most age groups exposed to most radionuclides are within a few percent of each other, the exceptions being a newborn exposed to H-3, P-32, Y-90, and I-131
  - ✓ Ingestion values differ by an order of magnitude
  - ✓ For emergency response, age specific dose coefficients may have merit for some radionuclides
  - ✓ Making age group specific calculations during the intermediate phase (where ingestion becomes more of a factor) should be considered
- Don Cool on NRC updating regulations
  - ✓ 10 CFR 20 may use age and gender weighted factors for chronic exposures
  - ✓ Part 50, App I used four age groups since 1976 and may go to six age groups
  - ✓ Coherence across agencies could happen, if only for a moment

- ✓ EPA & NRC Advanced Notices of Proposed Rulemaking may inform each other
- ✓ Look at ICRP 101 for Reference Person discussion about age groups and implication of simplifying, but note that it doesn't address short exposures

- Tony Huffert on NRC Emergency Preparedness
  - ✓ RASCAL updated with adult & 1 year old thyroid dose coefficients for the early phase
  - ✓ RASCAL now allows for merging source terms
  - ✓ Some nuclear power plant states already evacuate children at Site Area Emergency (SAE) – This decision is based on plant conditions and not on projected exposure (this is in contradiction to ICRP and made things "interesting" in Fukushima)
- Mike Boyd on Federal Guidance Report (FGR) updates
  - ✓ Note that ICRP has shifted to Residual Dose in their ICRP 103 recommendations
  - ✓ ICRP should issue new DCs within a few years to accompany those recommendations
  - ✓ FGR updates will proceed before & after that
  - ✓ FGR 11 workers adult only, FGR 15 (the new FGR 12) includes age and gender groups
- Nolan Hertel on ORNL Dose Conversions
  - ✓ DCAL will be updated with DCFPak on web for public when FGR 13 is published
  - ✓ ICRP Committees 2 and 4 and the main Commission are looking at use of Effective Dose
  - ✓ Effective dose coefficients: age-averaged versus adult are very, very similar due to 65% of the population being adults.
  - ✓ FGR 15 includes 29 organs, six age groups, gender averaged, with ICRP 103 tissue weighting factors, and 107 decay data. It is undergoing the last stages of editing and QA
  - ✓ Per capita dose coefficients (a.k.a. Reference Person) are great for chronic but for accidents, even age-averaged may underestimate some risks
- Terry Kraus (SNL – FRMAC Methods)
  - ✓ FRMAC method default is ICRP 60+ but can emulate 1992 PAG values (ICRP 26/30)
  - ✓ For the emergency phase, FRMAC uses the adult for most protection assessments except for KI administration, which is based on the 1-year old age group
  - ✓ Age groups are used when making DRL (and non FDA radionuclide DIL) calculations (usually intermediate phase)
  - ✓ If the most sensitive subgroup is used, then different PAG levels for each of the groups would be needed
  - ✓ For some scenarios, child whole body doses appear to be up to 15% higher than adult dose according to assessments presented. Further evaluations will be done to assess bounding cases
  - ✓ 2001 KI guidance has 7 age groups, thresholds, and dosages -- The simplified approach is to project 5 rem to 1 year old thyroid for KI for all
- Mike Noska on FDA's KI guidance and FDA's Food PAGs
  - ✓ 1998 Food PAG has six age groups and is based on diets for 10 age groups (includes drinking water as part of diet). Data based on EPA (1984) and USDA (1977-1978) study.
  - ✓ With the globalization of the food supply intake periods of less than one year should be examined as well as allowing for radionuclide decay (for I-131 this results in 1% of the original calculated activity)

- ✓ Using ICRP 60 DCs doesn't lead to large differences, but many other assumptions need to be updated as well (diet, supply, time)

- Next steps
  - ✓ It appears that most people endorse using the adult in early phase calculations (except for KI guidance when iodines are involved
  - ✓ For ingestion pathways involving food or water, and KI, the majority of the group was of the opinion that age specific calculation should be made
  - ✓ There are a lot of updates being made in the different agencies which may result in all agencies using the same methodology and DCFs
  - ✓ Presenting some worst-case projections, or bounding cases, to the Subcommittee should enable them to draft language ensuring protectiveness of all subpopulations while providing a simple PAG to implement
  - ✓ PAGs Subcommittee decide on language for PAG Manual users that includes a recommended approach with flexibility

***

To: Ferguson, Rafaela[Ferguson.Rafaela@epa.gov]
Cc: Edwards, Jonathan[Edwards.Jonathan@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]; DeCair, Sara[DeCair.Sara@epa.gov]
From: White, Rick
Sent: Mon 3/31/2014 7:05:07 PM
Subject: RE: PAGS 1-Pager 3-31-14 FINAL

Awesome. Thanks!

From: Ferguson, Rafaela
Sent: Monday, March 31, 2014 3:04 PM
To: White, Rick
Cc: Edwards, Jonathan; Perrin, Alan; Veal, Lee; DeCair, Sara
Subject: PAGS 1-Pager 3-31-14 FINAL
Importance: High

Rick,

Here's the 1-pager. Q&A to follow.

Rafie

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: White, Rick[White.Rick@epa.gov]
Cc: Edwards, Jonathan[Edwards.Jonathan@epa.gov]; Perrin, Alan[Perrin.Alan@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]; DeCair, Sara[DeCair.Sara@epa.gov]
From: Ferguson, Rafaela
Sent: Mon 3/31/2014 7:04:21 PM
Subject: PAGS 1-Pager 3-31-14 FINAL
PAGs TPs for AA 3-31-14 PM FINAL.docx

Rick,

Here's the 1-pager. Q&A to follow.

Rafie

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

Protective Action Guide (PAG) Manual and the 2013 Revision

Key Messages:

- On April 15, 2013, EPA proposed updates to the federal protective action guidelines for radiological incidents (PAG Manual) to reflect the best available radiation science and provide guidance to state and local emergency responders.
- The PAG Manual is a guideline, not a binding document, for use by state and local agencies as they develop their response strategies to nuclear emergencies.
- This document does not change the current regulatory structure or affect authorities including Superfund (CERCLA) or the National Contingency Plan.
- EPA expects to adjudicate comments (5,000+) and develop a final document by the end of 2014.

Background:

- Senators Markey and Boxer have both expressed interest in how protective the PAGs are of children, in particular with regard to water and cleanup.
    - They've asked us in the past about EPA's use of Reference Man, which is the old radiation dose assessment method that applied best to adult male workers in the nuclear industry. EPA is evaluating how best to incorporate the more modern (and complex) set of age- and gender-specific risk factors.
- The updated Protective Action Guides (PAG) Manual also includes a chapter on longer term cleanup and waste management. There is some misunderstanding that EPA is suggesting radioactive waste be disposed of in regular landfills.
- EPA has not proposed a specific drinking water PAG at this time, although we do solicit comment on this issue. We recommend that, to the extent practicable, emergency measures for drinking water be based on the enforceable drinking water standards (MCLs) under the Safe Drinking Water Act (SDWA).
- A total of 5,000+ comment sets were submitted to the on-line docket, around 350 of which provided substantive suggestions. We are in the process of adjudicating those comments now.

Sensitive subpopulations: PAG levels are set as health-based tipping points to prompt an action to avoid, not incur, that dose. When the PAGs were set in 1992, impacts to sensitive subpopulations were considered and a buffer built in to protect all members of affected communities. Conservatism is built into the PAGs because dose projections are made for the maximum exposed individuals. PAG levels were also set with consideration of economic and psychological impacts of evacuating communities and disrupting lives. We are considering all of these factors as we update the PAGs.

Drinking Water: Guidance on monitoring, notification and protective actions is provided in the PAG Manual, along with several online resources for drinking water system operators. However, in light of 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.

Cleanup: The late phase is the period beginning when cleanup and recovery actions have begun and ending when all recovery actions have been completed. Many federal, state, and local agencies have

important roles to play. Radiation protection considerations must 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 for designing cleanup and recovery efforts that could apply to a radiological incident. The cleanup process described in the PAG Manual, 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.

Waste management: Radioactive waste handling and disposal will be an ongoing endeavor during the entire emergency response. Planning guidance in the PAG Manual 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.

To: Ferguson, Rafaela[Ferguson.Rafaela@epa.gov]
Cc: Perrin, Alan[Perrin.Alan@epa.gov]; Edwards, Jonathan[Edwards.Jonathan@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]
From: White, Rick
Sent: Mon 3/31/2014 2:39:43 PM
Subject: RE: RPD One-Pagers and Q&As for Janet's Confirmation Hearing Final Submission

Thanks Rafie-

At quick and I mean quick glance, the PAGs document is very dense and doesn't really follow the look and feel of the other documents. Also, the key messages seem more like background vs. what are the answers to the questions she might get asked:

Why are we setting standards that are higher? Why are we setting clean-up levels that are different than Superfund? Answer to the misinformed questions that we have been getting all along should be addressed in the key messages. If that is confusing, let me know.

I'll start looking at them all now and rolling them into one package.

Thanks.

Rick

From: Ferguson, Rafaela
Sent: Monday, March 31, 2014 10:15 AM
To: White, Rick
Cc: Perrin, Alan; Edwards, Jonathan; Veal, Lee
Subject: RPD One-Pagers and Q&As for Janet's Confirmation Hearing Final Submission
Importance: High

Rick,

RPD's 1-pagers and Rad Q&A issues docs are attached.

Rafie

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: White, Rick[White.Rick@epa.gov]
Cc: Perrin, Alan[Perrin.Alan@epa.gov]; Edwards, Jonathan[Edwards.Jonathan@epa.gov]; Veal, Lee[Veal.Lee@epa.gov]
From: Ferguson, Rafaela
Sent: Mon 3/31/2014 2:15:08 PM
Subject: RPD One-Pagers and Q&As for Janet's Confirmation Hearing Final Submission
Rad ER TPs for AA 3-28-14 PM FINAL .docx
RadNet TPs for AA 3-28-14PM FINAL.docx
Fukushima TPs for AA 3-28-14 PM FINAL.docx
PAGs TPs for AA 3-28-14 PM FINAL.docx
WIPP TPs for AA 3-28-14 PM FINAL.docx
Confirmation Hearing - ORIA Radiation Issues 3-28-14 PM FINAL.docx

Rick,

RPD's 1-pagers and Rad Q&A issues docs are attached.

Rafie

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

Potential ORIA Issues for Confirmation Hearing

Radiation

Waste Isolation Pilot Plan (WIPP)

Q. What is EPA doing in response to the recent radiation release incident at the WIPP?

A. Since the release of radioactive material on February 14, 2014 at the WIPP, EPA has been working closely with the New Mexico Environment Department (NMED) in actively overseeing the actions being taken by the Department of Energy (DOE). Based on the available information, EPA does not believe that the radioactive releases from the WIPP present public health concerns or regulatory compliance issues. However, EPA is in daily communications with DOE and NMED and is taking the following actions to support and provide oversight of the response effort, and provide information for the public:

EPA Verification and Review of DOE Air Monitoring

- **Independent EPA air monitoring –** EPA's RadNet Monitor in Carlsbad continues to show radionuclide levels at background. Also, within the next 1-2 weeks, EPA plans to deploy 3-4 air samplers at the WIPP facility to corroborate DOE monitoring. These samplers are expected to be located on-site near existing DOE samplers and will be in place for a limited period of time during DOE's re-entry into the underground. The monitors will provide extra support during re-entry as well as independent verification of DOE's monitoring network. As the incident response progresses, EPA will continue to reevaluate whether additional monitors are needed in the near term.
- **Evaluation of DOE environmental monitoring system** – EPA is evaluating the number and location of DOE's environmental monitors to identify any needed improvements for the future to ensure adequate monitoring is in place should a similar incident occur in the future.

Oversight at the WIPP Site

- **On-site visits and inspections** – EPA plans to continue to conduct site visits, as needed, to oversee DOE's management of the incident including:
- EPA staff was on-site for an initial incident assessment and to attend public meetings;
- A more extensive site visit is planned shortly (along with the monitoring described above) to inspect the facility and gather information for EPA's review of DOE's environmental monitoring; EPA will conduct a follow-on site visit(s) to coordinate with DOE's incident investigation and to evaluate potential process improvements;
- A complete compliance inspection will be conducted at a later date when EPA can have full access to the underground, including the waste panels.

Communications

- EPA will continue to communicate regularly with DOE and the NMED, and will share information with the public on EPA's oversight actions at the WIPP facility through EPA's website and other mechanisms.

ED_001057_00023733

Q. What oversight has EPA been doing to make sure DOE was complying with environmental standards?

A. EPA's regulatory role under the Land Withdrawal Act is to certify that WIPP will remain in compliance with radioactive waste disposal standards (e.g., public dose and groundwater) for 10,000 years and recertify the facility every five years.

EPA determines WIPP's compliance by reviewing DOE submittals (planned change requests and recertification applications) and conducting regular inspections.

EPA reviews documents and procedures that are important to the long-term containment of waste. EPA also reviews DOE's compliance with operational doses from air releases (NESHAPs equivalent). EPA inspects waste generator sites (e.g., Hanford) that ship waste to WIPP, DOE's quality assurance program, and three on-site programs at WIPP including:

- Waste emplacement,
- Adherence to monitoring requirements (e.g., subsidence, groundwater flow), and
- DOE's compliance with public exposure to radiation (NESHAPs equivalent for annual radiation exposure estimates)

Q. It appears DOE's safety controls have gotten very lax over the years. What is EPA doing about it?

A. EPA's role at WIPP is primarily to ensure that WIPP will contain radioactive waste for 10,000 years. EPA does not have the authority to oversee other aspects of operational safety, as that is DOE's responsibility. EPA does review DOE's ability to identify radiation releases from WIPP and, if they occur, how DOE estimates the potential radiation exposure to the public. In the WIPP incident in February, DOE was able to measure the radioactivity released and to determine that the release did not represent a concern to public health.

Fukushima Contamination

Q. Seems radioactive contamination from Fukushima is still showing up on our West coast – what is EPA doing to address public fears about health risks?

A. EPA continues to monitor radiation levels nationwide with our RadNet fixed air stations. EPA's air monitoring data have not shown any radioactive elements associated with the damaged Japanese reactors since late 2011, and even then, the levels found were very low—always well below any level of public health concern. The monitoring data from RadNet is publicly available on EPA's web site.

EPA is aware of many of these public concerns and we are working closely with our federal and state partners who are tracking this situation in Japan. We've made more information available through our website (www.epa.gov/radiation) and through responses to citizens.

Q. Is EPA monitoring the ocean? Are our fish caught off Alaska and our West coast still safe to eat?

A. EPA does not monitor or sample ocean waters or operate outside of U.S. territories. We work with other federal agencies, including the National Oceanic and Atmospheric Administration

ED_001057_00023733

(NOAA), the Food and Drug Administration (FDA), and the Nuclear Regulatory Commission (NRC) to carefully follow the Fukushima ocean leak.

FDA has responsibility for monitoring food safety. As of March 2014, FDA has tested over 1300 import and domestic food samples (of which 225 were seafood or seafood products) to monitor for contamination from Fukushima. FDA has found no evidence that radionuclides from Fukushima are present in the U.S. food supply at levels that would pose a public health concern.

Q. What are you doing to guard against a major disaster at one of our nuclear power plants in the United States?

A. The Nuclear Regulatory Commission is responsible for overseeing the licensing and safe operation of nuclear power reactors. Based on lessons learned from Fukushima, the NRC is in the process of putting in place additional requirements and defense-in-depth measures to ensure power, operability and safety of reactors even under extreme conditions.

EPA routinely participates in response exercises and drills with our federal and state partners and nuclear power plants to ensure our ability to effectively deal with incidents.

Protective Action Guides

Q. Why is EPA even considering setting drinking water PAG levels above the MCL?

A. EPA has not proposed a specific drinking water PAG at this time. We recommend that, to the extent practicable, emergency measures for drinking water be based on the enforceable drinking water standards (MCLs) under the Safe Drinking Water Act (SDWA).

If this is not possible, the Agency recognizes it may be useful to provide information on what levels could be accepted for a short-term emergency situation, with the goal to return to compliance with drinking water standards as soon as possible.

States have the authority to determine if other corrective actions are needed (e.g. providing alternative water).

The Agency requested input on the appropriateness of, and possible values for, a drinking water PAG. We are considering public comments on this issue as we work towards a final PAGs document.

Q. Why have clean-up levels that are anything different than EPA's Superfund risk range?

A. The PAGs guide does not establish clean-up levels. We recognize that, as has been shown by the experience of Fukushima, decisions on clean-up, relocation and return of residents to contaminated areas following a major incident will be complex. 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—and the local communities themselves should be part of the decision making.

As part of this multi-faceted decision making process, it will be important to consider experience and reference levels from existing programs, such as the U.S. EPA's Superfund program, the U.S. NRC's process for decommissioning nuclear facilities and other national

ED_001057_00023733

recommendations.

Note that the PAGs are not binding and also are intended to apply in the phases following nuclear emergencies. The PAGs do not affect clean-ups or authorities under 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.

Radiological Emergency Preparedness

Q. Is EPA prepared to respond to a national radiation emergency?

A. EPA serves as the lead agency in responding to domestic impacts from a foreign nuclear incident, such as the Fukushima Dai'ichi power plant incident. For a domestic radiation incident, EPA plays a supporting role, providing key expertise and advice on radiation risks and protective actions. We stand ready to fulfill our role for any future incident.

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.

Q. Fukushima happened….what's EPA doing so we are prepared for a radiation emergency on US soil?

A. Much as with other significant emergency or disaster situations—natural or man-made—EPA will be part of a larger and broader federal response supporting state and local officials in the event of a radiation emergency on U.S. soil. And similar to those situation, we work continuously with our key partners—states, FEMA, the Department of Energy—to build our joint capabilities, ensure good coordination, and practice (or exercise) our response processes.

ED_001057_00023733

Fukushima

Key Messages

- EPA continues to coordinate with our partner federal, state, local and tribal agencies to follow the situation at the Fukushima nuclear power plant and respond to concerns.
- EPA's RadNet data have not shown any radioactive elements associated with the damaged Japanese reactors since July 2011.

Background

Fukushima Air Monitoring

- As a reminder, from late March to late July 2011, EPA RadNet data detected very low levels of radioactive material in the United States from the damaged nuclear reactors at Fukushima Daiichi.
    - All of the levels detected from March to July 2011 were very low, and were always numerous orders of magnitude below levels of public health concern.
- EPA is aware of continued concerns about any impacts from the Fukushima reactors, and we have updated our radiation website to include information and links to trusted scientific organizations that are monitoring the situation.

Ocean Monitoring

- EPA is not doing any ocean monitoring, but has been in discussions with NOAA.
- Experts agree that trace amounts of radioactive material associated with the Fukushima incident may be detected on the west coast of the United States, but the levels will be so low that there is no reason for concern.
- EPA is aware that the National Science Foundation awarded the Woods Hole Oceanographic Institute a $1.1 Million grant to track cesium and strontium from Fukushima in the North Pacific Ocean.
    - This project will provide data on how radionuclides are transported through the ocean and validate models used to predict the transport of these material through large bodies of water.

FDA Food Monitoring

- FDA Continues to sample fish as part of its food safety program, and is working with Alaska on its sampling plan.
- To date, FDA has no evidence that radionuclides from the Fukushima incident are present in the U.S. food supply at levels that would pose a public health concern.
- EPA continues to coordinate with FDA to maintain consistent public messaging and address public concerns.

Outreach

- In addition to continued coordination with our federal partners, EPA is actively reaching out to

concerned tribal communities and regularly participating in intergovernmental coordination conference calls led by the state of Alaska.

ED_001057_00023734

Protective Action Guide (PAG) Manual and the 2013 Revision

Key Messages:

- EPA OAR published an updated Protective Action Guide (PAG) Manual in April 2013 for public review and comment.
- Revisions to the guide include use of the best available radiation science and the addition of a chapter on longer term cleanup and waste management.
- EPA expects to adjudicate comments and develop a final document at the end of 2014.

Background: On April 15, 2013, EPA proposed updates to the federal protective action guidelines for radiological incidents (PAG Manual) to reflect the best available radiation science and provide guidance to state and local emergency responders. The guide was last updated in 1992, and we issued this update for public review and interim use. Radiation scientists and emergency response planners from multiple federal agencies - including FEMA, DOE, HHS, NRC and DOD - worked together to revise the PAG Manual.

Senators Markey and Boxer have both expressed interest in how protective the PAGs are of children, in particular with regard to water and cleanup. They've asked us in the past about our use of Reference Man, which is the old radiation dose assessment method that applied best to adult male workers in the nuclear industry but has since been replaced by a more modern (and complex) set of age- and gender-specific risk factors. They've also asked about how soon PAG levels would be returned to daily regulatory levels in an emergency, and whether we're suggesting radioactive waste be disposed of in regular landfills.

Implementation timeframe: We are in the midst of a two-year implementation timeframe as discussed with our state, NRC and FEMA partners. During this first year, we are incorporating the comments and producing a final revised Manual. Once that is issued, state, federal and local programs should take a year to update plans, procedures and training materials to start using the new Manual in 2015. 'Interim use' of the April 2013 draft allows states to use the new Manual sooner if needed, particularly if we have an incident before then.

Comments received: A total of 5,000 comment sets were submitted to the on-line docket, around 350 of which provided substantive suggestions. We are in the process of adjudicating those comments now.

State of preparedness in the US: FEMA established the Radiological Emergency Preparedness Program to (1) ensure the health and safety of citizens living around commercial nuclear power plants would be adequately protected in the event of a nuclear power plant accident and (2) inform and educate the public about radiological emergency preparedness. REP Program responsibilities encompass only "offsite" activities, that is, state, tribal and local government emergency planning and preparedness activities that take place beyond the nuclear power plant boundaries. Onsite activities continue to be the responsibility of the NRC. Decades of robust preparedness activities around nuclear plants also improve readiness to deal with a dirty bomb or other radiation events, as well. State radiation programs routinely deal with small incidents that don't warrant use of PAGs, or federal support at all.

Sensitive subpopulations: PAG levels are set as health-based tipping points to prompt an action to avoid, not incur, that dose. When the PAGs were set in 1992, impacts to sensitive subpopulations were

considered and a buffer built in to protect all members of affected communities. Conservatism is built into the PAGs because dose projections are made for the maximum exposed individuals. PAG levels were also set with consideration of economic and psychological impacts of evacuating communities and disrupting lives.

On March 5, we hosted an interagency group of experts on dose assessment to discuss how they are implementing International Commission on Radiation Protection (ICRP) 60 series recommendations and dosimetry factors, in particular age groups and gender. We hope to provide a set of recommended best practices for PAGs users to ensure the new dosimetry is implemented in a practical way for emergencies.

Drinking water: EPA has not proposed a specific drinking water PAG at this time. EPA has established enforceable drinking water standards for radionuclides under the Safe Drinking Water Act (SDWA). We recommend 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 the PAG Manual, along with several online resources for drinking water system operators. However, in light of 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.

Cleanup: 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 from months to years. The transition from response mode to cleanup 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 the PAG Manual, 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.

Waste management: Radioactive waste handling and disposal will be an ongoing endeavor during the entire emergency response. Planning guidance in the PAG Manual 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.

Radiological Emergency Response: US Plans and EPA Roles

Key Messages:

- **EPA's OAR has a primary role in radiological emergency preparedness and response.**
- **OAR brings unique capabilities necessary to protect public health and the environment.**
- **OAR staff are highly trained professionals with backgrounds including health physics, radiochemistry, engineering, biology, mathematics, and computer science.**

Background

EPA OAR's primary roles in radiological response are:

- conducting environmental monitoring, sampling, and data analysis
- assessing the national impact of any release on public health and the environment using RadNet
- providing technical advice on containment and cleanup of the radiological contamination
- assisting site restoration and recovery
- providing guidance to first responders on protecting people, resources, and the environment from radiation exposure through the Protective Action Guides (PAG) Manual.

OAR Capabilities: OAR's Radiological Emergency Response Team (RERT) is a team of multidisciplinary, specially trained staff from EPA, with the field component primarily from our National Center for Radiological Field Operations (NCRFO) in Las Vegas. The team provides critical scientific and technical support to state and local governments and to other federal agencies. Expertise in radiological monitoring and sampling with specialized equipment augment state and local capabilities and provide more detailed information than most field assets in the US. Our laboratory analysis capability at the National Analytical Radiation Environmental Laboratory (NAREL) in Montgomery provides services to a wide range of clients, including other EPA offices and Federal and State agencies. NAREL facilities incorporate state-of-the-art laboratory technology and equipment and include the latest health and safety techniques, as well as strict monitoring and control of laboratory emissions. Fundamental to the NAREL mission is a commitment to developing and applying the most advanced methods for measuring environmental radioactivity and evaluating its risk to the public.

National Context: Government resources alone cannot meet all the needs of those affected by terrorist attacks, natural disasters and other catastrophic events. When disaster strikes, people throughout the community and across our nation pitch in to help the response effort. The National Response Framework (NRF) provides context for how the whole community works together and how response efforts relate to other parts of national preparedness. It is one of the five documents in a suite of National Planning Frameworks. Each Framework covers one preparedness mission area: Prevention, Protection, Mitigation, Response or Recovery.

The Nuclear/Radiological Incident Annex of the NRF describes roles and responsibilities across numerous federal agencies and departments to address specific mission areas for radiation incidents. Depending on the origin of the radioactive material and the incident scenario, technical leadership will reside with the most expert federal agency. For instance, for Department of Defense radioactive materials, DoD leads the response. For radioactive materials that are foreign or can't be identified as regulated sources held by any federal agency (the "all others" category), EPA has a lead technical role with support from an interagency group called the Federal Radiological Monitoring and Assessment Center.

In any large disaster response in the US, DHS and/or FEMA will have an overall coordination role to assure that funding, legal authorities, priorities and situational awareness are maintained across federal, state and local layers of government.

EPA OAR Experience:

Incident	Description	EPA Response
Monitoring of Radiation from Foreign Incidents		
Fukushima, Japan (2011)	(please see separate one-pager)	(please see separate one-pager)
Tokaimura, Japan (1999)	Worker error led to the transfer of an excessive quantity of enriched uranium into a precipitation tank, causing an uncontrolled, self-sustained nuclear reaction.	EPA fully activated the nationwide RadNet system to monitor radioactivity in U.S. air and pasteurized milk, and found no increase in radioactivity levels.
Chernobyl (1986)	Reactor No. 4 exploded and burned for 10 days, emitting large quantities of radiation.	EPA was the Lead Federal Agency, conducting monitoring and assessment in the U.S., and providing public information.
Chinese Atmospheric Nuclear Tests, 1976	The People's Republic of China conducted two above-ground tests of nuclear weapons.	EPA fully activated ERAMS—now called RadNet—to monitor radioactivity in air, precipitation, and pasteurized milk and monitored continuously until levels returned to background levels.
Monitoring of Radiation from Domestic Incidents		
Los Alamos Fire (also known as the Cerro Grande Fire) (2000)	The Bandolier National Monument fire in New Mexico spread into the Los Alamos National Laboratory reservation, threatening areas with historical radiological contamination.	EPA set up low-volume air samplers and a mobile laboratory to monitor the air and confirmed that no radiation was released.
Brush Fires at DOE Hanford Reservation (2000)	Fires on the Reservation threatened to spread radioactivity to adjacent land.	EPA performed off-site air monitoring during the emergency to monitor for radioactivity.
Three Mile Island (1979)	A series of mechanical, electrical, and human failures led to the accidental release of radioactive vapor and water into the environment.	EPA provided off-site monitoring and assessment, assistance to the Lead Federal Agency, NRC, long-term monitoring after the accident.

RadNet Monitoring System

Key Messages

- RadNet is a comprehensive national radiological air monitoring system.
- RadNet monitoring results provide baseline data on background levels of radiation in the environment and can detect increased radiation from natural fluctuations and radiological incidents.

Background

- EPA's RadNet system has 132 air monitors across the country, detecting radiation in the air across the nation 24 hours a day, seven days a week.
    - The monitors provide real-time radiation measurement capability to track increases or decreases as they occur. Follow-up analysis of air filters in EPA's laboratories provides additional details on the levels and types of radionuclides, helping us understand the source of any changes in radiation levels.
    - These monitors are operated by trained volunteers from state and local agencies and universities.
- EPA's RadNet system also monitors precipitation, milk and drinking water as indicators of levels of radiation in the environment. **[Note: These are decades-old legacy systems that are currently being re-evaluated.]**
- All of EPA's RadNet air monitoring and sample analysis data is publically available.

Fukushima Monitoring

- In late March 2011, EPA air sample analysis detected very low levels of radioactive material in the United States from the damaged nuclear reactors at Fukushima Daiichi.
- EPA's RadNet data have not shown any radioactive elements associated with the damaged Japanese reactors since July 2011. The levels found from March to July 2011 were very low — above background but well below any level of public health concern.
- EPA is aware of public concern about the impacts of more recent radiation leaks in Japan on the United States.
- We continue to work with our partner federal agencies to follow the situation in Japan and respond to questions.
- We updated our radiation website, www.epa.gov/radiation, to include information and links to trusted scientific organizations that continue to monitor the situation.
    - Experts agree that the trace amounts of radioactive material associated with the Fukushima incident may be detected on the west coast of the United States, but the levels will be so low that there is no reason for concern.

Updates to RadNet System in Response to Inspector General 2011 report

- The IG Report from 2011 suggested three action items with regard to RadNet:
    1. Install the remaining monitors bringing the total number of monitors in the RadNet system to 134.
    2. Improve the support and maintenance contracts so that those maintaining the monitors have incentive to promptly fix and ensure the monitors are working correctly.
    3. Set an operational goal for the monitoring system.
- EPA has completed all the actions suggested.
    1. We committed to having 134 monitors installed by September 30, 2013. Currently, EPA's RadNet system has 132 air monitors installed and operating across the country, providing overlapping coverage in our ability to detect fluctuations in background levels of radiation across the nation. The remaining two are expected to be installed this spring, following slight delays due to the difficulty of identifying qualified available operators in remote locations.
    2. Since 2011, the EPA has strengthened contracts to provide disincentives when delivery schedules are not met and to complete maintenance in a timely fashion.
        - EPA has contracts in place for spare parts and monitor maintenance.
        - The maintenance contractor provides reports that document the status of the requested repairs at least monthly.
- EPA set a goal to have at least 80 percent of the monitors operational. These monitors are operated by trained volunteers from state and local agencies and universities. Most months, more than 90 percent of the monitors are operational.
- The IG is now confirming the status of corrective actions.

ED_001057_00023737