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The Trusted Integrator for Sustainable Solutions

REMOVAL SUPPORT TEAM 3
EPA CONTRACT EP-S2-14-01

April 15, 2016

Mr. Eric Daly, On-Scene Coordinator
U.S. Environmental Protection Agency
Response & Prevention Branch
2890 Woodbridge Avenue
Edison, NJ 08837

EPA CONTRACT NO: EP-S2-14-01
TDD NO: TO-0006-0064
DOCUMENT CONTROL NO: RST3-02-D-0248
SUBJECT: SITE-SPECIFIC HEALTH AND SAFETY PLAN – HOLY TRINITY CEMETERY SITE, LEWISTON, NIAGARA COUNTY, NEW YORK

Dear Mr. Daly,

Enclosed please find the Site-Specific Health and Safety Plan (HASP) for the radiation assessment activities to be conducted at the Holy Trinity Cemetery Site beginning the week of April 18, 2016. As part of the assessment, radiation surveying will be conducted to identify the extent of radiation exposure. If you have any questions or comments, please do not hesitate to contact me at (732) 585-4413.

Sincerely,

Weston Solutions, Inc.

For Bernard Nwosu
RST 3 Site Project Manager/Group Leader

Enclosure
cc: TDD File No.: TO-0006-0064

REGION II RST 3 HEALTH AND SAFETY PLAN
EMERGENCY RESPONSE/REMOVAL ASSESSMENT/REMOVAL ACTION

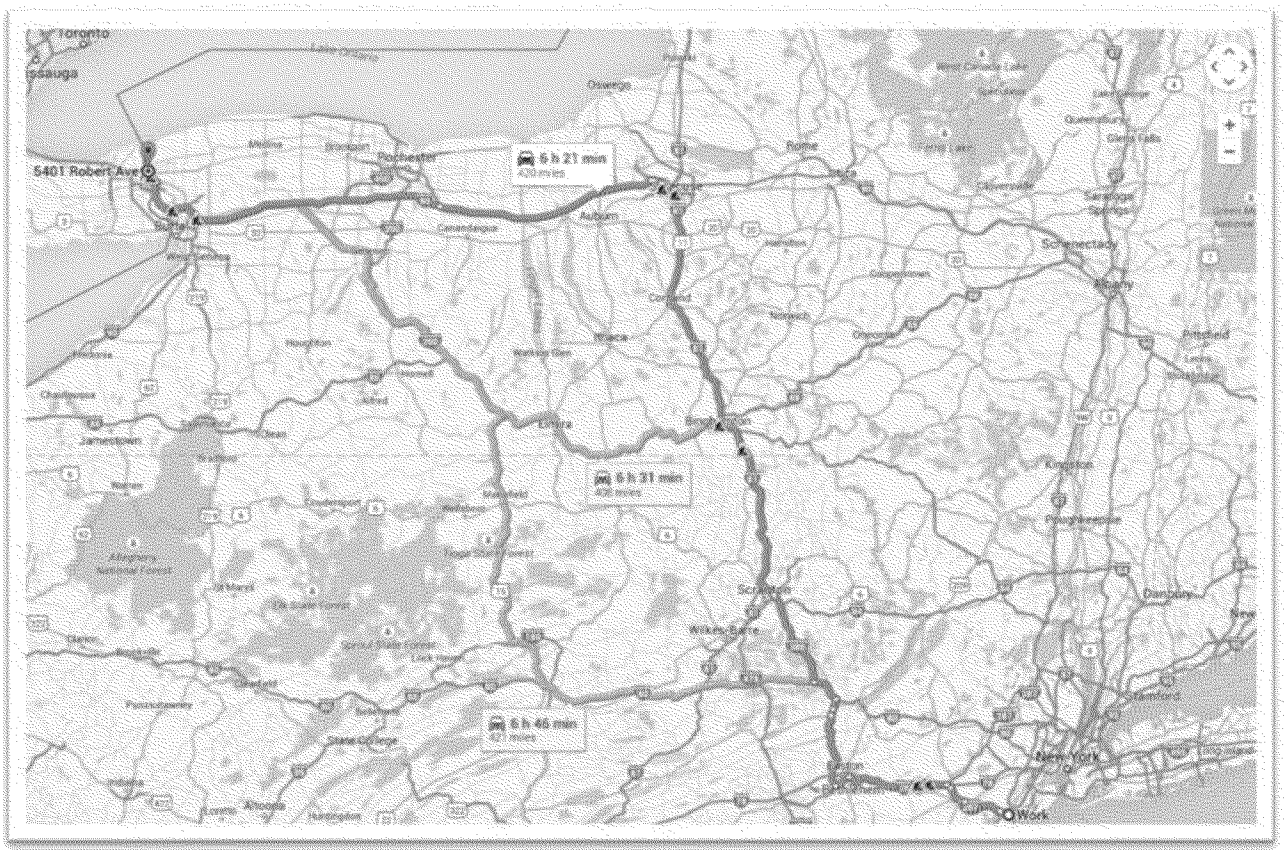
RST 3 TDD No.: TO-0006-0064 **Site Name**: Holy Trinity Cemetery Site

Site Address: Street: 5401 Robert Avenue
City/State: Lewiston, New York

Directions to Site: (Attach Color Map Following This Page)

1. Head **west** toward **King Georges Post Rd**	1.9 mi
2. Turn **left** onto **King Georges Post Rd**	289 ft
3. Turn **right** onto **Raritan Center Pkwy**	0.6 mi
4. Keep **right** at the fork, follow signs for **Middlesex County 514 E/Woodbridge Ave/I-287/NJ-440** and merge onto **Woodbridge Ave**	0.4 mi
5. Use the **right** lane to take the ramp onto **I-287 N**	0.8 mi
6. Merge onto **I-287 N**	2.1 mi
7. Keep **left** to stay on **I-287 N**	11.9 mi
8. Keep **right** to stay on **I-287 N**	6.3 mi
9. Use the **left** 2 lanes to take exit **21 B** toward **I-78 W/Easton PA**	1.5 mi
10. Merge onto **I-78 W**	31.0 mi
11. Keep **left** to stay on **I-78 W**	4.6 mi
12. Take exit **71** for **PA-33 N** toward **US-22/Stroudsburg**	0.4 mi
13. Continue onto **PA-33 N**	22.4 mi
14. Continue onto **PA-33 N/US-209 N**	2.0 mi
15. Keep **left** to continue on **PA-33 N/Hwy 33 N**, follow signs for **W Interstate 80 W/Bartonsville/Hazelton**	3.1 mi
16. Use the **left** lane to merge onto **I-80 W** toward **Hazelton**	9.0 mi
17. Keep **right** at the fork to continue on **I-380 N**, follow signs for **Scranton**	27.8 mi
18. Keep **right** to continue **I-380 N/I-84**, follow signs for **US-6 W/I-81 N/PA-347 Binghamton**	0.5 mi
19. Merge onto **I-81 N**	58.1 mi
20. Keep **right** at the fork to stay on **I-81 N**, follow signs for **I-88/Syracuse/Albany**	71.8 mi
21. Take the exit onto **I-690 W** toward **Fairgrounds/Baldwinsville**	7.7 mi
22. Keep **left** to stay on **I-690 W**	0.9 mi
23. Continue onto **NY-690 N**	0.2 mi
24. Take exit **1** to merge onto **I-90 W**	61.9 mi
25. Keep **left** to stay on **I-90 W**	69.0 mi
26. Take exit **50** for **I-290** toward **Niagara Falls**	0.4 mi
27. Continue on **I-290 W**	9.5 mi
28. Use the **right** 2 lanes to take the **Interstate 190 N** exit toward **Niagara Falls**	0.3 mi
29. Merge onto **I-190 N**	14.1 mi
30. Take exit **25 B** toward **NY-104/R. Moses Pkwy**	0.3 mi
31. Merge onto **Upper Mountain Rd**	0.3 mi
32. Use the **middle** lane to keep **left** at the fork and follow signs for **NY-104 W/R. Moses Pkwy**	0.1 mi
33. Keep **right**, follow signs for **New York 104 W/R. Moses N**	276 ft
34. Keep **right** and merge onto **NY-104 W**	0.3 mi
35. Turn **left** onto **Irving Dr**	0.3 mi
36. Irving Dr turns slightly **right** and becomes **Robert Ave; DESTINATION WILL BE ON RIGHT**	0.1 mi

Total Distance: 420 miles; Total Time: Approximately 6 hours, 21 minutes



This map is subject to Google's Terms of Service, and Google is the owner of rights therein.
Portions of this image have been removed for clarity.

Historical/Current Site Information:

The Holy Trinity Cemetery Site (the Site) consists of an area of radionuclide contamination located at a cemetery which is approximately 31.5 acres in Lewiston, New York. The Site is owned by Holy Trinity Cemetery, which has 2.91 acres of observed contamination located in the northernmost portion of the property on a relatively flat and slightly elevated grassy field, as well as on existing roadbeds. There is one building on the Site which is utilized both as a residence and cemetery maintenance facility. The Site is bordered to the north and east by Interstate 190; to the south by another cemetery; and to the west by Robert Avenue and a residential area.

In 1978, the U.S. Department of Energy (DOE) conducted an aerial radiological survey of the Niagara Falls region and identified more than 15 properties having elevated levels of radiation above background levels. It is believed that, in the early 1960s, slag from the Union Carbide facility located on 47th Street in Niagara Falls was used as fill on the properties prior to paving. The Union Carbide facility processed ore containing naturally-occurring high levels of uranium and thorium to extract niobium. The slag contained sufficient quantities of uranium and thorium to be classified as a licensable radioactive source material. Union Carbide subsequently obtained a license from the Atomic Energy Commission (AEC), now the Nuclear Regulatory Commission (NRC), and the State of New York; however, the slag had already been used as fill throughout the Niagara Falls region prior to licensing. Based on the original survey and subsequent investigations, it is believed that the radioactive Union Carbide slag was deposited on the Site.

In February 1980, the New York State Department of Health (NYSDOH) Bureau of Radiological Health and the Niagara County Health Department conducted a radiological survey of the Site to identify areas with elevated radioactivity resulting from the use of radioactive slag for fill on the property. The survey was conducted based on information that the slag used at the cemetery was from the same source used at two other locations in nearby Niagara Falls, which had been identified by the NYSDOH as containing elevated levels of radioactivity. During the survey, cemetery personnel showed NYSDOH a slag pile located near the caretaker's garage in the western portion of the property. Cemetery personnel stated that this slag was used as fill for the cemetery roads throughout the property.

In addition, the slag was used as fill for the base of two proposed roadbeds that extended approximately 500 to 600 feet from the caretaker's garage, northwest toward Robert Avenue. At the time of the survey, the construction of these roads had been abandoned. The underlying slag base was covered with an unknown amount of soil and was left as an open field. Using an Eberline PRM 7 radiation meter, radiological survey of the slag pile indicated gamma radiation measuring 250 microroentgens per hour (μR/hr) and along cemetery roads, gamma readings ranged from 5 μR/hr (i.e., background concentration) to 30 μR/hr. Gamma readings along the abandoned roadbeds ranged from 200 μR/hr to 400 μR/hr. Samples of the slag were collected as part of the investigation. Laboratory analyses of the samples indicated that the concentrations of isotopic uranium, isotopic thorium, radium-226, and radium-228, were significantly higher than background values.

In October 2006, the New York State Department of Environmental Conservation (NYSDEC) and the Niagara County Health Department conducted a reconnaissance of the Site. At the time, the slag pile previously observed near the caretaker's garage was no longer on the Site; the current caretaker had neither knowledge of the slag pile, nor what happened to it. The caretaker also indicated that children living nearby used this area for recreation. Since the 1980 NYSDOH site investigation, trees had grown through the abandoned slag roadbeds, pushing the slag to the surface. As part of the site visit, NYSDEC conducted a radiological survey with an Exploranium GR-135. Radiological measurements taken while walking along the roadbed indicated gamma readings ranging from 200 to 450 μR/hr at waist height (1 meter/3 feet above the ground) and at-contact reading (1 inch above the ground) ranging from 450 to 570 μR/hr. At-contact reading taken next to exposed slag near a tree was documented at 700 μR/hr. NYSDEC collected four slag samples which were analyzed for isotopic uranium and isotopic thorium via gamma-ray spectroscopy. Laboratory analytical results indicated the presence of uranium-238/234 at concentrations ranging from 114 picocuries per gram (pCi/g) to 1,664 pCi/g and thorium-232 from 114 pCi/g to 898 pCi/g.

In May 2007, NYSDEC visited the Site to identify contamination in an on-site debris pile using gamma-ray spectroscopy. During a 5-minute static survey, radium-226 was the only nuclide identified. A similar survey conducted on one of the roadbeds confirmed the presence of thorium-232.

During a reconnaissance performed by the NYSDOH and NYSDEC in July 2013, a radiological survey of on-site roadways and along the back roadway leading off site was conducted using a pressurized ion chamber (PIC) and a sodium iodide (NaI) 2x2 detector. Measurements taken along the roadways with the PIC indicated gamma levels up to 51 μR/hr and up to 50,000 counts per minute (cpm) with the sodium iodide detector.

On December 12 and 13, 2013, the U.S. Environmental Protection Agency (EPA) contractor, Weston Solutions, Inc., Site Assessment Team (SAT) personnel collected a total of 14 subsurface soil samples and three slag samples from the Site. In order to document background conditions, soil samples were also collected from two locations suspected to be outside of the

source area. At each sample location, soil samples were collected directly beneath slag material; at locations where a radioactive fill layer was not visually observed, the soil sample was collected at the equivalent depth interval. Each slag sample consisted of one single piece of slag material. The soil samples were analyzed by TestAmerica Laboratories for target analyte list (TAL) metals [Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES)] via EPA SW846 Method 6010C; isotopic thorium and isotopic uranium, via DOE alpha spectroscopy Health and Safety Laboratory (HASL)-300 Method A-01-R; radium-226, radium-228, and radioisotopes, via DOE gamma spectroscopy HASL-300 Method GA-01-R. The slag samples were analyzed for isotopic thorium and isotopic uranium, via DOE alpha spectroscopy HASL-300 Method A-01-R; radium-226, radium-228, and radioisotopes, via DOE gamma spectroscopy HASL-300 Method GA-01-R. For quality assurance/quality control (QA/QC) purposes, one soil sample for TAL metals analysis was designated as a matrix spike/matrix spike duplicate (MS/MSD) sample. One rinsate blank sample was collected to demonstrate adequate decontamination of non-dedicated sampling equipment (*i.e.*, Geoprobe® cutting shoe). Analytical results indicated concentrations of radionuclides in all the slag samples and seven soil samples, including the field duplicate, to be significantly higher than at background conditions.

On May 1, 2014, SAT personnel collected radon and thoron concentration measurements from locations on and in the vicinity of the Site. At the selected locations in background areas, above the source material, and off the source area, radon and thoron concentration measurements in picocuries per liter (pCi/L) were collected with RAD7 radon detectors. The radon and thoron measurements were collected at heights of one meter above the ground surface. The measurements included uncertainty values, which were taken into account to calculate adjusted concentrations for evaluation of observed release in the air migration pathway. There were no radon or thoron concentrations that exceeded the site-specific background concentration, nor were there any adjusted concentrations that equaled or exceeded a value two standard deviations above the mean site-specific background concentration for these radionuclides in this sample type (i.e., there was no evidence of an observed release to air from Site sources).

On August 10 through 13, 2015, EPA with the support of Weston Solutions, Inc., Removal Support Team 3 (RST 3) conducted a Removal Assessment of the Site. RST 3 determined the presence/absence of radon/thoron gases and gamma radiation through radiological surveys and delineated areas of observed contamination by comparing radiological survey measurements from suspected source areas with measurements obtained from a background location. RST 3 also utilized laboratory analyses to ascertain the concentration of radon gas being emitted within living spaces of the one on-site building and verified the presence of residual contamination and potential releases of radiation-containing materials in soil and fill material associated with slag from the former Union Carbide facility.

Gamma radiological surveys were conducted using Fluke Pressurized Ionization Chamber (FPIC) Model 451P, Ludlum Model 2241 (Ludlum-2241), and Reuter-Stokes RSS-131ER High Pressure Ion Chamber (HPIC) gamma survey meters. Specific isotopes were identified using a Berkeley Nucleonics Corporation (BNC) SAM 940™ (SAM 940) portable, radioisotope identification system. The gamma survey instruments were used to identify on-site locations with above-background gamma readings and to determine on-site locations least likely impacted by historic on-site activities in order to select a location to obtain background readings. The background reading of each instrument was compared with survey data collected with each instrument to determine areas with elevated gamma readings. A Durridge RAD7 electronic radon/thoron detector was utilized to measure the concentration of radon and thoron in air. The background readings of each instrument utilized for the radiological survey indicated gamma at 9,900 to 10,700 cpm with Ludlum-2241, 7 to 16 μR/hr at waist-high and 9 to 17 μR/hr at contact with the FPIC, and 9.52 μR/hr with the HPIC. Background radon/thoron concentrations ranged

from 0 to <4.0 pCi/L and no radionuclides were detected with the SAM-940.

Based upon the results from gross gamma survey conducted with Ludlum-2241 in the on-site building, gamma radiation exposure rates ranged from 6,500 cpm (below-background lower limit value) within the office to 16,100 cpm (less than 2x above the upper limit background value) within the viewing room. In most areas of the building, lower limit gamma exposure rates were generally below background values; however, upper limit gamma values were generally above the background upper limit value. There were no areas within the on-site building that exhibited gamma radiation exposure rates that were up to 2x above the background upper limit value. Based upon the results from outdoor gross gamma survey conducted with Ludlum-2241 throughout the Site, gamma radiation exposure rates ranged from 8,900 cpm (below background values) to 569,000 cpm (more than 53x above the background upper limit value). Outdoor gamma values were generally greater than the upper limit background value. Based upon the results from gamma survey conducted with the FPIC in the on-site building, waist-high and at-contact measurements, respectively, ranged from, 3 to 19 μR/hr. FPIC gamma values were generally within the background upper limit value.

Based upon the results from gamma survey conducted with HPIC at three locations in the on-site building, gamma radiation exposure rates ranged from 9.56 to 10.94 μR/hr. Based upon the results from outdoor gamma survey conducted with HPIC at all the on-site soil sampling locations, gamma radiation exposure rates ranged from 10.02 μR/hr at soil sample location H001-SS005 to 256.34 μR/hr (more than 26x above-background value) at soil sample location H002-SS008. Outdoor gamma values were generally greater than the background value. Based upon the results from gamma survey conducted with SAM-940 at a location on the east side of the on-site dirt road, radium-226 was detected.

Based upon the results from radon/thoron survey conducted with RAD7s in the on-site building, above-background concentrations of radon and thoron were not observed. Based upon the results from radon/thoron surveys conducted with RAD7s at all the eight on-site soil sampling locations, above-background concentration of radon was observed in at-contact measurement collected from soil sampling location H001-SS008. Waist-level thoron measurements collected from the eight soil sampling locations indicated above-background concentrations of thoron in five of the soil sampling locations (H001-SS003, H001-SS004, H001-SS005, H001-SS007, and H001-SS008) and at-contact measurements of thoron in two (H001-SS003 and H001-SS008) of the these five locations were above-background.

On August 10 through 13, 2015, an RST 3-procured National Radon Proficiency Program (NRPP)-certified company utilized passive activated charcoal canisters (radon canisters) to conduct short-term radon sampling tests that lasted a minimum of approximately 72 hours. A total of 15 radon canisters, including two field duplicates and one field blank, were deployed in the one on-site building. Canister placement was conducted in accordance with the guidelines set forth in the American National Standards Institute (ANSI)/American Association of Radon Scientists and Technologists (AARST) *Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings* (MAMF 2012) and as directed by the EPA OSC. Radon testing locations were focused on frequently occupied spaces in the on-site building. Analytical results were compared with the EPA Site-Specific Action Level (SSAL) of 4.0 pCi/L. Analytical results did not indicate radon concentration above the EPA SSAL in any living spaces sampled within the on-site building.

On August 12, 2015, RST 3 conducted a soil sampling event to verify the presence of residual radiation-containing material in soil. Based upon the radiological survey data from SAT's prior site investigation and survey data from the radiological investigation conducted by RST 3 during this event, soil sampling locations suspected to contain radionuclides and metals/metalloids were

identified and flagged on-site by the EPA OSC. RST 3 collected a total of nine soil samples including one field duplicate, from eight location on-site and one aqueous rinsate blank sample. The soil samples were analyzed for TAL metals (including mercury) via SW846, 6010C/7471B methods; isotopic thorium and isotopic uranium via alpha spectroscopy HASL-300-A-01-R; radium-226 (21 days ingrowth), radium-228 and other gamma emitting radioisotopes via gamma spectroscopy HASL-300-GA-01-R. The aqueous rinsate blank sample which was collected to demonstrate proper decontamination of non-dedicated sampling equipment i.e., Geoprobe cutting shoe, was analyzed for TAL metals, via EPA SW846 Method 6010C; total mercury, via EPA SW846 Method 7471B; isotopic thorium and isotopic uranium, via alpha spectroscopy HASL-300 Method A-01-R; other gamma emitting radioisotopes, via gamma spectroscopy Method GA-01-R; Radium-226, via EPA SW-846 Method 9315, and Radium-228 via EPA SW-846 Method 9320. Analytical results indicated elevated above-background concentrations of Ra-226 in three of the nine soil samples collected during this event. The concentration of cobalt was above the EPA Removal Management Level (RML) of 70 mg/kg in one soil sample with a concentration of 110 mg/kg. Thallium concentration was above the EPA RML of 2.3 mg/kg in one soil sample with a concentration of 2.4 mg/kg.

On August 12, 2015, EPA collected four wipe samples, including one field blank, from access doorways in the on-site building. The wipe samples were collected in order to determine if radiation-containing materials were being tracked into the building by human traffic. The wipe samples were analyzed by EPA's health physicist using Ludlum-3030. Based upon the analytical results of the wipe samples for the selected counting durations, the minimum detectable concentration (MDC) for 100 square centimeter (cm^2) was determined as 0.80 disintegrations per minute (dpm) for alpha and 29.5 dpm for beta. These levels are below the 100 dpm and 1,000 dpm, respectively, for alpha and beta counts, outlined in the **New York City** Department of Health and Mental Hygiene (NYC DOHMH) Article 175 of the NYC Health Code, "Radiation Control", §175.03 - Release of Materials or Facilities, which was adopted by EPA as the SSAL for alpha and beta counts. Alpha and beta counts for all wipe samples were at the natural background level conservatively estimated by counting a blank wipe.

RST 3 Scope of Work:

RST 3 will delineate the area of observed contamination by measuring the gamma radiation exposure rates within the source area and at background locations. In accordance with Hazard Ranking System (HRS) requirements for naturally-occurring radionuclides, areas of observed contamination are defined by site-attributable radionuclide concentrations that equal or exceed a value two standard deviations above the mean site-specific background concentration or by gamma radiation exposure rates, measured by a survey instrument. An all-terrain vehicle (ATV) will be used to conduct the surveys in areas of rough terrain. The EPA Emergency and Rapid Response Services (ERRS) contractor will provide support through brush clearing activities.

The presence/absence of gamma radiation will be determined by RST 3 using a Ludlum-2241 and a Fluke PIC Model 451P to obtain field survey data. A mobile radiological survey will be conducted using a radiation survey setup comprising a Ludlum-2241 with a sodium iodide (NaI) scintillator attachment linked to a Trimble® GPS unit which will be connected to a VIPER system, a wireless network-based communication systems, via an internet source. The VIPER system will provide instantaneous real-time gamma radiation readings through a computer server [Viper Deployment Manager (VDM)]. In addition, instantaneous gamma readings and corresponding coordinates of identified "Hot Spots" (locations with significantly elevated above-background gamma measurements) will be scribe documented. The Ludlum-2241 set up will be mounted on an all-terrain vehicle (ATV) in order to conduct the survey in areas of rough terrain. The EPA Emergency and Rapid Response Services (ERRS) contractor will provide support

through brush clearing activities. The PIC will be utilized at identified Hot Spots to provide additional gamma concentration information. Using the PIC, two instantaneous measurements will be recorded at each location surveyed; one at contact (1 inch above the ground) and one at waist height (1 meter/3 feet above the ground). Survey time for each reading will be at least 30 seconds depending on the settling of the value. All the results obtained from the PIC measurements will be recorded as a range (*e.g.* 4-6 μR/hr). If very low level gamma levels are observed, a Reuter Stokes RSS-131ER HPIC will be utilized to determine the exact levels. Specific radioisotopes will be identified using a BNC SAM 940 portable radioisotope identification system. If on-site soils are to be disturbed by any form of intrusive investigation, air monitoring will be conducted using DataRAM particulate monitors which will also be connected to the VIPER system to provide real-time instantaneous readings of particulate concentration. During such intrusive investigation, RST 3 personnel will conduct all site work in Level C personal protective equipment (PPE). In addition, a RADēCO volumetric air sampler with filter media attachment will be utilized to sample ambient air within the investigation area of concern (AOC)

In order to ascertain the concentration of Radon-222 in the residential building located adjacent to the Site, RST 3 will utilize the services of a National Radon Proficiency Program (NRPP)-certified company, Accu-View Property Inspections, Inc. (AVPI) for canister (Activated Charcoal Canisters) placement at up to 15 locations in accordance with the guidelines set forth in the ANSI/AARST Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings (MAMF 2012) and as directed by EPA. Canisters will be raised above the ground approximately 20 inches, away from drafts or vents. The canisters will collect ambient air for a minimum of approximately 72 hours at each location. For each sampling event, weather information including, temperature, humidity, wind speed, and wind direction will be recorded. The radon canister samples will be analyzed for radon gas by Radon Testing Corporation of America (RTCA) via EPA Method 402-R-92-014.

Three (3) S.M.A.R.T. Health and Safety Goals for the Project (Simple, Measurable, Actionable, Reasonable, & Timely):

1. Safe operation of vehicles while traveling to and from the Site, as well as when using ATVs at the Site.
2. Adherence to the Weston Solutions, Inc., Radiation Safety Program during on-site activities, including the usage of time, distance, and shielding to limit radiation exposure.
3. Appropriate PPE will be utilized throughout Site activities.

Incident Type:

☐ Emergency Response
☒ Removal Assessment: Beginning week of April 18, 2016
☐ Removal Action
☐ Residential Sampling/Investigation
☐ PRP Oversight
☐ Other

Location Class:

☐ Industrial
☐ Commercial
☒ Urban/Residential
☐ Rural

U.S. EPA OSC: Eric Daly Date of Initial Site Activities: 4/18/2016
Original HASP: No, Revision 1 Site Health & Safety Coordinator: Bernard Nwosu
Lead RST 3: Bernard Nwosu Site Health & Safety Alternate: Peter Lisichenko

Response Activities/Dates of Response (fill in as applicable)

Emergency Response:

- ☐ Perimeter Recon
- ☐ Site Entry
- ☐ Visual Documentation
- ☐ Multi-Media Sampling
- ☐ Decontamination

Removal Assessment:

- ☑ Site Radiation Screening: Beginning week of April 18, 2016
- ☑ Site Entry: Beginning week of April 18, 2016
- ☑ Visual Documentation: Beginning week of April 18, 2016
- ☐ Multi-Media Sampling:
- ☐ Decontamination:

Removal Action:

- ☐ Perimeter Recon
- ☐ Site Entry
- ☐ Visual Documentation
- ☐ Multi-Media Sampling
- ☐ Decontamination

Physical Safety Hazards to Personnel:

☑ Inclement Weather – Attach FLD02	☑ Heat – Attach FLD05	☑ Cold – Attach FLD06
☐ Confined Space – Attach FLD08	☐ Industrial Trucks – Attach FLD09	☐ Manual Lifting – Attach FLD10
☑ Terrain – Attach FLD11	☐ Structural Integrity – Attach FLD13	☐ Site Security
☐ Pressurized Containers, Systems – Attach FLD16	☐ Use of Boats – Attach FLD18	☐ Waterways – Attach FLD19
☐ Explosives – Attach FLD21	☑ Heavy Equipment – Attach FLD22	☐ Aerial Lifts and Manlifts – Attach FLD24

- [ ] Elevated Surfaces and Fall Protection – Attach FLD25
- [ ] Ladders – Attach FLD26
- [ ] Excavations/Trenching – Attach FLD28
- [ ] Fire Prevention – Attach FLD31
- [ ] Demolition – Attach FLD33
- [ ] Underground/Overhead Utilities – Attach FLD34
- [ ] Hand and Power Tools – Attach FLD38
- [ ] Illumination – Attach FLD39
- [ ] Storage Tanks – Attach FLD40
- [ ] Lead Exposure – Attach FLD46
- [ ] Sample Storage – Attach FLD49
- [ ] Cadmium Exposure – Attach FLD50
- [ ] Asbestos Exposure – Attach FLD52
- [ ] Hexavalent Chromium Exposure – Attach FLD 53
- [ ] Benzene Exposure – Attach FLD 54
- [ ] Drilling Safety – Attach FLD56
- [ ] Drum Handling – Attach FLD58
- [ ] Gasoline Contaminant Exposure – Attach FLD61
- [ ] Noise – Attach CECHSP, Section 7
- [x] Walking/Working Surfaces
- [ ] Oxygen Deficiency
- [ ] Unknowns in Tanks or Drums
- [ ] Nonionizing Radiation
- [x] Ionizing Radiation Attach Radiation Safety Operating Practice

Biological Hazards to Personnel:

- [ ] Infectious/Medical/Hospital Waste – Attach FLD 44 and 45
- [x] Non-domesticated Animals – Attach RST 3 FLD43A
- [x] Insects – Attach RST 3 FLD 43B
- [x] Poisonous Plants/Vegetation – Attach RST 3 FLD 43D
- [ ] Raw Sewage
- [ ] Bloodborne Pathogens – Attach FLD 44 and 45

Training Requirements:

- [x] 40-Hour HAZWOPER Training with three days supervised experience
- [ ] 8-Hour Management or Supervisor Training in addition to basic training course
- [x] 8-Hour Annual Refresher Health and Safety Training
- [x] Site Specific Health and Safety Training
- [ ] DOT (CMV Training - ERV in Use)
- [ ] Bio-Medical Collection and Response

Medical Surveillance Requirements:

- [x] Baseline initial physical examination with physician certification
- [x] Annual medical examination with physician certification
- [x] Site-specific medical monitoring protocol (Radiation, Heavy
- [ ] Asbestos worker medical protocol

Metals)

Vehicle Use Assessment and Selection:

Driving is one of the most hazardous and frequent activities for Weston Employees. As such, Weston Employees are required to adhere to established safe operating practices in order to maintain their eligibility to drive Weston owned, leased, or rented vehicles. Every person riding in a Weston vehicle, including passengers must maintain a commitment for a safe journey. This means being attentive while in the vehicle and helping the driver to notice hazards ahead of and around the vehicle and ensure that their presence does not distract the driver from safely operating the vehicle.

A high percentage of vehicle accidents occur when operating in reverse. Anytime a vehicle is operated in reverse, e.g., backing out of a parking area, if there are passengers, at least one of them are to assist the driver by acting as a guide person during the reverse movement or during other vehicle operation where it would be prudent to have a guide person(s) participate in the vehicle movement. When practical, the preferred parking method would be to back into the parking area.

At a minimum, each Weston Driver must:

- Possess a current, valid drivers' license
- Current Commercial Motor Vehicle (CMV) card when operating the Emergency Response Vehicle
- Obey posted speed limits and traffic laws
- Wear seat belts at all times while the vehicle is in operation
- Conduct a 360 degree inspection around the vehicle before attempting to drive the vehicle
- Report accidents / incidents immediately and complete a Notice of Incident (NOI)
- Keep vehicles on approved roadways (4WD doesn't guarantee mobility on unapproved surfaces)
-

All Region II RST 3 personnel are experienced and qualified to drive RST 3 fleet vehicles (Tahoe, Suburban, Minivan/Cargo Van, and Emergency Response Vehicle). However, in the event that vehicle rental is required, each person must take the time to familiarize themselves with that particular vehicle. This familiarization includes adjustment of the dashboard knobs/controls, mirrors, steering wheel, seats, and a 360 degree external inspection of the vehicle.

1. The following vehicles are anticipated to be used on this project:

☐ Car	☐ Pickup Truck
☑ Intermediate/Standard SUV (e.g. Chevy Trailblazer, Chevy Tahoe, Ford Explorer, Ford Escape)	☑ Full Size SUV (e.g. Chevy Suburban, Ford Expedition, GMC Yukon)
☐ Minivan/Cargo Van (e.g. Chevy Uplander, Chevy Express Van)	☐ Box Truck (Size:_____)
☐ Emergency Response Vehicle (ERV)	☑ Other ___ATV___

2. Are there any on-site considerations that should be noted:

☑ Working/Driving Surfaces	☐ Debris	☐ Overhead Clearance	☐ Obstructions
☑ Tire Puncture Hazards	☑ Vegetation	☑ Terrain	☐ Parking
☐ Congestion	☐ Site Entry/Exit Hazards	☑ Local Traffic Volume	☐ Security
☐ Heavy Equipment	☐ Time/Length of Work Day	☐ Other:	

3. Do any of the considerations above require further explanation: No

4. Was the WESTON Environmental Risk Management Tool completed in EHS? Yes

   Was an Environmental Compliance Plan required? No

5. Are there any seasonal considerations that should be noted (e.g., Anticipated Snowy Conditions): No

6. Is a Traffic Control Plan required? ☐ Yes ☑ No

Chemical Hazards to Personnel

Physical Parameters	**Radium (See Attachments)**	**Thorium (See Attachments)**	**Radon (See Attachments)**
Exposure Limits / IDLH Level	_____ ppm ____ mg/m^3 PEL _____ ppm ___ mg/m^3 REL _____ ppm ____ mg/m^3 IDLH	_____ ppm ____ mg/m^3 PEL _____ ppm ___ mg/m^3 REL _____ ppm ____ mg/m^3 IDLH	_____ ppm ____ mg/m^3 PEL _____ ppm ___ mg/m^3 REL _____ ppm ____ mg/m^3 IDLH
Physical Form (Solid/Liquid/Gas) Color	_____ Solid _____ Liquid _____ Gas Variable _Color	_____ Solid _____ Liquid _____ Gas Variable _Color	_____ Solid _____ Liquid _____ Gas Variable _Color
Odor			
Flash Point Flammable Limits	_____ Degrees F or C ____% UEL ____% LEL	_____ Degrees F or C ____% UEL ____% LEL	_____ Degrees F or C ____% UEL ____% LEL
Specific Gravity	____ Water = 1	____ Water = 1	____ Water = 1
Solubility			
Incompatible Materials			
Routes of Exposure	_____ Inh _____ Abs _____ Con _____ Ing	_____ Inh _____ Abs _____ Con _____ Ing	_____ Inh _____ Abs _____ Con _____ Ing
Symptoms of Acute Exposure			
First Aid Treatment			
Ionization Potential	_____ eV	_____ eV	_____ eV
Instruments for Detection	_____ PID w/ _____ Probe _____ FID _____ CGI ____ RAD _____ Det Tube _____ Other _____ Lumex	_____ PID w/ _____ Probe _____ FID _____ CGI ____ RAD _____ Det Tube _____ Other _____ Lumex	_____ PID w/ _____ Probe _____ FID _____ CGI ____ RAD _____ Det Tube _____ Other _____ Lumex

Control Measures: Work zones will be established on-site during Site orientation.

This map is subject to Google's Terms of Service, and Google is the owner of rights therein.
Portions of this image have been removed for clarity.

Work Zone Definitions:

Each work/control zone can be described as follows:

Exclusion Zone - the area where contamination is either known or expected to occur and the greatest potential for exposure exists. The outer boundary of the Exclusion Zone, called the Hotline, separates the area of contamination from the rest of the Site.

Contamination Reduction Zone (CRZ) - the area in which decontamination procedures take place. The purpose of the CRZ is to reduce the possibility that the Support Zone will become contaminated or affected by the site hazards.

Support Zone - the uncontaminated area where workers are unlikely to be exposed to hazardous substances or dangerous conditions. The Support Zone is the appropriate location for the command post, medical station, equipment and supply center, field laboratory, and any other administrative or support functions that are necessary to keep site operations running efficiently.

Communications:

- [x] Buddy System
- [ ] Radio
- [ ] Air Horn for Emergencies
- [x] Hand Signals/Visual Contact

Personnel Decontamination Procedures:

- [ ] Wet Decontamination (procedures as follows)
- [x] Dry Decontamination (procedures as follows)

Radiation survey activities conducted as part of the Removal Assessment will be conducted in Level D PPE. However, if on-site soils are to be disturbed by any form of intrusive investigation, RST 3 personnel will conduct all survey activities in Level C PPE. All used PPE will be grossly decontaminated and disposed of in accordance with applicable federal, state, and local regulations.

Equipment Decontamination Procedures:

- [x] None
- [ ] Wet Decontamination (procedures as follows)
- [ ] Dry Decontamination (procedures as follows)

No equipment decontamination is anticipated as part of this phase of the Removal Action.

Adequacy of decontamination determined by: RST 3 Health and Safety Officer

Personal Protective Equipment

TASK TO BE PERFORMED	ANTICIPATED LEVEL OF PROTECTION	TYPE OF CHEMICAL PROTECTIVE COVERALL	INNER GLOVE / OUTER GLOVE / BOOT COVER	APR CARTRIDGE TYPE or SCBA
Gamma Radiation and Radon/Thoron Gas Surveying	Level D/C	Proper work uniform, safety glasses	Nitrile/Nitrile/None	None
Site Documentation Activities	Level D/C	Proper work uniform, safety glasses	Nitrile/Nitrile/None	None

Hazard Task Analysis

RISK LEVEL (High, Medium, Low)	HAZARD	RECOGNITION/ SYMPTOMS	MITIGATION	LEVEL OF PROTECTION
High	Exposure to low-level alpha and gamma radiation	Realtime radiation monitoring equipment and comparison to site specific action levels	PPE for contamination control and limit time in hot zone.	Level D/C
Medium	Slips, trips, and falls	Uneven surface, steep gullies, unstable sides of gullies	Stay away from uneven and unstable surfaces and side slopes	Level D/C

Frequency and Types of Air Monitoring:

☑ Continuous ☐ Routine - _____ ☐ Periodic - _____

DIRECT READING INSTRUMENTS	Ludlum Model 2241 Survey Meter	Fluke 451P Ion Chamber Survey Meter	Reuter-Stokes RSS-131ER Survey Meter	Durridge RAD7 Radon Detector	BNC Model 940 SAM Eagle+
EQUIPMENT ID NUMBER	TBD	TBD	TBD	TBD	TBD
CALIBRATION DATE	TBD	TBD	TBD	TBD	TBD
RST 3 /START III PERSONNEL	Bernard Nwosu Peter Lisichenko Lionel Montanez	Bernard Nwosu Peter Lisichenko Lionel Montanez	Bernard Nwosu Peter Lisichenko Lionel Montanez	Bernard Nwosu Peter Lisichenko Lionel Montanez	Bernard Nwosu Peter Lisichenko Lionel Montanez
ACTION LEVEL	≥ 1000 uR/Hr– Exit Area, Establish Perimeter, Contact RST 3 HSO	≥ 1000 uR/Hr– Exit Area, Establish Perimeter, Contact RST 3 HSO	≥ 1000 uR/Hr– Exit Area, Establish Perimeter, Contact RST 3 HSO	NA	NA

Emergency Telephone Numbers

Emergency Contact	Location / Address	Telephone Number	Notified
Hospital	Mount St. Mary's Hospital and Health Center 5300 Military Road Lewiston, NY 14092	Call 911 or 716-297-4800	Yes
Ambulance	Twin City Ambulance 365 Fillmore Avenue Tonawanda, NY 14150	911	No
Police	Niagara Police Department 7105 Lockport Road Niagara Falls, NY 14305	Call 911 or 716-297-2150	No
Fire Department	Bergholz Fire Company 2470 Niagara Road Niagara Falls, NY 14304	Call 911 or 716-731-4848	No

Chemical Trauma Capability?

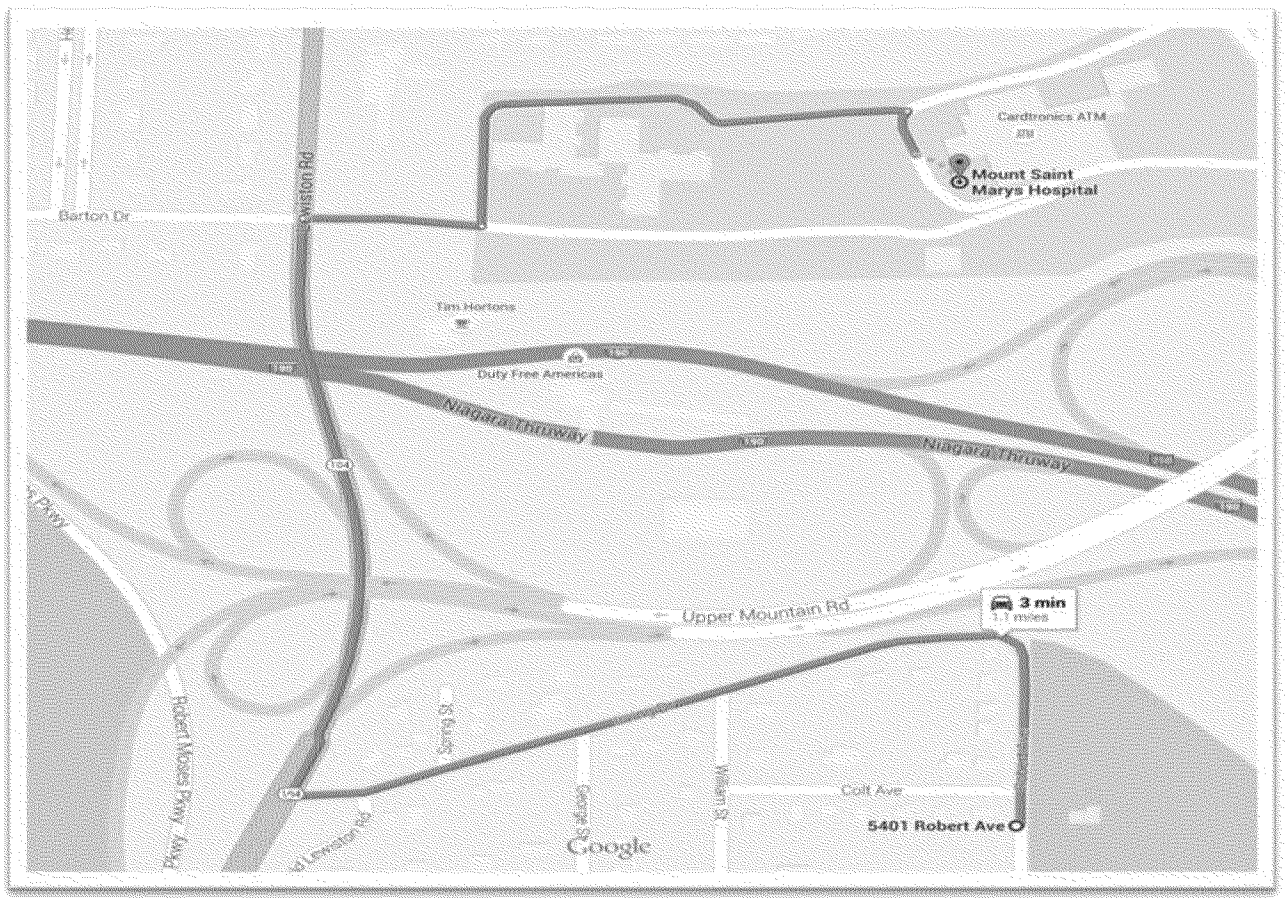
☑ Yes ☐ No

If no, closest backup: _____ Phone:

Directions to Hospital:

1. Head **north** on **Robert Ave** toward Colt Ave 0.1 mi
2. Robert Ave turns slightly **left** and becomes **Irving Dr** 0.3 mi
3. Turn **right** onto **NY-104 E** 0.3 mi
4. Turn **right** at **Barton Dr** 387 ft
5. Turn **left** 0.2 mi
6. Turn **right; DESTINATION WILL BE ON THE LEFT** 135 ft

Total Distance: 1.1 mile: Total Time: 3 minutes. See map on following page.



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Route verified by: _____ Date: __/__/__

Additional Emergency Telephone Contacts

WESTON Medical Emergency Service Dr. Peter Greaney, Medical Director WorkCare 300 South Harbor Blvd, Suite 600 Anaheim, California 92805	800-455-6155 Regular Business Hours (9AM to 7:30PM) **Dial 0 or Ext. 175 for Michelle Bui to request the on-call clinician.** 800-455-6155 After Hours (Weekdays 7:31PM to 8:59AM, Weekends, Holidays) **Dial 3 to reach the after-hours answering service. Request that the service connect you with the on-call clinician or the on-call clinician will return your call within 30 minutes.**
Chemtrec	800-424-9300
ATSDR	404-639-0615
ATF (explosives information)	800-424-9555
National Response Center	800-424-8802
National Poison Control Center	800-764-7661
Chemtel	800-255-3924
DOT	800-424-8802
CDC	800-232-0124

Pre-Response Approval

HASP prepared by: Michael Lang Date: 4/15/2016

Pre-Response/Entry Approval by: _____ Date: 4/15/2016

Tasks Conducted	Level of Protection/Specific PPE Used
Gamma Radiation and Radon/Thoron Gas Surveying	Level D/C
Site Documentation Activities	Level D/C

Hazardous Waste Site and Environmental Sampling Activities

Off Site: ☐ Yes ☑ No

On Site: ☐ Yes ☑ No

Describe types of samples and methods used to obtain samples:

Radon canisters will be deployed and retrieved by a procured radon specialist.

Was laboratory notified of potential hazard level of samples? ☑ Yes ☐ No

Disclaimer: This HASP was prepared for work to be conducted under the RST 3 Contract EP-S2-14-01. Use of this HASP by WESTON and its subcontractors is intended to fulfill the OSHA requirements found in 29 CFR 1910.120. Items not specifically covered in this HASP are included by reference to 29 CFR 1910 and 1926.

The signatures below indicate that the individuals have read and understood this Health and Safety Plan.

PRINTED NAME	SIGNATURE	AFFILIATION	DATE

Post-Response Approval

Final Submission of HASP by:		Date:
Post Response Approval by:		Date:
RST 3 HSO Review by:		Date:

Air Monitoring Summary Log

Date: __/__/__
Data Collected by: _____

Station/Location	CGI / O_2 Meter / CL2 / H2S	Radiation Meter	PID	FID / TVA-1000	Other (PDR)

ATTACHMENT A

RADIUM, RADON, AND THORIUM FACT SHEETS

5DGLDWLRQ└3UR\WHFWLRQ└

5DGLXP

5DGLXP└♂FKHPLFDO└V\PERO└5D└└LV└D└QDWXUDOO\┤RFFXUULQJ└UDGLRDFWLYH└PHWDO◄└,W└FRPH└RXW└FRPPRQ└LVRWRSHV└DUH└UDGLXP┤┴┴├☼└UDGLXP└┴┴┤☼└DQG└UDGLXP┤┴┴←◄└5DGLXP└LV└D└UDGLRQXFOLGH└IRUPHG└E\└WKH└GHFD\└RI└XUDQLXP└DQG└WKRULXP└LQ└WKH└HQYLURQPHQW◄└,W└RFFXUV└DW└ORZ└OHYHOV└LQ└YLUWXDOO\└DOO└URFN☼└VRLO☼└ZDWHU☼└SODQWV└DQLPDOV◄

2Q└WKLV└SDJH└

7KH└%DVLFV

- Á :KR└GLVFRYHUHG└UDGLXP"
- Á :KHUH└GRHV└UDGLXP└FRPH└IURP"
- Á :KDW└DUH└WKH└SURSHUWLHV└RI└UDGLXP"
- Á :KDW└LV└UDGLXP└XVHG└IRU"

(ISRVXUH└WR└5DGLXP└

- Á +RZ└GRHV└UDGLXP└JHW└LQWR└WKH└HQYLURQPHQW"
- Á +RZ└GRHV└UDGLXP└FKDQJH└LQ└WKH└HQYLURQPHQW"
- Á +RZ└GR└SHRSOH└FRPH└LQ└FRQWDFW└ZLWK└UDGLXP"
- Á +RZ└GRHV└UDGLXP└JHW└LQWR└WKH└ERG\"
- Á :KDW└GRHV└UDGLXP└GR└RQFH└LW└JHWV└LQWR└WKH└ERG\"

+HDOWK└(IIHFWV└RI└5DGLXP

- Á +RZ└FDQ└UDGLXP└DIIHFW└SHRSOHV└KHDOWK"
- Á .V└WKHUH└D└PHGLFDO└WHWW└WR└GHWHUPLQH└H[SRVXUH└WR└UDGLXP"

3UR\WHFWLQJ└3HRSOH└IURP└5DGLXP

- Á +RZ└GR└,└NQRZ└LI└,P└QHDU└UDGLXP"
- Á :KDW└FDQ└,└GR└WR└SUR\WHFW└P\VHOI└DQG└P\└IDPLO\└IURP└UGLXP"
- Á :KDW└LV└(3$└GRLQJ└DERXW└UDGLXP"

5HIHUHQFH└,QIRUPDWLRQ

- Á 3HRSOH└DQG└'LVFRYHULHV└
- á &RPPRQ└(QFRXQWHUHG└ 5DGLRQXFOLGHV└
  - Á $PHULFXP┤┴┤¶
  - Á &HVLXP┤¶┬→
  - Á &REDOW┤├!!
  - Á ,RGLQH┤¶┴└ └┤¶┬¶
  - á 3OXWRQLXP
  - á 5DGLXP
  - Á 5DGRQ
  - Á 6WURQWLXP┤ !!
  - Á 7HFKQHWLXP┤
  - Á 7ULWLXP
  - Á 7KRULXP
  - Á 8UDQLXP
- Á *RRWDU\
- á $FURQ\PV
- Á $┤=└6XEMHFW└,QGH[
- á 6LWH└0DS

7KH└%DVLFV└

:KR└GLVFRYHUHG└UDGLXP"

5DGLXP└ZDV└GLVFRYHUHG└LQ└¶← ←└E\└)UHQFK└SK\VLFLVW└DQG└1REHO└OD\UHDWH└0DULH└&XULH└LQ└
SLWFKEHQGH└♂D└XUDQLXP└DQG└UDGLXP┼EHDULQJ└PLQHUDO_◄└7KHUH└LV└DERXW└¶└JUDP└RI└UDGLXP└LQ└→└
WRQV└RI└SLWFKEHQGH◄└(QHPHQWDO└UDGLXP└ZDV└LVRODWHG└E\└0PH◄└&XULH└LQ└¶ ¶¶◄

:KHUH└GRHV└UDGLXP└FRPH└IURP"

5DGLXP└IRUPV└ZKHQ└LVRWRSHV└RI└XUDQLXP└RU└WKRULXP└GHFD \└LQ└WKH└EY\LURQPHQW◄└0RW└UDGLXP└
♂UDGLXP┼┴┴┼_└RULJLQDWHV└IURP└WKH└HGFD\└RI└WKH└SCHQWLIXO└XUDQLXP┼┴┬←◄

,Q└WKH└QDWXUDO└HQYLURQPHQW└UDGLXP└RFFXUV└DW└YHU\└CRZ└CHYHDV└LQYLUWXDOO\└DOO└URFN└VRLO└ZDWHU└
SCDQW└DQG└DQLPDOV◄└:KHQ└XUDQLXP└♂RU└WKRULXP_└RFFXUV└LQ└KJK└EYHDV└LQ└URFN└UDGLXP└LV└RIWHQ└
DOVR└IRXQG└LQ└KLJK└CHYHDV◄

:KDW└DUH└WKH└SURSHUWLHV└RI└UDGLXP"

5DGLXP└LV└D└QDWXUDOO\└UDGLRDFWLYH└VLOYHU\┼ZKLWH└PHWDO└ZKHQ└NHW\└FXW◄└,W└ECDFNHQV└RQ└
H[SRVXUH└WR└DLU◄

3XULILHG└UDGLXP└DQG└VRPH└UDGLXP└FRPSRXQGV└JCRZ└LQ└WKH└G DUN└♂OXPLQHVFH_◄└7KH└UDGLDWLRQ└
HPLWWHG└E\└UDGLXP└FDQ└DOVR└FDXVH└FHUWDLQ└PDWHULDOV└FDOOHG└|SKRSKRUV|└WR└HPLW└OLJKW◄└0L[WXUHV└
RI└UDGLXP└VDOWV└DQG└DSSURSULDWH└SKRVSKRUV└ZHUH└ZLGHD\└XVHG└IRU└FORFN└GLDOV└DQG└JDXJHV└EHIRUH└
WKH└ULVNV└RI└UDGLXP└H[SRVXUH└ZHUH└XQGHUVWRRG◄

0HWDOOLF└UDGLXP└LV└KLJKO\└FKHPLFDOO\└UHDFWLYH◄└,W└IRUPV└FRPSRXQG└WKDW└DUH└YHU\└VLPLODU└WR└
EDULXP└FRPSRXQGV└FDNLQJ└VHSDUDWH RQ└RI└WKH└WZR└HOHPHQW└GLIILFXW◄

7KH└YDULRXV└LVRWRSHV└RI└UDGLXP└RULJLQDWH└IURP└WKH└UDGLDFWLYH└GHFD\└RI└XUDQLXP└RU└WKRULXP◄└
5DGLXP┼┴┴┼└LV└IRXQG└LQ└WKH└XUDQXP┼┴┬←└GHFD\└VHULHV└DQG└UDGLXP┼┴┴←└DQG└┼┴┴┤└DUH└IRXQG└LQ└
WKH└WKRULXP┼┴┬┴└GHFD\└VHULHV◄└

5DGLXP┼┴┴┼└WKH└PRW└FRPPRQ└LVRWRSH└LV└DQ└DOSKD└HPLWWHU└ZLWKDFFRPSDQ\LQJ└JDPPD└
UDGLDWLRQ└DQG└KDV└D└KDOI┼OLIH└RI└┴↑◄→┼└WKDU5DGLXP┼┴┴┤└DQ└DOSKD└HPLWWHU└KDV└D└KDOI└OLIH└RI└┬◄┼┼└GD\V◄└
5DGLXP└GHFD\V└WR└IRUP└LVRWRSHV└RI└WKH└UDGLRDFWLYH└JDV└UDGRQ└ZK LFK└LV└QRW└FKHPLFDOO\└
UHDFWLYH◄└6WDECH└CHDG└LV└WKH└DDL└SURGXFW└RI└WKLV└CHQJWK\└UBBDFWLYH└GHFD\└VHULHV◄

:KDW└LV└UDGLXP└XVHG└IRU"

,Q└WKH└HDUO\└¶ !!!!V└ZKHQ└LW└ZDV└HXD\└GLVFRYHUHG└CR└RQH└XQGHUVWRRG└WKH└GDQJHUV└RI└UDGLXP◄└
3HRSCH└ZHUH└IDVFLQDWHG└ZLWK└LW└P\WWHULRXV└SURSHUWLHV└HVSHFLDOO└WKH└OXPLQHVFHQFH└SURGXFHG└
ZKHQ└LW└LV└PL[HG└ZLWK└D└SKRVSKRU◄└,QGXVWULHV└VSUDQJ└XS└WR└PDXIDFWXUH└KXQGUHGV└RI└
FRQVXPHU└SURGXFW└FRQWDLQLQJ└UDGLXP◄└$GYHUWLVHPHQW└SURFODLPHG└ LW└VSHFLDO└SRZHUV└DQG└
XQLTXH└HIIHFW└LQ└VXFK└SURGXFW└VXFK└DV└KDLU└WRQLF└WRRWKSH└RLQWPHQW└DQG└HOL[LUV◄└*CRZ└LQ└
WKH└GDUN└ZDWFK└DQG└FORFN└IDFHV└ZHUH└LPPHQVHO└SRSXODU◄

0RW└RI└LW└RULJLQDO└XVHV└KDYH└EHHQ└KDOWHG└IRU└KHDOWK└DQGHWDI└UHDVRQV└EXW└LW└ZLGH└XVH└LQ└
OXPLQHVFHQW└SDLQW└FRQWLQHG└WKURXJK└:RUOG└:DU└,,└EHFDXVH└WKH└VRIW└JCRZ└RI└UDGLXPV└
OXPLQHVFHQFH└PDGH└DLUFUDIW└GLDOV└JDXJHV└DQG└RWKHU└LQWXXPHQW└YLVLEOH└WR└WKHLU└RSHUDWRUV└DW└
QLJKW◄└5DGLXP└ZDV└DOVR└DQ└HDUO\└UDGLDWLRQ└VRXUFH└IRU└FDQFHU└WUHDWPHQW◄└6PDOO└VHHGV└ZHUH└

LPSOHPHQWHG└LQ└WKHRUV└WR└NHHS└FDQFHUHXV└FHOOV◄└6DIHJ└PRUH└HIILFLHQW└UDGLDWLRQ└VRXUFHV└VXFK└DV└FRHDOW┼┤!!└KDYH└PRWWR└UHSODFHG└LW◄

5DGLXP└LV└D└UDGLDWLRQ└VRXUFH└LQ└VRPH└LQGXVWULDO└UDGLRJUDSK└GHVLJHV└D└WHFKQRORJ└└VLPLODU└WR└[┼LD└└LPDJLQJ└XVHG└LQ└LQGXVWU└└WR└LQVSHFW└IRU└ICDZV└LQ└PHWDOORJ└:KHQ└UDGLXP└LV└PL[HG└ZLWK└EHU└OOLXP└LW└EHFRPHV└D└JRRG└VRXUFH└RI└QHXWURQV└XVHIXO└LQ└ZHOORJJLQJ└GHYLFHV└DQG└UHVHDUFK◄└5DGLXP└DOVR└KDV└EHHQ└DGGHG└WR└WKH└WLSV└RI└OLJKWHQLQJ└URGV└LPSOLQJ└WKHLU└HIIHFWLYHQHVV└E└LRQL]LQJ└WKH└DLU└DURXQG└LW◄

(([SRVXUH└WR└5DGLXP

+RZ└GRHV└UDGLXP└JHW└LQWR└WKH└HQYLURQPHQW'

5DGLXP└RFFXUV└QDWXUDOO└└LQ└WKH└HQYLURQPHQW◄└$V└D└GHFD└└SURGXFW└RI└XUDQLXP└DQG└WKRULXP└LW└LV└FRPPRQ└LQ└YLUWXDOO└└DOO└URFN└└VRLO└└DQG└ZDWHU◄└8VXDOO└└FRQFHQWUDWHV└DUH└YHU└└CRZ◄└+RZHYHU└└JHRORJLF└SURFHVVHV└FDQ└IRUP└FRQFHQWUDWLRQV└RI└QDWXUDOO└└DQG└DUDFWLYH└HOHPHQWV└└HVSHFLDOO└└XUDQLXP└DQG└UDGLXP◄└5DGLXP└DQG└LWV└VDOWV└DUH└VRXEECH└LQ└ZDWHU◄└$V└D└UHVXOW└└JURXQGZDWHU└LQ└DUHDV└ZKHUH└FRQFHQWUDWLRQV└RI└UDGLXP└DUH└KLJK└LQ└VXUURXQGLQJ└EHGURFN└WW└SLFDOO└└KDV└UHDWLYHO└└KLJK└UDGLXP└FRQWHQW◄

+RZ└GRHV└UDGLXP└FKDQJH└LQ└WKH└HQYLURQPHQW'

$OO└LVRWRSHV└RI└UDGLXP└DUH└UDGLRDFWLYH◄└$V└WKH└└GHFD└└WKHUL└W└UDGLDWLRQ└DQG└IRUP└QHZ└UDGLRDFWLYH└HOHPHQWV└└XQWLO└WKH└└UHDFH└WDEECH└HDGHRWRSHV└RI└UDGLXP└GHFD└└WR└IRUP└GL└IIHUHQW└LVRWRSHV└RI└UDGRQ◄└)RU└H[DPSOH└└UDGLXP┼└└└┤└GHFD└V└WR└UDGRQ┼└└└└DQG└UDGLXP┼└└└←└JRHV└WKURXJK└VHYHUDO└GHFD└V└WR└UDGLXP┼└└└┤└EHIIRUH└IRUPLQJ└UDGRQ┼└└└!!◄

+RZ└GR└SHRSOH└FRPH└LQ└FRQWDFW└ZLWK└UDGLXP"

6LQFH└UDGLXP└LV└SUHVHQW└DW└ORZ└OHYHOV└LQ└WKH└QDWXUDO└HQYLURQPHQW└└HYHU└RQH└KDV└VRPH└PLQRU└H[SRVXUH└WR└LW◄└+RZHYHU└└LQGLYLGXDOV└FD└└EH└H[SRVHG└WR└KLJKHU└OHYHOV└RI└UDGLXP└LI└WKH└└OLYH└LQ└DQ└DUHD└ZKHUH└WKHUH└LV└DQ└HOHYDWHG└OHYHO└RI└UDGLXP└LQ└WKH└URXQGLQJ└URFN└DQG└VRLO◄└3ULYDWH└ZHOO└ZDWHU└LQ└VXFK└DUHDV└FDQ└DOVR└EH└DQ└DGGHG└VRXUFH└RI└UDGLXP◄

7KH└FRQFHQWUDWLRQ└RI└UDGLXP└LQ└GULQNLQJ└ZDWHU└LV└JHQHUDOO└└CRZ└EXW└WKHUH└DUH└VHFLILF└JHRJUDSKLF└UHJLRQV└LQ└WKH└8QLWHG└6WDWHV└ZKHUH└KLJKHU└FRQFHQWUDWLRQV└RI└UDGLXP└RFFXU└LQ└ZDWHU└GXH└WR└JHRORJLF└VRXUFHV◄└/LPLWHG└LQIRUPDWLRQ└LV└DYDLODEECH└DERXWKH└DPRXQW└RI└UDGLXP└WKDW└DUH└WW└SLFDOO└└SUHVHQW└LQ└IRRG└DLU└EXW└WKH└└DUH└YHU└└CRZ◄

3HRSOH└FDQ└DOVR└EH└H[SRVHG└WR└UDGLXP└LI└LW└LV└UHOHDVHG└LQWR└WKH└EXLQLQJ└RI└FRDO└RU└RWKHU└IXHOV◄└&HUWDLQ└RFFXSDWLRQV└FDQ└DOVR└OHDG└WR└KLJK└H[SRVXUH└WR└UDGLXP└└VXFK└DV└ZRUNLQJ└LQ└D└XUDQLXP└PLQH└RU└LQ└D└SODQWKDW└SURFHVVHV└RUHV◄└3KRVSKDWH└URFNV└WW└SLFDOO└└FRQWDLQ└UHOHDWLYHO└└KLJK└OHYHOV└RI└ERWKDXLXP└DQG└UDGLXP└DQG└FDQ└EH└D└ SRWHQWDO└VRXUFH└RI└H[SRVXUH└LQ└DUHDV└ZKHUH└SKRVSKDWH└LV└PLQHG◄

,Q└VRPH└SDUW└RI└WKH└FRXQWU└└└IRUPHU└UDGLXP└SURFHVVLQJ└SODQW└H[LWW└WKDW└ZHUH└KLJKO└└FRQWDPLQDWHG└ZLWK└UDGLXP◄└+RZHYHU└└FRWW└RI└WKHVH└KDYH└EHHQ└FOHD QHG└XS└DQG└GR└QRW└SRVH└D└VHULRXV└KHDOWK└WKUHDW└DQ└└CRQJHU◄

5DGLXP└HPLWW└VHYHUDO└GLIIHUHQW└NLQGV└RI└UDGLDWLRQ☼└LQWHUDFWLRQ☼└DOSKD└DQG└JDPPD└UDGLDWLRQ◄└
$OSKD└UDGLDWLRQ└LV└RQH└RI└FRQFHUQ└LI└UDGLXP└LV└WDNHQ└LQWR└WKH└EXKURXJK└LQKDODWLRQ└RU└
LQJHVWLRQ◄└*DPPD└UDGLDWLRQ☼└RU└UDYV☼└FDQ└H[SRVH└LQGLYLGXDO└HYHQ└DW└D└GLVWDQFH◄└$V└D└UHVXOW☼└
UDGLXP└RQ└WKH└JURXQG☼└IRU└H[DPSOH☼└FDQ└H[SRVH└LQGLYLGXDOV└H[WHQDOO└WR└JDPPD└UDYV└RU└EH└
LQKDOHG└RU└LQJHVWHG└ZLWK└FRQWDPLQDWHG└IRRG└RU└ZDWHU◄└7KH└JUHDWH└WW└KHDOWK└ULVN└IURP└UDGLXP└LQ└
WKH└HQYLURQPHQW☼└KRZHYHU☼└LV└DFWXDOOY└LVW└GHFD└SURGXFW└UDGRQ└ZKLFK└FDQ└FRQFHW└LQ└EXLOGLQJV◄

+RZ└GRHV└UDGLXP└JHW└LQWR└WKH└ERG\"

3HRSOH└PD└VZDOORZ└UDGLXP└ZLWK└IRRG└DQG└ZDWHU☼└RU└PD└LQKDOH└LW└DV└SDUW└RI└GXW└LQ└WKH└DLU◄└
5DGLXP└FDQ└DOVR└EH└SURGXFHG└LQ└WKH└ERG\└IURP└|SDUHQW|└UDGLRQXFOLGHV└♂XUDQLXP└DQG└WKRULXP□└
WKDW└KDYH└EHHQ└LQKDOHG└RU└VZDOORZHG☼└EXW└WKLV└LV└QRW└D└VLJQLIWFDQW└FRXUFH◄

:KDW└GRHV└UDGLXP└GR└RQFH└LW└JHWW└LQWR└WKH└ERG\"

0RVW└UDGLXP└WKDW└LV└VZDOORZHG└♂DERXW└←!!◘□└SURPSWO\└CHDYHV└WKH└ERG\└WKURXJK└WKH└IHFHV◄└7KH└
RWKHU└⊥!!◘└HQWHUV└WKH└EORRGWWUHDP└DQG└DFFXPXODWHV└SUHIHUHQWLDOO\└LQ└WKH└ERQHV◄└6RPH└RI└WKLV└
UDGLXP└LV└H[FUHWHG└WKURXJK└WKH└IHFHV└DQG└XULQH└RYHU└DRQJ└WLPH◄└+RZHYHU☼└D└SRUWLRQ└ZLOO└
UHPDLQ└LQ└WKH└ERQHV└WKURXJKRXW└WKH└SHUVRQV└OLIHWLPH◄

+HDOWK└(IIHFWV└RI└5DGLXP

+RZ└FDQ└UDGLXP└DIIHFW└SHRSOH└KHDOWK"

5DGLXP└HPLWW└VHYHUDO└GLIIHUHQW└NLQGV└RI└UDGLDWLRQ☼└LQWHUDFWLRQ☼└DOSKD└SDUWLFOHV└DQG└JDPPD└
UDYV◄└$OSKD└SDUWLFOHV└DUH└JHQHUDOO\└ROD\└KDUPIXO└LI└HPLWWHG└LQWR└ERG\◄└+RZHYHU☼└ERWK└
LQWHUQDO└DQG└H[WHUQDO└H[SRVXUH└WR└JDPPD└UDGLDWLRQ└LV└KDUPIXO◄└DPPD└UDYV└FDQ└SHQHWUDWH└
WKH└ERG\☼└VR└JDPPD└HPLWWHUV└OLNH└UDGLXP└FDQ└UHVXOW└LQ└H[SRVXUHV└HYHQ└ZKHQ└WKH└VRXUFH└LV└D└
GLVWDQFH└DZD\◄

/RQJ┼WHUP└H[SRVXUH└WR└UDGLXP└LQFUHDVHV└WKH└ULVN└RI└GHYHORSLQJ└WHYHUDO└GLVHDVHV◄└,QKDOHG└RU└
LQJHVWHG└UDGLXP└LQFUHDVHV└WKH└ULVN└RI└GHYHORSLQJ└VXFK└GLVHDVHVDV└O\PSKRPD☼└ERQH└FDQFHU☼└
DQG└GLVHDVHV└WKDW└DIIHFW└WKH└IRUPDWLRQ└RI└ECRRG☼└WXFDV└CHXNHP LD└DQG└DSODWXLF└DQHPLD◄└7KHVH└
HIIHFWV└XVXDOO\└WDNH└\HDUV└WR└GHYHORS◄└([WHUQDO└H[SRVXUWR└UDGLXPV└JDPPD└UDGLDWLRQ└
LQFUHDVHV└WKH└ULVN└RI└FDQFHU└WR└YDU\LQJ└GHJUHHV└LQ└DOO└WLVXXHV└RUJDQV◄

+RZHYHU☼└WKH└JUHDWHWW└KHDOWK└ULVN└IURP└UDGLXP└LV└IURP└H[SRVXUH└WR└LW└UDGLRDFWLYH└GHFD└
SURGXFW└UDGRQ◄└,W└LV└FRPPRQ└LQ└PDQ└VRLOV└DQG└FDQ└FRQFHW└LQ└HRRV└DQG└RWKHU└EXLOGLQJV◄└

Á 5DGRQ
7KLV└IDFW└VKHHW└GHVFULEHV└WKH└EDVLF└SURSHUWLHV└DQG└WKH└KD]DUGV└DVVRFLDWHG└
ZLWK└WKLV└UDGLRQXFOLGH◄└,W└DOVR└GLVFXVHV└UDGLDWLRQ└SURWHFWLRQ└WR└LW◄└
á 5DGRQ└+RPH└3DJH
7KLV└VLWH└SURYLGHV└LQIRUPDWLRQ└DERXW└WKH└KD]DUGV└DQG└PDQDJHPHQW└RI└UDGRQ◄

,V└WKH└D└FHGLFDO└WHWW└WR└GHWHUPLQH└H[SR\XUH└WR└UDG LXP "

7KHUH└DUH└WHWW└WKDW└FDQ└GHWHUPLQH└H[SR\XUH└WR└UDGLXP└RU└R\WKHU└UDGLRDF\WLYH└VXEW\DQFHV◄└)RU└H[DPSOH└D└ZKRO└ERG\└FRXOW└FDQ└PHDV\XUH└WKH└WR\DO└DPRXQW└RI└UDGLRDF\WLYLW\└LQ└WKH└ERG\└DQG└XULQH└DQG└IHFHV└FDQ└EH└WHWW└HG└IRU└WKH└SUHVHQFH└RI└UDGLRQXFOLGH◄└

7KHVH└WHWW└DUH└QRW└URXWLQH\└SHUIRUPHG└LQ└D└GRFWRUV└RIFH└EHFDXVH└LW└UHTXLUHV└VSHFLDO└ODERUDWR\└HTXLSPHQW◄└7KHUH└LV└QR└WHWW└WKDW└FDQ└GHWHFW└H[WHUQDO└H[SR\XUH└WR└UDGLXPV└JDPPD└UDGLDWLRQ└XQOHW└WKH└GRVHV└ZHUH└YHU\└KLJK└DQG└FHOOXODU└GDPDJH└LV└GHWHFWDEOH◄

3UR\WHF\WLQJ└3HRSOH└IURP└5DGLXP

+RZ└GR└,└NQRZ└UDGLXP└LI└,P└QHDU└UDGLXP"

<RX└QHHG└\SHFLDO└HTXLSPHQW└WR└GHWHFW└WKH└SUHVHQFH└RI└UDGLXP◄└+RZHYHU└\RX└FDQ└EX\└UDGRQ└GHWHFWLRQ└NLW└DW└FRW└KDUGZDUH└WRUHV◄

:KDW└FDQ└,└GR└WR└SURWHFW└P\└VHOI└DQG└P\└IDPLO\└IURP└UDGLXP"

7KH└FRW└HI IHFWLYH└ZD\└WR└SURWHFW└\RXUVHOI└DQG└\RXU└DPLO\└LV└RW└WHW└\RXU└KRPH└IRU└UDGLXPV└GHFD\└SURGXFW└UDGRQ◄

Á 5DGRQ└+RPH└3DJH
7KLV└VLWH└SURYLGHV└LQIRUPDWLRQ└DERXW└WKH└KD]DUGV└DQG└PDQDJHPHQW└RI└UDGRQ◄

:KDW└LV└(3$└GRLQJ└DERXW└UDGLXP"

7KH└8◄6◄└&RQJUHW└SDVVHV└CDZ└WKDW└DXWKRUL]H└(3$└DQG└R\WKHU└IHGHUDO└DJHQFLHV└WR└SURWHFW└SXEOLF└KHDOWK└DQG└WKH└HQYLURQPHQW└IURP└UDGLXP└DQG└R\WKHU└UDGLRDF\WLYH└PDW└UDOV◄└(3$└KDV└LW└XHG└D└YDULHW\└RI└UHJXODW\RQ└WKDW└OLPLW└WKH└UHCHDVH└RI└UDGLXP└DQG└R\WKHU└UDGLRQXFOLGHV└WR└WKH└HQYLURQPHQW◄└)RU└H[DPSOH└&RQJ UHW└SDVHG└WKH└8UDQLXP└0LOO└7DLOQJV└5DGLDWLRQ└&RQWURO└$FW└♂8075&$└◄└(3$└KDV└HW└DEOLVKHG└WDQGDUGV└IRU└FCHDQLQJ└XS└DQG└PDQ DJLQJ└CHIWRYHJ└XUDQLXP└RUH└DW└LQDFW└RUH└SURFHW└SDQW└XQGHJ└WKH└DXWKRUL└WRI└8075&$ ◄└7KH└8◄6◄└'HSDUWPHQW└RI└(QHUJ\└LV└UHVSRQ└LECH└IRU└FRQGXFW└LQJ└WKH└FCHDQXSV└DQG└WKH└8◄└1XFCHDU└5HJXCDWRU\└&RPPL\WLRQ└RYHUW└HV└DQG└PDQDJHV└WKHP◄

Á 8075&$
7KLV└SDJH└SURYLGHV└D└VXPPDU\└DQG└OLQN└WR└WKH└IXOO└WDW└W└H◄

&RPSOHPHQWLQJ└WKHVH└HI IRUW└(3$└6XSHUIXQG└SURJUDP└LG HQW└I ILHV└DEDQGRQHG└LQGXW└UDO└VLWHV└FRQWDPLQDWHG└ZLWK└UDGLXP└DQG└R\WKHU└UDGLRQXFOLGHV└DQG└FKHPLFDOV◄ └,W└WKHQ└DVHVHV└WKH└KHDOWK└DQG└HQYLURQPHQWDO└UL\VN└WKH└VLWHV└SRVH└DQG└DV\LJQ└SULRUL\LHWRU└FCHDQLQJ└WKHP└XS└EDVHG└RQ└WKRVH└UL\VN◄└6XSHUIXQG└UHJXCDWLRQ└UHTXLUH└VLWHV└WR└EH└RQHHG└XS└WR└WKH└SRLQW└WKDW└SHRSOH└OLYLQJ└RQ└WKH└VLWHV└DMWHU└FCHDQXSRXOG└KDYH└QR└PRUH└WKDQ└D└¶┼LQ┼¶!!☼!!!! └WR└D└¶┼LQ┼¶☼!!!!☼!!!! └LQFUHDVHG└UL\N└RI└GHYHORSLQJ└FDQFHU└IURP└H[SR\XUH└WR└RW\DPLQDQ VW◄

Á &(5&/$
7KLV└SDJH└SURYLGHV└D└VXPPDU\└DQG└D└OLQN└WR└WKH└FRPSOHWH└WDWXWH◄
á 6XSHUIXQG
7KLV└VLWH└FRQWDLQV└LQIRUPDWLRQDERXW└LQGLYLGXDO└6XSHUIXQG└VLWHV◄

2WKHU└ODZV└SDVVHG└E\└&RQJUHVV└D GGUHVV└VSHFLILF└HQYLURQPHQWDO└PH GLD◄└7KH└&OHDQ└$LU└$FW└
DXWKRUL]HV└(3$└WR└HWWDEOLVK└DQQXDO└OLPLWW☼└NQRZQ└DV└1DWLRQDO└(PLVVLRQ└6WDQGDUGV└IRU└
+D]DUGRXV└$LU└3ROOXWDQWW☼└IRU└WKH└PD[LPXP└DPRXQW└RI└UDGLXP└DQG└ RWKHU└UDGLRQXFOLGHV└WKDW└
PD\└EH└UHOHDVHG└WR└WKH└DLU◄└)RUDGLXP└WKH└│1(6+$3│└LV└¶‼└PLOOLHP◄└7KH└6DIH└'ULQNLQJ└:DWHU└
$FW└DXWKRUL]HV└(3$└WR└OLPLW└WKH└0D[LPXP└&RQWDPLQDQW└/HYHOV└RI└UDGLXP└DQG└RWKHU└
UDGLRQXFOLGHV└LQ└SXEOLFO\└VXSSOLHG└GULQNLQJ└ZDWHU◄└)RU└┴┴├└DQG└└UDGLXP☼└WKH└0&/└LV└↑└
SLFRFXULHV└SHU└OLWHU└DQG└IRU└┴┴┤└UDGLXP└LW└LV└¶↑S&L↕O◄└%RWDLUWKDQG└ZDWHU└WDQGDUGV└OLPLW└WKH└
LQFUHDVHG└OLIHWLPH└FDQFHU└ULVN└WR└DERXW└┴└LQ└¶‼☼‼‼‼◄

Á &OHDQ└$LU└$FW
7KLV└SDJH└SURYLGHV└D└VXPPDU\└DQG└D└OLQN└WR└WKH└FRPSOHWH└DFW◄
á 6DIH└'ULQNLQJ└:DWHU└$FW
7KLV└SDJH└SURYLGHV└D└VXPPDU\└DQG└D└OLQN└WR└WKH└FRPSOHWH└DFW◄

Understanding Radiation in Your Life, Your World

3URJUDPV└ └7RSLFV└ └5HIHUHQFHV

KWWS ↕↕ZZZ◀HSD◀JRY↕UDGLDWLRQ↕UDGLRQXFOLGHV↕UDGRQ◀KWPO
/DWV└XSGDWHG└RQ└┴↕¶┬↕┴‼¶┬

5DGLDWLRQ└3URWHFWLRQ└

<RX└DUH└KHUH └(3$└+RPH 5DGLDWLRQ└3URWHFWLRQ 5HIHUHQFHV 5HIHUHQFH└,QIRUPD WLRQ 5DGLRQXFOLGHV 5DGRQ

6WXGHQWV↕7HDFKHUV /LEUDULDQV 5HSRUWHUV *HQHUDO└3XEOLF 7HFKQLFDO└8VHUV

352*5$06 723,&6 5()(5(1&(6

5DGRQ

5DGRQ└♂FKHPLFDO└V\PERO└5Q└ └LV└D└QDWXUDOO\└RFFXUULQJ└UDGLRDFWLYH└JDV└IRXQG└LQ└VRLOV☼└URFN☼└DQG└ZDWHU└WKLURXXV└WKH└8◀6◀└,W└KDV└QXPHURXV└GLIIHUHQW└LVRWRSHV☼└EXW└UDGRQ┼┴┴‼☼QGD┼┴┴┴└DUH└WKH└PRWW└FRPPRQ◀└5DGRQ└FDXVHV└OXQJ└FDQFHU☼└DQG└LV└D└WKUHDW└WR└KHDOWK└EHFDXVH└LW└WHQGV└WR└FROOHFW└LQ└KRPHV☼└VRPHWLPHV└WR└YHU\└KLJK└FRQFHQWUDWLRQV◀└$V└D└UHVXOW☼UDGRQ└LV└WKH└ODUJHWW└VRXUFH└RI└H[SRVXUH└WRQDWXUDOO\└RFFXUULQJ└UDGLDWLRQ

2Q└WKLV└SDJH

7KH└%DVLFV└

Á :KR└GLVFRYHUHG└UDGRQ"└
Á :KHUH└GRHV└UDGRQ└FRPH└IURP"└
Á :KDW└DUH└WKH└SURSHUWLHV└RI└UDGRQ"
Á 'RHV└UDGRQ└KDYH└DQ\└SUDFWLFDO└XVHV└"

([SRVXUH└WR└5DGRQ└

Á +RZ└GRHV└UDGRQ└JHW└LQWR└WKH└HQYLURQPHQW"
Á +RZ└GRHV└UDGRQ└FKDQJH└LQ└WKH└HQYLURQPHQW"
Á +RZ└DUH└SHRSOH└H[SRVHG└WR└UDGRQ"
Á +RZ└GRHV└UDGRQ└JHW└LQWR└WKH└ERG\"
Á :KDW└GRHV└UDGRQ└GR└RQFH└LW└JHWV└LQWR└WKH└ERG\"

+HDOWK└(IIHFWV└RI└5DGRQ└

Á +RZ└FDQ└UDGRQ└DIIHFW└SHRSOHV└KHDOWK"
Á ,V└WKHUH└D└PHGLFDO└WHWW└WR└GHWHUPLQH└H[SRVXUH└WR└UDGRQ"

3URWHFWLQJ└3HRSOH└)URP└5DGRQ└

Á +RZ└GR└,└NQRZ└LI└WKHUH└LV└UDGRQ└LQ└P\└KRPH"
Á :KDW└FDQ└,└GR└WR└SURWHFW└P\VHOI└DQG└P\└IDPLO\└IURP└UDGRQ"
Á :KDW└UHFRPPHQGDWLRQV└KDV└WKH└IHGHUDO└JRYHUQPHQW└PDGH└WR└SUR WHFW└KXPDQ└KHDOWK└IURP└UDGRQ"
Á :KDW└LV└(3$└GRLQJ└DERXW└UDGRQ"

5HIHUHQFH└,QIRUPDWLRQ

Á 3HRSOH└DQG└'LVFRYHULHV└
á &RPPRQO\└(QFRXQWHUHG└5DGLRQXFOLGHV└
Á $PHULFLXP┼┴┤¶
Á &HVLXP┼¶┬→
Á &REDOW┼┼‼
Á ,RGLQH┼¶┴└┼¶┬¶
á 3OXWRQLXP
á 5DGLXP
Á 5DGRQ
Á 6WURQWLXP┼‼
Á 7HFKQHWLXP┼
Á 7ULWLXP
Á 7KRULXP
Á 8UDQLXP
Á *ORVVDU\
á $FURQ\PV
Á $┼=└6XEMHFW└,QGH[
á 6LWH└0DS

7KH└%DVLFV└

:KR└ 'LVFRYHUHG└5DGR Q

7KH└ *HUPDQ└FKHPLWW└)ULHGULFK└(◄└'RUQ└GLVFRYHUHG└UDGRQ┼┴┴┴└LQ└¶ ‼‼☼└DQG└FDOOHG└LW└UDGLXP└HPDQDWLRQ◄└+RZHYHU☼└D└VFDUFHU└LVRWRSH☼└UDGRQ┼┴┴‼☼└ZDV└DFWXDOO\REVHUYHG└ILUWW☼└LQ└¶← ☼└E\└WKH└%ULWLVK└VFLHQWLWW☼└5◄%◄└2ZHQVDQG└WKH└1HZ└=HDODQG└VFLHQWLWW☼└(UQHWW└5XWKHUIRUG◄└7KH└PHGLFDO└FRPPXQLW\└QDWLRQZLGH└EHFDPH└DZDUH└RI└WKH└SRVVLEOH└H[WHQ W└RI└D└UDGRQ└SURECHP└LQ└¶ ←┤◄└7KDW└\HDU└D└QXFOHDU└SODQW└ZRHU└LQ└3HQQV\OYDQLD└GLVFRYHUHG└UDGLRDFWLYLW\└RQ└KLV└FORWKLQJ└ZKLOH└H[LWLQJ└KLV└SODFH└RI└ZRUN└WKURXJK└WKH└UDGLDWLRQ└HFWRUV◄└7KH└VRXUFH└RI└WKH└UDGLDWLRQ└ZDV└GHWHUPLQHG└WR└EH└UDGRQ└GHFD\└SURGXFW└RQ└KLV└FORWKLQJ└RULJLQDWLQJ└IURP└KLV└KRPH◄

:KHUH└GRHV└UDGRQ└FRPH└IURP"

5DGRQ┼┴┴┴└LV└WKH└GHFD\└SURGXFW└RI└UDGLXP┼┴┴├◄└5DGRQ┼┴┴┴└DQG└LWWSDUHQW☼└UDGLXP┼┴┴├☼└DUH└SDUW└RI└WKH└ORQJ└GHFD\└FKDLQ└IRUUDQLXP┼┴┬←◄└6LQFH└XUDQLXP└LVHVVHQWLDOO\└XELTXLWRXV└LQ└WKH└HDUWKV└FUXWW☼└UDGLXP┼┴┴├└DQG└UDGRQ┼┴┴┴└DUH└SUHVHQW└LQ└DOPRWW└DO└URFN└DQG└DOO└VRLO└DQG└ZDWHU◄

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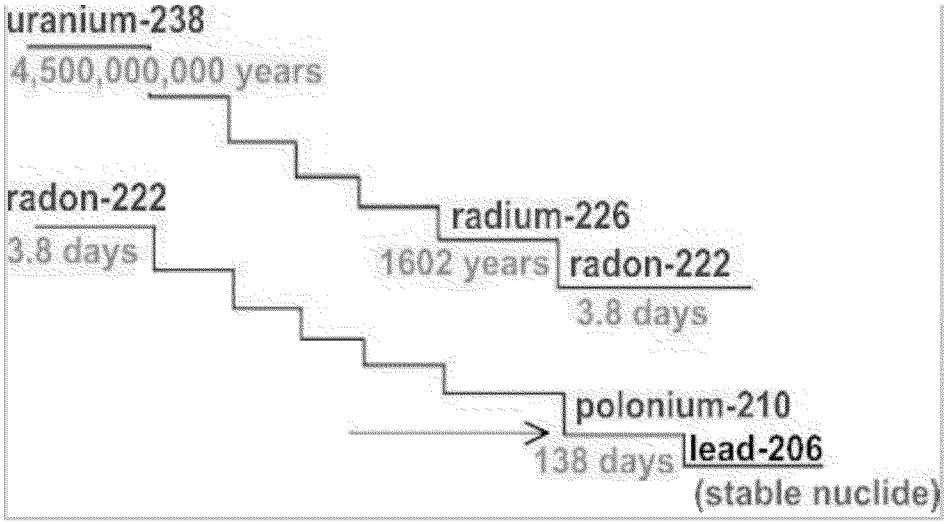
Á 'HFD\└&KDLQV└┼└8UDQLXP└'HFD\
7KLV└OLQNV└SURYLGHVDQ└LOOXWWUDWLRQ└RI└XUDQLXP┼┴┬←└GHFD\V└WKURXJK└D└VHULHV└RI└WWHSV└WR└EHFRPH└D└WWDECH└IRUP└RI└CHDG◄

á 8UDQLXP
7KLV└IDFW└VKHHW└GHVFULEHV└WKH└EDVLF└SURSHUWLHV└DQGHV☼└DQG└WKH└KD]DUGV└DVVRFLDWHG└ZLWK└WKLV└UDGLRQXFOLGH◄└,W└DOVR└GLVFXVVHV└UDGLDWLRQ└SURWHFWLRQWHG└WR└LW◄

:KDW└DUH└WKH└SURSHUWLHV└RI└UDGRQ"

5DGRQ└LV└D└QRECH└JDV☼└ZKLFK└PHDQV└LW└LV└EDVLFDOOQHUW└♂GRHV└QRW└FRPELQH└ZLWK└RWKHU└FKHPLFDOV└◄└5DGRQ└LV└D└KHDY\└JDV└DQG└WHQGV└WR└FROOHFW└LQ└EDPHQW└RU└RWKHU└ORZ└SODFHV└LQ└KRXVLQJ◄└,W└KDV└QR└FRORU☼└RGRU☼└RU└WDWWH◄└5DGRQ┼┴┴┴└LQXSHUR└E\└WKH└GHFD\└RI└UDGLXP☼└KDV└D└KDOI┼OLIH└RI└┬◄←└GD\V☼└DQG└HPLWW└DQ└DOSKD└SDUWLFOHGHFDLW└WR└SRORQLXP┼┴¶←☼└DQG└HYHQWXDOO\└WR└WWDECH└CHDG◄└5DGRQ┼┴┴‼☼└LV└WKH└GHFD\└SURGXFW└RI└WKRULXPLWLLV└VRPHWLPHV└FDOOHG└WKRURQ☼└KDV└D└KDOI┼OLIH└RI└↑┼WHFRQGV└DQG└HPLWW└DQ└DOSKD└SDUWLFOH└LQWW└GHFD\└WR└SRORQLXP┼┴¶├◄

7KH└LOOXWWUDWLRQ└EHORZ└SURYLGHV└DQ└RYHUYLHZ└RI└WKH└XUDQLXP┼┴┬←GHFD\└FKDLQ◄└5DGRQ└LV└SDUW└RI└WKDW└GHFD\└FKDLQ└DQG└LV└SURGXFHG└E\└WKH└UDGLRDFWLYH└GHFD\└RUDGLXP◄



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Á 5DGLRDFWLYH└ 'HFD\
7KLV└SDJH└H[SODLQV└UDGLRDFWLYH└GHFD\└FKDLQV◄└

'RHV└UDGRQ└KDYH└DQ\└SUDFWLFDO└XVHV"

5DGRQ└KDV└OLWWOH└SUDFWLFDO└XVH◄RF6I└PHGLFDO└WUHDWPHQW└KDYH└HP SOR\HG└UDGRQ└LQ└VPDOO└VHDOHG└JODVV└WXEHV☼└FDOOHG└VHHGV☼└WKDW└DUH└VSHFLDOO\└PDQXIDFWXUHG└WRQWDLQ└WKH└H[DFW└DPRXQW└RI└UDGLRDFWLYLW\└QHHGHG└IRU└WKH└DSSOLFDWLRQ◄└5DGRQ└VSDDUH└XVHG└H[WHQVLYHO\└LQ└5XVVLD└DQG└&HQWUDO└(XURSH└WR└WUHDW└D└QXPEHU└RI└FRQGLWLRQV◄

([SRVXUH└WR└5DGRQ└

+RZ└GRHV└UDGRQ└JHW└LQWR└WKH└HQYLURQPHQW"

5DGRQ┼┴┴┴└LV└WKH└UDGLRDFWLYH└GHFD\└SURGXFW└RI└UDGLXP┼┴┴├☼└ZKLFK└LV└IRXQG└DW└ORZ└FRQFHQWUDWLRQV└LQ└DOPRVW└DOO└URFN└DQG└VRLO◄└5DGRQ└LV└JHQHUDWHG└LQ└RNUHQG└VRLO☼└DQG└LW└FUHHSV└WKURXJK└FUDFNV└RU└VSDFHV└EHWZHHQ└SDUWLFOHV└XS└WR└WKHRXWVLGH└DLU◄└$QWKRXJK└RXWGRRU└FRQFHQWUDWLRQV└RI└UDGRQ└DUH└W\SLFDOO\└ORZ☼└DERXW└‼◄┤└SLFRFXULSHU└OLWHU└♂S&L↕O└RI└DLU☼└LW└FDQ└VHHS└LQWR└EXLOGLQJV└WKURXJK└IRXQGDWLRQ└FUDFNV└RU└RSHQLQJV└DQG└EXLOG└XS└WR└PXFK└KLJKHU└FRQFHQWUDWLRQV└LQGRRUV☼└LI└WKH└VRXUFHV└DUH└ODUJH└RXQK◄

7KH└DYHUDJH└LQGRRU└UDGRQ└FRQFHQWUDWLRQ└LV└DERXW└¶◄┬└S&L↕O└RIU└HDL,W└LV└QRW└XQFRPPRQ☼└WKRXJK☼└IRU└LQGRRU└UDGRQ└OHYHOV└WR└EH└IRXQG└LQ└WKH└UDQJH└RI└┼└↑‼└S&L↕O└DQG└WKH\└KDYH└EHHQ└IRXQG└DV└KLJK└DV└┴☼‼‼‼└S&L↕O◄└7KH└FRQFHQWUDWLRQ└RI└UDGRQ└PHDVXUHG└LQ└EXVH└GHSHQGV└RQ└PDQ\└IDFWRUV☼└LQFOXGLQJ└WKH└GHVLJQ└RI└WKH└KRXVH☼└ORFDO└JHRORJ\└DQG└FRQGLWLRQV☼└DQG└WKH└ZHDWKHU◄└5DGRQV└GHFD\└SURGXFW└DUH└DOO└PHWDOOLF└VROLGV☼└DQG└ZKHQ└UDGRQ└GHFD\└RFFXUV└LQ└DLU☼└WKH└GHFD\└SURGXFW└FDQ└FOLQJ└WR└DHURVROV└DQG└GXW☼└ZKLFK└PDNHV└WKHP└DYDLODEOH└IRU└LQKDODWLRQ└LQWR└WKH└OXQJV◄

5DGRQ└HDVLO\└GLVVROYHV└LQ└ZDWHU└LQ└DUHDV└RI└WKH└FRXQWU\└WKDDYH└KLJK└UDGLXP└FRQWHQW└LQ└VRLOV└DQG└URFNV☼└ORFDO└JURXQG└ZDWHU└PD\└FRQWDLQ└KLJK└FRQFHQWUDWLRQV└RI└UDGRQ◄└)RU└H[DPSOH☼└XQGHUO\LQJ└URFN└VXFK└DV└JUDQLWH☼└RU└SKRVSKDWH└URFN☼└W\SLFDOODYK└LQFUHDVHG└XUDQLXP└DQG└

UDGLXP☼└DQG└WKHUHIRUH└UDGRQ◄└:K LCH└UDGRQ└HDVLO\└GLVVROYHV└LQWBWHU☼└LW└DOVR└HDVLO\└HVFDSHV└
IURP└ZDWHU└ZKHQ└H[SRVHG└WR└WKH└DWPRVSKHUH☼└HVSHFLDOO\└ LI└LW└WXUUHG└RU└DJLWDWHG◄└
&RQVHTXHQWO\☼└UDGRQ└FRQFHQWUDWLRQV└DUH└YHU\└ORZ└LQ└ULYHUV└DQGGDNHV☼└EXW└FRXOG└WXUOO└EH└KLJK└LQ└
ZDWHU└SXPSHG└IURP└WKH└JURXQG◄└6RPH└QDWXUDO└VSULQJV☼└VXFK└DV└WKRVH└DW└+RW└6SULQJV☼└
$UNDQVDV☼└FRQWDLQ└UDGRQ☼└DQG└ZHUH└RQFH└FRQVLGHUHG└KHDOWKIXO◄

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Á 5DGRQ└LQ└:DWHU
7KLV└VLWH└SURYLGHV└LQIRUPDWLRQ└3XEOLF└+HDOWK└6HUYLFH└IRU└5DGRQ└LQ└'ULQNLQJ└:DWHU
á 5DGRQ└+RPH└3DJH
7KLV└VLWH└SURYLGHV└LQIRUPDWLRQ└DERXW└WKH└KD]DUGV└DQG└PDQDJHPHQW└RI└UDGRQ◄
á (3$└0DS└RI└5DGRQ└=RQHV
7KH└SXUSRVH└RI└WKLV└PDS└LV└WR└DVVLVW└1DWLRQDO☼└6WDWH☼└DQG└ORFDBDJDQL]DWLRQV└WR└WDUJHW└
WKHLU└UHVRXUFHV└DQG└WR└LPSOHPHQW└UDGRQ┼UHVLWDQW└EXLOGLQJ└FRGHV◄

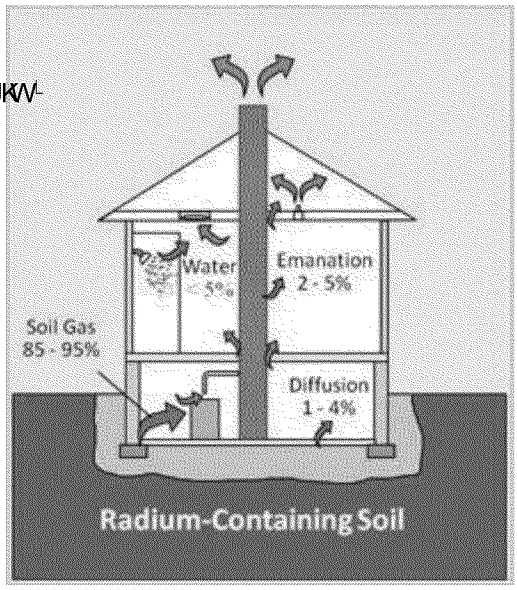
+RZ└GRHV└UDGRQ└FKDQJH└LQ└WKH└HQYLURQPHQW'

%HFDXVH└UDGRQ└LV└D└FKHPLFDOO\└LQHUW└♂XQUHDFWLYH└JDV☼└LW└FBQ\YH└HDVLO\└WKURXJK└URFN└DQG└VRLO└
DQG└DUULYH└DW└WKH└VXUIDFH◄└7KH└KDOI┼OLIH└RI└UDGRQ┼LV└┬◄←└GDY◄└$V└LW└XQGHUJRHV└UDGLRDFWLYH└
GHFD\☼└UDGRQ┼┴┴┴└UHCHDVHV└DOSKD└DGLDWLRQ└DQG└FKDQJHV└WR└SRORQLXP┼┴¶←☼└D└VKRUW┼OLYHG└
UDGLRDFWLYH└VRODG◄└$WWHU└VHYHUDO└PRUWDQ/IRUPDWLRQV└♂ORVV└RI└SDUWLFOHV└RU└HOHFWURPDJQHWLF└
UDGLDWLRQ└IURP└WKH└QXFOHXV☼└WKH└VHULHV└HQGV└DW└CHDG┼┴!!┼☼└ZKLFK└WXDECH◄

5DGRQ└GLVVROYHV└LQ└ZDWHU☼└DQG└HDVLO\└CHDYHV└ZDWHU└WKDW└LV└H[SRVHG└WR└WKH└DWPRVSKHUH☼└
HVSHFLDOO\└LI└WKH└ZDWHU└LV└DJLWDWHG◄└&RQVHTXHQWO\☼└UDGRQ└CHYHDDH└YHU\└ORZ└LQ└ULYHUV└DQG└
CDNHV☼└EXW└ZDWHU└GUDZQ└IURP└XQGHUJURXQG└FDQ└KDYH└HCHYDWHG└U DGRQ└FRQFHQWUDWLRQV◄└5DGRQ└
WKDW└GHFD\V└LQ└ZDWHU☼└CHDYHV└RQO\└VROLG└GHFD\└SURGXFWV└ZKLFK└DUH└UHPDLQ└LQ└WKH└ZDWHU└DV└WKH\└
GHFD\└WR└WXDECH└CHDG◄

+RZ└DUH└SHRSOH└H[SRVHG└WR└UDGRQ"

0RVW└RI└WKH└SXEOLFV└H[SRVXUH└WR└QDWXUDO└UDGLDWLRQ└
FRPHV└IURP└UDGRQ└ZKLFK└FDQ└EH└IRXQG└LQ└KRPHV☼└
VFKRROV☼└DQG└RI ILFH└EXLOGLQJV◄└7KH└LOOXVWUDWLRQ└DW└ULJKW└
VKRZV└WKH└VRXUFHV└RI└UDGRQ└WKDW└FDQ└DFFXPXODWH└LQ└
EXLOGLQJV◄



0RVW└UDGRQ└LQ└KRPHV└FRPH└V└IURP└UDGRQ└LQ└WKH└VRLO└
WKDW└VHHSV└LQWR└KRPHV└WKURXJK└FUDFNV└LQ└WKH└
IRXQGDWLRQ└RU└VODE◄└7KH└DPRXQW└RI└UDGRQ└LQ└WKH└VRLO└
YDULHV└ZLGHO\└DQG└GHSHQGV└RQ└WKH└FKHPLFDO└PDNH└XS└
RI└WKH└VRLO◄└7KHUH└FDQ└EH└DWUJH└GLIIHUHQFH└LQ└UDGRQ└
FRQFHQWUDWLRQV└LQ└WKH└VRLO└IURP└KRXVH└WR└KRXVH◄└7KH└
RQO\└ZD\└WR└NQRZ└LV└WR└WHVW◄

5DGRQ└LV└DOVR└IRXQG└LQ└WKH└ZDWHU└LQ└KRPHV☼└LQ└
SDUWLFXODU☼└KRPHV└WKDW└KDYH└WKHLU└RZQ└ZHOO└UDWKHU└
WKDQ└PXQLFLSDO└ZDWHU◄└:KHQ└WKH└ZDWHU└LV└DJLWDWHG☼└DV└
ZKHQ└VKRZHULQJ└RU└ZDVKLQJ└GLVKHV☼└UDGRQ└HVFDSHV└
LQWR└WKH└DLU◄└+RZHYHU☼└UDGRQ└URP└ZDWHU└LQ└WKH└KRPH└JHQHUDOO\└FRQWULEXWHV└RQO\└D└VPDOO└

SURSRUWLRQ└♂CHVV└WKDQ└↑◘└RI└WKH└WRWDO└UDGRQ└LQ└LQGBBBU└LQ└RWW-KRXVLQJ◄└0XQLFLSDO└ZDWHU└
V\WWHPV└KRQG└DQG└WUHDW-ZDWHU☼└ZKLFK└KHOSV└WR└UHCHDVH└UDGRQ☼└WRKDW-CHYHDV└DUH└YHU\└CRZ└E\└
WKH└WLPH└WKH└ZDWHU└UHDFKHV└RXU└KRPHV◄└%XW☼└SHRSCH└ZKR└KDYH└SULYDWH└ZHOOV☼└SDUWLFXODUO\└LQ└
DUHDV└RI└KLJK└UDGLXP└VRLO└FRQWHQW☼└PD\└EH└H[SRVHG└WR└KLJKHU└CHNDV└RI└UDGRQ◄

(3$└HXWLPDWHV└WKDW-WKH└QDWLRQDOÐYHUDJH└LQGRRU└UDGRQ└CHYHO└LQ└RPHV└LV└DERXW-¶◄┬└S&L↕O└RI└DLU◄└
:H└DOVR└HXWLPDWH└WKDW-DERXW-¶└LQ└¶↑└KRPHV└QDWLRQZLGH└KDYH└CHYHDV└DW-RU└DERYH└WKH└CHYHO└RI└┤└
S&L↕O☼└WKH└CHYHO└DW-ZKLFK└(3$└UHFRPPHQGV└WDNLQJ└DFWLRQ└WR└UHGXH└FRQFHQWUDWLRQV◄└/HYHDV└
JUHDWHU└WKDQ└┴☼!!!!└S&L↕O└RI└DDDYHKEHHQ└PHDVXUHG└LQ└VRPH└KRPH└V◄└7KH└RQO\└ZD\└\RX└FDQ└
NQRZ└LI└WKHUH└LV└UDGRQ└LQ└\RXU└KRPH└LV└WR└WHXW-IRU└LW◄

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Á 5DGRQ└LQ└:DWHU
7KLV└VLWH└SURYLGHV└LQIRUPDWLRQ└3XEOLF└+HDOWK└&ODQGDUGV└IRU└5DGRQ└LQ└'ULQNLQJ└:DWHU◄
á 5DGRQ└+RPH└3DJH
7KLV└VLWH└SURYLGHV└LQIRUPDWLRQ└DERXW└WKH└KD]DUGV└DQG└PDQDJHPHQW└RI└UDGRQ◄└

+RZ└GRHV└UDGRQ└JHW-LQWR└WKH└ERG\"

3HRSCH└PD\└LQJHXW└WUDFH└DPRXQW└RI└UDGRQ└ZLWK└IRRG└DQG└ZDWHU◄└-RZHYHU☼└LGKDDDWLRQ└LV└WKH└
PDLQ└URXWH└RI└HQWU\└LQWR└WKH└ERG\└IRU└UDGRQ└DQG└LWWFD\└SURGX FW◄└5DGRQ└GHFD\└SURGXFW└
PD\└DWWDFK└WR└SDUWLFXODWHV└DQG└DHURVROV└LQ└WKH└DLU└ZH└EUHDWKH└H[DPSCH☼└FRRNLQJ└RLO└
YDSRUV└◄└:KHQ└WKH\└DUH└LGKDCHG☼└VRPH└RI└WKHVH└SDUWLGHV└DUH└UHDWLQHG└LQ└WKH└OXQJV◄└5DGRQ└
GHFD\└SURGXFW└DOVR└FOLQJ└WR└WREDFFR└CHDYHV☼└ZKLFK└BUWXLFN\☼GXULQJ└WKH└JURZLQJ└VHDVRQ☼└DQG└
HQWHU└WKH└OXQJV└ZKHQ└WREDFFR└LV└VPRNHG◄└6PRNH└LQ└LQGRRU└HQYLURQPHQW└DOVR└LV└YHU\└HI IHFWLYH└
DW-SLFNLQJ└XS└UDGRQ└GHFD\└SURGXFW└IURP└WKH└DLU└DQG└PDNLQJ└WKP└DYDLCDECH└IRU└LGKDDDWLRQ◄└,W-
LV└OLNHO\└WKDW-UDGRQ└GHFD\└SURGXFW└FRQWULEXWH└VLJQL ILFDQWO\└WWR└ULVN└RI└OXQJ└FDQFHU└IURP└
FLJDUHWWH└VPRNH◄

:KDW-GRHV└UDGRQ└GR└RQFH└LW-JHW└LQWR└WKH└ERG\"

0RW-RI└WKH└UDGRQ└JDV└WKDW-\RX└LGKDCH└LV└DOVR└H[KDG└+RZHYHU☼└VRPH└RI└UDGRQ└GHFD\└
SURGXFW└DWWDFK└WR└GXWW└DQG└DHURVROV└LQ└WKH└DLU└DQG└DUH└WKHEBGLO\└GHSRVLW-HG└LQ└WKH└OXQJV◄└
6RPH└RI└WKHVH└DUH└FCHDUHG└E\└WKH└OXQJV└QDWXUDO└GHIHQVH└V\WWHP☼└DQG└VZDOORZHG└RU└FRXJKHG└
RXW◄└7KRVH└SDUWLFCHV└WKDW-DUH└UHWDLQHG└CRQJ└HQRXJK└CHDVH└UDGLDWLRQ└GDPDJLQJ└VXUURXQGLQJ└
OXQJ└WLVVXHV◄└$└VPDOO└DPRXQW-RI└UDGRQ└GHFD\└SURGXFW└LQ└WKH└OXQJ└DUH└DEVRUEHG└LQWR└WKH└
EORRG◄

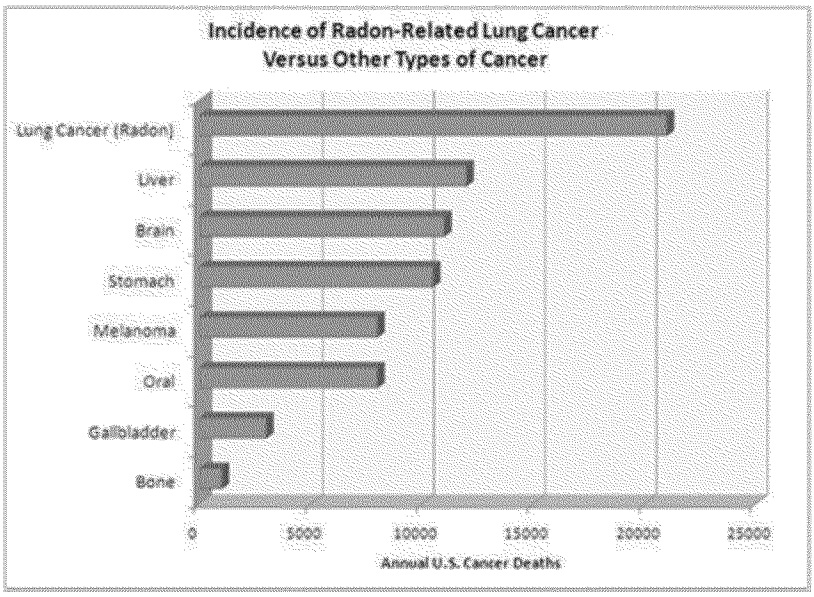
0RW-RI└WKH└UDGRQ└LQJHXWHG└LQ└ZDWHU└LV└H[FUHWHG└ZLWK└KRXUV◄└RHUH└LV└VRPH└ULVN└IURP└
GULQNLQJ└ZDWHU└ZLWK└HCHYDWHG└UDGRQ☼└EHFDXVH└UDGLRDFWLYH└GHFD\└FDQ└RFFXU└ZLWKLQ└WKH└ERG\└
ZKHUH└WLVVXHV☼└VXFK└DV└WKH└WRPDFK└OLQLQJ☼└ZRXOG└EH└H[SRHG◄└+RZHYHU☼└DOSKD└SDUWLFCHV└
HPLWWHG└E\└UDGRQ└DQG└LW-GHFD\└SURGXFW└LQ└ZDWHU└SULRU└WR└GULQNL└TXLFNO\└CRVH└WKHLU└HQHUJ\└
DQG└DUH└WDNHQ└XS└E\└RWKHU└FRPSRXQGV└LQ└ZDWHU☼└DQG└GR└QRW-WKHPVHOYHV└SRVH└D└KHDOWK└
FRQHUQ◄

+HDOWK└(IIHFWV└RI└5DGR Q

+RZ└FDQ└UDGRQ└DIIHFW└SHRSOHV└KHDOWK"

$OPRVW└DOO└ULVN└IURP└UDGRQ└FRPHV└IURP└EUHDWKLQJ└DLU└FRQWDLQLQJUDGRQ└DQG└LWV└GHFD\└SURGXFWV◀└
7KH└KHDOWK└ULVN└RI└LQJHVWLQJ└♂VZDOORZLQJ□└UDGRQ☼└LQ└ZDWHU└IRU[EPSOH☼└LV└PXFK└VPDOOHU└WKDQ└
WKH└ULVN└RI└LQKDOLQJ└UDGRQ└DQG└LWV└GHFD\└SURGXFWV◀

:KHQ└UDGRQ└LV└LQKDOHG☼└WKH└DOSKD└SDUWLFOHV└IURP└LWV└UDGLRDFWLYH└GHFD\└GLUHFWO\└WRXOLNH└VHQVLWLYH└
OXQJ└WLVVXH└FDXVLQJ└GDPDJH└WKDW└FDQ└OHDG└WR└OXQJ└FDQFHU◀└+RZHYHU☼└VLQFH└UDGRQ└LV└D└JDV☼└PRVW└
RI└LW└LV└H[KDOHG◀└7KH└UDGLDWLRQ└GRVH└FRPHV└ODUJHO\└IURP└UDGRQ└GHFD\└SURGXFWV◀└7KH└HQWHU└
WKH└OXQJV└RQ└GXVW└SDUWLFOHV└WKDW└RGJH└LQ└WKH└DLUZD\V└RI└WKHQDW◀└7KHVH└UDGLRQXFOLGHV└GHFD\└
TXLFNO\☼└H[SRVLQJ└OXQJ└WLVVXH└WRDDPDJH└DQG└SURGXFLQJ└RWKHU└UDG LRQXFOLGHV└WKDW└FRQWLQXH└
GDPDJLQJ└WKH└OXQJ└WLVVXH◀



7KHUH└LV└QR└VDIH└OHYHO└RI└UDGRQ└
DQ\└H[SRVXUH└SRVHV└VRPH└ULVN└
RI└FDQFHU◀└7KH└1DWLRQDO└
$FDGHP\└RI└6FLHQFHV└♂1$6□└
WWKGLHG└DQG└UHSRUWHG└RQ└WKH└
FDXVHV└RI└OXQJ└FDQFHU└LQ└WZR└
¶ └UHSRUWV◀└7KH└FRQFOXGHG└
WKDW└UDGRQ└LQ└LQGRRU└DLU└LV└WKH└
VHFRQG└OHDGLQJ└FDXVH└RI└OXQJ└
FDQFHU└LQ└WKH└8◀6◀└DIWHU└
FLJDUHWWH└VPRNLQJ◀

7KH└1$6└HWWLPDWHG└WKDW└¶↑☼!!!!┼
┴┴☼!!!!└$PHULFDQV└GLH└HYHU\└
\HDU└IURP└UDGRQ┼UHODWHG└OXQJ└
FDQFHU◀└:KHQ└SHRSOH└ZKR└
VPRNH└DUH└H[SRVHG└WR└UDGRQ└DV└
ZHOO☼└WKH└ULVN└RI└GHYHORSLQJ└OXQJ└
FDQFHU└LV└VLJQLILFDQWO\└KLJKHU└WKDQ└WKH└ULVN└RI└VPRNLQJ└DORQH◀└FKDUW└DW└ULJKW└FRPSDUHV└OXQJ└
FDQFHU└FDVHV└FDXVHG└E\└UDGRQ└WR└WKH└LQFLGHQFH└RI└RWKHU└RUJDQV└RI└FDQFHU◀

7KH└1$6└DOVR└HWWLPDWHG└WKDW└UDGRQ└LQ└GULQNLQJ└ZDWHU└FDXVHV└DQ└DGGLWLRQDO└¶←!!└FDQFHU└GHDWKV└
SHU└\HDU◀└+RZHYHU☼└DOPRVW└ !!□└RI└WKRVH└GHDWKV└ZHUH└IURP└OXQJ└FDQFHU└FDXVHG└E\└LQKDOLQJ└
UDGRQ└UHOHDVHG└WR└WKH└LQGRRU└DLU└IURP└ZDWHU◀└2QO\└DERW└¶!!□└RI└WKH└GHDWKV└ZHUH└IURP└
FDQFHUV└RI└LQWHUQDO└RUJDQV☼└PRVWO\└WKH└WWRPDFK☼└FDXVHG└E└LQJHWWLQJ└UDGRQ└LQ└ZDWHU◀

,V└WKHUH└D└PHGLFDO└WHWW└WR└GHWHUPLQH└H[SRVXUH└WR└UDG RQ"

6HYHUDO└GHFD\└SURGXFWV└FDQ└EH└GHWHFWHG└LQ└XULQH☼└EORRG☼└DQ└OXQJ└DQG└ERQH└WLVVXH◀└+RZHYHU☼└
WKHVH└WHWW└DUH└QRW└JHQHUDOOD└DYDLODEOH└WKURXJK└WVSLFDO└PHGLFDO└IDFLOLWLHV◀└$OVR☼└WKH└FDQQRW└EH└
XVHG└WR└GHWHUPLQH└DFFXUDWH└H[SRVXUH└HYHOV☼└VLQFH└PRWW└UDGRQ└GHFD\└SURGXFWV└GHOLYHU└WKHLU└
GRVH└DQG└GHFD\└ZLWKLQ└D└IHZ└KRXUV◀

7KH└EHWW└ZD\└WR└DVVHVV└H[SRVXUH└WR└UDGRQ└LV└E\└PHDVXULQJ└FRQFHQWUDWLRQV└RI└UDGRQ└♂RU└UDGRQ└
GHFD\└SURGXFWV□└LQ└WKH└DLU└\RX└EUHDWKH└DW└KRPH◀

3URWHFWLQJ└3HRSOH└IURP└5DGR Q

+RZ└GR└,└NQRZ└LI└WKHUH└LV└UDGRQ└LQ└P\└KRPH"

<RX└FDQQRW└VHH└IHHO└VPHOO└RU└WDVWH└UDGRQ◄└7HVWLQJ└WKHUH└LV└WKH└RQO\└ZD\└WR└NQRZ└LI└\RX└DQG└\RXU└IDPLO\└DUH└DW└ULVN└IURP└UDGRQ◄└(3$└DQG└WKHX6JHRQ└*HQ HUDO└UHFRPPHQG└WHWWLQJ└IRU└UDGRQ└LQ└DOO└KRPHV└EHORZ└WKH└WKLGH└ICRRU◄└(3$└DOVR└UHFRPPHQGV└WHWWLQJ└LQ└VFKRRO◄

5DGRQ└WHWWLQJ└LV└LQH[SHQVLYH└DQG└HDV\└WR└GR◄└,W└VKRXOGQ└WDNH└D└IHZ└PLQXWHV└RI└\RXU└WLPH◄└0LOOLRQV└RI└$PHULFDQV└KDYH└DOUHDG\└WHWWHG└WKHLU└KRPHV└IRU└UDGRQ◄└9DULRXV└ORZ┼FRWW└GR┼LW┼└\RXUVHOI└WHWW└NLW└DUH└DYDLODEOH└WKURXJK└WKH└PDLO└DQG└LQ└KDUGZDUH└VWRUHV└DQG└RWKHU└UHWDLO└RXWOHWV◄└<RX└FDQ└DOVR└KLUH└D└WUDLQHG└FRQWUDFWRU└WR└GR└WKHWWLQJ└IRU└\RX◄

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- Á (3$└&LWL]HQV└*XLGH└WR└5DGRQ
  7KLV└ERRNOHW└GHVFULEHV└FRPPRQ\└ DYDLODEOH└WHWWW└IRU└PHDVXULQJ└DDRQ└FRQFHQWUDWLRQV└LQ└WKH└KRPH◄└♂6HH└│:KDW└LV└(3$└'RLQJ└$ERXW└5DGRQ"│◄□
- Á :KR└&DQ└7HWW└IRU└)L[└<RXU└+RPH
  7KLV└SDJH└SURYLGHV└FRQWDFW└IRU└KHOS└LQ└ILQGLQJ└TXDOLILHG└SURIHRQDOV└DQG└GR┼LW┼└\RXUVHOI└WHWW└NLW◄

:KDW└FDQ└,└GR└WR└SURWHFW└P\└VHOI└DQG└P\└IDPLO\└IURP└UDGRQ"

7KH└ILUWW└WWHS└LV└WR└WHWW└\RXU└KRPH└IRU└UDGRQ└DDGH└KLW└ILQH└LI└LW└LV└DW└RU└DERYH└(3$V└$FWLRQ└/HYHO└RI└┼└SLFRFXULHV└SHU└OLWHU◄└<RX└PD\└ZDQW└WR└WDNH└DFWLRQW└CHYHOV└DUH└LQ└WKH└UDQJH└RI└┴┼┤└SLFRFXULHV└SHU└OLWHU◄└*HQHUDO└CHYHOV└FDQ└EH└EURXJKW└EHZR└└S&L↕O└IDLUO└VLPSO◄

7KH└EHWW└PHWKRG└IRU└UHGXFLQJ└UDGRQ└LQ└\RXU└KRPH└ZLOO└GHSHQG└RQ└KRZ└UDGRQ└HQWHUV└\RXU└KRPH└DQG└WKH└GHVLJQ└RI└\RXU└KRPH◄└)RU└H[DPSOH└VHDOLQJ└FUDFNV└LQ└ICRRUV└DQG└ZDOOV└PD\└KHOS└WR└UHGXFH└UDGRQ└EXW└LV└QW└VXIILFLHQW◄└7KHUH└DUH└DOWHUW└WKDW└UHFRYH└UDGRQ└IURP└WKH└FUDZO└VSDFH└RU└IURP└EHQHDWK└WKH└FRQFUHWH└ICRRU└RU└EDVHQW└VODE└WKDW└DUH└HIIHFWLYH└DW└NHHSLQJ└UDGRQ└IURP└HQWHULQJ└\RXU└KRPH◄└7KHVH└V\WWHPV└DUH└VLPS CH└DQG└GRQ W└UHTXLUH└PDMRU└FKDQJHV└WR└\RXU└KRPH◄└2WKHU└PHWKRGV└PD\└EH└QHFHVVDU\◄

3HRSOH└ZKR└KDYH└SULYDWH└ZHOO└VKRXOG└WHWW└WKHLU└ZHOO└ZDWHU└WHVWHG└WKDW└UDGRQ└CHYHOV└PHHW└(3$V└SURSRVHG└WDQGDUG◄

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- Á 5DGRQ└LQ└'ULQNLQJ└:DWHU
  7KLV└SDJH└SURYLGHV└LQIRUPDWLRQ└RQ└UHJXODWLRQV└└WXKGLHV└└DQG└WHW└FRQWDFW└UHODWHG└WR└UDGRQ└LQ└GULQNLQJ└ZDWHU◄
- á 5DGRQ└
  7KLV└SDJH└SURYLGHV└DFFHVV└WR└D└ZHH└YDULHW\└RI└LQIRUPDWLRQ└DQG$XEOLFDWLRQV└RQ└UDGRQ└DQG└SUHYHQWLQJ└H[SRVXUH└WR└UDGRQ◄
- á 1DWLRQDO└5DGRQ└+RWOLQH
  ←‼‼◄→├→┼→┴┬├

:KDW└UHFRPPHQGDWLRQV└KDV└WKH└IHGHUDO└JRYHUQPHQW└PDGH└WR└ SURWHFW└KXPDQ└KHDOWK└IURP└UDGRQ"

6LQFH└¶ ←←☼└(3$└DQG└WKH└8◄6◄└6XUJHRQ└*HQHUDO└KDYH└LVVXHG└+HDOWK└$GYLVRULHV└UHFRPPHQGLQJ└WKDW└DOO└KRPHV└EH└WHVWHG└EHORZ└WKH└WKLUG└ICRRU└IRU└UDGRQ◄└7KHVH└UHFRPPHQGHG└IL[LQJ└KRPHV└ZLWK└UDGRQ└CHYHOV└DW└RU└DERYH└┤└SLFRFXULHV└SHUWDLQ└♂S&L/□☼└(3$V└1DWLRQDO└9RODWLOH└$FWLRQ└/HYHO◄└(3$└DQG└WKH└6XUJHRQ└*HQHUDO└DOVR└UHFRPPHQG└W KDW└VFKRROV└QDWLRQZLGH└EH└WHVWHG└IRU└UDGRQ◄

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Á (3$└5DGRQ└3XEOLFDWLRQV☼└LQFOXGLQJ └
Á (3$V└|$└&LWL]HQV└*XLGH└WR└5DGRQ
á &RQVXPHUV└*XLGH└WR└5DGRQ└5HGXFWLRQ

:KDW└LV└(3$└GRLQJ└DERXW└UDGRQ"

(3$└KDV└HVWDEOLVKHG└D└YROXQWDU\└SURJUDP└WR└SURPRWH└UDGRQ└DZDUHQ HVV☼└WHVWLQJ☼└DQG└UHGXFWLRQ◄└7KH└SURJUDP└VHW└DQ└µ$FWLRQ└/HYHO└RI└$LFRFXULHV└SHU└OLWHU└♂S&L↕O□└RI└DLU└IRU└LQGRRU└UDGRQ◄└7KH└DFWLRQ└CHYHO└LV└QRW└WKH└PD[LPXP└VDIH└CHYHO└IRU└RQ└LQ└WKH└KRPH◄└+RZHYHU☼└WKH└CRZHU└WKH└CHYHO└RI└UDGRQ☼└WKH└EHWWHU◄└*HQHUDOO\☼└CHYHOV└FDEEUHKUKW└EHORZ└┴└S&L↕O└IDLUD\└VLPSO\◄└

,Q└DGGLWLRQ└WR└ZRUNLQJ└ZLWK└KRPHRZQHUV☼└(3$└LV└ZRUNLQJ└ZLWK└KRP H└EXLGHUV└DQG└EXLGLQJ└FRGH└RUJDQL]DWLRQV◄└7KH└JRDOV└DUH└WR└KHOS└QHZO\└FRQWUXFWHG└KRPHV└EH└PRUH└UDGRQ└UHVLVWDQW└DQG└WR└HQFRXUDJH└UDGRQ└WHVWLQJ└ZKHQ└H[LWLQJ└KRPHV└DUH└VROG◄

0RUH└,QIR

Á 5DGRQ└5HVLVWDQW└1HZ└&RQVWUXFWLRQ
7KLV└SDJH└SURYLGHV└LQIRUPDWLRQ└RQ└UDGRQ└UHVLVWDQW└KRPHV◄└
á 5DGRQ└DQG└5HDO└(VWDWH
<RX└ZLOO└ILQG└D└QXPEHU└RI└WRROV└DQG└UHVRXUFHV└XVH└E\└WKHDDHHWWDWH└FRPPXQLW\└WKDW└(3$└DQG└LW└UDGRQ└SDUWQHUV└KDV└GHYHORSHG◄

7KH└¶ ←←└,QGRRU└5DGRQ└$EDWHPHQW└$FW└DXWKRUL]HV└(3$└WR└SURYLGH └JUDQWV└WR└WDWHV└WR└VXSSRUW└WHVWLQJ└DQG└UHGXFLQJ└UDGRQ└LQ└KRPHV◄└:LWK└YDULRXV└GRQ┤JRYHUQHQ WDO└DQG└SXEOLF└KHDOWK└RUJDQL]DWLRQV☼└(3$└SURPRWHV└DZDUHQHVV└DQG└UHGXFWLRQ└RI└LQGRRU└UDGRQ◄└3DUWQHUV└LQFOXGH└WKH└$PHULFDQ└/XQJ└$VVRFLDWLRQ☼└WKH└1DWLRQDO└(QYLURQPHQWDO└+HDOWK└$VVRFLDWLRQ☼└WKH└$PHULFDQ└6RFLHW\└RI└+RPH└,QVSHFWRUV☼└DQG└RWKHUV◄└7KH└SDJH☼└5DGRQ└3XEOLFDWLRQV└DQG└5HVRXUFHV☼└SURYLGHV└D└OLWW└RI└(3$┤VSRQVRUHG└SXEOLFDWLRQV└LQ└(QJOLVKDQG└6SDQLVK◄

(3$└KDV└DOVR└SURSRVHG└D└WDQGDUG└IRU└WKH└PD[LPXP└DPRXQW└RI └UDGRQ└WKDW└PD\└EH└IRXQG└LQ└GULQNLQJ└IURP└FRPPXQLW\└ZDWHU└V\VWHPV└XVLQJ└JURXQG└ZDWHU◄

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Á 3URSRVHG└5DGRQ└5XOH
7KLV└UXOH└SURSRVHV└PD[LPXP└FRQWDPLQDQW└CHYHOV└LQ└GULQNLQJ└ZDWHU ◄
á ,QGRRU└5DGRQ└$EDWHPHQW└$FW
7KLV└DFW└SURYLGHV└JUDQWV└WR└WDWHV└WR└VXSSRUW└WKH└UHGXFRQ└RI└UDGRQ└LQ└KRPHV◄
á 5DGRQ└3XEOLFDWLRQV└DQG└5HVRXUFHV
7KLV└LV└D└OLWW└RI└(3$┤VSRQVRUHG└SXEOLFDWLRQV└LQ└(QJOLVK└DQG└6SDQLVK◄└

Understanding Radiation in Your Life, Your World

3URJUDPV└ └7RSLFV└ └5HIHUHQFH

5DGLDWLRQ└3URWHFWLRQ└

7KRULXP└

7KRULXP└♂FKHPLFDO└V\PERO└7K□└LV└D└QDWXUDOO\┤RFFXUULQJ└
UDGLRDFWLYH└PHWDO└IRXQG└DW└YHU\└ORZ└CHYHOV└LQ└VRLO☼└VDRFDQG└
ZDWHU◄└,W└KDV└VHYHUDO└GLIIHUHQW└LVRWRSHV☼└ERWK└QDWXUDO└DQG┤
PDGH☼└DOO└RI└ZKLFK└DUH└UDGLRDFWLYH◄└7KH└PRWW└FRPPRQ└IRUP└RI└
WKRULXP└LV└WKRULXP┤┴┬┴☼└IRXQG└QDWXUDOO\◄

2Q└WKLV└SDJH └

7KH└%DVLFV

Á :KR└GLVFRYHUHG└WKRULXP"
Á :KHUH└GRHV└WKRULXP└FRPH└IURP"
Á :KDW└DUH└WKH└SURSHUWLHV└RI└WKRULXP"
Á :KDW└LV└WKRULXP└XVHG└IRU"

([SRVXUH└WR└7KRULXP└

Á +RZ└GRHV└WKRULXP└JHW└LQWR└WKH└HQYLURQPHQW'
Á +RZ└GRHV└WKRULXP└FKDQJH└LQ└WKH└HQYLURQPHQW'
Á +RZ└DUH└SHRSOH└H[SRVHG└WR└WKRULXP"
Á +RZ└GRHV└WKRULXP└JHW└LQWR└WKH└ERG\"
Á :KDW└GRHV└WKRULXP└GR└RQFH└LW└JHWV└LQWR└WKH└ERG\"

+HDOWK└(IIHFWV└RI└7KRULXP└

Á +RZ└FDQ└WKRULXP└DIIHFW└SHRSOHV└KHDOWK"
Á ,V└WKHUH└D└PHGLFDO└WHWW└WR└GHWHUPLQH└H[SRVXUH└WR└WKRULXP"

3URWHFWLQJ└3HRSOH└)URP└7KRULXP└

Á +RZ└GR└,└NQRZ└LI└,P└QHDU└WKRULXP"
Á :KDW└FDQ└,└GR└WR└SURWHFW└P\VHOI└DQG└P\└IDPLO\└IURP└WKRULXP"
Á :KDW└LV└(3$└GRLQJ└DERXW└WKRULXP"

5HIHUHQFH└,QIRUPDWLRQ

Á 3HRSOH└DQG└'LVFRYHULHV└
á &RPPRQO\└(QFRXQWHUHG└
5DGLRQXFOLGHV└
Á $PHULFLXP┤┴┤¶
Á &HVLXP┤¶┬→
Á &REDOW┤┤‼
Á ,RGLQH┤¶┴ └ ┤¶┬¶
á 3OXWRQLXP
á 5DGLXP
Á 5DGRQ
Á 6WURQWLXP┤ ‼
Á 7HFKQHWLXP┤
Á 7ULWLXP
Á 7KRULXP
Á 8UDQLXP

Á *ORVVDU\
á $FURQ\PV
Á $┤=└6XEMHFW└,QGH[
á 6LWH└0DS

7KH└%DVLFV

:KR└GLVFRYHUHG└WKRULXP"

7KRULXP└ZDV└GLVFRYHUHG└LQ└¶←┴←└E\└WKH└6ZHGLVK└FKHPLWW└-RQV└-DNR E└%HU]HOLXV◄└$IWHU└
GHWHUPLQLQJ└WKDW└LW└ZDV└D└QHZ└HSPHQW☼└%HU]HOLXV└QDPHG└KLV└GLVFRYHU\└DIWHU└WKH└1RUVH└JRG└RI└

WKXQGHU└DQG└ZHDWKHU└7KRU◄└7KRULXP└ZDV└GLVFRYHUHG└WR└EH└UDGLRDFWLYH└LQGHSHQGHQWO\└LQ└¶← ←└
E\└*HUKDUG└&DUO└6FKPLGW└DQG└E\└0DULH└&XULH◄

:KHUH└GRHV└WKRULXP└FRPH└IURP"└

$CPRWW└DOO└WKRULXP└LV└QDWXUDO└EXW└WKRULXP└LVRWRSHV└FDQ└EH└DUWLFLDOO\└SURGXFHG◄└7KRULXP└
RFFXUV└DW└YHU\└CRZ└CHYHDV└LQ└YLUWXDOO\└DOO└URFN└VRLO└DQG└ZDWHUWKHUHIRUH└LV└IRXQG└LQ└SCDQW└
DQG└DQLPDOV└DV└ZHOO◄└0LGHUDOV└VXFK└DV└PRQ]LWH└WKRULWH└DQG└RWKDUDQLWH└DUH└ULFK└LQ└WKRULXP└DQG└
PD\└EH└PLQHG└IRU└WKH└PHWDO◄└*HQHUDOO\└DUWLILFLDO└LVRWRSHV└FRP└GHFD\└RI└RWKHU└PDQ┼
PDGH└UDGLRQXFOLGHV└RU└DEVRUSWLRQ└LQ└QXFOHDU└UHDFWLRQV◄

:KDW└DUH└WKH└SURSHUWLHV└RI└WKRULXP"

7KRULXP└LV└D└VRIW└VLOYHU└ZKLWH└PHWDO◄└3XUH└WKRULXP└ZLOO└UHPDQ└VKLQ└IRU└PRQWKV└LQ└DLU└EXW└LI└
LW└FRQWDLQV└LPSXULWLHV└LW└WDUQLVKHV└WR└ECDFN└ZKHQ└H[SRVHG└WR└OL:KHQ└KHDWHG└WKRULXP└R[LGH└
JCRZV└EULJKW└ZKLWH└D└SURSHUW└WKDW└PDNHV└LW└XVHI└XQ└CDQWHUDPDQWHV◄└,W└GLVWROYHV└VCRZO└LQ└
ZDWHU◄└7KRULXP┼┴┬┴└KDV└D└KDOI┤LOH└RI└¶┤└ELOOLRQ└♂¶┤[¶!! □└)HDDG└GHFD\V└E\└DOSKD└
HPLVVLRQ└ZLWK└DFFRPSDQ\LQJ└JDPPD└UDGLDWLRQ◄└7KRULXP┼┴┬┴└LV└WKH└WRS└RI└D└CRQJ└GHFD\└VHULHV└
WKDW└FRQWDLQV└NH\└UDGLRXFOLGHV└VXFK└DV└UDGLXP┼┴┴←└LW└GLUHBWFD\└SURGXFW└DQG└UDGRQ┼┴┴!!◄└
7ZR└RWKHU└LVRWRSHV└RI└WKRULXP└ZKLFK└FDQ└EH└VLJQLILFDQW└LQ└WKHQYLURQPHQW└DUH└WKRULXP┼┬!!└
DQG└WKRULXP┼┴┴←◄└%RWK└EHCRQJ└WR└RWKHU└GHFD\└E\└DOSKD└HPLVVLRQ└ZLWK└
DFFRPSDQ\LQJ└JDPPD└UDGLDWLRQ└DQG└KDYH└KDOI┤OLYHV└RI└→↑┤!!!!└\HDUV└DQG└¶◄ └\HDUV└
UHVSHFWLYHD\◄

:KDW└LV└WKRULXP└XVHG└IRU"

7KRULXP└KDV└FRCRULQJ└SURSHUWLHV└WKDW└KDV└PDGH└LW└XVHIXO└LQ└FHPDF└JCD]HV◄└%XW└LW└KDV└EHHQ└
PRW└ZLGHD\└XVHG└LQ└CDQWHUQ└PDQWCHV└IRU└WKH└EULJKWQHVV└LW└LPSWW└WKRXJK└DQWHUQDWLYHV└DUH└
UHSCDFLQJ└LW└DQG└LQ└ZHDGLQJ└URGV└ZKLFK└EXUQ└EHWWHU└ZLWK└WHDDRXQW└RI└DGGHG└WKRULXP◄└
7KRULXP└LPSURYHV└WKH└SURSHUWLHV└RI└RSKWKDCPLF└CHCVHV└DQG└LV└DQ└DOOR\LQJ└DJHQW└LQ└FHUWDLQ└
PHWDCV└XVHG└LQ└WKH└DHURVSDFH└LQGXWW\◄└0RUH└WKDQ┬!!└\HDUV└DJR└WKRULXP└R[LGHV└ZHUH└XVHG└LQ└
KRVSLWDCV└WR└PDNH└FHUWDLQ└NLQGV└RI└GLDJCRWLF└;┤UD\└SKRWRJUDSKW└%XW└WKLV└SUDFWLFH└KDV└EHHQ└
GLVFRQWLQXHG◄

([SRVXUH└WR└7KRULXP

+RZ└GRHV└WKRULXP└JHW└LQWR└WKH└HQYLURQPHQW"

1DWXUDO└WKRULXP└LV└SUHVHQW└LQ└YHU\└VPDOO└TXDQWLWLHV└LQ└YLUWXDOOO└URFN└VRLO└ZDWHU└SCDQW└DQG└
DQLPDCV◄└:KHUH└KLJK└FRQFHQWUDWLRQ V└RFFXU└LQ└URFN└WKRULXP└PD\└EH└PLQHG└DQG└UHILQHG└
SURGXFLQJ└ZDWH└SURGXFW└VXFK└DV└PLOO└WDLOLQJV◄└,└QRW└SURSHUEQWURCHG└ZLQG└DQG└ZDWHU└FDQ└
LQWURGXFH└WKH└WDLOLQJV└LQWR└WKEHHGHU└HQYLURQPHQW◄└&RPPHUFLDO└D QG└IHGHUDO└IDFLOWLHV└WKDW└KDYH└
SURFHVVHG└WKRULXP└PD\└DOVR└KDYH└U HCHDVHG└WKRULXP└WR└WKH└DLU└ZDWHU└RU└VRLO◄└0DQ┼PDGH└
WKRULXP└LVRWRSHV└DUH└UDUH└DQGEDCPRWW└GHYHU└HQWHU└WKH└HQYLURQPH QW◄

+RZ└GRHV└WKRULXP└FKDQ JH└LQ└WKH└HQYLUQPHQW "

$V└WKRULXP┼┴┬┴└XQGHUJRHV└UDGLRDFWLYH└GHFD\└LW└HPLWV└DQ└DOSKD└SDUWLFOH└ZLWK└DFFRPSDQ\LQJ└JDPPD└UDGLDWLRQ└DQG└IRUPV└UDGLXP┼┴┴←◄└7KLV└SURFHVV└RI└UHCHDYLQJ└UDGLDWLRQ└DQG└IRUPLQJ└D└CHZ└UDGLRQXFOLGH└FRQWLQXHV└XQWLO└WWDECH└CHDG┼┴!!←└LV└IRUPHG◄└7KHDOI┼OLIH└RI└WKRULXP┼┴┬┴└LV└DERXW└¶┤└ELOOLRQ└\HDUV◄└7ZR└RWKHU└LVRWRSHV└RI└WKRULXP└ZKLFK└FHEH└VLJQLILFDQW└LQ└WKH└HQYLUQPHQW└DUH└WKRULXP┼┬!!└DQG└WKRULXP┼┴←◄└%RWK└GHFD\└E\└DSSKD└HPLWWLRQ└ZLWK└DFFRPSDQ\LQJ└JDPPD└UDGLDWLRQ└L Q└→↑└┤!!!!└\HDUV└DQG¶◄ └\HDUV└WSHFWLYHO\◄

+RZ└DUH└SHRSOH└H[SRVHG└WR└WKRULXP"

6LQFH└WKRULXP└LV└QDWXUDOO\└SUHVHQW└WLQ└WKH└HQYLUQPHQW└SHRSOH└DH└H[SRVHG└WR└WLQ\└DFRXQW└LQ└DLU└IRRG└DQG└ZDWHU◄└7KH└DPRXQW└DUH└XVXDOO\└YHU\└VPDOO└DQG└SRW└OLWWOH└KHDOWK└KD]DUG◄└7KRULXP└LV└DOVR└SUHVHQW└LQ└PDQ\└FRQVXPHU└SURGXFWV└V XFK└DV└FHUDP LF└JOD]HV└└ODQWHUQ└PDQWOHV└DQG└ZHOGLQJ└URGV◄

3HRSOH└ZKR└OLYH└QHDU└D└IDFLOLW\└WKDW└PLQHV└RU└PLOOV└WKRULXP└FDQ└XIDFWXUHV└SURGXFWV└ZLWK└WKRULXP└PD\└UHFHLYH└KLJKHU└H[SR VXUHV◄└$OVR└SHRSOH└ZKR└ZRUN└ZLWK└WKRULXP└LQ└YDULRXV└LQGXVWULHV└PD\└UHFHLYH└KLJKHU└H[SRVXUHV◄

+RZ└GRHV└WKRULXP└JHW└LQWR└WKH└ERG\"

3HRSOH└PD\└LQKDOH└FRQWDPLQDWHG└GXVW└RU└VZDOORZ└WKRULXP └ZLWK└IRG└RU└ZDWHU◄└/LYLQJ└QHDU└D└WKRULXP└FRQWDPLQDWHG└VLWH└RU└ZRUNLQJ└LQ└DQ└LQGXVWU\└ZKHUH└WKRULXP└LV└XVHG└LQFUHDVHV└\RXU└FKDQFH└RI└H[SRVXUH└WR└WKRULXP◄

:KDW└GRHV└WKRULXP└GR└RQFH└LW└JHWV└LQWR└WKH└ERG\"

,I└LQKDOHG└DV└GXVW└VRPH└WKRULXP└PD\└UHPDLQ└LQ└WKH└OXQJV└IRU└QBU└SHULRGV└RI└WLPH└GHSHQGLQJ└RQ└WKH└FKHPLFDO└IRUP◄└,I└LQJHVWHG└WKRULXP└W\SLFDOO\└CHDYHV└WKHERG\└WKURXJK└IHFHV└DQG└XULQH└ZLWKLQ└VHYHUDO└GD\V◄└7KH└VPDOO└DPRXQW└RI└WKRULXP└CHWV└LQ└WKH└GBR└ZLOO└HQWHU└WKH└ECRRGWUHDP└DQG└EH└GHSRVLWHG└LQ└WKH└ERQHV└ZKHUH└LW└PD\└UHPDLQ└IRU└PDQ\└\HDUV◄└7KHUH└LV└VRPH└HYLGHQFH└WKDW└WKH└ERG\└PD\└DEVRUE└WKRULXP└WKURXJK└WKH└VNLQ└EXW└WKDW└ZRXOG└QRW└OLNHO\└EH└WKH└SULPDU\└PHDQV└RI└HQWU\◄

+HDOWK└(IIHFWV└RI└7KRULXP

+RZ└FDQ└WKRULXP└DIIHFW└SHRSOHV└KHDOWK"

7KH└SULQFLSDO└FRQFHUQ└IURP└ORZ└WR└PRGHUDWH└CHYHO└H[SRVXUH└WR└LRQL]LQJ└UDGLDWLRQ└LV└LQFUHDVHG└ULVN└RI└FDQFHU◄└6XXGLHV└KDYH└VXRQ└WKDW└LQKDOLQJ└WKRULXP└GXW└EXVHV└DQ└LQFUHDVHG└ULVN└RI└GHYHORSLQJ└OXQJ└FDQFHU└└DQG└FDQFHU└RI└WKH└SDQFUHDV◄└%RQH└FDQFHU└ULVN└LV└DOVR└LQFUHDVHG└EHFDXVH└WKRULXP└PD\└EH└WWRUHG└LQ└ERQH◄

,V└WKHUH└D└PHGLFDO└WHXW└WR└GHWHUPLQH└H[SRVXUH└WR└WKR ULXP"

7KHUH└DUH└VSHFLDO└WHWWV└WKDW└PHDVXUH└WKH└CHYHO└RI└WKRULXP└WKH└XULQH☼└IHFHV☼└DQG└DOVR└YLD└
H[KDCHG└DLU└WKDW└FDQ└GHWHUPLQH└IL└D└SHUVRQ└KDV└EHHQ└H[SRVHG└WR└WKRULXP◄└7KHVH└WHWWV└DUH└
XVHIXO└RQO\└LI└WDNHQ└ZLWKLQ└D└ZHHN└DIWHU└H[SRVXUH◄└<RX└QHHG└VSHFLDO└HTXLSPHQW└WR└GHWHFW└
WKRULXP└QRW└DYDLODEOH└LQ└GRFWRUV└RIILFHV└RU└PRWW└KRVSLWDOV└6H└IHGHUDO└IDFLOLWLHV└DQG└
VSHFLDOL]HG└ODERUDWRULHV└KDYH└WKLV└FDSDEOLOW\◄

3UR\WHFWLQJ└3HRSOH└IURP└7KRULXP

+RZ└GR└,└NQRZ└WKRULXP└LI└,P└QHDU└WKRULXP"

<RX└QHHG└VSHFLDO└HTXLSPHQW└WR└GHWHFW└WKRULXP☼└DQG└VSHFLDO└WUDLQLQJ◄└+HDOWK└SK\VLFLWW└DQG└
UDGLDWLRQ└VDIHW\└RIILFHUV└DUH└WUDLQHG└WR└PHDVXUH└WKRULXP◄

:KDW└FDQ└,└GR└WR└SURWHFW└P\└VHOI└DQG└P\└IDPLO\└IURP└WKRULXP "

0RVW└SHRSOH└DUH└QRW└H[SRVHG└WR└GDQJHURXV└CHYHOV└RI└WKRULXP◄└+RZ HYHU☼└SHRSOH└ZKR└OLYH└QHDU└
WKRULXP└PLQLQJ└DUHDV☼└RU└QHDU└FHUWDLQ└JRYHUQPHQW└RU└LQGXWXULDO└DFLOLWLHV└PD\└KDYH└LQFUHDVHG└
H[SRVXUH└WR└WKRULXP☼└HVSHFLDOO\└IL└WKHU└ZDWHU└LV└IURP└D└SUWPDWHDO◄└$QDO\WLFDO└CDERUDWRULHV└
FDQ└WHWW└ZDWHU└IRU└WKRULXP└FRQWHQW◄└2FFDVLRQDOO\☼└KRXVHKROGWHPV└PD\└EH└IRXQG└ZLWK└WKRULXP└
LQ└WKHP☼└VXFK└DV└VRPH└ROGHU└FHUDPLF└ZDUHV└LQ└ZKLFK└XUDQLXP└ZDV└ XVHG└LQ└WKH└JCD]H☼└RU└JDV└
CDQWHUQ└PDQWOHV◄└7KHVH└JHQHUDOO\└GR└QRW└SRVH└VHULRXV└KHDOWK└UISW☼└EXW└PD\└QHYHUWKHOHVV└EH└
UHWUHG└IURP└XVH└DV└D└SUXGHQW└DRLGDQFH└PHDVXUH◄└$└UDGLDWLRQ└FRXQWHU└LV└UHTXLUHG└WR└FRQILUP└
LI└FHUDPLFV└FRQWDLQ└WKRULXP◄

:KDW└LV└(3$└GRLQJ└DERXW└WKRULXP"

(3$└SURWHFWV└SHRSOH└DQG└WKH└HQYLURQPHQW└IURP└WKRULXP└ E\└HVWDEOLVKLQJ└WDQGDUGV└IRU└WKH└
FOHDQ└XS└RI└FRQWDPLQDWHG└VLWHV☼└DQG└E\└VHWWLQJ└OLPLWV└RQ└WKH└RRQW└RI└WKRULXP└♂DQG└RWKHU└
UDGLRQXFOLGHV└WKDW└PD\└EH└UHOHDVHG└WR└WKH└DLU└IURP└VSHFLILF└XUWHHV☼└RU└IRXQG└LQ└SXEOLF└
GULQNLQJ└ZDWHU◄

7KH└WDQGDUGV└IRU└WKH└FOHDQ└XS└RI└H[LWWLQJ└FRQWDPLQDWHG└VLWHV└HQHUDOO\└IDOO└XQGHU└WKH└
&RPSUHKHQVLYH└(QYLURQPHQWDO└5HVSRQVH☼└&RPSHQVDWLRQ☼└DQG└/LDELOL W\└$FW☼└FRPPRQO\└FDOOHG└
6XSHUIXQG◄└&HDQ└XSV└PXW└PHHW└ DOO└UHTXLUHPHQW└WKDW└DUH└UHOHYDW└RU└DSSOLFDEOH☼└VXFK└DV└
WDWH└UHJXODWLRQV└DQG└UHJXODWLRQV└LWXHG└LQ└FRQHFWLRQ└ZLWK└RWK└HQYLURQPHQWDO└CDZV◄└:KHQ└
WKHVH└WWSHV└RI└UHJXODWLRQV└DUH└QRW└DSSOLFDEOH☼└RU└QRW└SRWW└HFWLYH└HQRXJK☼└(3$└VHWW└VLWH└VSHFLILF└
FOHDQXS└CHYHOV└WKDW└OLPLW└WKH└FKDQFH└RI└GHYHORSLQJ└FDQFHU└RWKHU└H[SRVXUH└WR└D└VLWH└UHODW└G└
FDUFLQRJHQ└♂VXFK└DV└WKRULXP☐└WR└EHWZHHQ└RQH└LQ└¶!!☼!!!!└DQG└RQH└LQ└¶☼!!!!☼!!!!◄

(3$└LWXHG└VSHFLDO└UHJXODWLRQV└IRU└FOHDQLQJ└XS└XUDQLXP└DQG└WKRULXP└PLOO└WDLOLQJ└VLWHV└XQGHU└
WKH└|8UDQLXP└0LOO└7DLOLQJV└5DGLDWRQ└&RQWURO└$FW|└♂IHGHUDO└UHQDWLRQV└DUH└IRXQG└LQ└┤!!&)5¶ ┴☼└
|+HDOWK└DQG└(QYLURQPHQWDO└3UR\WHFWLRQ└6\VWHPV└IRU└8UDQLXP└ DQG└7KRULXP└0LOO└7DLOLQJV|☐◄└
7KHVH└PLOOV└DUH└IRXQG└PRWWO\└LQ└WKH└ZHWWHUQ└WWDWHV└RWRRUDGR☼└8WDK☼└$UL]RQD└DQG└1HZ└
0H[LFR◄

Á 6XSHUIXQG└(3$└5DGLDWLRQ└*XLGDQFHV└DQG└5HSRUWW└
7KLV└VLWH└SURYLGHV└LQIRUPDWLRQ└RQ└UDGLRQXFOLGHV└DW└6XSHUIXQG└WHHV◄

Á (3$V└6XSHUIXQG└+RWOLQH └¶┼←‼‼┼┤┴┤┼ ┬┤├└RU└¶┼←‼‼┼↑┬↑┼‼┴‼┴

á &CHDQ└$LU└$FW└
(3$└XVHV└WKLV└DXWKRULW\└WR└VHW└OLPLWV└RQ└WKH└HPLVVLRQV└KD]DUGRXV└DLU└SROOXWDQWV└IURP└
VSHFLILF└VRXUFHV◄└+D]DUGRXV└DLU└SROOXWDQWV└LQFOXGH└ERWK└FKHPLFDV└DQG└UDGLRQXFOLGHV└
WKDW└DUH└NQRZQ└RU└VXVSHFWHG└WR└FDXVH└VHULRXV└KHDOWK└SBECHPV◄└: KLCH└QR└DLU└HPLVVLRQV└
WWDQGDUGV└OLWW└WKRULXP└VSHFLILFDOO\☼└UDGLRQXFOLGHV└DUH└OLPLWHGD└JURXS◄

á 5DG1(6+$36
7KLV└VLWH└SURYLGHV└LQIRUPDWLRQ└RQ└(3$V└1DWLRQDO└(PLVVLRQ└6WDQGDUGV└IRU└
+D]DUGRXV└$LU└3ROOXWDQWV └5DGLRQXFOLGHV◄

á 5DGLRQXFOLGHV└LQ└'ULQNLQJ└:DWHU
7KLV└VLWH└SURYLGHV└LQIRUPDWLRQ└DERXW└UDGLRQXFOLGHV└LQ└GULQNLQJDWHU└DQG└JXLGDQFH└WR└
KHOS└WWDWHV└DQG└ZDWHU└V\WWHPV└FRPSO\└ZLWK└WKH└WWDQGDUG◄└(3$└XVHV└LWW└6DIH└'ULQNLQJ└
:DWHU└$FW└DXWKRULW\└WR└HWWDEOLVK└PD[LPXP└FRQWDPLQDQW└OHYHOV└♂0& /V□└IRU└DOSKD└
HPLWWHUV└VXFK└DV└WKRULXP└LQ└SXEOLF└GULQNLQJ└ZDWHU◄└7KH└0&/└WRDOSKD└HPLWWHUV└LV└¶↑└
SLFR&XULHV└SHU└OLWHU└RI└ZDWHU◄

Understanding Radiation in Your Life, Your World

3URJUDPV└ └7RSLFV└ └5HIHUHQFHV

ATTACHMENT B

WESTON FLDS

FLD 02 INCLEMENT WEATHER

Hot weather (ambient temperatures over 70°F), cold weather (ambient temperatures below 40°F), rain, snow, ice, and lightning are examples of inclement weather that may be hazardous or add risk to work activities. Extremes of heat, cold, and humidity, as well as rain, snow, and ice, can adversely affect monitoring instrument response and reliability, respiratory protection performance, and chemical protective clothing materials.

RELATED FLDs AND OP

FLD 05 – Heat Stress Prevention and Monitoring
FLD 06 – Cold Stress
OP 05-03-008 – Inclement Weather & Business Disruption Policy

PROCEDURE

The potential for exacerbating the impact of physical hazards must be considered for tasks that expose personnel to inclement weather. Risk assessment and hazards analysis should be accomplished during the planning stages of a project for the most likely inclement weather conditions that may be encountered, i.e., rain and lightning in late spring, summer, and early fall, or lightning prone areas; cold, snow, and ice in winter. The Field Safety Officer (FSO) must determine the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his/her work and be actively alert to these hazards. Managers and workers must be familiar with the requirements of FLD 05 and FLD 06.

A pre-site activity risk assessment must be completed when inclement weather occurs. Weather conditions that affect instruments and personal protective equipment (PPE) function must be conveyed to site workers who should monitor function and integrity of PPE and be alert to changing weather conditions. A decision must be made on the proper safety procedures to use if work must continue, or to stop work if the risk is too great. The appropriate Safety Professional **must be notified of all instances of the need to stop work for safety reasons, including inclement weather**.

Heat

Hot, dry weather increases risk of soil drying, erosion, and dust dispersion, which may present or increase risk of exposure and environmental impact from toxic hazards. Hot weather will increase pressure on closed containers and the rate of volatilization, thereby potentially increasing the risk of exposure to toxic, flammable, or explosive atmospheres.

<u>Prevention and Protective Measures</u>

Employees must be protected from airborne contaminants using engineering controls such as wetting dry soil to prevent particle dispersion, and providing local ventilation to reduce volatile air contaminants to safe levels, or if engineering controls are infeasible, using prescribed PPE. Wind shifts and velocity should be measured where change may result in dispersion of airborne contaminants into the work area.

Rain, Wet Weather, and High Humidity

Wet conditions resulting from rain and wet weather increase slipping and tripping hazards, braking distances of vehicles, the potential for vehicle skidding, or difficulties in handling powered devices such as augers and drills. Rain fills holes, obscures trip and fall hazards, and increases risk of electrical shock

when working with electrical equipment. Changes in soil conditions caused by rain can impact trenching and excavating activities, creating the potential for quicksand formation, wall collapse, and cave-in. Vehicles become stuck in mud, and tools and personnel can slip on wet surfaces. Rain and wet conditions may decrease visibility (especially for personnel wearing respiratory protection) and limit the effectiveness of certain direct-reading instruments (e.g., photoionization detectors [PIDs]).

Feet that become wet and are allowed to remain wet can lead to serious problems under both heat and cold conditions. Activities that may result in wet feet include extended work in chemical protective clothing and wading in water/liquid during biological assessments. Trench foot, paddy foot, and immersion foot are terms associated with foot ailments resulting from feet being wet for long periods of time. All have similar symptoms and effects. Initial symptoms include edema (swelling), tingling, itching, and severe pain. These may be followed by more severe symptoms including blistering, death of skin tissue, and ulceration. (NOTE: The following Preventive and Protective Measures also apply to Cold, Snow, and Ice.)

Preventive and Protective Measures

Walkways, stairs, ladders, elevated workplaces, and scaffold platforms must be kept free of mud, ice, and snow. Employees shall be prohibited from working on scaffolds covered with snow, ice, or other slippery material except as necessary for removal of such materials.

Vehicles used in rain or cold weather must have working windshield wipers and defrosters, and windows must be kept clear of obstruction.

Drivers must observe traffic laws, including maintaining speed within limits safe for weather conditions, and wearing seat belts at all times. Note that this may mean operating below the posted speed limit.

When walking, workers should use a walking stick or probe to test footing ahead where there is standing water, snow, or ice to protect the walker against stepping into potholes or onto puncture hazards, buried containers, or other potential structurally unsound surfaces.

Prior to using vehicles or equipment in off-road work, workers should walk the work area or intended travelway when puddles or snow may obscure potholes, puncture hazards, or buried containers, or other potential structurally unsound surfaces.

Project managers should arrange to have winches, come-alongs, or other mechanical assistance available when vehicles are used in areas where there is increased risk of getting stuck. Cable or rope and mechanical equipment used for pulling stuck vehicles must be designed for the purpose, of sufficient capacity for the load, and be inspected regularly and before use to ensure safety. **Manually pushing stuck vehicles is to be avoided**.

Prevention methods are required when work is performed in wet conditions or when conditions result in sweating, causing the feet to become and remain wet. Proper hygiene is critical. Workers must dry their feet and change socks regularly to avoid conditions associated with wet feet. Use of foot talc or powder can additionally assist in prevention of this type of condition.

Cold, Snow, and Ice

Cold weather affects vehicle operation by increasing difficulty in starting and braking. Ice, frost, and snow can accumulate on windows and reduce vision. Cold, wet weather can cause icing of roadways,

driveways, parking areas, general work places, ladders, stairs, and platforms. Ice is not always as obvious to see as snow or rain, and requires special attention, especially when driving or walking.

Snow and ice increase the risk of accidents such as slipping when walking, climbing steps and ladders, or working at elevation, and the risk of accidents when driving vehicles or operating heavy equipment. Heavy snow and ice storms may cause electric lines to sag or break, and the use of electrical equipment in snow increases the risk of electric shock. Snow can hide potholes and mud, which can result in vehicles getting stuck or persons falling when stepping into hidden holes. Snow also may cover water, drums or other containers, sharp metal objects, debris, or other objects that can cause falls or punctures.

Preventive and Protective Measures

WESTON personnel are cautioned against operating motor vehicles such as cars or trucks on ice under any circumstances. If traveling in icy conditions, WESTON personnel should follow all public service advisories that curtail driving activities.

Personnel performing activities that require working over ice should be aware of minimal ice thickness safety guidelines as follows:

- 4-inch minimum: activities such as walking or skating.
- 6-inch minimum: activities such as snowmobiling or the use of equipment with the same weight and cross-sectional area as a snowmobile.

Personnel should always be aware that these measurement guidelines are under ideal conditions and that snow cover, conditions on rivers, ponds, or lakes with active currents, and other environmental factors impact the safety of working on ice. Clear ice typically is the strongest, while ice that appears cloudy or honeycombed (contains entrained air) is not as structurally strong. Measurements made by drilling or cutting through the ice should be made every few feet to verify safe conditions. Provisions for rescue (e.g., ladders or long poles and effective communications) must be available at the work site.

Lightning

Lightning represents a hazard of electrical shock that is increased when working in flat open spaces, elevated work places, or near tall structures or equipment such as stacks, radio towers, and drill rigs. Lightning has caused chemical storage tank fires and grass or forest fires. Static charges associated with nearby electrical storms can increase risk of fire or explosion when working around flammable materials, and can adversely affect monitoring instruments.

Lightning is the most dangerous and frequently encountered weather hazard people experience each year. Lightning affects all regions. **Florida, Michigan, Pennsylvania, North Carolina, New York, Ohio, Texas, Tennessee, Georgia, and Colorado** have the most lightning deaths and injuries.

Preventive and Protective Measures

Prior to working in areas or beginning projects when or where there is an increased potential for lightning striking personnel, steps must be taken to predict the occurrence of lightning strikes. Recommendations include:

- Check with client management to determine if there are any patterns or noted conditions that can help predict lightning or if there are structures that are prone to lightning strikes. Arrange for

client notification when there is increased potential for lightning activities. Ensure that clients include WESTON workers in lightning contingency plans.

- Monitor weather reports.
- Note weather changes and conditions that produce lightning.
- Stop work in open areas, around drill rigs or other structures that may attract lightning, on or in water and in elevated work places when lightning strikes are sighted or thunder is heard near a work site.
- Ensure all personnel are provided with safe areas of refuge. Prevent personnel from standing in open areas, under lone trees, or under drill rigs.
- Observe the "30-30" Rule. If you see lightning and thunder is heard within 30 seconds (approximately 6 miles), seek shelter. If you hear thunder, but did not see the lightning, you can assume that lightning is within 6 miles and you should seek shelter. Remain in the sheltered location for 30 minutes following the last lightning strike.
- Use a hand held static potential meter (lightning detection device) to monitor the potential difference between a cloud and the ground. When the measured potential is greater than 2 kV/m, there is a potential for a lightning strike – seek shelter.

High Wind and Tornado Safety

High Winds

Many construction workers have died due to wind-related accidents and injuries. A ladder that seems secure under normal circumstances can become unstable during windy conditions and cause you to fall. Scaffolding that is improperly secured can rip free during strong winds and kill bystanders. The risk of injury for construction workers increases during strong winds. Keep in mind that changing weather conditions can affect your daily work tasks, and make sure you have a game plan to prevent proper damage and personal injury.

Stay Informed: With today's modern technology available at the touch of a button, you should keep up to date with the latest local weather reports. Visit weatherbug.com or weather.gov to stay informed in case of wind warnings, watches, and advisories. Larger projects may have their own weather station on site to provide instant weather data. Use daily hazard assessments to determine if working conditions have changed or will change throughout the day.

Be Prepared: When you know the weather will be windy, secure loose building materials, scaffolding and fencing that could be picked up or torn loose by strong winds and thrown onto surrounding streets, structures, vehicles, or bystanders.

Know the Limits of Your Equipment: When operating any equipment, take time to read the operator's manual and become familiar with the wind specifications. Many crane manufacturers have high-wind guidelines to prevent you from operating a crane in unsafe weather. You should also check safety equipment such as fall protection to determine if it is adequate for windy conditions.

Know the Terminology

Severe Thunderstorm Watch

A Severe Thunderstorm Watch means that strong thunderstorms capable of producing winds of 58 mph or higher and/or hail 3/4 inches in diameter or larger are possible. If you are in the area of a Severe Thunderstorm Watch, you should be prepared to take shelter from thunderstorms. Severe Thunderstorm Watches are generally issued for 6-hour periods.

Severe Thunderstorm Warning

A Severe Thunderstorm Warning means that thunderstorms capable of strong winds and/or large hail are occurring or could form at any time. If you are in the area of a severe thunderstorm, you should take shelter indoors immediately, avoid windows, and be prepared for high winds and hail. Severe Thunderstorm Warnings are generally in effect for an hour or less.

High Wind Watch

A High Wind Watch is issued when sustained winds exceeding 40 mph and/or frequent gusts over 60 mph are likely to develop in the next 24 to 48 hours. For summit areas, high wind watches are issued when sustained winds are expected to exceed 45 mph and/or frequently gust over 60 mph. If you are in an area for which a High Wind Watch has been issued you should secure loose objects outdoors that may blow about and avoid outdoor activity that exposes you to high winds.

High Wind Warning

A High Wind Warning is issued when sustained winds exceeding 40 mph and/or frequent gusts over 60 mph are occurring or imminent. For summit areas, warnings are issued for winds exceeding 45 mph and/or frequently gusting over 60 mph. Wind warnings may issued up to 24 hours ahead of the onset of high winds and remain in effect for 6 to 12 hours. If you are in an area where a high wind warning is in effect you should avoid activities that expose you to high winds. Loose objects may be blown around. Tree limbs may break and fall. Power lines may be blown down.

Wind Advisory

A Wind Advisory is issued when sustained winds of 30 to 39 mph and/or frequent gusts to 50 mph or greater are occurring or imminent. Wind advisories may be in effect for 6 to 12 hours. If you are in an area where a wind advisory is in effect you should secure loose objects that may be blown about outdoors and limit activity that may expose you to high winds.

Work Safely: If you will be working on a windy day, you should be alert and protected. Wear eye protection to prevent dust and other particles from entering or striking your eyes. Keep your hard hat on at all times to prevent injuries from falling or flying objects. The likelihood of falls from heights is greatly increased by strong winds. Wear the necessary PPE to ensure your safety.

To avoid flying debris and to minimize damage during high winds:

- Shut down outdoor activities involving work at elevation on ladders, scaffolding, aerial lifts, etc.; handling large tarps and plastic sheeting when wind speeds exceed 25 mph; including work with radioactive materials and highly toxic materials that could be dispersed by the winds.
- At 13 - 18 mph wind will raise dust. Follow the dust action level.

- Move mobile items stored outside to indoor storage.
- Secure any items that cannot be moved inside.
- Be careful opening exterior doors.
- Be cautious about downed power lines, tree limbs, and debris on roads.
- Be alert for animals who have escaped from farms and zoos.

Stay Away from Power Lines: High winds can cause tree limbs to fall on power lines resulting in electrocution hazards or loss of power. Your best bet is to keep your distance.

Tornados

What is a TORNADO?

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. It is spawned by a thunderstorm or as a result of severe weather associated with hurricanes. A funnel cloud is formed as cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage from a tornado results from high wind velocity and wind blown debris.

Tornado Safety

When a tornado approaches, you have only a brief amount of time to make life-or-death decisions. Advance planning and quick response are the keys to surviving a tornado.

Purchase a NOAA Weather Alert radio with an alert feature. When tuned to the proper frequency, these weather radios remain silent until a weather emergency occurs. Once they pick up the alarm tone, they will begin broadcasting emergency weather information so that citizens can protect themselves and their property. Some models of the NOAA weather radio incorporate the Specific Area Message Encoder technology, allowing users to target only those warnings that affect their immediate geographic area.

Conduct tornado drills. Designate an area to serve as your safe area, and practice having team members assemble there in response to a mock tornado warning.

Emergency Communications Plan. Develop an emergency communications plan in case team members are separated from one another when a tornado warning goes into effect. Designate an emergency coordinator. Instruct everyone to contact this coordinator in a weather emergency for instructions on what to do during the storm and where to reassemble after the emergency has passed. Design contingency plans to be consistent with client contingency plans. When possible use client warning and alerting systems and confirm that team members have access to shelters and know how to get to them.

Know the Difference between a Tornado Watch and a Tornado Warning

Tornado Watch: Issued by the National Weather Service when tornadoes are possible in your area. You should remain alert for approaching storms. Remind family members of where the safe areas are within your home, and carefully monitor radio or television reports for further developments.

Tornado Warning: Indicates that a tornado has been sighted in your area, or is indicated on weather radar. You should proceed to safe shelter immediately.

When A Tornado Warning Goes In Effect, Put Your Safety Plans In Action.

In Your Automobile: Motor vehicles are easily overturned by tornado winds. Leave your vehicle and seek shelter in a sturdy building. As a last resort, seek shelter in a ditch or culvert. Do not try to outrun or outmaneuver a tornado! Use the time to seek appropriate shelter outside your vehicle.

Office Buildings, Hotels, and Shopping Centers: Take shelter in an interior hallway on a lower floor. A closet, bathroom or other small room with short, stout walls will give some protection from collapse and flying debris. Otherwise, get under heavy furniture and stay away from windows. Many tornado deaths have occurred in large buildings due to the collapse of a roof or wide span wall. A corner area, away from a window, is safer than the middle of a wide span wall.

Out In Open Country: When severe weather approaches, seek inside shelter immediately. The chances of encountering falling trees, downed power lines and lightning are far greater than encountering a tornado itself. If a tornado approaches, lie flat in the nearest depression, such as a culvert or ditch, and cover your head with your arms.

BE ALERT TO CHANGING WEATHER CONDITIONS

HAVE AN EMERGENCY WEATHER PLAN IN PLACE

REHEARSE YOUR CONTINGENCY PLANS PERIODICALLY

KNOW WHERE TO GO WHEN A TORNADO THREATENS.

FLD 05 HEAT STRESS PREVENTION AND MONITORING

Heat stress may occur at any time work is performed at elevated temperatures. If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur such as fatigue, irritability, anxiety, and decreased concentration or dexterity, and possibly death. Because heat stress is one of the most common and potentially serious illnesses at field sites, regular monitoring and other preventive measures are vital to ensure worker safety. Wearing chemical protective clothing often decreases natural body heat loss (cooling) and increases the risk of heat stress.

Employees who are taking prescription or over-the-counter medications should consult with their personal physician prior to working in high-temperature environments to see if their medication would impair their ability to handle heat stress.

REFERENCES

OSHA 29 CFR 1910 and 1926

RELATED FLDs

FLD 02 – Inclement Weather
FLD 03 – Hot Processes – Steam, Low Temperature Thermal Treatment Unit, and Transportable Incinerator
FLD 08 – Confined Space Entry Program
FLD 36 – Welding/Cutting/Brazing/Radiography
FLD 37 – Pressure Washers/Sandblasting

PROCEDURE

Heat Stress Symptoms and Treatment

Heat Rash

Heat rash, also known as prickly heat, may occur in hot and humid environments where sweat is not easily removed from the surface of the skin by evaporation and is aggravated by chafing clothes. When extensive or complicated by infection, heat rash can be so uncomfortable that it inhibits sleep and impairs a worker's performance.

Symptoms – Mild red rash, especially in areas of the body that come into contact with protective gear.

Treatment – Decrease amount of time spent working in protective gear and provide body powder to help absorb moisture and decrease chafing. Heat rash can be prevented by showering, resting in a cool place, and allowing the skin to dry.

Heat Cramps

Heat cramps are caused by inadequate electrolyte intake. The individual may be receiving adequate water; however, if not combined with an adequate supply of electrolytes, the blood can thin to the point where it seeps into the active muscle tissue, causing cramping.

Symptoms – Acute painful spasms of voluntary muscles, most notably the abdomen and extremities.

Treatment – Move the victim to a cool area and loosen clothing. Have the victim drink 1 to 2 cups of cool potable water or diluted commercial electrolyte solution (e.g., Gatorade, Quench) immediately, and then every 20 minutes thereafter until symptoms subside. Electrolyte supplements can enhance recovery; however, it is best to double the amount of water required by the dry mix package directions or add water to the liquid form.

Heat Exhaustion

Heat exhaustion is a state of weakness or exhaustion caused by the loss of fluids from the body. Heat exhaustion is not as dangerous as heat stroke, but if not properly managed in the field it may lead to heat stroke.

Symptoms – Pale, clammy, and moist skin, profuse perspiring, and extreme weakness. Body temperature is normal, pulse is weak and rapid, and breathing is shallow. The person may have a headache, may vomit, may feel dizzy, and may be irritable or confused.

Treatment – Move the victim to a cool, air-conditioned or temperature-controlled area, loosen clothing, place in a position with the head lower than the feet (shock prevention), and allow the victim to rest. Consult a physician. Ensure that the victim is not nauseated or vomiting. If not nauseated or vomiting, give the victim small sips of cool water or diluted electrolyte replenishment solution (one to one dilution with water, or if mixing from powder, double the water added). If this is tolerated, have the victim drink 1 to 2 cups of fluid immediately, and every 20 minutes thereafter until symptoms subside. Seek medical attention at the advice of the consulting physician.

Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the body's heat regulating mechanisms, i.e., the individual's temperature control system (sweating) stops working correctly. Body temperature rises so high that brain damage and death may result if the person is not cooled quickly.

Symptoms – Red, hot, dry skin (although the person may have been sweating earlier); nausea, dizziness, confusion, extremely high body temperature (i.e., 104°F or greater as measured with an oral thermometer), rapid respiratory and pulse rate, seizures or convulsions, unconsciousness or coma.

Treatment – Immediately call for emergency medical assistance. Remove the victim from the source of heat and cool the victim quickly. If the body temperature is not brought down quickly, permanent brain damage or death may result. Remove all PPE and as much personal clothing as decency permits. Fan the person while sponging or spraying with cool or tepid water. Apply ice packs (if available) to the back of the neck, armpits, groin area, or behind the knees. Place the victim flat on their back or with head and shoulders slightly elevated. If conscious, and not nauseated or vomiting, the victim may be provided sips of cool water. Do not give the victim coffee, tea, or alcoholic beverages. Emergency medical personnel will take over treatment when they arrive.

Recognition and Risk Assessment

In the planning stages of a project, the potential for heat stress disorders must be considered as a physical hazard in the site-specific Health and Safety Plan (HASP). Risk assessment can be accomplished in the development stages of a project by listing in the HASP the most likely heat stress disorders that may occur. The Field Safety Officer (FSO) must make decisions on the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his or her work and be actively alert to these hazards. Any site worker may stop work if safety procedures are not

followed or the risk is too great. In addition, all site personnel must be aware of these symptoms in both themselves and their co-workers.

Prevention and Protection Programs

Heat stress is affected by several interacting factors including, but not limited to, age, obesity, physical condition, substance abuse, level of personal protective equipment (PPE) worn, and environmental conditions (temperature, shade, and humidity). Site workers must learn to recognize and treat the various forms of heat stress. The following recommendations should be followed to prevent heat stress:

- The most important measure to prevent heat-related illness is adequate fluid intake. Workers should drink 1/2 to 1 quarts of liquids per hour in high heat conditions. Most of this liquid should be water. Under heavy work and heat conditions, the body may lose up to 2 gallons of fluids per day. To prevent heat stress symptoms, the individual must ensure replacement of this fluid.
- Provide disposable cups that hold about 4 ounces, and water that is maintained at 50 to 60°F. Workers should drink 16 ounces of water before beginning work, and a cup or two at each break period.
- Provide a shaded area for rest breaks. Ensure that adequate shelter is available to protect personnel against heat and direct sunlight. When possible, shade the work area.
- Discourage the intake of caffeinated drinks during working hours.
- Monitor for signs of heat stress.
- Encourage workers to maintain a good diet during these periods. In most cases, a balanced diet and lightly salted foods should help maintain the body's electrolyte balance. Bananas are especially good for maintaining the body's potassium level.
- If utilizing commercial electrolyte mixes, double the amount of water called for in the package directions. Indications are that "full-strength" preparations taken under high heat stress conditions may actually decrease the body's electrolytes.
- Acclimate workers to site work conditions by slowly increasing workloads (i.e., do not begin work activities with extremely demanding tasks).
- Rotate shifts of workers who are required to wear impervious clothing in hot weather.
- Encourage workers to wear lightweight, light-colored, loose-fitting clothing.
- In extremely hot weather, conduct field activities in the early morning and evening.
- Provide cooling devices to aid natural body heat regulation. These devices, however, add weight and their use should be balanced against worker efficiency. An example of a cooling aid is long cotton underwear, which acts as a wick to absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.
- Good hygienic standards must be maintained by frequent showering and changes of clothing.
- Clothing should be permitted to dry during rest periods.
- Whenever working in the sun, provide employees with sunscreen with both UVA and UVB protection.
- Persons who notice skin problems should immediately consult medical personnel.

Heat Stress Monitoring and Work Cycle Management

When strenuous field activities are part of on-going site work conducted in hot weather, the following guidelines should be used to monitor the body's physiological response to heat, and to manage the work cycle, even if workers are not wearing impervious clothing. These procedures should be instituted when the temperature exceeds 70°F and the tasks/risk analysis indicates an increased risk of heat stress problems. Consult the HASP and a safety professional (e.g., Division EHS Manager, FSO) if questions arise as to the need for specific heat stress monitoring. In all cases, the site personnel must be aware of the signs and symptoms of heat stress and provide adequate rest breaks and proper aid as necessary.

Measure Heart Rate – Heart rate should be measured by the radial pulse for 30 seconds as early as possible in the rest period. The heart rate at the beginning of the rest period should not exceed 110 beats per minute. If the heart rate is higher, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats per minute at the beginning of the next rest period, the following work cycle should be further shortened by 33%. The procedure is continued until the rate is maintained below 110 beats per minute.

Measure Body Temperature – When ambient temperatures are over 90°F, body temperatures should be measured with a clinical thermometer as early as possible in the rest period. If the oral temperature exceeds 99.6°F (or 1 degree change from baseline) at the beginning of the rest period, the following work cycle should be shortened by 33%. The procedure is continued until the body temperature is maintained below 99.6°F (or 1 degree change from baseline). Under no circumstances should a worker be allowed to work if their oral temperature exceeds 100.6°F.

Measure Body Water Loss – Body water loss greater than 1.5% of total body weight is indicative of a heat stress condition. Body weight is measured before PPE is donned and after the PPE is removed following a work cycle. Body water loss can be measured with an ordinary bathroom scale; however, the scale must be sensitive to one-half pounds increments. A worker is required to drink additional fluids and rest if their body water loss is greater than 1.5%.

NOTE: For purposes of this operating practice, a break is defined as a 15-minute period and/or until an individual's vital signs are within prescribed guidelines.

A physiological monitoring schedule is determined by following the steps below:

- Measure the air temperature with a standard thermometer.
- Estimate the fraction of sunshine by judging what percent the sun is out (refer to Table 1).
- Calculate the adjusted temperature based on the following formula:

Adjusted Temperature = Actual Temperature + 13 X (where X = sunshine fraction from Table 1)

- Using Table 2, determine the physiological monitoring schedule for fit and acclimated workers for the calculated adjusted temperature.

The length of work period is governed by frequency of physiological monitoring (Table 2). The length of the rest period is governed by physiological parameters (heart rate and oral temperature).

Table 1. Percent Sunshine Factors
Heat Stress Prevention and Monitoring

Percent Sunshine (%)	Cloud Cover	Sunshine fraction
100	No cloud cover	1.0
50	50% cloud cover	0.5
0	Full cloud cover	0.0

Table 2. Physiological Monitoring Schedule
Heat Stress Prevention and Monitoring

Adjusted Temperature	Level D (Permeable clothing)	Level C, B, or A (Nonpermeable clothing)
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°F (30.8° - 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5° - 87.5°F (28.1° - 32.2°C)	After each 90 minutes of work	After each 60 minutes of work
77.5° - 82.5°F (25.3° - 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5° - 77.5°F (22.5° - 25.3°C)	After each 150 minutes of work	After each 120 minutes of work

Example: Site personnel anticipate wearing level C (impermeable clothing) during site activities. The air temperature is 80°F and there are no clouds in the sky (100% sunshine). The adjusted temperature is calculated in the following manner:

Adjusted Temperature (Adj T °F) = Actual Temperature (Amb T °F) + (13 x sunshine fraction)
Adj T °F = 80°F + (13 x 1.0)
Adj T °F = 93°F

Using Table 2, the pulse rate, oral temperature and body water loss monitoring would be conducted after each 15 minutes of work. The adjusted temperature may need to be redetermined if the percent sunshine and ambient temperature changes drastically during site work.

If an individual's heart rate exceeds 110 beats per minute at the beginning of the rest period, that individual will continue to rest until his or her heart rate drops to baseline; the next work period is then decreased by 33%.

FLD 06 COLD STRESS

Three major factors that contribute to cold stress are cold temperatures, dampness, and wind velocity. Persons working outdoors in low temperatures, especially in wet or windy conditions, are subject to cold stress. Exposure to extreme cold for even a short time can cause severe injury to the surface of the body, or result in cooling of the body core temperature which, if unchecked, can be fatal. Site workers must learn to recognize and treat the various forms of cold stress.

RELATED FLDs

FLD 02 – Inclement Weather
FLD 17 – Diving
FLD 19 – Working Over or Near Water
FLD 25 – Working at Elevation/Fall Protection

GENERAL INFORMATION

Body heat is conserved through the constriction of surface blood vessels. This constriction reduces circulation at the skin layers and keeps blood nearer the body core. Loss of body heat can occur through:

1. Respiration – The process of breathing; inhaling and exhaling air. Heat is lost when breathing cold air into the lungs.
2. Evaporation – Heat loss from the body by vaporization of water from the skin surface.
3. Conduction – Direct transfer of body heat by contact with a cooler object. Conduction may occur when sitting on snow, touching cold equipment, and working in the rain. Body heat is lost rapidly when a person becomes wet. Most clothing loses approximately 90 percent of its insulating properties when wet. Additionally, water conducts heat 240 times faster than air; thus, the body cools suddenly when the layer of clothing that contacts the skin becomes wet.
4. Radiation – Heat radiated outward from the body to a cooler environment. The greatest amount of body heat is lost from uncovered surfaces of the body, especially the head, neck, and hands.
5. Convection – Heat transferred to cool air moving across the surface of the body. The body continually heats a thin layer of air next to the skin. Clothing retains this warm surface layer of air. If this warm air is removed by air currents (wind), the body will be cooled while attempting to rewarm the surface air. Wind chill is the chilling effect of moving air in combination with low temperature.

Other factors may contribute to cold stress, such as:

1. Medications, including antidepressants, sedatives, tranquilizers and some heart medications may affect the body's ability to thermo-regulate.
2. Dehydration, or the loss of body fluids, occurs in a cold environment and may increase the susceptibility of workers to cold injury due to a significant change in blood flow to the extremities.
3. Heavy work typically causes sweating that will result in wet clothing.

4. A worker's predisposing health condition such as cardiovascular disease, diabetes, and hypertension.
5. Older people are not able to generate heat as quickly, thus may be at more risk than younger adults.

When the body is unable to warm itself, serious cold-related illness and injuries may occur, including permanent tissue damage and possible death.

RECOGNITION AND RISK ASSESSMENT

In the planning stages of a project, the potential for cold-related hazards must be considered in the site-specific Health and Safety Plan (HASP) and during risk assessment. The Field Safety Officer (FSO) must make decisions on the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his or her work and be actively alert to these hazards. Any site worker may stop work if safety procedures are not followed or the risk is too great.

Low Temperature + Wind Speed + Wetness = Injuries and Illness

The Cold Stress Equation (OSHA Card-3156) is a quick-reference tool provided on the Weston Portal.

Frostbite

Frostbite is the freezing of tissue and most commonly affects the toes, ears, fingers, and face. Frostbite occurs when an extremity loses heat faster than it can be replaced by the circulating blood. Frostbite may result from direct exposure to extreme cold or cool, high wind. Damp socks and shoes may contribute to frostbite of the toes.

Signs and symptoms of frostbite include:

- Cold, tingling, aching, or stinging feeling followed by numbness
- Skin color is red, purple, white, or very pale and is cold to the touch
- Blisters may be present (in severe cases)

Treatment for frostbite:

- Call for emergency medical assistance.
- Move the victim indoors and/or away from additional exposure to cold, wet, and wind.
- Wrap the affected area in a soft, clean cloth (sterile, if available).
- Give a warm drink (water or juices, not coffee, tea or alcohol). Do not allow the victim to smoke.
- Do not rub the frostbitten part (this may cause gangrene).
- Do not use ice, snow, gasoline or anything cold on the frostbitten area.
- Do not use heat lamps or hot water bottles to rewarm the frostbitten area.
- Do not place the frostbitten area near a hot stove.
- Do not break blisters.
- After rewarming, elevate the area and protect it from further injury.

Hypothermia

Hypothermia means "low heat" and is a potentially serious condition. Systemic hypothermia occurs when body heat loss exceeds body heat gain and the body core temperature falls below the normal 98.6°F. While some hypothermia cases are caused by extremely cold temperatures, most cases develop in air

temperatures between 30° and 50°F, especially when compounded with water immersion and/or windy conditions.

The victim of hypothermia may not know, or refuse to admit, that he or she is experiencing hypothermia. All personnel must be observant for these signs for themselves and for other team members. Hypothermia can include one or more of the following symptoms.

- Cool bluish skin
- Uncontrollable shivering
- Vague, slow, slurred speech
- Irritable, irrational, or confused behavior
- Memory lapses
- Clumsy movements, fumbling hands
- Fatigue or drowsiness

Below the critical body core temperature of 95°F, the body cannot produce enough heat by itself to recover. At this point, emergency measures must be taken to reverse the drop in core temperature. The victim may slip into unconsciousness and can die in less than 2 hours after the first signs of hypothermia are detected. Treatment and medical assistance are critical.

Treatment for hypothermia:

- Call for emergency medical assistance.
- Do not leave the victim alone.
- Prevent further heat loss by moving the person to a warmer location out of the wind, wet, and cold.
- Remove cold, wet clothing and replace with warm dry clothing or wrap the victim in blankets.
- If the victim is conscious, provide warm liquids, candy, or sweetened foods. Carbohydrates are the food most quickly transformed into heat and energy. Do not give the victim alcohol or caffeine.
- Have the person move their arms and legs to create muscle heat. If they are unable to move, place warm bottles or hot packs in the arm pits, groin, neck, and head. Do not rub the arms and legs or place the person in warm water.

Prevention and Protection

The following general guidelines are recommended for preventing or minimizing cold stress:

- Wear loose, layered clothing, masks, woolen scarves, and hats. Wear liners under hard hats
- Protect hands with gloves or mittens.
- Never touch cold metal with bare hands.
- Wear waterproof, slip-resistant, insulated boots
- Use chemical foot and hand warmers (commercially available) inside boots and gloves.
- In extreme cold, cover the mouth and nose with wool or fur to “pre-warm” the air you breathe.
- If wearing a face protector, remove it periodically to check for frostbite.

- Ensure that clothing remains secure around the body, especially at the neck and waist.
- If required to wear chemical protective clothing, remember that it generally does not afford protection against cold stress. In many instances, chemical protective clothing increases susceptibility. Dress carefully if both chemical protection and thermal insulation are required.
- Remove outer layers to avoid overheating and soaking clothing with perspiration; replace layers to avoid becoming chilled.
- Keep clothes dry by wearing water-resistant and wind-resistant clothing and outerwear.
- Wear clothing that will "breathe" or allow water vapor to escape.
- Eat well-balanced meals, ensure adequate intake of liquids and avoid alcoholic beverages. Drink warm sweet beverages and soups. Limit the intake of caffeinated drinks due to the diuretic and circulatory effects.
- Utilize available warm shelters and implement work-rest schedules.
- If warm shelters are not available, use cars/vehicles as shelter from the cold. (Ensure that tailpipes are not covered by heavy snowfall).
- Use radiant heaters to provide warmth (if using propane heaters ensure adequate ventilation to avoid carbon monoxide poisoning).
- Monitor yourself and others for changes in physical and mental condition.
- Use the buddy system or supervision to ensure constant protective observation.
- If heavy work must be done, resulting in sweating/wet clothing, take rest periods in heated shelters and change into dry clothing as necessary.
- New employees should not work full-time in the cold during the first days of employment until they become accustomed to the working conditions and the use of required protective clothing.
- Include the weight and bulkiness of clothing in estimating the required work performance and weights to be lifted by the worker.
- Arrange the work in such a way that sitting or standing still for long periods is minimized.
- Perform work protected from drafts to the greatest extent possible. If possible, shield the work area from wind.
- Instruct workers in safety and health procedures. The training program should include, as a minimum, instruction in:
  - Signs and symptoms of frostbite, impending hypothermia, or excessive cooling of the body
  - Proper use of clothing
  - Proper eating and drinking habits
  - Safe work practices
  - Proper rewarming procedures and appropriate first aid treatment
- Tables 1 and 2 should be consulted to adjust working schedules for wind chill conditions based on equivalent chill temperature (ECT). These tables are guidelines only; ambient temperatures and wind conditions should be monitored frequently and work schedules adjusted as required. If workers show signs or symptoms of cold stress, the work schedule must be adjusted, as required.

Work/Warming Regimen

Work should be performed in the warmest part of the day. If work is performed continuously in the cold or winter conditions or where rain or cool winds are expected, provide heated warming shelters, tents, cabins, or break rooms nearby. Encourage workers to use the shelter at regular intervals depending on the severity of the cold exposure. Table 2, Cold Work/Warmup Schedule for 4-Hour Shifts, provides guidance for working in severe cold weather. The onset of heavy shivering, the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for immediate return to the shelter. Pain, numbness, or tingling in the extremities are indications for immediate return to the shelter. When entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing loosened to permit sweat evaporation, or the worker should change into dry clothing. Never return to work in wet clothing.

Table 1. Wind Chill Chart

Wind (mph)	Temperature (°F)																	
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

NWS/NOAA

Table 2. Cold Work/Warmup Schedule for 4-Hour Shifts

EQUIVALENT CHILL TEMPERATURE	MAXIMUM WORK PERIOD	NO. OF BREAKS
≥-24°F	Normal	1
-25° to –30°F	75 minutes	2
-31° to –35°F	55 minutes	3
-36° to –40°F	40 minutes	4
-41° to –45°F	30 minutes	5
≤-46°F	Stop work	Stop work

FLD 11 ROUGH TERRAIN/ATV USE

RELATED FLDs

FLD 02 – Inclement Weather
FLD 05 – Heat Stress Prevention and Monitoring
FLD 06 – Cold Stress
FLD 22 – Heavy Equipment Operation
FLD 47 – Clearing, Grubbing, and Logging Operations
FLD 57 – Motor Vehicle Safety

HAZARD

Physical hazards associated with rough terrain include vehicle accidents, heavy equipment incidents, falling, slipping, and tripping.

Driving vehicles on uneven surfaces creates a possibility of the vehicle rolling, getting stuck in mud or ditches, or of an accident due to flat tires or striking obstacles and other vehicles.

When working on foot, step inclines and heavy or downed vegetation can hide holes or breaks in the terrain, increasing the risk of slips, trips, and falls.

RECOGNITION AND RISK ASSESSMENT

Rough terrain complicates work activities and adds to or increases risk. In the planning stages of a project, rough terrain must be considered as a physical hazard and identified in the site-specific health and safety plan (HASP). Risk assessment is usually accomplished from site history information (i.e., site topography) and on site by the Field Safety Officer (FSO).

HAZARD PREVENTION AND PROTECTION PROGRAMS

Safety on Foot

Personnel working on rough terrain should maintain a high level of physical conditioning due to increased body stress and exertion.

The site crew should be alert and observe terrain while walking to minimize slips, trips, and falls.

Boots should be ankle high or higher to provide additional support and stability.

Work will be completed in adequate natural light or sufficient illumination will be maintained.

Site personnel will conduct an initial walkover and the "buddy system" will be implemented.

Emergency communications such as a cell phone or two-way radio should be carried at all times.

Personnel should be aware of potential hazards and ensure the availability of first-aid supplies and knowledge of the location of the nearest medical assistance.

VEHICLE SAFETY

Vehicle drivers and passengers will wear seatbelts at all times.

Hazards can be prevented by ensuring regular maintenance is performed on vehicles and all safety features are working. Have brakes and wheel bearings of vehicles used off road or in four wheel drive inspected at increased frequency (suggest inspections at twice the manufacturer's recommended frequency).

In order to minimize accidents, site surveillance on foot may be required to ensure clear driving paths.

Minimize side hill travel. Travel straight up and down hills whenever possible. Passengers will not be allowed when side hill travel is required.

Take into account loads or superstructure of vehicles which raise the center of gravity and increase risk of tipping.

Cross streams, small logs or other passable (there is adequate clearance of the undercarriage) obstructions at right angles.

Four wheel drive vehicles should be used if terrain conditions are wet, frozen, broken, or otherwise deemed unsafe for two wheel drive vehicles by the FSO. Use of vehicles off-road will be specifically addressed in the HASP and personnel operating vehicles will be checked for proficiency.

- Before moving a vehicle in the field, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts, and similar obstacles.
- Always check the brakes of a vehicle before traveling, particularly on rough, uneven, or hilly ground.
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.
- Engage the all wheel drive when traveling off highway on hilly terrain.
- Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.
- After the vehicle/equipment has been moved to a new site, set all brakes and/or locks. When grades are steep, block the wheels.

Definitions

Class I, All-terrain vehicle (ATV): A motorized off-highway vehicle, 50 in. (127 cm) or less in width, having dry weight of 800 lbs (362.9 kg) or less, and traveling on three or more low pressure tires (10 lbs [4.5 kg] psi or less), with a seat designed to be straddled by the operator.

Class I, Category G, ATV: An ATV intended for general recreational and utility use.

Class I, Category U, ATV: An ATV intended primarily for utility use.

Class II, ATV: A motorized off-highway vehicle with a width which exceeds 50 in. (127 cm) or having a dry weight that exceeds 800 lbs (362.9 kg), traveling on four or more low-profile, low-pressure tires (10 lbs [4.5 kg] psi or less) and having a bench seat.

NOTE: Utility Vehicles are designed to perform off-road utility tasks such as passenger and cargo transportation and are addressed separately below. Examples are Rangers, Rhino, M-Gators, Gators, and Mules.

Rollover Protective Structure (ROPS). A cab or frame that provides a safe environment for the tractor operator in the event of a rollover.

ALL TERRAIN VEHICLES (ATVS)

Qualifications

ATV operators will have completed a nationally recognized accredited ATV training course (such as provided by the Specialty Vehicles Institute of America or in-house resources that have been certified as trainers by an accredited organization) prior to operation of the vehicle.

The operator must pass an operating skills test prior to being allowed to operate an ATV. Proof of completion of this training will be maintained.

Equipment

All ATVs shall be equipped with:

- An operable audible warning device (horn);
- Headlights (if it will be used during hours of darkness);
- Taillights; and
- Brake lights.
- Mufflers and spark arresters.

All Class II ATVs will be equipped with ROPS and seatbelts

Operation

Only Class I and Class II ATVs with four or more wheels may be used. Class III ATV's may not be used.

The manufacturer's recommended payload will not be exceeded at any time.

Gloves and an approved motorcycle helmet with full-face shield or goggles will be worn at all times while operating a Class I ATV.

An ATV will not be driven on public roadways except to cross the roadway, and it will only be driven on a public roadway at designated crossing points or with a road guard (no paved road use unless allowed by the manufacturer).

A copy of the operator's manual will be kept on the vehicle and protected from the elements (if practicable).

Tires shall be inflated to the pressures recommended by the manufacturer.

Passengers are prohibited on Class I ATVs.

UTILITY VEHICLES

Utility vehicles are defined as specialty Class II ATVs designed to perform off-road utility tasks such as passenger and cargo transportation. Examples are Rangers, Rhino, M-Gators, Gators, and Mules.

Utility vehicle operators shall be trained and familiar with the use of all controls; understand proper moving, stopping, turning and other operating characteristics of the vehicle. Operators must review all training materials provided by the manufacturer for the specific vehicles, and training should be in accordance with appropriate manufacturer recommendations. A copy of the operator's manual shall be kept on the vehicle at all times and protected from the elements. At a minimum, training should address:

- Basic riding tips from the manufacturer's published literature for each vehicle.
- Reading terrain.
- Climbing hilly terrain.
- Descending a hill.
- Traversing a slope.
- Riding through water.
- Cargo carriers and accessories.
- Loading and unloading.
- Troubleshooting.
- Proper preventative maintenance, (i.e., oil levels, tire pressure requirements and scheduled maintenance requirements according to the manufacturer's guidelines.).

Utility vehicles shall be equipped with:

- Operable audible warning device (horn).
- Headlights.
- Taillights.
- Brake lights.
- Seatbelts.
- ROPS.

Occupancy in utility vehicles is limited to manufacturer designated seating that has built-in seatbelts. Passengers may not ride in the vehicle's back cargo area unless the vehicle is otherwise equipped. Note: When used for emergency response, medical litters may be placed in the back cargo area but must be secured as described below.

The manufacturer's recommended load carrying capacity, personnel capacity, or maximum safe vehicle speed shall not be exceeded at any time.

Cargo items will be secured as necessary to prevent movement/tipping. All loads over fifty pounds (to include medical litters) must be securely strapped to cargo tie-downs in the rear and to the cargo shelf in the front.

Seatbelts will be worn by operators and passengers of specialty vehicles where installed by the manufacturer. Operators and passengers shall wear goggles at all times when a utility vehicle, not equipped with a windshield, is in motion.

Utility vehicles will not normally be driven on public roadways except to cross the roadway, and will only be driven on a public roadway at designated crossing points or with a road guard. Utility vehicles that are allowed to operate outside a controlled work area and/or on public roads will meet the minimum vehicle safety standards in accordance with 49 CFR 571.5, to include ROPs, seatbelts and placement of "Slow Moving Vehicle" emblems where required.

Manufacturer-installed safety equipment will be maintained in working order and used in compliance with the requirement of this regulation and in accordance with manufacturer's recommendations.

RULES

Observe the following practices to help prevent accidents:

- Do not misuse utility vehicles.
- Reduce speed and exercise extreme caution on slopes or on rough ground.
- Do not overload vehicle and avoid shifting loads. Reduce load when operating over rough or hilly terrain.
- Do not stop or start suddenly when going uphill or downhill. Be especially cautious when changing direction on slopes.
- Stay alert for holes, rocks, and other hidden hazards in the terrain.
- Keep away from drop-offs, ditches, embankments, as well as ponds and other bodies of water. The machine could suddenly turn over if a wheel is over the edge of a cliff or ditch, or if an edge caves in.
- Keep front wheels straight at crest of hill or going over bumps.
- When descending a hill, remove foot from accelerator and apply brakes to reduce speed and maintain control.

Transport Loads Safely

- Be sure load is evenly distributed.
- Do not load above the load guard.
- Securely anchor all loads in cargo box.
- Reduce cargo box capacity when operating on rough or hilly terrain.
- Use existing trails. Avoid terrain such as dangerous slopes and impassable swamps. Watch carefully for sharp bumps, holes, ruts, or obstacles.
- Look ahead at terrain. Know what is coming and be prepared to react. Be alert for hazards.
- Keep front wheels straight at the crest of a hill or going over bumps.
- Reduce speed according to trail, terrain, and visibility conditions.
- The passenger should always use the hand holds.

Climbing or Descending a Hill

- Y Always use the brakes when going down slopes, the utility vehicle can speed up (freewheel) going down a slope. Engine or clutch braking effect is minimal.
- Y Balance loads evenly and secure them. Braking could shift the load and affect vehicle stability.
- Y Sit on the center of the seat and keep both feet within the foot platform.
- Y Never drive past the limit of visibility. Slow down near the crest of a hill until getting a clear view of the other side.
- Y If the vehicle stops or loses power going up a hill, lock the park brake to hold the vehicle on slope. Maintain direction of travel and release the brake slowly. Back straight down hill slowly while maintaining control. Do not turn the vehicle sideways. The vehicle is more stable in a straight forward or rearward position.
- Y If the utility vehicle begins to tip, turn the front wheel downhill to gain control before proceeding.

Riding Through Water

- Y Avoid water whenever possible. If the drive belt becomes wet, slippage will occur and the vehicle will lose power.
- Y Never cross any body of water where the depth may be unknown to the operator. As an operational guideline, deep water is considered anything in excess of 152 mm (6 in.) in depth. Tires may float, making it difficult to maintain control.
- Y Choose a course within the waterway where both banks have a gradual incline. Cross at a point known to be safe.
- Y Proceed at a slow steady speed to avoid submerged obstacles and slippery rocks.
- Y Avoid water crossings where the operation of a utility vehicle may cause damage to waterway beds or erode waterway shoreline.

FLD 22 EARTH MOVING EQUIPMENT/MATERIAL HANDLING EQUIPMENT

REFERENCES

29 CFR Part 1926 Subparts 600-602

RELATED FLDs

FLD 23 – Cranes, Rigging, and Slings
FLD 24 – Aerial Lifts/Manlifts
FLD 34 – Utilities
FLD 35 – Electrical Safety

PROCEDURE

These rules apply to the following types of earthmoving equipment: scrapers, loaders, crawler or wheel tractors, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, and similar equipment.

Machinery and Mechanized Equipment Safety

Before any machinery or mechanized equipment is placed in use, it will be inspected and tested by a competent mechanic and certified to be in safe operating condition.

WESTON will designate a competent person to be responsible for the inspection of all machinery and equipment daily and during use to make sure it is in safe operating condition. Tests will be made at the beginning of each shift during which the equipment is to be used to determine that the brakes and operating systems are in proper working condition.

Preventative maintenance procedures recommended by the manufacturer will be followed.

Any machinery or equipment found to be unsafe shall be removed from service and its use prohibited until unsafe conditions have been repaired or corrected.

Inspections or determinations of road conditions and structures will be made in advance to ensure that clearances and load capacities are safe for the passing or placement of any machinery or equipment.

Machinery and mechanized equipment will be operated only by designated personnel. Equipment deficiencies observed at any time that affect safe operation will be corrected before continuing operation.

Seat belts shall be provided on all equipment covered by this section and shall meet the requirements of the Society of Automotive Engineers (J386-1969) and Seat Belts for Construction Equipment. Seat belts for agricultural and light industrial tractors shall meet the seat belt requirements of Society of Automotive Engineers (J333a-1970), Operator Protection for Agricultural and Light Industrial Tractors.

Seat belts shall be worn when provided by the manufacturer. Passengers shall not be allowed to ride on equipment unless equipment is designed with additional seats with safety belts.

<u>Audible alarms</u>. All bi-directional machines, such as rollers, compacters, front-end loaders, bulldozers, and similar equipment, shall be equipped with a horn, distinguishable from the surrounding noise level, which shall be operated as needed when the machine is moving in either direction. The horn shall be maintained in an operative condition.

Getting off or on any equipment while it is in motion is prohibited.

Machinery or equipment requiring an operator will not be permitted to run unattended.

Machinery or equipment will not be operated in a manner that will endanger persons or property, nor will the safe operating speeds or loads be exceeded.

All machinery or equipment will be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. The only exemption is equipment designed to be serviced or maintained while running.

All repairs on machinery or equipment will be made at a location that will provide protection from traffic or other hazards to maintenance personnel.

Machinery and equipment, or parts thereof, that are suspended or held apart by slings, hoists, or jacks also will be substantially blocked or cribbed before personnel are permitted to work underneath or between them.

Bulldozer and scraper blades, front end-loader buckets, dump bodies, and similar equipment will be either fully lowered or blocked when being repaired or when not in use. All controls will be in a neutral position, with the engines stopped and brakes set, unless work being performed on the machine requires otherwise.

Stationary machinery and equipment will be placed on a firm foundation and secured before being operated.

All points requiring lubrication during operation will have fittings so located or guarded to be accessible without hazardous exposure.

When necessary, all mobile equipment and the operating area will be adequately illuminated while work is in progress.

Mechanized equipment will be shut down prior to and during fueling operations. Closed systems, with automatic shutoff that will prevent spillage if connections are broken, may be used to fuel diesel powered equipment left running.

All towing devices used on any combinations of equipment will be securely mounted and structurally adequate for the weight drawn.

Persons will not be permitted to get between a piece of towing equipment and the item being towed until the towing equipment has come to a complete stop.

All equipment with windshields will be equipped with powered wipers. Vehicles that operate under conditions that cause fogging or frosting of windshields will be equipped with operable defogging or defrosting devices.

All equipment left unattended at night, adjacent to a highway in normal use, or adjacent to construction areas where work is in progress, will have lights or reflectors, or barricades equipped with lights or reflectors, to identify the location of the equipment.

Whenever the equipment is parked, the parking brake will be set. Equipment parked on inclines will have the wheels chocked or track mechanism blocked and the parking brake set. Equipment such as lift trucks and stackers will have the rated capacity posted on the vehicle so as to be clearly visible to the operator. When auxiliary removable counterweights are provided by the manufacturer, corresponding alternate rated capacities also will be clearly shown on the vehicle. The ratings will not be exceeded.

Steering or spinner knobs will not be attached to the steering wheel unless the steering mechanism prevents road reactions from causing the steering hand wheel to spin. When permitted, the steering knob will be mounted within the periphery of the wheel.

All industrial trucks in use will meet the requirements of design, construction, stability, inspection, testing, maintenance, and operation, defined in American National Standards Institute (ANSI) B56.1, Safety Standards for Powered Industrial Trucks.

The installation of live booms on material and personnel hoists is prohibited.

The controls of loaders, excavators, or similar equipment with folding booms or lift arms will not be operated from a ground position unless so designed.

Personnel will not work or pass under the buckets or booms of loaders in operation.

Cranes and any other equipment used for lifting must be inspected as required and records of inspection must be maintained.

Drill Rigs

See FLD 56, *Drilling Safety*

RST 2 FLD 43A ANIMALS

Animals represent hazards because of their poisons or venoms, size and aggressiveness, diseases transmitted, or the insects they may carry.

Feral Animals

Landfills and abandoned buildings often attract stray or abandoned dogs. These animals often become pack-oriented, very aggressive, and represent serious risk of harm to unprotected workers.

Workers entering abandoned buildings should be alert for such animals and avoid approaching them since this may provoke aggressive behavior. Avoidance and protection protocols include watching for animal dens, using good housekeeping, and using repellents.

Dangerous Wild Animals

Work in remote areas inhabited by wild animals that have been known to cause injury and kill human beings, requires that companies working in these areas carefully plan for wildlife encounters. This FLD outlines actions that, when properly implemented, should provide a high degree of protection for WESTON employees and wildlife.

See Wildlife Hazard Recognition and Protection Procedure (Attached).

Venomous Snakes and Lizards

Venomous Snakes

Venomous snakes are common around the world. The major variables are the likelihood of encounter and the snake that is likely to be encountered. Encounters with snakes may be caused by moving containers, reaching into holes, or just walking through high grass, swampy areas, or rocks. **Do not attempt to catch any snakes.**

Symptom of venomous snake bites:

- Bloody wound discharge, blurred vision, burning, convulsions, diarrhea, dizziness, excessive sweating, fainting, fang marks in the skin, fever, increased thirst, local tissue death, loss of muscle coordination, nausea and vomiting, numbness and tingling, rapid pulse, severe pain, skin discoloration, swelling at the site of the bite, weakness.

Venom from venomous snakes and lizards can be divided into three types of toxins, however, there are some indications that snake venom may have more than one toxin and characteristics may change as a snake ages. The three types of toxins and their effects are:

Hemotoxins destroy blood cells and affect the circulatory system. The site of the bite rapidly becomes swollen, discolored, and painful. This is usually accompanied by swelling, discoloration, and pain progressing toward the heart.

Neurotoxins affect the nervous system and symptoms vary from foggy vision, dizziness, and other comparatively mild symptoms to rigid or flaccid paralysis, shortness of breath, weakness or paralysis of the lower limbs, double vision, inability to speak or swallow, drooping eyelids, and involuntary tremors of the facial muscles. Death can occur in as little as ten minutes, usually due to abrupt cessation of respiration.
Myotoxins destroy cells and cause muscle necrosis.

In the US, with the exception of the coral snakes which tend to have neuron-toxic venom, most venomous snakes have been categorized as having hemotoxic venom (in some areas Mojave rattlesnakes are found to have neuron-toxic venom). There is some indication that some species of rattlesnakes have both hemotoxic and neuron-toxic venom. It is also reported that venom of younger snakes may be more neuron-toxic

There are many are highly venomous snakes worldwide, some are deadly and most can be deadly without proper care.

Geographical Listing of Venomous Snakes

Following is a list of poisonous snakes by geographic area. This list is extensive but may not be all inclusive. In planning for work around the world, also contact local agencies to determine whether there may be additional venomous snakes or lizards.

North America

Copperheads (Broad-banded, Northern, Osage, Southern, Trans-Pecos)
Rattlesnakes Diamondback (eastern and western), Massasauga (eastern and western)
Cottonmouth or water moccasin (Eastern)

Prevention of Bites

Key factors to working safely in areas where snakes or lizards may be encountered include:

- Be alert
- Use care when reaching into or moving containers
- Use sticks or long-handled tools when reaching where you cannot see
- Be familiar with the habits and habitats of snakes in the vicinity of an incident or site
- In areas or activities where encounters with snakes are likely, wear sturdy leather or rubber work boots and snake chaps
- Do not attempt to catch snakes unless required and qualified

A snake bite warrants medical attention after administration of proper first-aid procedures. It is important to contact local medical facilities to determine where anti-venoms are located.

First-Aid

1. Keep the person calm. Restrict movement, and keep the affected area below heart level to reduce the flow of venom.

2. Remove any rings or constricting items because the affected area may swell. Create a loose splint to help restrict movement of the area.

3. If the area of the bite begins to swell and change color, the snake was probably venomous.

4. Monitor the person's vital signs -- temperature, pulse, rate of breathing, and blood pressure if possible. If there are signs of shock (such as paleness), lay the person flat, raise the feet about a foot, and cover the person with a blanket.

5. Get medical help immediately.

6. Try to photograph or identify the snake. Do not waste time hunting for the snake, and do not risk another bite. Be careful of the head of a dead snake. A snake can actually bite for up to an hour after it is dead (from a reflex).

- DO NOT allow the person to become over-exerted. If necessary, carry the person to safety.
- DO NOT apply a tourniquet.
- DO NOT apply cold compresses to a snake bite.
- DO NOT cut into a snake bite with a knife or razor.
- DO NOT try to suction the venom by mouth.
- DO NOT give stimulants or pain medications unless instructed to do so by a doctor.
- DO NOT give the person anything by mouth.
- DO NOT raise the site of the bite above the level of the person's heart
- Transport the victim to medical attention immediately

Animal Borne Diseases

Rabies

Animal borne diseases include rabies (generally found in dogs, skunks, raccoons, bats, and foxes). Rabies varies from area to area as do the animals most likely to be rabid.

Questions and Answers about Rabies

Q. What is Rabies and how is it transmitted?

A. Rabies is a viral infection most often transmitted by bites of animals infected with the virus.

Q. What animals are most likely to be infected?

A. Skunks, raccoons, foxes, and bats are wild animals most frequently found to be infected with rabies; however, any warm blooded animal can be infected. Squirrels, groundhogs, horses, cattle, and rabbits have been tested positive for rabies. Dogs and cats are frequently rabies-infected if not immunized.

Q. How can you tell if an animal is rabies-infected?

A. Rabies infection is not always apparent. Signs to look for in wild animals are over-aggressiveness or passivity. Spotting animals which are normally nocturnal (active at night) during the day and being able to approach them would be an example of unusual behavior. Finding a bat alive and on the ground is abnormal. The best precaution, however, is to observe wild animals from a safe distance, even if they are injured. Avoid dogs and cats that you do not know.

Q. What should you do if bitten by an animal you suspect is infected with rabies?

A. As quickly as possible, wash the bite area with soap and water, then disinfect with 70% alcohol and seek medical attention for follow-up. Try to capture the animal. Avoid being bitten again or contacting the mouth or any saliva of the animal. Keep the animal under surveillance and call the police for assistance to capture it. Have the animal tested.

A dead animal believed to be infected should be preserved and tested for rabies. Health departments are often sources where information can be found regarding testing.

Q. Is there a cure for rabies?

A. Rabies is preventable, even after being bitten, if treatment is begun soon enough. Getting prompt medical attention and confirming the rabies infection of an animal are very important. **Rabies is not curable once symptoms or signs of rabies appear.**

There are vaccines available that should be considered if a work assignment involves trapping animals likely to carry rabies. Medical consultants must be involved in decisions to immunize workers against rabies.

Hantavirus

WESTON employees or contractors/subcontractors conducting field work in areas where there is evidence of a rodent population should be aware of an increased level of concern regarding the transmission of "Hantavirus"-associated diseases. Hantavirus is associated with rodents, especially the deer mouse (*Peromyscus maniculanis*) as a primary reservoir host. Hantavirus has resulted in several deaths in the U.S.

The Hantavirus can be transmitted by infected rodents through their saliva, urine, and feces. Human infection may occur when infected wastes are inhaled as a result of aerosols produced directly from the animals. They also may come from dried materials introduced into broken skin or onto mucous membranes. Infections in humans occur most in adults and are associated with

activities that provide contact with infected rodents in rural/semi-rural areas. Hantavirus begins with one or more flu-like symptoms (i.e., fever, muscle aches, headache, and/or cough) and progresses rapidly to severe lung disease. Early diagnosis and treatment are vital.

Prevention

Personnel involved in work areas where rodents and the presence of the Hantavirus are known or suspected will need to take personal protective measures and to develop an expanded site safety plan.

Field personnel involved in trapping or contacting rodents or their waste products will need to wear respirators with high-efficiency particulate air (HEPA) filters, eye protection, Tyvek coveralls, chemical-resistant gloves, and disposable boot covers. Strict decontamination requirements are needed. Double-bag, label, and specific handling, packaging, shipping, storage, and analytical procedures are required to minimize the risks of exposure from collected mice. More detailed procedures can be obtained from WESTON Corporate Health and Safety.

For employees and facilities in rural/semi-rural areas, the following risk-reduction strategies are appropriate:

- Eliminate rodents and reduce availability of food sources and nesting sites used by rodents.
- Store trash/garbage in rodent-proof metal or thick plastic containers with tight lids.
- Cut all grass/underbrush in proximity to buildings.
- Prevent rodents from entering buildings (e.g., use steel wool, screen, etc., to eliminate openings).

Plague

Described under Insects (Fleas)

Anthrax

Anthrax is an acute infectious disease caused by the spore-forming bacterium *Bacillus anthracis*. Anthrax most commonly occurs in wild and domestic lower vertebrates (cattle, sheep, goats, and other herbivores), but it can also occur in humans when they are exposed to infected animals or tissue from infected animals.

Anthrax is most common in agricultural regions where it occurs in animals. When anthrax affects humans, it is usually due to an occupational exposure to infected animals or their products. Workers who are exposed to dead animals and animal products from other countries where anthrax is more common may become infected with *B. anthracis* (industrial anthrax). Anthrax in wild livestock has occurred in the U.S.

Anthrax infection can occur in three forms: cutaneous (skin), inhalation, and gastrointestinal. *B. anthracis* spores can live in the soil for many years, and humans can become infected with anthrax by handling products from infected animals or by inhaling anthrax spores from contaminated animal products. Anthrax can also be spread by eating undercooked meat from infected animals. It is rare to find infected animals in the U.S.

Cutaneous: Most (about 95%) anthrax infections occur when the bacterium enters a cut or abrasion on the skin, such as when handling contaminated wool, hides, leather, or hair products (especially goat hair) of infected animals. Skin infection begins as a raised itchy bump that resembles an insect bite but within 1-2 days develops into a vesicle and then a painless ulcer, usually 1-3 cm in diameter, with a characteristic black necrotic (dying) area in the center. Lymph glands in the adjacent area may swell. About 20% of untreated cases of cutaneous anthrax will result in death. Deaths are rare with appropriate antimicrobial therapy.

Inhalation: Initial symptoms may resemble a common cold. After several days, the symptoms may progress to severe breathing problems and shock. Inhalation anthrax is usually fatal.

Intestinal: The intestinal disease form of anthrax may follow the consumption of contaminated meat and is characterized by an acute inflammation of the intestinal tract. Initial signs of nausea, loss of appetite, vomiting, and fever are followed by abdominal pain, vomiting of blood, and severe diarrhea. Intestinal anthrax results in death in 25% to 60% of cases.

Anthrax is not known to spread from one person to another person. Communicability is not a concern in managing or visiting patients with inhalation anthrax.

Prevention

In countries where anthrax is common and vaccination levels of animal herds are low, humans should avoid contact with livestock and animal products and avoid eating meat that has not been properly slaughtered and cooked. Also, an anthrax vaccine has been licensed for use in humans. The vaccine is reported to be 93% effective in protecting against anthrax.

Doctors can prescribe effective antibiotics. To be effective, treatment should be initiated early. If left untreated, the disease can be fatal.

Direct person-to-person spread of anthrax is extremely unlikely; however, a patient's clothing and body may be contaminated with anthrax spores. Effective decontamination of people can be accomplished by a thorough wash down with anti-microbe effective soap and water. Waste water should be treated with bleach or other anti-microbial agent. Effective decontamination of articles can be accomplished by boiling contaminated articles in water for 30 minutes or longer and using common disinfectants. Chlorine is effective in destroying spores and vegetative cells on surfaces. Burning the clothing is also effective. After decontamination, there is no need to immunize, treat, or isolate contacts of people ill with anthrax unless they also were also exposed to the same source of infection. Early antibiotic treatment of anthrax is essential–delay seriously lessens chances for survival. Treatment for anthrax infection and other bacterial infections

includes large doses of intravenous and oral antibiotics, such as fluoroquinolones, like ciprofloxacin (cipro), doxycycline, erythromycin, vancomycin, or penicillin. In possible cases of inhalation anthrax exposure to unvaccinated personnel, early antibiotic prophylaxis treatment is crucial to prevent possible death.

No skin, especially if it has any wounds or scratches, should be exposed. Disposable personal protective equipment is preferable, but if not available, decontamination can be achieved by washing any exposed equipment in hot water, bleach and detergent. Disposable personal protective equipment and filters should be burned and buried. The size of Bacillus anthracis bacillii ranges from 0.5 μm to 5.0 μm. Anyone working with anthrax in a suspected or confirmed victim should wear respiratory equipment capable of filtering this size of particle or smaller. The U.S. National Institute for Occupational Safety and Health (NIOSH) and Mine Safety and Health Administration (MSHA) approved high efficiency-respirator, such as a half-face disposable respirator with a HEPA filter, is recommended. All possibly contaminated bedding or clothing should be isolated in double plastic bags and treated as possible bio-hazard waste. Dead victims that are opened and not burned provide an ideal source of anthrax spores; the victim should be sealed in an airtight body bag. Cremating victims is the preferred way of handling body disposal. No embalming or autopsy should be attempted without a fully equipped biohazard lab and trained and knowledgeable personnel.

Delays of only a few days may make the disease untreatable and treatment should be started even without symptoms if possible contamination or exposure is suspected. Animals with anthrax often just die without any apparent symptoms. Initial symptoms may resemble a common cold – sore throat, mild fever, muscle aches and malaise. After a few days, the symptoms may progress to severe breathing problems and shock and ultimately death. Death can occur from about two days to a month after exposure with deaths apparently peaking at about 8 days after exposure. [8] Antibiotic-resistant strains of anthrax are known.

Aerial spores can be trapped by a simple HEPA or P100 filter. Inhalation of anthrax spores can be prevented with a full-face mask using appropriate filtration. Unbroken skin can be decontaminated by washing with simple soap and water. All of these procedures do not kill the spores which are very hard to kill and require extensive treatment to eradicate them. Filters, clothes, etc. exposed to possible anthrax contaminated environments should be treated with chemicals or destroyed by fire to minimize the possibility of spreading the contamination.

In recent years there have been many attempts to develop new drugs against anthrax; but the existing supply still works fine if treatment is started soon enough.

Prevention can also be accomplished through early detection. In response to the U.S. Postal Service (USPS) anthrax attacks of October 2001, the USPS has installed BioDetection Systems (BDS) in their large-scale mail cancellation facilities. BDS response plans have been formulated by the USPS in conjunction with local responders including fire, police, hospitals, and public health. Employees of these facilities have been educated about anthrax, response actions and prophylactic medication. Because of the time delay inherent in getting final verification that anthrax has been used, prophylactic antibiotics for possibly exposed personnel should commence as soon as possible.

The ultimate in prevention is vaccination against infection but this has to be done well in advance of exposure.

Anthrax spores can survive for long periods of time in the environment after release. Methods for cleaning anthrax contaminated sites commonly use oxidizing agents such as peroxides, ethylene Oxide, Sandia Foam, chlorine dioxide (used in the Hart Senate office building), and liquid bleach products containing sodium hypochlorite. These agents slowly destroy bacterial spores. A bleach solution for treating hard surfaces has been approved by the EPA and can be prepared by mixing one part bleach (5.25%-6.00%) to one part white vinegar to eight parts water. Bleach and vinegar must not be combined together directly, rather some water must first be added to the bleach (e.g., two cups water to one cup of bleach), then vinegar (e.g., one cup), and then the rest of the water (e.g., six cups). The pH of the solution should be tested with a paper test strip; and treated surfaces must remain in contact with the bleach solution for 60 minutes (repeated applications will be necessary to keep the surfaces wet).

Chlorine dioxide has emerged as the preferred biocide against anthrax-contaminated sites, having been employed in the treatment of numerous government buildings over the past decade. Its chief drawback is the need for *in situ* processes to have the reactant on demand.

To speed the process, trace amounts of a non-toxic catalyst composed of iron and tetro-amido macrocyclic ligands are combined with sodium carbonate and bicarbonate and converted into a spray. The spray formula is applied to an infested area and is followed by another spray containing tertiary-butyl hydroperoxide

Using the catalyst method, a complete destruction of all anthrax spores takes 30 minutes. A standard catalyst-free spray destroys fewer than half the spores in the same amount of time. They can be heated, exposed to the harshest chemicals, and they do not easily die.

Brucellosis

Brucellosis, also called undulant fever or Malta fever, is a zoonosis (infectious disease transmitted from animals to humans) caused by bacteria of the genus *Brucella*. It is primarily a disease of domestic animals (goats, pigs, cattle, dogs, etc.) and humans and has a worldwide distribution.

Although brucellosis can be found worldwide, it is more common in countries that do not have good standardized and effective public health and domestic animal health programs. Areas currently listed as high risk include the Caribbean.

The disease is transmitted either through contaminated or untreated milk (and its derivates) or through direct contact with infected animals, which may include dogs, pigs, camels, and ruminants, primarily sheep, goats, cattle, and bison. This also includes contact with their carcasses.

Leftovers from parturition are also extremely rich in highly virulent brucellae. Brucellae, along with leptospira have the unique property of being able to penetrate through intact human skin, so infection by mere hand contact with infectious material is likely to occur.

The disease is now usually associated with the consumption of un-pasteurized milk and soft cheeses made from the milk of infected animals and with occupational exposure of veterinarians and slaughterhouse workers. Some vaccines used in livestock, most notably *B. abortus* strain 19 also cause disease in humans if accidentally injected. Problems with vaccine induced cases in the United States declined after the release of the RB-51 strain developed in the 1990s and the relaxation of laws requiring vaccination of cattle in many states.

The incubation period of brucellosis is, usually, of one to three weeks, but some rare instances may take several months to surface.

Brucellosis induces inconstant fevers, sweating, weakness, anemia, headaches, depression and muscular and bodily pain.

The symptoms are like those associated with many other febrile diseases, but with emphasis on muscular pain and sweating. The duration of the disease can vary from a few weeks to many months or even years. In first stage of the disease, septicaemia occurs and leads to the classic triad of undulant fevers, sweating (often with characteristic smell, likened to wet hay) and migratory arthralgia and myalgia.

Prevention

The main way of preventing brucellosis is by using fastidious hygiene in producing raw milk products, or by pasteurization of all milk that is to be ingested by human beings, either in its pure form or as a derivate, such as cheese.

Provide protection from skin contact when handling potentially infected animals.

Q fever

Q fever is caused by infection with *Coxiella burnetii*. This organism is uncommon but may be found in cattle, sheep, goats and other domestic mammals, including cats and dogs. The infection results from inhalation of contaminated particles in the air, and from contact with the vaginal mucus, milk, feces, urine or semen of infected animals. The incubation period is 9-40 days.
It is considered possibly the most infectious disease in the world, as a human being can be infected by a single bacterium.

The most common manifestation is flu-like symptoms with abrupt onset of fever, malaise, profuse perspiration, severe headache, myalgia (muscle pain), joint pain, loss of appetite, upper respiratory problems, dry cough, pleuritic pain, chills, confusion and gastro-intestinal symptoms such as nausea, vomiting and diarrhea. The fever lasts approximately 7-14 days.

During the course, the disease can progress to an atypical pneumonia, which can result in a life threatening acute respiratory distress syndrome (ARDS), whereby such symptoms usually occur during the first 4-5 days of infection.

Less often the Q fever causes (granulomatous) hepatitis which becomes symptomatic with malaise, fever, liver enlargement (hepatomegaly), pain in the right upper quadrant of the abdomen and jaundice (icterus).

The chronic form of the Q fever is virtually identical with the inflammation of the inner lining of the heart (endocarditis), which can occur after months or decades following the infection. It is usually deadly if untreated. However, with appropriate treatment this lethality is around 10%.

The common way of infection is inhalation of contaminated dust, contact with contaminated milk, meat, wool and particularly birthing products. Ticks can transfer the pathogenic agent to other animals. Transfer between humans seems extremely rare and has so far been described in very few cases.

Prevention

Q fever is effectively prevented by intradermal vaccination with a vaccine composed of killed *Coxiella burnetii* organisms. Skin and blood tests should be done before vaccination to identify preexisting immunity; the reason is that vaccinating subjects who already have immunity can result in a severe local reaction. After a single dose of vaccine, protective immunity lasts for many years. Revaccination is not generally required. Annual screening is typically recommended.

Wear appropriate PPE when handling potentially infected animals or materials**.**

Leptospirosis

Leptospirosis is a bacterial disease that affects humans and animals. It is caused by bacteria of the genus *Leptospira*.

The time between a person's exposure to a contaminated source and becoming sick is 2 days to 4 weeks. Illness usually begins abruptly with fever and other symptoms. Leptospirosis may occur in two phases; after the first phase, with fever, chills, headache, muscle aches, vomiting, or diarrhea, the patient may recover for a time but become ill again. If a second phase occurs, it is more severe; the person may have kidney or liver failure or meningitis. This phase is also called Weil's disease.

The illness lasts from a few days to 3 weeks or longer. Without treatment, recovery may take several months. In rare cases death occurs.

Many of these symptoms can be mistaken for other diseases. Leptospirosis is confirmed by laboratory testing of a blood or urine sample.

Leptospira organisms have been found in cattle, pigs, horses, dogs, rodents, and wild animals. Humans become infected through contact with water, food, or soil containing waste from these infected animals. This may happen by consuming contaminated food or water or through skin contact, especially with mucosal surfaces, such as the eyes or nose, or with broken skin. The disease is not known to be spread from person to person.

Leptospirosis occurs worldwide but is most common in temperate or tropical climates. It is an occupational hazard for many people who work outdoors or with animals, for example, farmers, sewer workers, veterinarians, fish workers, dairy farmers, or military personnel. It is a recreational hazard for campers or those who participate in outdoor sports in contaminated areas and has been associated with swimming, wading, and whitewater rafting in contaminated lakes and rivers. The incidence is also increasing among urban children.

The risk of acquiring leptospirosis can be greatly reduced by not swimming or wading in water that might be contaminated with animal urine.

Protective clothing or footwear should be worn by those exposed to contaminated water or soil because of their job or recreational activities.

Prevention

Avoid risky foods and drinks.

Buy it bottled or bring it to a rolling boil for 1 minute before drink it. Bottled carbonated water is safer than non-carbonated water.

Ask for drinks without ice unless the ice is made from bottled or boiled water. Avoid popsicles and flavored ices that may have been made with contaminated water.
Eat foods that have been thoroughly cooked and that are still hot and steaming

Avoid raw vegetables and fruits that cannot be peeled. Vegetables like lettuce are easily contaminated and are very hard to wash well. When eating raw fruit or vegetables that can be peeled, peel them yourself. (Wash your hands with soap first.) Do not eat the peelings.

Avoid foods and beverages from street vendors. It is difficult for food to be kept clean on the street, and many travelers get sick from food bought from street vendors.

Leptospirosis is treated with antibiotics, such as doxycycline or penicillin, which should be given early in the course of the disease. Intravenous antibiotics may be required for persons with more severe symptoms. Persons with symptoms suggestive of leptospirosis should contact a health care provider.

Ebola

Ebola is both the common term used to describe a group of viruses belonging to genus Ebolavirus, family Filoviridae, and the common name for the disease which they cause, Ebola hemorrhagic fever. Ebola viruses are morphologically similar to the Marburg virus, also in the family Filoviridae, and share similar disease symptoms. Ebola has caused a number of serious and highly publicized outbreaks since its discovery.

Despite considerable effort by the World Health Organization, no animal reservoir capable of sustaining the virus between outbreaks has been identified. However, it has been hypothesized that the most likely candidate is the fruit bat.

Ebola hemorrhagic fever is potentially lethal and encompasses a range of symptoms including fever, vomiting, diarrhea, generalized pain or malaise, and sometimes internal and external bleeding. Mortality rates are extremely high, with the human case-fatality rate ranging from 50% - 89%, according to viral subtype. [2] The cause of death is usually due to hypovolemic shock or organ failure.

Because Ebola is potentially lethal and since no approved vaccine or treatment is available, Ebola is classified as a biosafety level 4 agent, as well as a Category A bioterrorism agent by the Centers for Disease Control and Prevention.

Symptoms are varied and often appear suddenly. Initial symptoms include high fever (at least 38.8°C), severe headache, muscle joint, or abdominal pain, severe weakness and exhaustion, sore throat, nausea, and dizziness. Before an outbreak is suspected, these early symptoms are easily mistaken for malaria, typhoid fever, dysentery, influenza, or various bacterial infections, which are all far more common and less reliably fatal.

Ebola may progress to cause more serious symptoms, such as diarrhea, dark or bloody feces, vomiting blood, red eyes due to distention and hemorrhage of sclerotic arterioles, petechia, maculopapular rash, and purpura. Other secondary symptoms include hypotension (less than 90 mm Hg systolic /60 mm Hg diastolic), hypovolemia, tachycardia, organ damage (especially the kidneys, spleen, and liver) as a result of disseminated systemic necrosis, and protinuria. The interior bleeding is caused by a chemical reaction between the virus and the platelets which creates a chemical that will cut cell sized holes into the capillary walls.

Among humans, the virus is transmitted by direct contact with infected body fluids, or to a lesser extent, skin or mucus membrane contact. The incubation period can be anywhere from 2 to 21 days, but is generally between 5 and 10 days.

Although airborne transmission between monkeys has been demonstrated by an accidental outbreak in a laboratory located in Virginia, USA, there is very limited evidence for human-to-human airborne transmission in any reported epidemics.

The infection of human cases with Ebola virus has been documented through the handling of infected chimpanzees, and gorillas--both dead and alive.

So far, all epidemics of Ebola have occurred in sub-optimal hospital conditions, where practices of basic hygiene and sanitation are often either luxuries or unknown to caretakers and where disposable needles and autoclaves are unavailable or too expensive. In modern hospitals with disposable needles and knowledge of basic hygiene and barrier nursing techniques, Ebola rarely spreads on such a large scale.

Prevention

Prevention methods include good hygiene in medical settings and awareness of the virus in travel areas. There is no known effective vaccine for humans.

Prevention efforts should concentrate on avoiding contact with host or vector species. Travelers should not visit locations where an outbreak is occurring. Contact with rodents should be avoided. Minimize exposure to arthropod bites by using permethrin-impregnated bed nets and insect repellents.

Strict compliance with infection control precautions (i.e., use of disposable gloves, face shields, and disposable gowns to prevent direct contact with body fluids and splashes to mucous membranes when caring for patients or handling clinical specimens; appropriate use and disposal of sharp instruments; hand washing and use of disinfectants) is recommended to avoid health care-associated infections.

Contact with dead primates should be avoided.

Bird and Bat Borne or Enhanced Diseases

See also under Molds and Fungus

Histoplasmosis

Histoplasmosis is a fungal infection which enters the body through the lungs. The infection enters the body through the lungs. The fungus grows as a mold in the soil, and infection results from breathing in airborne particles. Soil contaminated with bird or bat droppings are known to have a higher concentration of histoplasmosis.

There may be a short period of active infection, or it can become chronic and spread throughout the body. Most people who do develop symptoms will have a flu-like syndrome (acute-fever, chills cough, and chest pain; chronic-chest pain, cough with blood, fever, shortness of breath, sweating) and lung complaints related to pneumonia or other lung involvement. Approximately 10% of the population will develop inflammation in response to the initial infection. This can effect the skin, bones or joints, or the lining of the heart (pericardium). These symptoms are not due to fungal infection of those body parts, but due to inflammation.

In a small number of patients, histoplasmosis may become widespread (disseminated) in involve the blood, brain, adrenal glands, or other organs. Very young or old are at a higher risk for

disseminated histoplasmosis. Symptoms include fevers, headache, neck stiffness, mouth sores, skin lesions.

Histoplasmosis may be prevented by reducing dust exposure in areas containing bird or bat droppings. Wear PPE and respirator when working within this environment. Institute work practices and dust control measures, i.e. moist/wet area, that eliminate or reduce dust generation which will reduce risks of infection and subsequent development of disease.

Treatment

The main treatment for histoplasmosis is antifungal drugs. Amphotericin B, itraonazole, and ketoconazole are the usual treatments. Long-term treatment with antifungal drugs may be needed.

Psittacosis

Psittacosis is a disease caused by a bacteria that is found in bird droppings and other secretions (often carried by pet birds). The bacteria is found worldwide.

Symptoms of psittacosis infection may include a low-grade fever that often becomes worse as the disease progresses, including anorexia, sore throat, light sensitivity, and a severe headache.

Ammonia and sodium hypochlorite based disinfectants are effective disinfectants for Psittacossis.

Where it is necessary to remove bat droppings from buildings prior to renovation or demolition it is prudent to assume infection and use the following precautions:

- Avoid areas that may harbor the bacteria, e.g., accumulations of bird or bat droppings.

- Areas known or suspected of being contaminated by *the organisms causing* Psittacosis such as bird roosts, attics, or even entire buildings that contain accumulations of bat or bird manure, should be posted with signs warning of the health risk. The building or area should be secured

- Before an activity is started that may disturb any material that might be contaminated by Psittacosis, workers should be informed in writing of the personal risk factors that increase an individual's chances of developing these diseases. Such a written communication should include a warning that individuals with weakened immune systems are at the greatest risk of developing severe forms of these diseases become infected. These people should seek advice from their health care provider about whether they should avoid exposure to materials that might be contaminated with these organisms.

The best way to prevent exposure is to avoid situations where material that might be contaminated can become aerosolized and subsequently inhaled. A brief inhalation exposure to

highly contaminated dust may be all that is needed to cause infection and subsequent development of psittacosis. Therefore, work practices and dust control measures that eliminate or reduce dust generation during the removal of bat manure from a building will also reduce risks of infection and subsequent development of disease. For example, instead of shoveling or sweeping dry, dusty material, carefully wetting it with a water spray can reduce the amount of dust aerosolized during an activity. Adding a surfactant or wetting agent to the water might reduce further the amount of aerosolized dust.

Once the material is wetted, it can be collected in double, heavy-duty plastic bags, a 55-gallon drum, or some other secure container for immediate disposal. An alternative method is use of an industrial vacuum cleaner with a high-efficiency filter to *bag* contaminated material. Truck-mounted or trailer-mounted vacuum systems are recommended for buildings with large accumulations of bat or bird manure. These high-volume systems can remove tons of contaminated material in a short period. Using long, large-diameter hoses, such a system can also remove contaminated material located several stories above its waste hopper. This advantage eliminates the risk of dust exposure that can happen when bags tear accidentally or containers break during their transfer to the ground.

The removal of all material that might be contaminated from a building and immediate waste disposal will eliminate any further risk that someone might be exposed to aerosolized spores. Air sampling, surface sampling, or the use of any other method intended to confirm that no infectious agents remain following removal of bat manure is unnecessary in most cases. However, before a removal activity is considered finished, the cleaned area should be inspected visually to ensure that no residual dust or debris remains.

Spraying 1:10 bleach to water mixture on droppings and allowing it to dry is also a recommended practice for the psittacosis organisms.

Because work practices and dust control measures to reduce worker exposures to these organisms have not been fully evaluated, using personal protective equipment is still necessary during some activities. During removal of an accumulation of bat or bird manure from an enclosed area such as an attic, dust control measures should be used, but wearing a NIOSH-approved respirator and other items of personal protective equipment is also recommended to reduce further the risk of exposure to the organisms that cause Psittacosis.

Treatment

Psittacosis is often hard to diagnoses and while a concern, it does not occur with great frequency. Knowledge of the symptoms and of potential exposure is important when seeking medical follow-up for potential exposure.

There are various medical treatments for psittacosis based on extent of infection. The sooner the disease is diagnosed and treatment is begun the more effective the treatment will be.

APPENDIX A

Dangerous Animals - Wildlife Hazard Recognition and Protection

GENERAL

Work in remote areas inhabited by wild animals that have been known to cause injury and kill human beings, requires that companies working in these areas carefully plan for wildlife encounters. This procedure outlines actions that when properly implemented should provide a high degree of protection for employees and wildlife.
These procedures apply to employees who prepare Health and Safety Plans or perform fieldwork in environments in which wild animals may be encountered. However, due to the unpredictable nature of wild animals this single document cannot possibly cover all potential risks or protective measures. Therefore, prior to entering remote areas inhabited by dangerous wildlife, contact local wildlife agencies to gather additional information concerning local risks and protective measures.

ATTACHMENTS

Attachments 1 and 2 outline behavioral characteristics of and outline controls that will minimize human injury, loss of property, and unnecessary destruction of wildlife, while ensuring a safe work environment.

WILDLIFE AVOIDANCE AND BASIC PROTECTIVE MEASURES

The best protective measure is simply avoidance. Large numbers of humans present deterrence to wild animals; therefore, whenever possible teams in the field should work together in groups of four or more. Whenever practical, fieldwork should be scheduled around the seasonal cycles of wildlife in the area. When wild animal avoidance cannot be achieved through scheduling, personnel involved in field activities in which encounters with wild animals may result, will take the following steps and will be equipped and trained, as set forth below.

CLEAR THE AREA

Evaluate and control the area before entry by

- Determine areas of recent sightings through local Fish and Game, state troopers, etc.;
- Conduct a site observation from an off-site elevated point, if possible;
- Conduct a controlled walk through in the area by a trained observer;
- Arrange a briefing by a local specialist, e. g., Fish and Game, etc.; and
- Utilizing appropriate noisemakers.

BASIC EQUIPMENT

Employees entering an environment where encounters with wild animals are possible should be provided, as a minimum:

- Noisemakers, such as air horns, bells, etc.; and
- Bear spray of not less than 16-ounce capacity (with holster), equivalent to capsicum pepper (red pepper extract), which is capable of spraying at least 15 feet. (Notes: Normally cannot be transported in side aircraft passenger compartments and may be

considered a hazardous material, check with airlines and hazardous material shippers for current information).

TRAINING

Prior to entering and / or working in areas inhabited by dangerous wildlife each employee should receive training as outlined in this procedure. At a minimum, training must include information related to:

- Wildlife present, habitat, behavior patterns, including when wild animals are most active, etc.
- Warning signs, such as tracks, bedding areas, scat, claw marks, offspring, paths, etc.,
- Avoidance measures
- Other hazards, precautions, and protective measures as outlined in the Attachments,
- (At the jobsite) spray demonstration and safety instructions which include location of and persons designated as "bear watch"

An outline of the training content should be reviewed and approved by the Divisional EHS manager and should be documented. A record of the training will be maintained at the job site, filed with the SSHSP and in the employee's training records.

VEHICLE SAFETY

Use extreme caution, particularly in darkness, when operating vehicles in areas where wild animals may be present. Collisions with large animals have been known to cause significant property damage and personal injuries to vehicle passengers, including fatalities.

ATTACHMENT 1

BEAR SAFETY – HAZARD RECOGNITION AND PRECAUTIONS

On occasion fieldwork may be conducted in a location where bears may be encountered. The following technical information, precautions, and guidelines for operations in which bears could be encountered are based on experience and conditions for field work. Bears are intelligent, wild animals and are potentially dangerous, and would rather be left alone. The more bears are understood the less they will be feared. This attachment is intended to provide information that will enable Weston to plan for bear encounters and to properly address face-to-face encounters.

Bear Life History

Although bears are creatures of habit, they are also intelligent, and each has its own personality. The way a bear reacts is often dictated by what it has learned from its mother, the experience it has had on its own, and the instincts nature has provided. Like other intelligent animals, we can make general statements about bears, but few people can accurately predict their behavior.

Bears have an incredible sense of smell, and seem to trust it more than any other sense. Hearing and sight are also important, but to a lesser degree. A bear's hearing is probably better than ours, but not as keen as a dog's hearing. Their sight is probably comparable to that of a human. Black bears tend to favor forested habitats.

Bears are opportunists, relying on their intelligence and their senses to find food. They use different habitats throughout the year, depending on the availability of food and other necessities. The area a bear covers in a given year is partially dependent on how far it has to go to satisfy these basic needs. In some areas, individual bears have home ranges of less than a square mile; in other areas ranges can encompass hundreds of square miles. Males usually range over larger areas than females.

In spring, bears begin coming out of hibernation. Males are usually the first bears to emerge, usually in April, and females with new cubs are usually the last, sometimes as late as late June. When bears emerge from their dens, they are lethargic for the first few days, frequently sleeping near their dens and not eating. When they do start eating, they seek carrion (deer, etc.), roots, and emerging vegetation. In coastal areas, beaches become travel corridors as bears seek these foods.

In early summer, bears eat new grasses and forage as they develop in higher elevations. In coastal areas, salmon are the most important food from June through September. This period is one of the few times that bears are found in large groups, and it is the time that most people see bears. Bears often travel, eat, and sleep along streams for weeks at a time.

Other summer foods for bears include grasses and ground squirrels. When bears kill or scavenge large prey, they commonly cover the portions they cannot eat with sticks and duff. A bear may remain near a food cache for days and it will defend it from intruders.

During the late summer and early fall, bears move inland and consume large amounts of blueberries, and other succulent fruits. As the seasons progress towards winter, a bear's diet becomes more varied. This is the time that bears are adding final deposits of fat before their long winter naps.

In October and November, bears move into their denning areas and begin preparing a suitable den. Black bears usually den in holes under large trees or rock outcrops, or in small natural cavities. Dens are just large enough for the bears to squeeze into. Bears rarely eat, drink, urinate, or defecate while they are denning. They sleep deeply, but do not truly hibernate, and they can be awakened by loud noises or disturbances.

Cubs are born in the den, usually in January. Black bear cubs usually stay with their mothers for a year and a half. Black bears are sexually mature at age 2. Mating season is in the spring (May or June) and both species are polygamous (multiple mates). Black bears can live for 25 – 30 years, although most live less than 20 years.

BEAR AND HUMAN INTERACTIONS

Bears generally prefer to be left alone, but they share their homes with other creatures, including humans, who intrude on virtually every aspect of the bear's life. Bears are normally tolerant of these activities and generally find a secure way to avoid them. Humans can help bears make a graceful retreat and avoid many close encounters by letting them know we are coming. Walking in groups, talking, and wearing noise making devices, such as bear bells, all serve to warn a bear of your approach. When possible, avoid hiking and camping in areas where bears are common, such as bear trails through heavy brush or along salmon streams. Always keep an eye out for bears and bear signs. If you happen upon a dead animal, especially one that is covered with sticks and duff (a bear cache), immediately retreat the way you came, but do not run, and make a detour around the area. If you see a cub up a tree or a small bear walking alone, immediately retreat and detour around the area. Like all young animals, cubs wander away from their mothers, but females are furiously protective when they believe their cubs are threatened. Even if we do everything possible to avoid meeting a bear, sometimes bears come to us.

Bears are both intelligent and opportunistic, and they express these qualities through their curiosity. This curiosity frequently brings them into "human habitat." When this happens, we often feel vulnerable, and the bear is sometimes viewed as a threat or nuisance. In most cases, a curious bear will investigate a "human sign," perhaps test it out (chew on a raft, bite into some cans, etc.), and leave, never to return. If the bear was rewarded during his investigation by finding something to eat, it is hard to stop them from returning once they have had a food-reward. That is why we emphasize the importance of keeping human food and garbage away from bears. When in bear country, always think about the way you store, cook, and dispose of your food. **Never feed bears!** This is both illegal and foolish. Food should be stored in airtight containers, preferably away from living and sleeping areas. Garbage should be thoroughly incinerated as soon as possible. Fish and game should be cleaned well away from camp, and clothing that smells of fish and game should be stored away from sleeping areas. Menstruating women should take extra precautions to keep themselves as clean as possible, and soiled tampons and pads should

be treated as another form of organic garbage. Once a bear has obtained food from people, it may continue to frequent areas occupied by people. If a bear does not find food or garbage after the next few tries, it may give up and move back into a more natural feeding pattern. Occasionally, though, the bear will continue to seek human foods and can become a "problem bear." Some bears become bold enough to raid campsites and break into cabins to search for human food. Shooting bears in the rump with cracker shells, flares, rubber bullets, and birdshot are common methods of "aversive conditioning." These are also very dangerous techniques, because they may seriously injure a bear if not done properly and/or they may cause a bear to attack the shooter.

BLACK BEARS

Black Bear Identification: Black bears are the smallest and most abundant of the bear species. They are five to six feet long and stand about two to three feet high at the shoulders. They weigh from 200 to 500 pounds. While they are most commonly black, other color phases include brown (cinnamon), and, rarely, gray (blue), and white. Muzzles are usually brown. Black bears can be distinguished from brown bears by:

- Their head shape (a black bear's nose is straight in profile, a brown bear's is dished);
- Their claws (black bear's claws are curved and smaller, brown bears are relatively straight and longer);
- Their body shape (when standing, a black bear's rump seems to be higher than its shoulders; a brown bear's shoulders are usually higher than its rump); and

Typical Habitat: Black bears occupy a wide range of habitats, but seem to be most common in forested areas.

AVOIDING BEAR ENCOUNTERS WHEN

- The Bear sees you but you do not know the bear is around: The bear will likely avoid detection people and will simply move away when they sense a human.
- You see a bear and it does not know you are there: Move away slowly. Avoid intercepting the bear if it is walking. If possible, detour around the bear. If the bear is close to you, stand where you are or back away slowly. Do not act threateningly toward the bear, it may know you are there but it has chosen to ignore you as long as you are not a threat.
- You see the bear and the bear sees you: Do not act threateningly, but let the bear know you are human. Wave your arms slowly, talk in a calm voice, and walk away slowly in a lateral direction, keeping an eye on the bear. Unless you are very close to a car or a building, never run from bears. In a bear's world, when something runs it is an open invitation to chase it. Bears will chase a running object even if they have no previous intention of catching it. Bears can run as fast as a racehorse, so humans have little or no chance of outrunning a bear.
- You see a bear; the bear sees you and stands on its hind legs: This means that the bear is seeking more information. Bears stand on their hind legs to get a better look, or smell, at something they are uncertain of. It is your cue to help it figure

out what you are. Help the bear by waving your arms slowly and talking to it. Standing is not a precursor to an attack. Bears do not attack on their hind legs. It is also important to remember that when a bear goes back down on all fours from a standing position, it may come towards you a few steps. This is normal, and probably not an aggressive act.

- The bear sees you, recognizes you as a human, but continues to come towards you slowly: This may mean several things, depending on the bear and the situation. It may mean that the bear does not see you as a threat, and just wants to get by you (especially if the bear is used to humans, as in a National Park); the bear wants to get food from you (if it has gotten food from people before); the bear wants to test your dominance (it views you as another bear); or may be stalking you as food (more common with black bear, but a rare occurrence). In all cases, your reaction should be to back off the trail very slowly, stand abreast if you are in a group, talk loudly, and/or use a noise-making device. If the bear continues to advance, you should stop. At this point, it is important to give the bear the message that if he continues to advance it will cost him. Continue to make loud noises and present a large visual image to the bear (standing abreast, open your coat). In bear language, bears assert themselves by showing their size. If an adult brown bear continues to come at you, climbing 20 feet or higher up a tree may also be an option if one is next to you (remember, never run from bears). Keep in mind, though, black bears can climb trees.
- The bear recognizes you as a human and acts nervous or aggressive: When bears are nervous or stressed they can be extremely dangerous. This is when it is important to try to understand what is going on in the bears mind. Nervous bears growl, woof, make popping sounds with their teeth, rock back and forth on their front legs, and often stand sideways to their opponent. A universal sign of a nervous bear is excessive salivation (sometimes it looks like they have white lips). When a bear shows any of these signs, stand where you are and talk in a calm voice. Do not try to imitate bear sounds, this may only serve to confuse and further agitate the bear. If you are in a group, stand abreast.
- The bear charges: If all other signals fail, a bear will charge. Surprisingly, most bear charges are just another form of their language. The majority of these are "bluff charges," that is; the bear stops before making contact with their opponent. There are many different types of bluff charges ranging from a loping uncertain gait to a full-blown charge. If a bear charges, stand still.
- The bear attacks: When all else fails, a bear may attack. Attacks may be preceded by all of the behaviors previously described or they may be sudden. Seemingly unprovoked attacks are often the result of a bear being surprised (and feeling threatened), a bear defending its food cache, or a female defending her cubs. When a bear attacks, it typically runs with its body low to the ground, legs are stiff, ears are flattened, hair on the nape of the neck is up, and the bear moves in a fast, determined way. Front paws are often used to knock the opponent down and jaws are used to subdue it.

AFTER A BEAR ENCOUNTER

Black bears have been known to view humans as prey, and if you struggle with the attacking black bear, it will probably go elsewhere for its meal.

- Bear Sprays: Are easy to carry and use, little risk of permanent damage to bears and humans, effective in many situations. However, using a spray may change a false charge into a real charge, they are ineffective at ranges greater than 20 feet, ineffective in windy conditions, dangerous if accidentally discharged in a closed area such as an aircraft cockpit.

The most effective tool you have against an attacking bear is your brain. Although bears are intelligent animals, we are smarter and can often think our way out of a bad situation if we try.

ATTACHMENT 2

HAZARDS AND PRECAUTIONS – DEER

The following technical information, precautions, and guidelines for operations in which Deer may be encountered. The more the species are understood, the easier it will be to avoid contact with them thus preventing injury to ourselves and to the animals. All big game species are unpredictable and can be dangerous under certain conditions. This attachment is intended to provide information that will enable Weston to plan for encounters and to properly address face-to-face encounters.

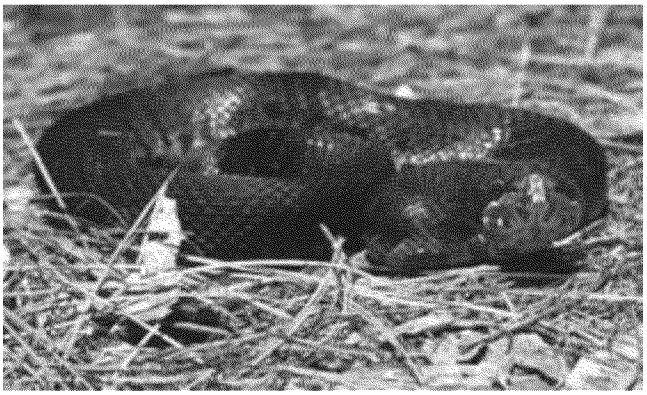
WHITE-TAILED DEER

The White-tailed deer found thought the eastern and western part of the United States have been known to attack people on many occasions. It is unknown whether Black-tailed deer have made any such attacks, but it is possible for someone to be injured by an irate buck in the breeding season (late fall). Deer are well equipped to injure humans. They are very fast. Bucks have sharp antlers and can clear amazingly high obstacles with graceful, arching leaps. They can run with remarkable speed, even in dense cover, and have excellent camouflage. When working in areas populated with deer, it is just common sense not to approach any large wild animal too closely. It is unlikely that an attack from a deer would be fatal but it is possible and serious injury is likely.

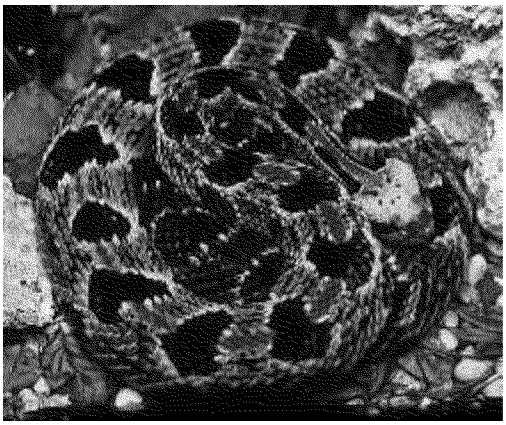
APPENDIX B - PICTURES OF POISONOUS SNAKES AND LIZARDS

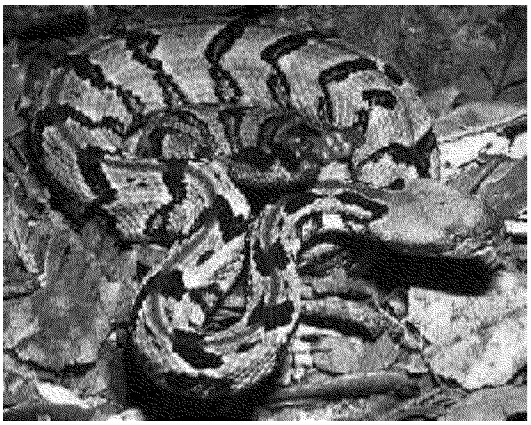
Americas

American copperhead



Cotton Mouth – East and Southeast US





Timber Rattlesnake – Eastern US

FLD 43 B INSECTS

Sting and Biting Insects

Contact with stinging insects may result in site personnel experiencing adverse health affects that range from being mildly uncomfortable to being life threatening. Therefore, stinging insects present a serious hazard to site personnel and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects. These include the following:

- Bees (Honeybees, bumble bees, wasps, and hornets and wingless wasps)
- Scorpions
- Fire ants
- Spiders
- Ticks
- Deer Flies
- Mosquito
- Fleas
- Bed Bugs

Bees, Wasps, Hornets and Yellow Jackets

The severity of an insect sting reaction varies from person to person. A normal reaction will result in pain, swelling and redness confined to the sting site. Simply disinfect the area (washing with soap and water will do) and apply ice to reduce the swelling.

A large local reaction will result in swelling that extends beyond the sting site. For example, a sting on the forearm could result in the entire arm swelling twice its normal size.

Although alarming in appearance, this condition is often treated the same as a normal reaction. An unusually painful or very large local reaction may need medical attention. Because this condition may persist for two to three days, antihistamines and corticosteroids are sometimes prescribed to lessen the discomfort.

Yellow jackets, hornets and wasps can sting repeatedly. Honeybees have barbed stingers that are left behind in their victim's skin. These stingers are best removed by a scraping action, rather than a pulling motion, which may actually squeeze more venom into the skin.

Scorpions (Caribbean)

Scorpion stings are a major public health problem in many underdeveloped tropical countries. For every person killed by a poisonous snake, 10 are killed by a poisonous scorpion. In the United States, only 4 deaths in 11 years have occurred as a result of scorpion stings. Furthermore, scorpions can be found outside their normal range of distribution, ie, when they

accidentally crawl into luggage, boxes, containers, or shoes and are unwittingly transported home via human travelers.

Out of 1,500 scorpion species, 50 are dangerous to humans. Scorpion stings cause a wide range of conditions, from severe local skin reactions to neurologic, respiratory, and cardiovascular collapse.

Almost all of these lethal scorpions belong to the scorpion family called the Buthidae. The Buthidae are small to mid-size scorpions (0.8 inch to 5.0 inches) and normally uniformly colored without patterns or shapes. Poisonous scorpions also tend to have weak-looking pincers, thin bodies, and thick tails, as opposed to the strong heavy pincers, thick bodies, and thin tails seen in nonlethal scorpions. The lethal members of the Buthidae family include the genera of *Tityus* which can be found in the Caribbean.

A scorpion has a flattened elongated body and can easily hide in cracks. Scorpions are members of the Arachnid (spider) family. The bodies consist of 3-segments, they also have 4 pairs of legs, a pair of claws, and a segmented tail that has a poisonous spike at the end. Scorpions vary in size from 1-20 cm in length.

However, scorpions may be found outside their habitat range of distribution when inadvertently transported with luggage and cargo.

Prevention

Preventive measures include awareness of scorpions, shaking out clothing and boots before putting them on looking before reaching into likely hiding places and wearing gloves, long sleeved shirts and pants.

Symptoms

In mild cases, the only symptom may be a mild tingling or burning at site of sting.

In severe cases, symptoms may include:

- Eyes and ears - Double vision
- Lungs - Difficulty breathing, No breathing, Rapid breathing,
- Nose, mouth, and throat – Drooling, Spasm of the voice box, Thick-feeling tongue
- Heart and blood - High blood pressure, Increased or decreased heart rate, Irregular heartbeat
- Kidneys and bladder Urinary incontinence, Urine output, decreased
- Muscles and joints - Muscle spasms
- Nervous system – Paralysis, Random movements of head, eye, or neck, Restlessness, Seizures, Stiffness
- Stomach and intestinal tract - Abdominal cramps, Fecal incontinence
- Other -Convulsions

Treatment

1. Recognize scorpion sting symptoms:
2. Wash the area with soap and water.
3. Apply a cool compress on the area of the scorpion sting. Ice (wrapped in a washcloth or other suitable covering) may be applied to the sting location for 10 minutes. Remove compress for 10 minutes and repeat as necessary.
4. Call the Poison Control Center. If you develop symptoms of a poisonous scorpion sting, go to the nearest emergency care facility.
5. Keep your tetanus shots and boosters current.

Fire Ants (Caribbean)

Fire ants are aggressive, reddish-brown to black ants that are 1/8 inch to 1/4 inch long. They construct nests, which are often visible as dome-shaped mounds of soil, sometimes as large as 3 feet across and 1 1/2 feet in height. In sandy soils, mounds are flatter and less visible. Fire ants usually build mounds in sunny, open areas such as lawns, pastures, cultivated fields and meadows, but they are not restricted to these areas. Mounds or nests may be located in rotting logs, around trees and stumps, under pavement and buildings, and occasionally indoors.

Fire ants use their stingers to immobilize or kill prey and to defend ant mounds from disturbance by larger animals, such as humans. Any disturbance sends hundreds of workers out to attack anything that moves. The ant grabs its victim with its mandibles (mouthparts) and then inserts its stinger. The process of stinging releases a chemical, which alerts other ants, inducing them to sting. In addition, one ant can sting several times without letting go with its mandibles.

Once stung, humans experience a sharp pain that lasts a couple of minutes, then after a while the sting starts itching and a welt appears. Fire ant venom contains alkaloids and a relatively small amount of protein. The alkaloids kill skin cells; this attracts white blood cells, which form a pustule within a few hours of being stung. The fluid in the pustule is sterile, but if the pustule is broken, the wound may become infected. The protein in the venom can cause allergic reactions that may require medical attention.

Some of the factors related to stinging insects that increase the risk associated with accidental contact are:

- The nests for these insects are frequently found in remote wooded or grassy areas and hidden in cavities
- The nests can be situated in trees, rocks, bushes or in the ground, and are usually difficult to see
- Accidental contact with these insects is highly probable, especially during warm weather conditions when the insects are most active
- If a site worker accidentally disturbs a nest, the worker may be inflicted with multiple stings, causing extreme pain and swelling which can leave the worker incapacitated and in need of medical attention

- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock
- Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth and respiratory passages
- The hypersensitivity needed to cause anaphylactic shock, can in some people, accumulate over time and exposure, therefore, even if someone has been stung previously, and not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction if they are stung again

With these things in mind, and with the high probability of contact with stinging insects, use the following safe work practices:

- If a worker knows that he is hypersensitive to bee, wasp or hornet stings, inform the site Safety officer of this condition prior to participation in site activities
- All site personnel will be watchful for the presence of stinging insects and their nests, and will advise the Site Safety officer if a stinging insect nest is located or suspected in the area
- Any nests located on site will be flagged off and site personnel will be notified of its presence
- If attacked, site personnel will immediately seek shelter and stay there. Do not jump in water (bees will still be in the area when you come up). Once safe, remove stings from your skin, it does not matter how you do it, but do it as quickly as possible to reduce the amount of venom they inject. Obtain first aid treatment and contact the safety officer who will observe for signs of allergic reaction

Treatment for fire ant stings is aimed at preventing secondary bacterial infection, which may occur if the pustule is scratched or broken. Clean the blisters with soap and water to prevent secondary infection. Do not break the blister. Topical corticosteroid ointments and oral antihistamines may relieve the itching associated with these reactions.

Site personnel with a known hypersensitivity to stinging insects will keep required emergency medication on or near their person at all times

Spiders

A large variety of spiders may be encountered during site activities. Extreme caution must be used when lifting logs and debris, since spiders are typically found in these areas.

While most spider bites merely cause localized pain, swelling, reddening, and in some cases, tissue damage, there are a few spiders that, due to the severity of the physiological affects caused by their venom, are dangerous.

Black Widow: The black widow is a coal-black bulbous spider 3/4 to 1 1/2 inches in length, with a bright red hourglass on the under side of the abdomen. The black widow is usually found in dark moist locations, especially under rocks, rotting logs and may even be found in outdoor toilets where they inhabit the underside of the seat. Victims of a black widow bite may exhibit the following signs or symptoms:

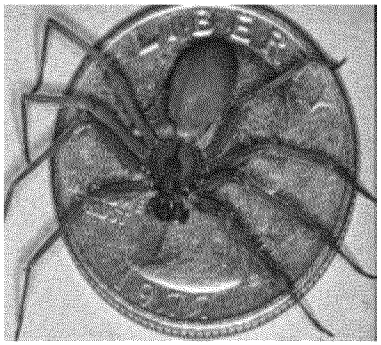
- Sensation of pinprick or minor burning at the time of the bite
- Appearance of small punctures (but sometimes none are visible)
- After 15 to 60 minutes, intense pain is felt at the site of the bite which spreads quickly, and is followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils and generalized swelling of face and extremities

Brown Recluse: The brown or violin spider is brownish to tan in color, rather flat, and 1/2 to 5/8 inches long. However, unlike the typical species, this spider has been encountered without a violin or "fiddle" shaped mark on the top of the head. Of the brown spider, there are three varieties found in the United States that present a problem to site personnel. These are the brown recluse, the desert violin and the Arizona violin. These spiders may be found in a variety of locations including trees, rocks or in dark locations. Victims of a brown or violin spider bite may exhibit the following signs or symptoms:

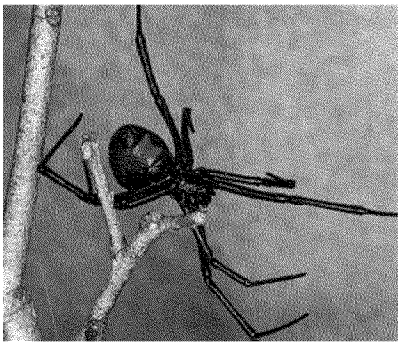
- Blistering at the site of the bite, followed by a local burning at the site 30 to 60 minutes after the bite
- Formation of a large, red, swollen, postulating lesion with a bull's-eye appearance
- Systemic affects may include a generalized rash, joint pain, chills, fever, nausea and vomiting
- Pain may become severe after 8 hours, with the onset of tissue necrosis

There is no effective first aid treatment for either of these bites. Except for very young, very old or weak victims, spider bites are not considered to be life threatening. However, medical treatment must be sought to reduce the extent of damage caused by the injected toxins.

Brown Recluse Spider



Black Widow Spider



First aid should include:

- If possible, catch the spider to confirm its identity. Even if the body is crushed, save it for identification
- Clean the bitten area with soap and water or rubbing alcohol
- To relieve pain, place an ice pack over the bite
- Keep the victim quiet and monitor breathing

Seek immediate medical attention

Sensitivity Reaction to Insect Stings or Bites

A sensitivity reaction is one of the more dangerous and acute effects of insect bites or stings. It is the most common cause of fatalities from bites, particularly from bees, wasps, and spiders. Anaphylactic shock due to stings can lead to severe reactions in the circulatory, respiratory, and central nervous system. This can also result in death.

Site personnel must be questioned regarding their allergic reaction to insect bites. Anyone knowingly allergic should be required to carry and know how to use a response kit (e.g., Epi-Kit). First aid providers must be instructed on how to use the kit also. The kit must be inspected to ensure it is updated.

Administer first aid and observe persons reporting stings for signs of allergic reaction, such as unusual swelling, nausea, dizziness, and shock. At the first sign of these symptoms, take the individual to a medical facility for attention.

Insect Borne Diseases

Diseases that are spread by insects include the following: Lyme Disease (tick); Bubonic and other forms of Plaque (fleas); Malaria, West Nile Virus and Equine Encephalitis (mosquito).

Tick Borne Diseases

Lyme disease is the second most rapidly spreading disease in the U.S.

Lyme Disease

1. Facts

Definition:

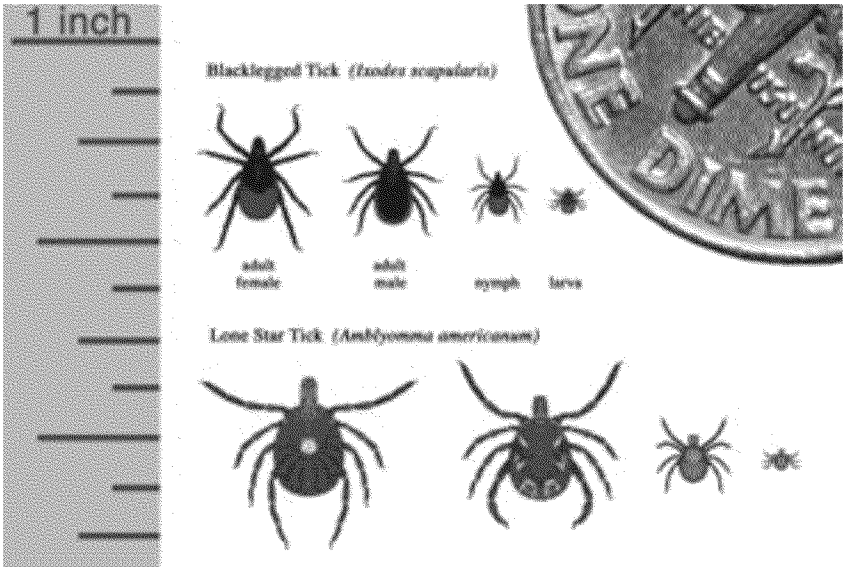
- Bacterial infection transmitted by the bite of an infected black-legged tick more popularly known as the deer tick.

- Prevalence (nationwide and other countries).

- Three stages/sizes of deer ticks:
    - Larvae
    - Nymph
    - Adult

Tick season is May through October.

Not all ticks transmit Lyme disease (Black legged or deer tick [upper] compared to the Lone Star tick [lower])



- Ticks must be attached for several hours before Lyme disease can be transmitted.
- Being bitten by a tick does not mean you will get Lyme disease.

2. Prevention and Protection:

- Wear light-colored, tight-knit clothing.
- Wear long pants and long-sleeved shirts.
- Tuck pant legs into shoes or boots.
- Wear a hat.
- Use insect repellant containing DEET ((follow manufacturer's instructions for use).
- Check yourself daily for ticks after being in grassy, wooded areas.
- Request information from the Health and Safety Medical Section regarding Lyme Disease.

3. If Bitten:

- Remove the tick immediately with fine-tipped tweezers. Grasp the tick as close to the skin as possible. Pull gently but firmly without twisting or crushing the tick.
- Wash your hands and dab the bite with an antiseptic.

- Save the tick in a jar in some alcohol. Label the jar with the date of the bite, the area where you picked up the tick and the spot on your body where you were bitten.
- Monitor the bite for any signs of infection or rash.

4. Symptoms:

Early Signs (may vary from person to person)

- Expanding skin rash.

- Flu-like symptoms during summer or early fall that include the following:
  - Chills, fever, headache, swollen lymph nodes.
  - Stiff neck, aching joints, and muscles.
  - Fatigue.

- Later signs
  - Nervous system problems.
  - Heart problems.
  - Arthritis, especially in knees.

5. Upon Onset of Symptoms:

- Notify your Safety Officer (SO) and your supervisor.

Ehrlichiosis

Ehrlichiosis is the general name used to describe several bacterial diseases that affect animals and humans. These diseases are caused by the organisms in the genus *Ehrlichia*. Worldwide, there are currently four ehrlichial species that are known to cause disease in humans.

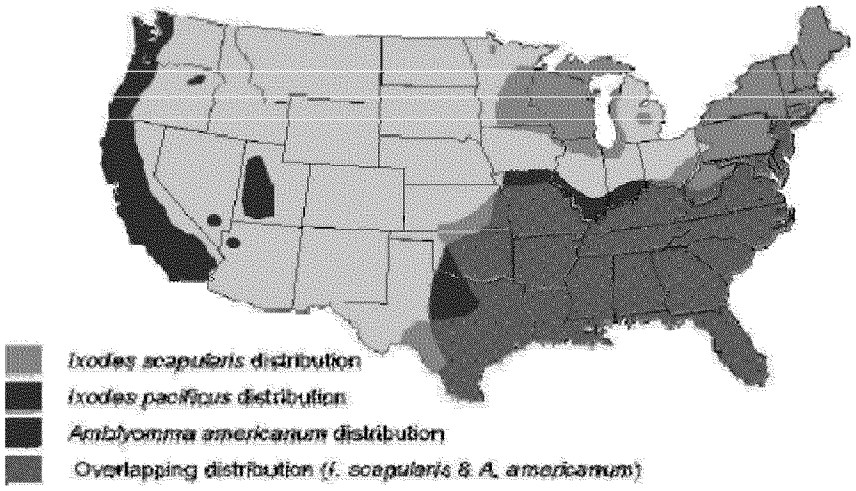
In the United States, ehrlichiae are transmitted by the bite of an infected tick. The lone star tick (*Amblyomma americanum*) and the blacklegged tick (*Ixodes scapularis)* are known vectors of ehrlichiosis.

The symptoms of ehrlichiosis may resemble symptoms of various other infectious and non-infectious diseases. These clinical features generally include fever, headache, fatigue, and muscle aches. Other signs and symptoms may include nausea, vomiting, diarrhea, cough, joint pains, confusion, and occasionally rash. Symptoms typically appear after an incubation period of 5-10 days following the tick bite. It is possible that many individuals who become infected with ehrlichiae do not become ill or they develop only very mild symptoms.

Most cases of ehrlichiosis are reported within the geographic distribution of the vector ticks (see map below). Occasionally, cases are reported from areas outside the distribution of the tick vector. In most instances, these cases have involved persons who traveled to areas where the diseases are endemic, and who had been bitten by an infected tick and developed symptoms after

returning home. Therefore, if you traveled to an ehrlichiosis-endemic area 2 weeks prior to becoming ill, you should tell your doctor where you traveled.

Figure 20. Areas where human ehrlichiosis may occu r based on approximate distribution of vector tick species



A diagnosis of ehrlichiosis is based on a combination of clinical signs and symptoms and confirmatory laboratory tests. Blood samples can be sent to a reference laboratory for testing. However, the availability of the different types of laboratory tests varies considerably. Other laboratory findings indicative of ehrlichiosis include low white blood cell count, low platelet count, and elevated liver enzymes.

Ehrlichiosis is treated with a tetracycline antibiotic, usually doxycycline.

Very little is known about immunity to ehrlichial infections. Although it has been proposed that infection with ehrlichiae confers long-term protection against reinfection, there have been occassional reports of laboratory-confirmed reinfection. Short-term protection has been described in animals infected with some *Ehrlichia* species and this protection wanes after about 1 year. Clearly, more studies are needed to determine the extent and duration of protection against reinfection in humans.

Limiting exposure to ticks reduces the likelihood of infection in persons exposed to tick-infested habitats. Prompt careful inspection of your body and removal of crawling or attached ticks is an important method of preventing disease. It may take 24–48 hours of attachment before microorganisms are transmitted from the tick to you.

Preventive measures - Follow protection protocols for Lyme disease

Babesiosis

Babesiosis is an intraerythrocytic parasitic infection caused by protozoa of the genus *Babesia* and transmitted through the bite of the *Ixodes* tick, the same vector responsible for transmission of Lyme disease. While most cases are tick-borne, transfusion and transplacental transmission

have been reported. In the United States, babesiosis is usually an asymptomatic infection in healthy individuals. Several groups of patients become symptomatic, and, within these subpopulations, significant morbidity and mortality occur. The disease most severely affects patients who are elderly, immunocompromised, or asplenic. Among those symptomatically infected, the mortality rate is 10% in the United States.

The primary vectors of the parasite are ticks of the genus *Ixodes*. In the United States, the black-legged tick, *Ixodes scapularis* (also known as *Ixodes dammini*) is the primary vector for the parasite. The *Ixodes* tick vector for *Babesia* is the same vector that locally transmits *Borrelia burgdorferi*, the agent implicated in Lyme disease. The primary US animal reservoir is the white-footed mouse, *Peromyscus leucopus*. Additionally, white-tailed deer serve as transport hosts for the adult tick vector, *I scapularis*.

The Ixodid ticks ingest *Babesia* during feeding from the host, multiply the protozoa in their gut wall, and concentrate it in their salivary glands. The tick inoculates a new host when feeding again. The parasite then infects red blood cells (RBCs) and differentiated and undifferentiated trophozoites are produced. The former produce 2-4 merozoites that disrupt the RBC and go on to invade other RBCs. This leads to hemolytic anemia, thrombocytopenia, and atypical lymphocyte formation. Alterations in RBC membranes cause decreased conformability and increased red cell adherence, which can lead to development of acute respiratory distress syndrome (ARDS) among those severely affected.

The signs and symptoms mimic malaria and range in severity from asymptomatic to septic shock.

Symptoms include: Generalized weakness, fatigue, depression, fever, anorexia and weight loss, CNS - Headache, photophobia, neck stiffness, altered sensorium, pulmonary - Cough, shortness of breath, GI - Nausea, vomiting, abdominal pain, Musculoskeletal - Arthralgia and myalgia and Renal - Dark urine

Prevention

Prevention measures are the same as for Lyme and other insect borne diseases

Tularemia

Tularemia (also known as "rabbit fever") is a serious infectious disease caused by the bacterium *Francisella tularensis*. The disease is endemic in North America. The primary vectors are ticks and deer flies, but the disease can also be spread through other arthropods. Animals such as rabbits, prairie dogs, hares and muskrats serve as reservoir hosts.

Depending on the site of infection, tularemia has six characteristic clinical syndromes: ulceroglandular, glandular, oropharyngeal, pneumonic, oculoglandular, and typhoidal.

The disease has a very rapid onset, with headache, fatigue, dizziness, muscle pains, loss of appetite and nausea. Face and eyes redden and become inflamed. Inflammation spreads to the

lymph nodes, which enlarge and may suppurate (mimicking bubonic plague). Lymph node involvement is accompanied by a high fever. Death may result.

Francisella tularensis is one of the most infective bacteria known; fewer than ten organisms can cause disease leading to severe illness. The bacteria penetrate into the body through damaged skin and mucous membranes, or through inhalation. Humans are most often infected by tick bite or through handling an infected animal. Ingesting infected water, soil, or food can also cause infection. Tularemia can also be acquired by inhalation; hunters are at a higher risk for this disease because of the potential of inhaling the bacteria during the skinning process. Tularemia is not spread directly from person to person.

No vaccine is available to the general public The best way to prevent tularemia infection is to wear rubber gloves when handling or skinning rodents or lagomorphs (as rabbits), avoid ingesting uncooked wild game and untreated water sources, and wearing long-sleeved clothes and using an insect repellant to prevent tick bites.

Prevention

No vaccine is available to the general public The best way to prevent tularemia infection is to wear rubber gloves when handling or skinning rodents or lagomorphs (as rabbits), avoid ingesting uncooked wild game and untreated water sources, and wearing long-sleeved clothes and using an insect repellant to prevent tick bites.

Other diseases primarily transmitted by Arthropods (Ticks, mites, lice etc.)

Thyphus (Not to be confused with Typhoid Fever [discussed in these FLDs])

For the unrelated disease caused by Salmonella typhi, see Typhoid fever. For the unrelated disease caused by Salmonella paratyphi, please refer to Paratyphoid fever. For the monster of Greek mythology, see Typhus (monster).

Typhus is any one of several similar diseases caused by louse-borne bacteria. The name comes from the Greek *typhos*, meaning smoky or lazy, describing the state of mind of those affected with typhus. *Rickettsia* is endemic in rodent hosts, including mice and rats, and spreads to humans through mites, fleas and body lice. The arthropod vector flourishes under conditions of poor hygiene, such as those found in prisons or refugee camps, amongst the homeless, or until the middle of the 20th century, in armies in the field. In tropical countries, typhus is often mistaken for dengue fever.

Endemic typhu

Endemic typhus (also called "flea-borne typhus" and "murine typhus" or "rat flea typhus") is caused by the bacteria *Rickettsia typhi*, and is transmitted by the flea that infest rats. Symptoms of endemic typhus include headache, fever, chills, myalgia, nausea, vomiting, and cough.

Endemic typhus is highly treatable with antibiotics. Most people recover fully, but death may occur in the elderly, severely disabled or patients with a depressed immune system.

Encephalitis Arboviral Encephalitides

Perspectives

Arthropod-borne viruses, i.e., arboviruses, are viruses that are maintained in nature through biological transmission between susceptible vertebrate hosts by blood feeding arthropods (mosquitoes, psychodids, ceratopogonids, and ticks). Vertebrate infection occurs when the infected arthropod takes a blood meal. The term 'arbovirus' has no taxonomic significance. Arboviruses that cause human encephalitis are members of three virus families: the *Togaviridae* (genus Alphavirus, *Flaviviridae*, and *Bunyaviridae*.

All arboviral encephalitides are zoonotic, being maintained in complex life cycles involving a nonhuman primary vertebrate host and a primary arthropod vector. These cycles usually remain undetected until humans encroach on a natural focus, or the virus escapes this focus via a secondary vector or vertebrate host as the result of some ecologic change. Humans and domestic animals can develop clinical illness but usually are "dead-end" hosts because they do not produce significant viremia, and do not contribute to the transmission cycle. Many arboviruses that cause encephalitis have a variety of different vertebrate hosts and some are transmitted by more than one vector. Maintenance of the viruses in nature may be facilitated by vertical transmission (e.g., the virus is transmitted from the female through the eggs to the offspring).

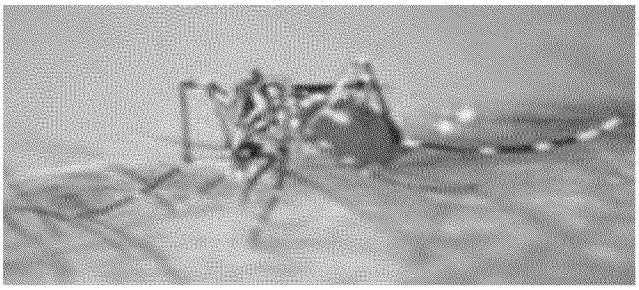
Arboviral encephalitides have a global distribution, but there are four main virus agents of encephalitis in the United States, all of which are transmitted by mosquitoes. A new Powassan-like virus has recently been isolated from deer ticks. Its relatedness to Powassan virus and its ability to cause disease has not been well documented. Most cases of arboviral encephalitis occur from June through September, when arthropods are most active. In milder (i.e., warmer) parts of the country, where arthropods are active late into the year, cases can occur into the winter months.

There is expanded discussion of several of these diseases (West Nile and Eastern Equien Encephalitis elsewhere in this document. A more general discussion is found in Attachment 2.

Mosquito Borne Diseases

Malaria

Malaria is a mosquito-borne disease caused by a parasite. Four kinds of malaria parasites can infect humans: *Plasmodium falciparum, P. vivax, P. ovale,* and *P. malariae*.



People with malaria often experience fever, chills, and flu-like illness. Left untreated, they may develop severe complications and die. Each year 350-500 million cases of malaria occur worldwide. Infection with any of the malaria species can make a person feel very ill; infection with *P. falciparum*, if not promptly treated, may be fatal. Although malaria can be a fatal disease, illness and death from malaria are largely preventable.

This sometimes fatal disease can be prevented and cured. Bed nets, insecticides, and anti-malarial drugs are effective tools to fight malaria in areas where it is transmitted. Travelers to a malaria-risk area should avoid mosquito bites and take a preventive anti-malarial drug. Malaria was eradicated from the United States in the early 1950s. However, malaria is common in many developing countries and travelers who visit these areas risk getting malaria.

Returning travelers and arriving immigrants could also reintroduce the disease in the United States if they are infected with malaria when they return. The mosquito that transmits malaria, *Anopheles*, is found throughout much of the United States. If local mosquitoes bite an infected person, those mosquitoes can, in turn, infect local residents (*introduced malaria*).

Because the malaria parasite is found in red blood cells, malaria can also be transmitted through blood transfusion, organ transplant, or the shared use of needles or syringes contaminated with blood. Malaria may also be transmitted from a mother to her fetus before or during delivery ("congenital" malaria).

Malaria is not transmitted from person to person like a cold or the flu. You cannot get malaria from casual contact with malaria-infected people.

Prevention and control

You can prevent malaria by:

- keeping mosquitoes from biting you, especially at night
- taking anti-malarial drugs to kill the parasites
- eliminating places where mosquitoes breed
- spraying insecticides on walls to kill adult mosquitoes that come inside
- sleeping under bed nets - especially effective if they have been treated with insecticide,
- wearing insect repellent and long-sleeved clothing if out of doors at night

The surest way for you and your health-care provider to know whether you have malaria is to have a diagnostic test where a drop of your blood is examined under the microscope for the presence of malaria parasites. If you are sick and there is any suspicion of malaria (for example, if you have recently traveled in a malaria-risk area) the test should be performed without delay.

The disease should be treated early in its course, before it becomes severe and poses a risk to the patient's life. Several good anti-malarial drugs are available, and should be administered early on. The most important step is to think about malaria, so that the disease is diagnosed and treated in time.

West Nile Virus

West Nile virus (WNV) is a potentially serious illness. Experts believe WNV is established as a seasonal epidemic in North America that flares up in the summer and continues into the fall. This fact sheet contains important information that can help you recognize and prevent WNV.

The easiest and best way to avoid WNV is to prevent mosquito bites.

- When you are outdoors, use insect repellent containing an EPA-registered active ingredient . Follow the directions on the package.

- Many mosquitoes are most active at dusk and dawn. Be sure to use insect repellent and wear long sleeves and pants at these times or consider staying indoors during these hours.

- Make sure you have good screens on your windows and doors to keep mosquitoes out.

- Get rid of mosquito breeding sites by emptying standing water from buckets, barrels and drainage ditches.

About one in 150 people infected with WNV will develop severe illness. The severe symptoms can include high fever, headache, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis. These symptoms may last several weeks, and neurological effects may be permanent.

Up to 20 percent of the people who become infected have symptoms such as fever, headache, and body aches, nausea, vomiting, and sometimes swollen lymph glands or a skin rash on the chest, stomach and back. Symptoms can last for as short as a few days, though even healthy people have become sick for several weeks.

Approximately 80 percent of people (about 4 out of 5) who are infected with WNV will not show any symptoms at all. Most often, WNV is spread by the bite of an infected mosquito. Mosquitoes become infected when they feed on infected birds. Infected mosquitoes can then spread WNV to humans and other animals when they bite.

In a very small number of cases, WNV also has been spread through blood transfusions, organ transplants, breastfeeding and even during pregnancy from mother to baby.

WNV is not spread through casual contact such as touching or kissing a person with the virus.

Symptoms typically develop between 3 - 14 days after being bitten by an infected mosquito.

There is no specific treatment for WNV infection. In cases with milder symptoms, people experience symptoms such as fever and aches that pass on their own, although even healthy people have become sick for several weeks. In more severe cases, people usually need to go to the hospital where they can receive supportive treatment including intravenous fluids, help with breathing and nursing care.

Milder WNV illness improves on its own, and people do not necessarily need to seek medical attention for this infection though they may choose to do so. If you develop symptoms of severe WNV illness, such as unusually severe headaches or confusion, seek medical attention immediately. Severe WNV illness usually requires hospitalization. Pregnant women and nursing mothers are encouraged to talk to their doctor if they develop symptoms that could be WNV. People over the age of 50 are more likely to develop serious symptoms of WNV if they do get sick and should take special care to avoid mosquito bites.

The more time you're outdoors, the more time you could be bitten by an infected mosquito. Pay attention to avoiding mosquito bites if you spend a lot of time outside, either working or playing.

All donated blood is checked for WNV before being used. The risk of getting WNV through blood transfusions and organ transplants is very small, and should not prevent people who need surgery from having it. If you have concerns, talk to your doctor.

Equine Encephalitis

Eastern equine encephalitis (EEE) is a mosquito-borne viral disease. EEE virus (EEEV) occurs in the eastern half of the United States where it causes disease in humans, horses, and some bird species. Because of the high mortality rate, EEE is regarded as one of the most serious mosquito-borne diseases in the United States.

EEEV is transmitted to humans through the bite of an infected mosquito. It generally takes from 3 to 10 days to develop symptoms of EEE after being bitten by an infected mosquito. The main EEEV transmission cycle is between birds and mosquitoes.

Many species of mosquitoes can become infected with EEEV. The most important mosquito species in maintaining the bird-mosquito transmission cycle is *Culiseta melanura*, which reproduces in freshwater hardwood swamps. *Culiseta melanura*, however, is not considered to be an important vector of EEEV to horses or humans because it feeds almost exclusively on birds.

Transmission to horses or humans requires mosquito species capable of creating a "bridge" between infected birds and uninfected mammals such as some *Aedes*, *Coquillettidia*, and *Culex* species.

Horses are susceptible to EEE and some cases are fatal. EEEV infections in horses, however, are not a significant risk factor for human infection because horses are considered to be "dead-end" hosts for the virus (i.e., the amount of EEEV in their bloodstreams is usually insufficient to infect mosquitoes).

Eastern equine encephalitis virus is a member of the family Togaviridae, genus *Alphaviru* closely related to Western equine encephalitis virus and Venezuelan equine encephalitis virus

Many persons infected with EEEV have no apparent illness. In those persons who do develop illness, symptoms range from mild flu-like illness to inflammation of the brain, coma and death.

The mortality rate from EEE is approximately one-third, making it one of the most deadly mosquito-borne diseases in the United States.

There is no specific treatment for EEE; optimal medical care includes hospitalization and supportive care (for example, expert nursing care, respiratory support, prevention of secondary bacterial infections, and physical therapy, depending on the situation).

Approximately half of those persons who survive EEE will have mild to severe permanent neurologic damage.

Incidence rate includes:

- Approximately 220 confirmed cases in the US 1964-2004, Average of 5 cases/year, with a range from 0-15 cases

- States with largest number of cases includes New Jersey.

- EEEV transmission is most common in and around freshwater hardwood swamps in the Atlantic Coast states and the Great Lakes region.

- Human cases occur relatively infrequently, largely because the primary transmission cycle takes place in and around swampy areas where human populations tend to be limited.

Risk Groups:

- Residents of and visitors to endemic areas (areas with an established presence of the virus)

- People who engage in outdoor work and recreational activities in endemic areas.

- Persons over age 50 and younger than age 15 seem to be at greatest risk for developing severe EEE when infected with the virus.

Prevention

- A vaccine is available to protect equines.

- People should avoid mosquito bites by employing personal and workplace protection measures, such as using an EPA-registered repellent according to manufacturers' instructions, wearing protective clothing, avoiding outdoor activity when mosquitoes are active (some bridge vectors of EEEV are aggressive day-biters), and removing standing water that can provide mosquito breeding sites.

- There are laboratory tests to diagnosis EEEV infection including serology, especially IgM testing of serum and cerebrospinal fluid (CSF), and neutralizing antibody testing of acute- and convalescent-phase serum.

Meningitis

Meningitis is a viral disease that can affect the central nervous system that is transmitted through the bite from an infected mosquito.

Symptoms can be nonexistent or severe and flu-like, with fever, chills, tiredness, headache, nausea and vomiting. If not treated promptly the disease can be fatal.

Prevention

- A vaccine is available. It's 80% effective after a single dose and 97.5% effective after a second dose.

  Use precautions as for other mosquito borne diseases. Avoid mosquito bites by employing personal and workplace protection measures, such as using an EPA-registered repellent according to manufacturers' instructions, wearing protective clothing, avoiding outdoor activity when mosquitoes are active and removing standing water that can provide mosquito breeding sites.

Deer Flies (See Tularemia above)

Fleas

Flea is a common name for insects of the order Siphonaptera which are wingless insects with mouthparts adapted for piercing skin and sucking blood. Fleas are external parasites, living by hematophagy off the blood of mammals (including humans). Some species include the cat flea (*Ctenocephalides felis*), dog flea (*Ctenocephalides canis*), and human flea (*Pulex irritans*).

Fleas are small (1.5 to 3.3 mm) long, agile, dark-colored, wingless insect with tube-like mouth parts adapted to feeding on the blood of their hoists. Their legs are long, with the hind pair well adapted for jumping. A flea can jump vertically up to seven inches and horizontally up to 13 inches. The flea body is hard, polished, and covered with many hairs and short spines directed backwards which assists its movement on the host. The body is able to withstand great pressure. Hard squeezing between the fingers is not normally sufficient to kill a flea.

Fleas lay tiny white oval-shaped eggs. The larva is small, pale, has bristles covering its worm-like body, lacks eyes, and has mouthparts adapted to chewing.

Fleas can cause medical problems include flea allergy dermatitis, secondary skin irritations and, in extreme cases, anemia, tapeworms, and stomach flu. Fleas can transmit murine typhus (endemic typhus) fever among animals and from animal to humans. Fleas can also transmit bubonic plague. Tapeworms normally infest in human severe cases. Although the bite is rarely felt, it is the resulting irritation caused by the flea salivary secretions that varies among individuals. Some result in a severe reaction including a general rash or inflammation resulting in secondary infections caused by scratching the irritated shin. Most bites are found on the feet and legs with the formation of small, hard, red, slightly raised itching spots with a single puncture point in the center of each spot.

Treatment

Flea bites can be treated with anti-itch creams, usually antihistamines or hydrocortisone.

Bed Bugs

Bed bugs are small parasitic insects that feed on human blood. A number of health effects may occur due to bed bugs including skin rashes, prominent blisters, psychological effects and allergic symptoms. Diagnosis involves finding the bed bugs and the occurrence of compatible symptoms. Treatment is otherwise symptomatic.

Adult bed bugs are reddish-brown, flattened, oval and wingless. Bed bugs have microscopic hairs that give them a banded appearance. Adults grow to 4-5mm in length and 1.5-3 mm wide. A bed bug pierces the skin of its host with two hollow feeding tubes shaped like tongues. The one tube injects its saliva, which contains anticoagulants and anesthetics, while the other draws blood of its host. After feeding for approximately five minutes, the bug returns to its hiding place. Although bed bugs can live for a year without feeding, they normally feed every five to ten days.

Eradication of bed bugs frequently requires a combination of pesticide and non-pesticide approaches. Pyrethroids, dichlorvos, and malathion have historically been effective. Mechanical approaches include vacuuming and heat treating or wrapping mattresses have also been recommended.

ATTACHMENT 1

RICKETTSIAL INFECTIONS

Rickettsial Infections

Description

Many species of Rickettsia can cause illnesses in humans (Table below). The term "rickettsiae" conventionally embraces a polyphyletic group of microorganisms in the class Proteobacteria, comprising species belonging to the genera *Rickettsia*, *Ehrlichia, Coxiella*, and *Bartonella*. These agents are usually not transmissible directly from person to person except by blood transfusion or organ transplantation, although sexual and placental transmission has been proposed for *Coxiella*. Transmission generally occurs via an infected arthropod vector or through exposure to an infected animal reservoir host. However, sennetsu fever is acquired following consumption of raw fish products. The clinical severity and duration of illnesses associated with different rickettsial infections vary considerably, even within a given antigenic group. Rickettsioses range in severity from diseases that are usually relatively mild (cat scratch disease) to those that can be life-threatening (murine typhus) and they vary in duration from those that can be self-limiting to chronic (Q fever and bartonelloses) or recrudescent (Brill-Zinsser disease). Most patients with rickettsial infections recover with timely use of appropriate antibiotic therapy.

Travelers may be at risk for exposure to agents of rickettsial diseases if they engage in occupational or recreational activities which bring them into contact with habitats that support the vectors or animal reservoir species associated with these pathogens.

The geographic distribution and the risks for exposure to rickettsial agents are described below and in the Table below.

Trench Fever

Trench fever, which is caused by *Bartonella quintanta*, is transmitted from one person to another by the human body louse. Contemporary outbreaks of both diseases are rare in most developed countries and generally occur only in communities and populations in which body louse infestations are frequent, especially during the colder months when louse-infested clothing is not laundered. Foci of trench fever have also been recognized among homeless populations in urban centers of industrialized countries. Travelers who are not at risk of exposure to body lice or to persons with lice are unlikely to acquire these illnesses. However, health-care workers who care for these patients may be at risk for acquiring louse-borne illnesses through inhalation or inoculation of infectious louse feces into the skin or conjunctiva.

Murine Typhus

Murine typhus, which is caused by infection with *Rickettsia typhi*, is transmitted to humans by rat fleas, particularly during exposure in rat-infested buildings (3). Flea-infested rats can be found throughout the year in humid tropical environments, especially in harbor or riverine environments. In temperate regions, they are most common during the warm summer months.

Travelers who participate in outdoor activities in grassy or wooded areas (e.g., trekking, camping, or going on safari) may be at risk for acquiring tick-borne illnesses, including those caused by *Rickettsia,* and *Ehrlichia* species (see below).

TABLE Epidemiologic features and symptoms of rickettsial diseases

ANTIGENIC GROUP	DISEASE	AGENT	PREDOMINANT SYMPTOMS*	VECTOR OR ACQUISITION MECHANISM	ANIMAL RESERVOIR	GEOGRAPHIC DISTRIBUTION OUTSIDE THE US
Typhus fevers	Murine typhus	*R. typhi*	As above, generally less severe	Rat flea	Rats, mice	Worldwide
Spotted fevers						
Coxiella	Q fever	*Coxiella burnetii*	Fever, headache, chills, sweating, pneumonia, hepatitis, endocarditis	Most human infections are acquired by inhalation of infectious aerosols; tick	Goats, sheep, cattle, domestic cats, other	Worldwide
Bartonella	Cat-scratch disease	*Bartonella henselae*	Fever, adenopathy, neuroretinitis, encephalitis	Cat flea	Domestic cats	Worldwide
	Trench fever	*B. quintana*	Fever, headache, pain in shins, splenomegaly, disseminated rash	Human body louse	Humans	Worldwide
Ehrlichia	Ehrlichosis	*Ehrlichia chaffeensis*#	Fever, headache, nausea, occasionally rash	Tick	Various large and small mammals, including deer and rodents	Worldwide

This represents only a partial list of symptoms. Patients may have different symptoms or only a few of those listed.

Anaplasmosis aznd Ehrlichiosis

Human ehrlichiosis and anaplasmosis are acute tick-borne diseases, associated with the lone star tick, *Amblyomma americanum*, and *Ixodes* ticks, respectively. Because one tick may be infected with more than one tick-borne pathogen (e.g. *Borrelia burgdorferi*, the causative agent of Lyme disease, or various *Babesia* species, agent of human babesiosis), patients may be present with

atypical clinical symptoms that complicate treatment. Ehrlichioses and anaplasmosis are characterized by infection of different types of leukocytes, where the causative agent multiplies in cytoplasmic membrane-bound vacuole called morulae. Morulae can sometimes be detected in Giemsa-stained blood smears.

Q FEVER

Q fever occurs worldwide, most often in persons who have contact with infected goat, sheep, cat and cattle, particularly parturient animals (especially farmers, veterinarians, butchers, meat packers, and seasonal workers). Travelers who visit farms or rural communities can be exposed to *Coxiella burnetii*, the agent of Q fever, through airborne transmission (via animal-contaminated soil and dust) or less commonly through consumption of unpasteurized milk products or by exposure to infected ticks. These infections may initially result in only mild and self-limiting influenza-like illnesses, but if untreated, infections may become chronic, particularly in persons with preexisting heart valve abnormalities or with prosthetic valves. Such persons can develop chronic and potentially fatal endocarditis.

Cat-Scratch Disease

Cat-scratch disease is contracted through scratches and bites from domestic cats, particularly kittens, infected with *Bartonella henselae*, and possibly from their fleas (3, 4). Exposure can therefore occur wherever cats are found.

Symptoms

Clinical presentations of rickettsial illnesses vary (Table above), but common early symptoms, including fever, headache, and malaise, are generally nonspecific. Illnesses resulting from infection with rickettsial agents may go unrecognized or are attributed to other causes. Atypical presentations are common and may be expected with poorly characterized non-indigenous agents, so appropriate samples for examination by specialized reference laboratories should be obtained. A diagnosis of rickettsial diseases is based on two or more of the following: 1) clinical symptoms and an epidemiologic history compatible with a rickettsial disease, 2) the development of specific convalescent-phase antibodies reactive with a given pathogen or antigenic group, 3) a positive polymerase chain reaction test result, 4) specific immunohistologic detection of rickettsial agent, or 5) isolation of a rickettsial agent. Ascertaining the likely place and the nature of potential exposures is particularly helpful for accurate diagnostic testing.

Prevention

With the exception of the louse-borne diseases described above, for which contact with infectious arthropod feces is the primary mode of transmission (through autoinoculation into a wound, conjunctiva, or inhalation), travelers and health-care providers are generally not at risk for becoming infected via exposure to an ill person. Limiting exposures to vectors or animal reservoirs remains the best means for reducing the risk for disease. Travelers and persons working in areas where organisms may be present should implement prevention based on avoidance of vector-infested habitats, use of repellents and protective clothing, prompt detection and removal of arthropods from clothing and skin, and attention to hygiene.

Q fever and *Bartonella* group diseases may pose a special risk for persons with abnormal or prosthetic heart valves, and *Rickettsia, Ehrlichia*, and *Bartonella* for persons who are immuno-compromised.

ATTACHMENT 2

ENCEPHALITIS ARBOVIRAL ENCEPHALITIDES

Encephalitis Arboviral Encephalitides

Perspectives

Arthropod-borne viruses, i.e., arboviruses, are viruses that are maintained in nature through biological transmission between susceptible vertebrate hosts by blood feeding arthropods (mosquitoes, psychodids, ceratopogonids, and ticks). Vertebrate infection occurs when the infected arthropod takes a blood meal. The term 'arbovirus' has no taxonomic significance. Arboviruses that cause human encephalitis are members of three virus families: the *Togaviridae* (genus Alphavirus, *Flaviviridae*, and *Bunyaviridae*.

All arboviral encephalitides are zoonotic, being maintained in complex life cycles involving a nonhuman primary vertebrate host and a primary arthropod vector. These cycles usually remain undetected until humans encroach on a natural focus, or the virus escapes this focus via a secondary vector or vertebrate host as the result of some ecologic change. Humans and domestic animals can develop clinical illness but usually are "dead-end" hosts because they do not produce significant viremia, and do not contribute to the transmission cycle. Many arboviruses that cause encephalitis have a variety of different vertebrate hosts and some are transmitted by more than one vector. Maintenance of the viruses in nature may be facilitated by vertical transmission (e.g., the virus is transmitted from the female through the eggs to the offspring).

Arboviral encephalitides have a global distribution which is transmitted by mosquitoes. Powassan, is a minor cause of encephalitis in the northern United States, and is transmitted by ticks. A new Powassan-like virus has recently been isolated from deer ticks. Its relatedness to Powassan virus and its ability to cause disease has not been well documented. Most cases of arboviral encephalitis occur from June through September, when arthropods are most active. In milder (i.e., warmer) parts of the country, where arthropods are active late into the year, cases can occur into the winter months.

The majority of human infections is asymptomatic or may result in a nonspecific flu-like syndrome. Onset may be insidious or sudden with fever, headache, myalgias, malaise and occasionally prostration. Infection may, however, lead to encephalitis, with a fatal outcome or permanent neurologic sequelae. Fortunately, only a small proportion of infected persons progress to frank encephalitis.

Experimental studies have shown that invasion of the central nervous system (CNS), generally follows initial virus replication in various peripheral sites and a period of viremia. Viral transfer from the blood to the CNS through the olfactory tract has been suggested. Because the arboviral encephalitides are viral diseases, antibiotics are not effective for treatment and no effective antiviral drugs have yet been discovered.

Prevention

Arboviral encephalitis can be prevented in two major ways: personal protective measures and public health measures to reduce the population of infected mosquitoes. Personal measures include reducing time outdoors particularly in early evening hours, wearing long pants and long sleeved shirts and applying mosquito repellent to exposed skin areas. Public health measures often require spraying of insecticides to kill juvenile (larvae) and adult mosquitoes.

Selection of mosquito control methods depends on what needs to be achieved; but, in most emergency situations, the preferred method to achieve maximum results over a wide area is aerial spraying. In many states aerial spraying may be available in certain locations as a means to control nuisance mosquitoes. Such resources can be redirected to areas of virus activity. When aerial spraying is not routinely used, such services are usually contracted for a given time period. Financing of aerial spraying costs during large outbreaks is usually provided by state emergency contingency funds. Federal funding of emergency spraying is rare and almost always requires a federal disaster declaration. Such disaster declarations usually occur when the vector-borne disease has the potential to infect large numbers of people, when a large population is at risk and when the area requiring treatment is extensive. Special large planes maintained by the United States Air Force can be called upon to deliver the insecticide(s) chosen for such emergencies. Federal disaster declarations have relied heavily on risk assessment by the CDC.

There are no commercially available human vaccines for these U.S. diseases.

Powassan Encephalitis

Powassan (POW) virus is a flavivirus and currently the only well documented tick-borne transmitted arbovirus occurring in the United States and Canada. Recently a Powassan-like virus was isolated from the deer tick, *Ixodes scapularis*. Its relationship to POW and its ability to cause human disease has not been fully elucidated. POW's range in the United States is primarily in the upper tier States. In addition to isolations from man, the virus has been recovered from ticks *(Ixodes marxi, I. cookei* and *Dermacentor andersoni*) and from the tissues of a skunk (*Spiligale putorius*). It is a rare cause of acute viral encephalitis. POW virus was first isolated from the brain of a 5-year-old child who died in Ontario in 1958. Patients who recover may have residual neurological problems.

Other Arboviral Encephalitides

Many other arboviral encephalitides occur throughout the world. Most of these diseases are problems only for those individuals traveling to countries where the viruses are endemic.

West Nile Encephalitis

Discussed elsewhere in this document

FLD 43 D HAZARDOUS PLANTS

A number of hazardous plants may be encountered during field operations. The ailments associated with these plants range from mild hay fever to contact dermatitis. Plants that present the greatest risk to site workers are those that produce allergic reactions and tissue injury.

Plants That Cause Skin and Tissue Injury

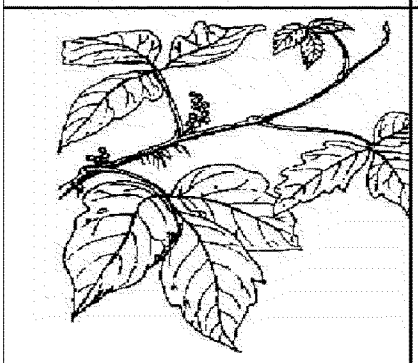
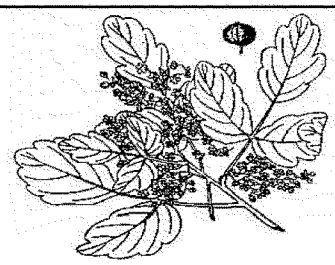
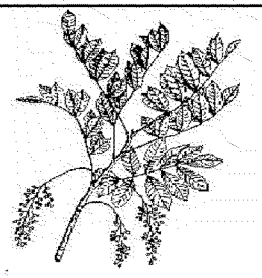
Contact with sharp leaves and thorns are of special concern to site personnel. This concern stems from the fact that punctures, cuts, and even minor scrapes caused by accidental contact may result in skin lesions and the introduction of fungi or bacteria through the skin. This is especially important in light of the fact that the warm moist environment created inside protective clothing is ideal for the propagation of fungal and bacterial infection. Personnel receiving any of the injuries listed above, even minor scrapes shall report immediately for continued observation and care. Keeping the skin covered as much as possible (i.e., long pants and long sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.

Plants That Cause an Allergic Reaction

The poisonous plants of greatest concern are poison ivy, poison oak, and poison sumac. Contact with the poisonous sap of these plants produces a severe rash characterized by redness, blisters, swelling, and intense burning and itching. The victim also may develop a high fever and may be very ill. Ordinarily, the rash begins within a few hours after exposure, but it may be delayed for 24 to 48 hours.

The most distinctive features of poison ivy and poison oak are their leaves, which are composed of three leaflets each. In certain seasons, both plants also have greenish-white flowers and berries that grow in clusters. Poison sumac is a tall shrub or small tree with 6 to 12 leaflets arranged in pairs with a single leaflet at the end. This plant grows in wooded, swampy areas.

Poison Ivy/Poison Oak/Poison Sumac

Poison Ivy	Poison Oak	Poison Sumac
		

The reaction associated with exposure to these plants will generally cause the following signs and symptoms:

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact
- Reddening, swelling, itching and burning at the site of contact
- Pain, if the reaction is severe
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin

If the rash is scratched, secondary infections can occur. Preventive measures that are effective for most site personnel include:

- Avoid contact with any poisonous plants on site, and keep a steady watch to identify, report and mark poisonous plants found on site
- Wash hands, face or other exposed areas at the beginning of each break period and at the end of each workday
- Avoid contact with, and wash on a daily basis, contaminated tools, equipment and clothing
- Barrier creams, detoxification/wash solutions and orally administered desensitization may prove effective and should be tried to find the best preventive solution

Keeping the skin covered as much as possible (i.e., long pants and long sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.

Plants That are Poisonous

There are a number of plants worldwide beside poison ivy, oak and sumac which have poisonous properties. In many cases consumption of these plants or parts of these plants can result in poisoning. In other cases, contact with the plants may be poisonous. The following is a listing with pertinent information on poisonous properties and locations of a number of plants.

In general, when working in the outdoors or where you may come in contact with household plants or where your families may come in contact with these plants, it is important that as soon as possible after contact the area or areas should be thoroughly washed and hands must be thoroughly washed before eating drinking, smoking or any other hand to mouth contact.

In keeping with our 24/7 BBS concept, it is important to remember that children are particularly vulnerable to many of the poisonous parts of these plants. Many of these poisonous parts resemble non-poisonous food items such as berries and are attractive.

As with most lists there is extensive information but the list may not include all poisonous plants.

It is important to remember that this document is a starting point to be supplemented with local information. The majority of this information is from a list found in Wikipedia an on line Dictionary readily accessible via Google. The website has pictures of these plants as well as links to other information sources.

POISONOUS PLANTS

From Wikipedia,

This is a list of plants containing poisonous parts that pose a serious risk of illness, injury, or death to humans.

Poisonous Food Plants

- Apple (*Malus domestica*) **Found worldwide in cooler climates**. Seeds contain cyanogenic glycosides; although the amount found in most apples won't kill a person.

- Cherry (*Prunus cerasus*), as well as other species (*Prunus spp*) such as peach (*Prunus persica*), plum (*Prunus domestica*), almond (*Prunus dulcis*) and apricot (*Prunus armeninaca*). **There are around 430 species of *Prunus*, spread throughout the northern temperate regions of the globe.** Leaves and seeds contain cyanogenic glycosides

- Rhubarb (*Rheum rhaponticum*) **Found worldwide**. Leaves, but not stems, contain oxalic acid salts, causing kidney disorders, convulsions, and coma. Rarely fatal.

- Tomato (*Solanum lycopersicum*) **Found worldwide.** Foliage and vines contain alkaloid poisons which cause digestive upset and nervous excitement.

Other Poisonous Plants

- Autumn crocus. **Found in North America.** The bulbs are poisonous and cause nausea, vomiting, diarrhea. **Can be fatal**.

- Azalea **Found Worldwide.** All parts of the plant are poisonous and cause nausea, vomiting, depression, breathing difficulties, and coma. Rarely fatal.

- Bittersweet nightshade N**aturalized in North America.** All parts are poisonous, containing solanine and causing fatigue, paralysis, convulsions and diarrhea. Rarely fatal.

- Bleeding heart / Dutchman's breeches. **Found in North America.** Leaves and roots are poisonous and cause convulsions and other nervous symptoms.

- Black locust. **Naturalized in North America**. Pods are toxic

- Caladium / Elephant ear. **Ornamental plants in North America.** All parts of the plant are poisonous. Symptoms are generally irritation, pain, and swelling of tissues. If the mouth or tongue swells, breathing may be fatally blocked.

- Castor Oil Plant (*Ricinus communis*) Castor Oil Plant. **Found Worldwide.** The phytotoxin is **ricin**, an extremely toxic water soluble protein, which is concentrated in the seed. Also present are ricinine, an alkaloid, and an irritant oil. Causes burning in mouth and throat, convulsions, and is **often fatal.**

- Daffodil. **Found worldwide.** The bulbs are poisonous and cause nausea, vomiting, and diarrhea. **Can be fatal**.

- Daphne (*Daphne sp.*) **Ornamental plant worldwide**. The berries (either red or yellow) are poisonous, causing burns to mouth and digestive tract, followed by coma. **Often fatal.**

- Darnel/Poison Ryegrass (*Lolium temulentum*) **Usually grows in the same production zones as wheat and is considered a weed.** The seeds and seed heads of this common garden weed may contain the alkaloids temuline and loliine. Some experts also point to the fungus ergot or fungi of the genus endoconidium both of which grow on the seed heads of rye grasses as an additional source of toxicity.

- Deadly nightshade (*Atropa belladonna*) **Naturalized in parts of North America**. All parts of the plant contain the toxic alkaloid atropine. The young plants and seeds are especially poisonous, causing nausea, muscle twitches, paralysis; **often fatal**.

- Dumbcane / dieffenbachia. **Found in tropical areas and popular as house plants.** All parts are poisonous, causing intense burning, irritation, and immobility of the tongue, mouth, and throat. Swelling can be severe enough to block breathing leading to death.

- Ivy**. Native to North America** where winters are not severe. The leaves and berries are poisonous, causing stomach pains, labored breathing, possible coma.
- Jerusalem cherry **United States** All parts, especially the berries, are poisonous, causing nausea and vomiting. **Looks like a cherry tomato**. It is occasionally fatal, especially to children.

- Lilies **Worldwide** There are some 3500 species that comprise the lily (Lilaceae) family. Some are beneficial including (foods such as onion, shallot, garlic, chives [all *Allium* spp] and asparagus) and some with medicinal uses (colchicine and red squill) Many produce alkalids which are poisonous, especially to cats.

- Manchineel (*Hippomane mancinella*) **Native to the Caribbean (including Puerto Rico and the Virgin Islands).** It is one of the most poisonous trees in the world All parts of this tree including the fruit contain toxic phorbol esters typical of the Euphorbiacea. Sap may cause burning of the skin and smoke form burning may cause eye irritation and blindness. Fruits, which are similar in appearance to an apple, are green or greenish-yellow when ripe.

- Oak Worldwide Most species foliage and acorns are mildly poisonous, causing digestive upset, heart trouble, contact dermatitis. Rarely fatal.

- Poison-ivy (*Toxicodendron radicans*), Poison-oak (*T. diversilobum*), and Poison Sumac (*T.vernix*) **North America** All parts of these plants contain a highly irritating oil with urushiol (this is actually not a poison but an allergen). Skin reactions can include blisters and rashes. It spreads readily to clothes and back again, and has a very long life. Infections can follow scratching.

- Pokeweed (*Phytolacca sp.*) **Native to North America.** Leaves, berries and roots contain phytolaccatoxin and phytolaccigenin - toxin in young leaves is reduced with each boiling and draining.

RADIATION SAFETY

THE APPROVAL SIGNATURES ARE KEPT ON FILE
WITH WESTON'S POLICIES AND PRACTICES

Document Number: OP 11-01-022
Type of Document: Operating Practice
Effective Date: 12/01/07
Revision Number: 03

Initiated by: R.P. Schoenfelder
Legal Review: D.B. Bauer
Approved by: O.B. Douglass

1.0 PURPOSE

It is the policy of Weston Solutions, Inc. (WESTON®) that all managers and employees will conduct radiological work activities in a manner that keeps radiation exposures as low as reasonably achievable (ALARA), and in compliance with the requirements of WESTON's source material licenses and applicable regulations as specified in Section 2.

WESTON and its subcontractors will take all reasonable precautions in planning and conducting work activities at sites actually or potentially contaminated with radioactive materials to minimize exposures to workers and the public, and to prevent the spread of contamination to the environment. WESTON will maintain this policy by implementing project designs, field engineering controls, administrative exposure limits, and work practices in accordance with guidance provided in this operating practice. WESTON may adopt as policy the recommendations of the International Commission of Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP) to the extent that they are consistent with existing corporate policy and regulatory requirements. In addition, WESTON and its subcontractors shall conduct work activities in compliance with applicable Federal, state and local regulations.

This operating practice defines the WESTON radiation safety organization and the administrative health and safety responsibilities of project personnel.

It provides guidance for radiological projects from conceptual design through field implementation. It specifies criteria for complying with regulatory standards, and describes radiological protection program components, guidelines for storage and transportation of radioactive materials, and administrative limits applicable to radiological operations. It is intended to provide uniformity in WESTON's approach to field projects involving potential exposures to ionizing radiation.

2.0 STANDARDS AND REGULATIONS

WESTON and its subcontractors will comply with all applicable Federal, state, and local radiation safety regulations and requirements including, but not limited to, those established by the Occupational Safety and Health Administration (OSHA) and the U.S. Nuclear Regulatory Commission (NRC). Special attention should be given to the regulations listed below. Other requirements may apply at facilities owned or regulated by other Federal departments or state agencies.

- 29 CFR Part 1910, "Occupational Safety and Health Standards."

- 49 CFR Parts 172-174, "Transportation of Hazardous Materials."

- 10 CFR Part 20, "Standards for Protection Against Radiation."

- 10 CFR Part 835, Chapter 3 – Department of Energy "Occupational Radiation Protection."

3.0 RADIATION EXPOSURE STANDARDS AND WESTON ADMINISTRATIVE LIMITS

To ensure compliance with applicable radiation exposure standards, WESTON institutes administrative limits for WESTON employees and subcontractors that are more restrictive than the regulatory limits provided in 29 CFR 1910.1096. These administrative limits are 100 millirem (mrem) per calendar year dose to the whole body from internal and external sources, and 10 percent of the applicable limits for inhalation and ingestion. The applicable limits for inhalation and ingestion will be taken from 10 CFR 20 Subpart C when no other regulatory limits apply. The administrative limits will not be exceeded without prior approvals in accordance with the following provisions:

- Exposures ranging from the administrative limit of 100 mrem per year up to 500 mrem per year and 30 percent of the 10 CFR 20 Appendix B, Table I limits may be approved by the Profit Center Manager or Project Manager only if affected employees have received site-specific training that describes the potential exposure levels and health risks associated with the project or emergency response action involving nuclear, biological and/or chemical materials, appropriate health physics monitoring is conducted under the supervision of a professional health physicist (with appropriate experience), and a task-specific ALARA program has been reviewed by a health physicist and implemented for the project.

- Planned exposures above 500 mrem per year, including emergency response operations that have the potential for exposures up to a maximum of 5000 mrem per year or 3000 mrem per calendar quarter (the maximum radiation dose allowed per 29 CFR 1910.1096), are permitted after a Project/Program-specific Radiation Safety Plan has been developed and reviewed by the Director, Corporate Environmental Health and Safety (CEHS) and/or the Corporate Radiation Safety Officer (CRSO). Weston employees or subcontractors shall not participate in work activities for any duration where the work exposures (dose equivalents) have the potential to exceed 3000 mrem per quarter or 5000 mrem in one year, not even on a voluntary basis for emergency response activities. A Project/Program-specific Radiation Safety Plan provides details as to personnel qualifications, instrumentation, monitoring protocols, personal protective equipment (PPE), respiratory protection, and radiation safety training requirements. It also identifies local/regional professional health physics resources that will directly supervise operations utilizing ALARA principles. Exposures that may approach 5000 mrem per year or high dose-rate environments (e.g., 100 mrem/hour or greater) must be conducted under the direction and guidance of a Certified Health Physicist (CHP), or similarly qualified professional health physicist, possessing relevant experience.

- Documented doses in excess of 100 mrem per year or 50 mrem per calendar quarter without the prior approvals described above must be reported immediately to the Director, CEHS and CRSO. **NOTE:** Exposures in excess of 5000 mrem per year or 3000 mrem per calendar quarter must be immediately reported to the Director, CEHS and CRSO, as well as the NRC or other responsible agency.

- The annual occupational dose limits for minors are 10 percent of the annual dose limits specified for adults. In addition, the dose to a woman who has declared herself to be pregnant must be less than 500 mrem during the entire gestation period. Work activities must not increase exposures to individuals in unrestricted areas above 100 mrem per year. These regulatory and administrative limits exclude exposures due to natural background and medical sources.

4.0 RADIATION SAFETY PROGRAM ORGANIZATION AND RESPONSIBILITIES

The Radiation Safety Program is administered by WESTON's CEHS Department. The corporate programs are implemented by the Division Managers. The Profit Center Managers and Project Managers implement specific programs and procedures associated with radioactive materials licenses and radiological projects. Individual responsibilities are described in the following subsections.

4.1 Director, Corporate Environmental Health and Safety and Quality Assurance

The Director, CEHS, has overall responsibility for establishing and managing the programs of the CEHS Department. The CEHS Director's duties in maintaining the Radiation Safety Program include the following:

- Revise this operating practice and radiation safety guidance documents when required to ensure compliance with regulatory changes.

- Develop and maintain supplemental guidance documents for WESTON's radiation safety programs.

- Inform the Division Managers of the Radiation Safety Program requirements, as necessary.

- Organize and manage a central recordkeeping file to maintain the personnel radiation dose records and other data required by this operating practice.

- Approve or deny requests for variances from the guidelines of this operating practice and requests to exceed administrative limits.

- Ensure that radiation safety training is provided to employees as needed, and in compliance with license requirements.

4.2 Division Manager

The Division Manager is ultimately responsible for implementing the policy and procedures associated with health and safety. The day-to-day management and implementation are normally delegated to the Profit Center Manager or Project Manager.

4.3 Profit Center Manager

The Profit Center Manager is responsible for approving requests and applications for radioactive material licenses and ensuring that radiation safety programs are established and maintained to ensure compliance with license conditions. Specific responsibilities include the following:

- Sign license applications to indicate the company's agreement to meet commitments described in the application.

- Ensure that license fees are paid in a timely manner.

- Ensure that radiation safety programs, source inventories, personnel monitoring, and inspections are conducted as required by licenses.

- Ensure that documentation and recordkeeping are completed as required by regulations and license requirements.

4.4 Project Manager

The Project Manager is responsible for establishing and maintaining radiation safety programs on projects that involve radiological hazards. Specific responsibilities include the following:

- Develop, approve, and implement a project-specific health and safety plan that describes detailed requirements for the project Radiation Safety Program.

- Ensure that professional health physics support is provided to the project during planning and field activities.

- Document the results of radiological measurements, contamination monitoring, and personnel dosimetry and place them into the permanent project files.

- Provide personnel dosimetry results to the Director, CEHS for inclusion in the corporate database.

4.5 WESTON Employees and WESTON Subcontractors

All employees of WESTON and WESTON subcontractors who work on radiological projects have health and safety responsibilities that include the following:

- Read and become familiar with health and safety plans for projects in which they are involved.

- Abide by applicable radiation safety policies and procedures, and state and Federal regulations.

- Help ensure that their radiation doses and doses received by their co-workers are as low as reasonably achievable.

- Report all unsafe radiological conditions to the Site Manager and suggest improvement in operations to minimize exposures of personnel.

5.0 GENERAL REQUIREMENTS

The Director, CEHS maintains guidance documents that provide specific radiation safety program requirements. General guidance for addressing radioactive materials licenses, acquiring radioactive sources, and responding to radiological incidents is provided in the following subsections.

5.1 Licensing, Permitting, and Legal Correspondence

All correspondence that addresses licensing, permitting, or other legal or regulatory matters will be generated and signed by the Profit Center Manager whose operations require the license and are affected by the regulations. The Profit Center Manager is responsible for ensuring that adequate resources are provided to maintain radiation safety programs that will ensure compliance with license requirements. A co-signature of the appropriate Division Manager may also be required where certain commitments of corporate funds or policy are expressed. Copies of radioactive material licenses and related correspondence must be provided to the CEHS Director for maintenance in corporate files.

5.2 Purchasing

All purchases of regulated radioactive materials must have the approval of the Profit Center Manager whose operations require the materials. The Profit Center Manager is responsible for ensuring that licenses are acquired and maintained as necessary to allow possession and use of radioactive materials, or that proper precautions are in place for using radioactive materials that may be acquired without a license.

5.3 Incident Records and Notification Procedure

Radiological incidents will be handled as specified in the emergency procedures section of the project health and safety plan. The Project Manager will follow corporate accident/injury reporting requirements as specified by the CEHS and Risk Management Departments. Additional notification and reporting requirements will be followed as required by Federal, state, or local regulations.

5.4 Transportation, Storage, and Disposal of Radioactive Materials

WESTON and its subcontractors will comply with applicable Federal and state regulations regarding transportation of radioactive contaminated materials. Prior to transport of such materials, the radionuclides and activities involved will be estimated to determine the appropriate procedures and precautions to be followed. Persons shipping or transporting radioactive materials are responsible for ensuring that regulations are met and must comply with Corporate dangerous goods shipping procedures. For more detailed guidance, project-specific requirements will be developed and provided in the health and safety plan.

Radioactive materials will be stored in a manner to maintain exposures to personnel ALARA and to prevent the spread of contamination. Radioactive materials will be disposed in compliance with license requirements and applicable regulations.

5.5 Emergency Response

Emergency response procedures will be developed as part of the site-specific health and safety plans to address the radiological aspects of potential accidents, spills, and contaminating events. Procedures will emphasize the importance of containing radioactive materials on the site, and will designate an individual to oversee cleanup activities and conduct contamination surveys in case of a contaminating event. Emergency response agencies will be informed of the radiological hazards that exist at the project site. Guidelines for emergency response will include notification of appropriate regulatory agencies and radiation safety personnel.

6.0 IMPLEMENTATION

The Director, CEHS, or his/her designee, is responsible for interpreting this operating practice.