DoD 3150.8-M

NUCLEAR WEAPON ACCIDENT RESPONSE PROCEDURES (NARP)

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Under Secretary of Defense
for
Acquisition, Technology, and Logistics

FOREWORD

This manual has been developed by the Defense Threat Reduction Agency (DTRA) under the authority of the Department of Defense (DoD) Directive (DoDD) 3150.8, *DoD Response to Radiological Accidents*, June 13, 1996, and supersedes DoD Manual 5100.52-M, *Nuclear Weapon Accident Response Procedures (NARP) Manual*, September 4, 1990.

This manual applies to the Office of the Secretary of Defense (OSD), the Military Departments (including the U.S. Coast Guard when it is operating as a Military Service in the U.S. Navy), the Chairman of the Joint Chiefs of Staff (CJCS), the Combatant Commands, the Defense Agencies, other Federal organizations when operating with DoD, and the DoD Field Activities (hereafter referred to collectively as "the DoD Components"). The term "Services," as used herein, refers to the U.S. Army, Navy, Air Force, and Marine Corps. This manual is effective immediately (its use is mandatory by all DoD components).

This manual provides planners for Combatant Commanders, the Services, Response Task Force (RTF) Commanders and Initial Response Force (IRF) Commanders with the information necessary to understand the overall response concept, the role of the IRF and RTF, the relationship of the IRF, RTF, and DoD to other Federal agencies. This manual also provides guidance in conducting site remediation activities following an accident involving a nuclear weapon in DoD custody or other types of radiological accidents or incidents. It assumes that a radiological release of some magnitude has occurred and that some remediation of the affected land is required. It is not intended as a comprehensive document to encompass all aspects of site remediation, but seeks to define a process by which response organizations may effectively face the challenge of site remediation.

This manual provides a notional RTF organization, identifies applicable DoD publications and resources used in response efforts, describes the policies and responsibilities outlined in these publications, identifies specific radiological information available in other publications, and provides a basis for Combatant Command and RTF planners to develop detailed plans tailored to each Theater of Operations and RTF area of operations. It provides a framework for DoD elements responding to non-DoD radiological events. This manual also describes the substantial resources other Federal agencies make available to assist in the response effort.

This manual will be widely disseminated and made available to all commanders and staff who are tasked to primarily respond to a nuclear weapon accident and, secondly, to radiological accidents or incidents. It should serve as a guide for more detailed planning by response forces and will be used to improve training and exercise programs.

Suggestions to update or improve this manual are encouraged. Send proposed changes through appropriate channels to:

Defense Threat Reduction Agency (DTRA)
ATTN: NSER
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Alexandria, VA 22310-3398

DoD components may obtain copies of this manual through their own publications channels. Other Federal agencies and the public may obtain copies from the U.S. Department of Commerce, National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

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USD (AT&L)

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REFERENCES

(a) DoD Directive 3150.8, "DoD Response to Radiological Accidents," June 13, 1996
(b) Federal Radiological Emergency Response Plan (FRERP), May 1, 1996
(c) DoD 8910.1-M, "DoD Procedures for Management of Information Requirements," June 1998
(d) DSWA 5100.52.1-L, "Nuclear Accident Response Capability Listing," April 1997
(e) DoD Directive 5200.8, "Security of Military Installations and Resources," April 25, 1991
(f) CJCSM 3150.03, "Joint Reporting Structures, Event and Incident Reports," June 19, 1998
(g) DoD Directive 5230.16, "Nuclear Accident and Incident Public Affairs (PA) Guidance," December 20, 1993
(h) Joint DoD, DOE, and FEMA Agreement for Response to Nuclear Weapon Accidents and Nuclear Weapon Significant Incidents, January 1981
(i) TP 20-11, "General Firefighting Guidance," July 1995
(j) Naval Ships Technical Manual (NSTM) 079, Vol II, "Damage Control - Practical Damage Control," February 25, 1999
(k) BUMEDINST 6470.10A, "Irradiated or Radioactively Contaminated Personnel," December 7, 1998
(l) Federal Guidance Report No. 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion," EPA, 1988
(m) AR 40-14, "Control and Recording Procedures for Occupational Exposure to Ionizing Radiation," September 1984
(n) NAVMED P-5055, "Radiation Health Protection Manual," December 2, 1992
(o) AFI 48-125, "The U.S. Air Force Personnel Dosimetry Program"
(p) AR 600-10, "The Army Casualty System," August 1987
(q) AFI 36-3002, "Casualty Services," August 1994
(r) BUPERS Manual Article 4210100, "Personnel Casualty Reporting," February 1982
(s) NCRP Report #37, June 1980
(t) Joint Pub 4-06.
(u) DA Circular 40-82-3, "Prevention of Heat Injury"
(v) Explosive Ordnance Disposal Procedures 60-1, August 1997
(w) "Internal Security Act of 1950" (50 USC 797)
(x) DoD Directive 5210.41-M, "Nuclear Weapon Security Manual," April 1994

(y) DoD Directive 5210.41, "Security Policy for Protecting Nuclear Weapons," September 23, 1988

(z) DoD Regulation 5200.1-R, "Information Security Regulation," January 1997

(aa) DoD Directive 5210.2, "Access to and Dissemination of Restricted Data," January 12, 1978

(ab) CJCSI 6110.01, "CJCS-Controlled Tactical Communications Assets," June 25,1996

(ac) Allied Communications Publication 134, "Communications Assets," January 1975

(ad) U.S. Forces Command Manual 105-1,"Joint Communication Deployment and Employment," June 1980

(ae) USA FM 24-2, "Spectrum Management," August 21, 1991

(af) AFI 33-118, "Radio Spectrum Frequency Management," August 1997

(ag) Joint Pub 3-61, "Doctrine for Public Affairs in Joint Operations," May 14, 1997

(ah) DoD Directive 5400.13, "Joint Public Affairs Operations," January 9, 1996

(ai) DoD Instruction 5400.14, "Procedures for Joint Public Affairs Operations," January 22, 1996

(aj) Nuclear Regulatory Guide 8.29, January 1984

(ak) DoD 4000.25-1-M, "Military Standards Requisitioning and Issue Procedure (MILSTRIP)," May 1987

DL1. **DEFINITIONS**

DL1.1.1. Access Procedures. See Explosive Ordnance Disposal Procedures.

DL1.1.2. Accident Response Group (ARG). A group of technical and scientific experts, with specialized equipment; composed of a cadre of senior scientific advisors, weapons engineers and technicians, experts in nuclear safety and high-explosive safety, health physicists, radiation control technicians, industrial hygienists, physical scientists, packaging and transportation specialists, and other specialists from the Department of Energy (DOE) weapons complex. ARG maintains readiness to provide DOE technical assistance to peacetime accidents and significant incidents involving special nuclear materials anywhere in the world.

DL1.1.3. Accident Scene. The cordoned area surrounding an accident site from which all non-essential personnel and resources are evacuated and prohibited.

DL1.1.4. Accident Site. The area surrounding the impact point in which hazards to personnel (wreckage, fire, or damage) are readily identifiable.

DL1.1.5. Aerial Measuring System (AMS). Performs aerial measurements of ground and airborne radioactivity over large areas by utilizing instrumentation for detecting and recording gamma radiation, both as gross count rates and gamma energy spectra. Equipment for determining the position of the aircraft is also integrated into the system. Can be both fixed- and rotary-wing aircraft.

DL1.1.6. Airborne Radioactivity. Any radioactive material suspended in the atmosphere.

DL1.1.7. Air Force Radiation Assessment Team (AFRAT). A field-qualified team of worldwide deployable physicists and health physics technicians established at the Institute for Environment, Safety, and Occupational Health Risk Analysis (IERA). The mission of AFRAT is to provide commanders and leaders with viable solutions to operational obstacles imposed by the presence of radioactive materials or radiation hazards, nuclear weapon accidents, nuclear facility incidents, radiation releases, or terrorist activity.

DL1.1.8. Air Sampler. A device used to collect a sample of the radioactive particulates suspended in the air.

DL1.1.9. Alpha Particle, Radiation. A positively charged particle made up of

two neutrons and two protons, emitted by certain radioactive nuclei. Alpha particles can be stopped by thin layers of light materials, such as a sheet of paper, and pose no direct or external radiation threat; however, they can pose a serious health threat, if internalized.

DL1.1.10. Armed. The configuration of a nuclear weapon in which a single signal initiates the action for a nuclear detonation.

DL1.1.11. Armed Forces Radiobiology Research Institute (AFRRI). A tri-Service facility chartered in 1961 that conducts research in the field of radiobiology and related matters essential to the operational and medical support of the U.S. Department of Defense (DoD) and the Military Services. The institute collaborates with other governmental facilities, academic institutions, and civilian laboratories in the United States and other countries. AFRRI provides the Medical Radiobiology Advisory Team (MRAT) component of the Defense Nuclear Advisory Team (DNAT).

DL1.1.12. Atmospheric Release Advisory Capability (ARAC). A centralized computer-based system that provides estimates of the transport, diffusion, and deposition of radioactive or other hazardous material (HAZMAT) released to the atmosphere and dose projections to people and the environment.

DL1.1.13. Background Count. (In connection with health protection.) The background count includes radiation produced by naturally occurring radioactivity and cosmic rays.

DL1.1.14. Background Radiation. The natural radioactivity in the environment. Nuclear (or ionizing) radiation arising from within the body and from the surroundings to which individuals are always exposed.

DL1.1.15. Becquerel. The International System unit of activity of a radionuclide, equal to the activity of a quantity of a radionuclide having 1 spontaneous nuclear transition per second. Symbolized as Bq.

DL1.1.16. BENT SPEAR. A DoD term used to identify and report a nuclear weapon significant incident involving a nuclear weapon/warhead, nuclear component, or vehicle when nuclear loaded.

DL1.1.17. Beta Particle, Radiation. An electron or positron emitted by an atomic nucleus during radioactive decay. Beta radiation can be harmful depending upon the dose and time of exposure; it is easily shielded by aluminum.

DL1.1.18. Bioassay. The method(s) for determining the amount of internal contamination received by an individual.

DL1.1.19. BROKEN ARROW. A DoD term to identify and report an accident involving a nuclear weapon, warhead, or nuclear component

DL1.1.20. CentiGray (cGy). A unit of absorbed dose of radiation (one centiGray equals one radiation absorbed dose [RAD]).

DL1.1.21. Combined Information Bureau (CIB). A facility at the scene of a radiological accident or significant incident that occurred overseas to coordinate all public affairs. The CIB includes representation from DOE, DoD, other agencies, and foreign government organizations.

DL1.1.22. Consequence Management. Those planning actions and preparations taken prior to an accident to identify, organize, equip, and train emergency response forces and to develop the executable plans implemented in response to an accident, and the actions taken following an accident to mitigate and recover from the effects of an accident.

DL1.1.23. Contamination. The deposit, adsorption, or absorption of radioactive material on or by structures, areas, personnel, or objects.

DL1.1.24. Contamination Control. Procedures to avoid, reduce, remove, or render harmless, temporarily or permanently, nuclear materials contamination for the purpose of maintaining or enhancing the efficient conduct of military operations.

DL1.1.25. Contamination Control Line (CCL). A control line surrounding the radiological control area. Initially, the contamination control line extends 100 meters beyond the known/suspected radiological contamination to provide a measure of safety. Once the Contamination Control Station (CCS) is operational, the CCL becomes the outer boundary that separates the reduced hazard area from the clean area.

DL1.1.26. Contamination Control Station. An area (tent or facility) specifically designated for permitting ingress and egress of personnel and equipment to/from the radiation control area. The outer boundary of the CCS is the CCL, and the inner boundary is the line segment labeled the hot line. For illustration of the CCS, see Figures C2.F2., C6.F1., and C6.F2.

DL1.1.27. Contamination Reduction Area (CRA). The area concept is employed

at the CCS to eliminate (or reduce to an acceptable level) contamination adhering to personnel in the contaminated area. The concept uses supervised, structured, and meticulous clothing/equipment removal procedures precluding mechanical transfer of contamination on a person/object and outside the CCS.

DL1.1.28. Critical Nuclear Weapons Design Information (CNWDI). TOP SECRET RESTRICTED DATA or SECRET RESTRICTED DATA revealing the theory of operation or design of the components of a thermonuclear or implosion-type fission bomb, warhead, demolition munition, or test device. Specifically excluded is information concerning arming, fusing, and firing systems; limited-life components; and totally contained quantities of fissionable, fusionable, and high-explosive materials by type.

DL1.1.29. Cumulative Dose (Radiation). The total dose resulting from repeated exposure to radiation in the same region or of the whole body.

DL1.1.30. Curie (Ci). A unit of radioactivity; the activity of a quantity of any radioactive nuclide undergoing 37 thousand million disintegrations per second, the amount of activity in 1 gram of radium.

DL1.1.31. Custody. The responsibility for the control of, transfer and movement of, and access to weapons and components. Custody also includes the maintenance of and accountability for weapons, components, and radioactive materials.

DL1.1.32. Decay (Radioactive). The decrease in the radiation intensity or mass of any radioactive material with respect to time.

DL1.1.33. Decontamination. The process of making any person, object, or area safe by absorbing, destroying, neutralizing, making harmless, or removing contaminated material clinging to or around it.

DL1.1.34. Decontamination Station. A building or location suitably equipped and organized where personnel and material are cleansed of radiological contaminents.

DL1.1.35. Defense Coordinating Element. A staff formed to provide support to the Defense Coordinating Officer (DCO) in a disaster area.

DL1.1.36. Defense Coordinating Officer (DCO). A Commander-in-Chief (CINC)-appointed officer who serves as the DoD single point of contact to the Federal Coordinating Officer (FCO) for the purpose of providing DoD resources during disaster assistance operations.

DL1.1.37. Director of Military Support (DOMS). The Secretary of Defense directs the Secretary of the Army to act as the DoD executive agent to plan for and commit DoD resources in response to requests from civil authorities. The DOMS serves as the Army's action agent for planning and executing DoD's support mission to civilian authorities within the United States.

DL1.1.38. Disaster Control. Measures taken before, during, or after hostile action or natural or manmade disasters to reduce the probability of damage, minimize its effects, and initiate recovery.

DL1.1.39. Disaster Control Group (DCG). The U.S. Air Force (USAF) Response Force element that goes to the scene of a major accident or natural catastrophe to provide command and control under the direction of the On-Scene Commander (OSC).

DL1.1.40. Disaster Cordon. A physical barrier surrounding the accident scene where control is established to preclude unauthorized entry.

DL1.1.41. Disaster Field Office (DFO). The on-scene focal point established by the Senior Federal Emergency Management Agency (FEMA) Official (SFO), as required, for coordinating the Federal response to a radiological accident or significant incident. Representatives of other Federal, State, local, and volunteer agencies will be located in the center.

DL1.1.42. Disaster Preparedness. That series of actions to control and manage radiological accidents or incidents and bring them to a practicable conclusion within the established security, response, and recovery framework. These actions include initial and subsequent reporting response, Explosive Ordnance Disposal (EOD) procedural action on the weapon(s), appropriate security, legal and medical aspects, public information, and control of hazards caused by the accident. Control of the accident-caused hazards includes survey of the incident/accident area to establish isodose lines and all types of monitoring, personnel, and area decontamination, and disposition of nuclear, high-explosive, and contaminated items.

DL1.1.43. Disaster Response Force. The USAF base-level organization that responds to disasters/accidents, establishing command and control (C2) and supporting disaster operations.

DL1.1.44. Disaster Support Group. A USAF major command and field operating agency headquarters command and control element. It coordinates and supports the headquarters response to a contingency.

DL1.1.45. Dose. The amount of energy deposited in body tissue due to radiation exposure. Various technical terms, such as dose equivalent, effective dose equivalent and collective dose, are used to evaluate the amount of radiation an exposed person receives. These terms are used to describe the differing interactions of radiation with tissue as well as to assist in the management of personnel exposure to radiation.

DL1.1.46. Dose Rate Contour Line. A line on a map, diagram, or overlay joining all points at which the radiation dose rate at a given time is the same.

DL1.1.47. Dosimetry. The measurement of radiation dose. It applies to both the devices used (dosimeters) and to the techniques.

DL1.1.48. DULL SWORD. A team used in DoD to identify and report a nuclear weapon safety deficiency.

DL1.1.49. Emergency Action and Coordination Team (EACT). The DOE senior management team at headquarters that coordinates the initial Federal Radiological Monitoring and Assessment Plan (FRMAP) response to radiological emergencies.

DL1.1.50. EMPTY QUIVER. A reporting term used by DoD to identify and report the seizure, theft, or loss of a U.S. nuclear weapon.

DL1.1.51. Entry Control Point. The place where entry into and exit from the disaster cordon is controlled. It is located on the disaster cordon near the onscene control point.

DL1.1.52. Exclusion Area. Any designated area containing one or more nuclear weapons, components, or radioactive materials.

DL1.1.53. Explosive Ordnance. All munitions containing explosives, nuclear fission or fusion materials, and biological and chemical agents. This ordnance includes bombs and warheads, guided and ballistic missiles, and artillery, mortar, rocket, and small arms ammunition. Also, ordnance includes all mines, torpedoes, and depth charges; pyrotechnics; clusters and dispensers; cartridges and propellant actuated devices; electro-explosive devices; clandestine and improvised explosive devices; and all similar or related items or components explosive in nature.

DL1.1.54. Explosive Ordnance Disposal (EOD). The detection, identification, field evaluation, rendering-safe, and/or disposal of explosive ordnance that has become hazardous by damage or deterioration when the disposal of such explosive ordnance is beyond the capabilities of personnel assigned to routine disposal.

DL1.1.55. Explosive Ordnance Disposal Incident. The suspected or detected presence of unexploded ordnance or damaged explosive ordnance that constitutes a hazard to operations, installation, personnel, or material. Not included in this definition are the accidental arming or other conditions that develop during the manufacture of high-explosive material, technical service assembly operations, or the laying of mines and demolition charges.

DL1.1.56. Explosive Ordnance Disposal Procedures. Those particular courses or modes of action for access to, recovery, rendering safe, and final disposal of explosive ordnance or any HAZMAT associated with an explosive ordnance disposal incident.

DL1.1.56.1. Access Procedures. Those actions to exactly locate and gain access to unexploded ordnance.

DL1.1.56.2. Recovery Procedures. Those actions to recover unexploded explosive ordnance.

DL1.1.56.3. Render Safe Procedures. The portion of the explosive ordnance disposal procedures involving the application of special explosive ordnance disposal methods and tools to provide the interruption of functions or separation of essential components of unexploded explosive ordnance to prevent an unacceptable detonation.

DL1.1.57. Explosive Ordnance Disposal Unit. Personnel with special training and equipment who render explosive ordnance (such as bombs, mines, projectiles, and booby traps) safe, make intelligence reports on such ordnance, and supervise the safe removal thereof.

DL1.1.58. Explosive Ordnance Reconnaissance. Reconnaissance involving the investigation, detection, location, marking, initial identification, and reporting of suspected unexploded ordnance, by explosive ordnance reconnaissance agents, to determine further action.

DL1.1.59. Exposure. The level of radiation flux to which a material or living tissue is exposed. The actual dose of radiation resulting from the exposure depends upon a number of factors.

DL1.1.60. FADED GIANT. A reporting term to identify an event involving a nuclear reactor or radiological accident.

DL1.1.61. Federal Coordinating Officer. Appointed by the Director of the Federal Emergency Management Agency, on behalf of the President, to coordinate Federal assistance to a State affected by a disaster or emergency. The source and level of the Federal Coordinating Officer will likely depend on the nature of the Federal response.

DL1.1.62. Federal Emergency Management Agency (FEMA). This Agency establishes Federal policies for and coordinates all civil defense and civil emergency planning, management, mitigation, and assistance functions of executive agencies. FEMA assists local and State agencies in their emergency planning. Its primary role in a radiological accident is one of coordinating Federal, State, local, and volunteer response actions.

DL1.1.62.1. Emergency Information and Coordination Center (EICC). The EICC is the location in FEMA Headquarters in Washington, DC, from which the Emergency Support Team (EST) provides coordination support for Federal and State emergency response activities to a radiological accident or emergency.

DL1.1.62.2. Emergency Response Team (ERT). An inter-Agency team, headed by FEMA, deployed to a radiological emergency scene by the FEMA Director to make an initial assessment of the situation and then provide FEMAs primary response capability.

DL1.1.62.3. Emergency Support Team (EST). The FEMA Headquarters team that carries out notification activation and coordination procedures from the FEMA EICC. The EST is responsible for Federal Agency headquarters coordination, staff support of the FEMA Director, and support of the SFO.

DL1.1.63. Federal Radiological Emergency Response Plan (FRERP). The Federal plan to assist State and local government officials or other Federal Agencies in the response to a radiological emergency in the United States, its possessions, and territories.

DL1.1.64. Federal Radiological Monitoring and Assessment Center (FRMAC). A coalition of all Federal off-site monitoring and assessment efforts to assist the Lead Federal Agency (LFA), State(s), and local authorities. A FRMAC, led by a DOE FRMAC Director, is established in response to the LFA or State request when a major radiological emergency is anticipated or has occurred.

DL1.1.65. Field Instrument for the Detection of Low-Energy Radiation (FIDLER). A field survey instrument specifically designed to measure low-energy x-rays and gamma rays from weapons grade plutonium. The detector consists of a 5-inch diameter by 1/16-inch thick sodium iodide crystal coupled through a quartz light pipe to a 5-inch diameter photomultiplier tube. The detector is coupled to a single-channel analyzer instrument such as the ESP-2 or E600.

DL1.1.66. Film Badge. A photographic film packet or badge carried by personnel for measuring and recording gamma ray dosage permanently. Mostly replaced by Thermoluminescent Dosimetry.

DL1.1.67. Final Disposal Procedures. See Explosive Ordnance Disposal Procedures.

DL1.1.68. Follow-On Element. The USAF non-emergency response element of a disaster response force that deploys to the accident scene after the initial response element to expand C2 and perform support functions.

DL1.1.69. Formerly Restricted Data (FRD). Information removed from the Restricted Data category upon determination jointly by DOE and DoD that such information relates primarily to the military utilization of atomic weapons and that such information can be safeguarded adequately as national security information.

DL1.1.70. Fragmentation Zone. A calculated distance that fragments created by an explosion are projected.

DL1.1.71. Gamma-Ray, Radiation. High-energy electromagnetic radiation emitted from atomic nuclei during a nuclear reaction. Gamma radiation requires thick layers of dense materials, such as lead, for shielding. Potentially lethal to humans, depending on the intensity of the field.

DL1.1.72. Half-Life. The time required for the activity of a given radioactive species to decrease to half of its initial value due to radioactive decay. The half-life is a characteristic property of each radioactive species and is independent of its amount

or condition. The effective half-life of a given isotope in the body is the time in which the quantity in the body will decrease to half as a result of both radioactive decay and biological elimination.

DL1.1.73. Hazard Prediction and Assessment Capability (HPAC). HPAC is a forward deployable modeling capability available for Government, Government-related or academic use. This software tool assists in emergency response to hazardous agent releases. Its fast running, physics-based algorithms enable users to model and predict hazard areas and human collateral effects in minutes. HPAC provides the capability to accurately predict the effects of hazardous material (HAZMAT) releases into the atmosphere and its impact on civilian and military populations.

DL1.1.74. Hazardous Material (HAZMAT). Any material that is flammable, corrosive, an oxidizing agent, explosive, toxic, poisonous, etiological, radioactive, nuclear, unduly magnetic, a chemical agent, biological research material, compressed gases, or any other material that, because of its quantity, properties, or packaging, may endanger life or property.

DL1.1.75. High Explosive. An energetic material that detonates (instead of deflagrating or burning); the rate of advance of the reaction zone into the unreacted material exceeds that velocity of sound in the unreacted material.

DL1.1.76. Hot Line. The inner boundary of the contamination control station, marked with tape or line. The station personnel use the line as the inner side being contaminated and the side away from the accident as an area of reduced contamination.

DL1.1.77. Hotspot. A mobile radiological laboratory deployed with the DOE ARG to conduct soil, water, and air samples as well as bioassays and whole body counting. Hotspot is also a modeling program similar to HPAC.

DL1.1.78. Hot Spot. The region in a contaminated area in which the level of radioactive contamination is considerably greater than in neighboring regions in the area.

DL1.1.79. Ingestion Pathway. The means by which a person is exposed to radiation through ingestion (i.e., hand-to-mouth, inhalation with open mouth, etc.).

DL1.1.80. Inhalation Pathway. The means by which a person at the accident area or downwind is subjected to respiratory radiation exposure.

DL1.1.81. Initial Render Safe Procedure. An EOD process that results in electrical isolation of the high explosive preventing a nuclear yield.

DL1.1.82. Initial Response Force (IRF). That DoD entity directed to proceed to the scene of a radiological accident or incident for the purpose of rendering emergency assistance, including maintaining command and control of the accident site until relieved by the Commander, Response Task Force (CRTF). Subject to its capabilities, the IRF may be tasked to perform the following:

DL1.1.82.1. Rescue operations.

DL1.1.82.2. Accident site security.

DL1.1.82.3. Firefighting.

DL1.1.82.4. Initiation of appropriate EOD procedures.

DL1.1.82.5. Radiation monitoring.

DL1.1.82.6. Establishment of C2 and communications.

DL1.1.82.7. Public affairs activities.

DL1.1.83. Institute for Environmental, Safety, and Occupational Health Risk Analysis. A USAF unit that provides consultant, engineering, and analytical support in radiological, occupational, and environmental health programs. The USAF unit offers a multitude of technical services on radiological problems. The radiological field unit of the IERA is called the AFRAT.

DL1.1.84. Joint Communications Contingency Station Assets. The communications station provides high-frequency radio, tropospheric scatter terminals, automatic digital network terminals, manual secure voice, and other equipment.

DL1.1.85. Joint Communications Support Element (JCSE). Provides Chairman, Joint Chiefs of Staff (CJCS)-directed contingency and crisis communications to meet operational and support needs of the Joint Chiefs of Staff (JCS), Services, Unified Commands, Defense Agencies, and non-Defense agencies.

DL1.1.86. Joint Hazard Evaluation Center (JHEC). A facility, staffed by representatives from each of the agencies conducting hazard survey and radiological operations, for the coordination of hazard survey data and radiological safety/health physics matters on site.

DL1.1.87. Joint Information Center (JIC). A facility at the scene of a radiological accident or significant incident to coordinate all public affairs. The JIC includes representation from DOE, DoD, FEMA, and other Federal, State, and local agencies.

DL1.1.88. Joint Nuclear Accident Coordinating Center (JNACC). DoD and DOE operate coordiating centers for exchanging and maintaining information about radiological assistance capabilities and activities. These centers are separated geographically but linked by direct communications networks.

DL1.1.89. Lead Federal Agency (LFA). The Agency that is responsible for leading and coordinating all aspects of the Federal response is referred to as the LFA and is determined by the type of emergency. In situations where a Federal Agency owns, authorizes, regulates, or is otherwise deemed responsible for the facility or radiological activity causing the emergency, and has authority to conduct and manage Federal actions on site, that Agency normally will be the LFA.

DL1.1.90. Licensed Material. Source material, special nuclear material, or byproduct material received, possessed, used, or transferred under a general or specific license issued by the Nuclear Regulatory Commission (NRC) or a State.

DL1.1.91. Linear Accelerator (LINAC). A DOE ARG asset that provides high-energy radiography and real-time radiography in the field.

DL1.1.92. Liquid Abrasive Cutter (LAC). A DOE ARG remotely operated cutting tool using high-pressure water and abrasive medium.

DL1.1.93. Maximum Permissible Dose. That radiation dose that a military commander or other appropriate authority may prescribe as the limiting cumulative radiation dose to be received over a specific period of time by members of the command, consistent with operational military considerations.

DL1.1.94. Medical Radiobiology Advisory Team. AFFRIs team of highly qualified radiation medicine physicians, health physicists, and related scientists who provide state-of-the-art advice and assistance to CINCs of U.S. and allied forces,

Federal Agencies, State and local governments, and others in radiological matters including accidents and incidents of nuclear weapons, nuclear reactors, radiological dispersal devices, and industrial/medical sources. They provide expertise for emergency treatment of radiation injuries, operational health physics, physical and bio-dosimetry, hazard prediction, and site remediation.

DL1.1.95. Monitoring. The act of detecting the presence of radiation and the measurement thereof with radiation measuring instruments.

DL1.1.96. National Defense Area (NDA). An area established on non-Federal lands located within the United States, its possessions, or territories for the purpose of safeguarding classified defense information or protecting DoD equipment and/or material. Establishment of an NDA temporarily places such non-Federal lands under the effective control of DoD and results only from an emergency event. The senior DoD representative at the scene will define the boundary, have the boundary marked with a physical barrier, and have warning signs posted. The landowners consent and cooperation will be obtained whenever possible; however, military necessity will dictate the final decision regarding location, shape, and size of the NDA.

DL1.1.97. National Security Area (NSA). An area established on non-Federal lands located within the United States, its possessions, or territories for the purpose of safeguarding classified and/or restricted data information or protecting DOE equipment and/or material. Establishment of an NSA temporarily places such non-Federal lands under the effective control of DOE and results only from an emergency event. The senior DOE representative having custody of the material at the scene will define the boundary, have the boundary marked with a physical barrier, and have warning signs posted. The landowners consent and cooperation will be obtained whenever possible; however, operational necessity will dictate the final decision regarding location, shape, and size of the NSA.

DL1.1.98. Need-to-Know. A criterion used in security procedures that requires the custodians of classified information to establish, prior to disclosure, that the intended recipient must have access to the information to perform his or her official duties.

DL1.1.99. Nuclear Accident Response Capabilities Listing (NARCL). A listing of DoD and DOE installations, facilities, or activities with nuclear accident/incident response and radiation detection capabilities.

DL1.1.100. Nuclear Component. Weapon components composed of fissionable or fusionable materials that contribute substantially to nuclear energy released during detonation. Nuclear components include radioactive boosting materials.

DL1.1.101. Nuclear Contribution. Explosive energy released by nuclear fission or fusion reactions as part of the total energy released by a radiological accident or incident. Any nuclear contribution equivalent to 4 or more pounds of trinitrotoluene (TNT) is considered significant and would add beta and gamma radiation hazards to other radiological and toxic hazards present at a radiological accident site.

DL1.1.102. Nuclear Detonation. A nuclear explosion resulting from fission or fusion reactions in nuclear materials, such as from a nuclear weapon.

DL1.1.103. Nuclear Radiation. Particulate and electromagnetic radiation emitted from atomic nuclei in various nuclear processes. The important nuclear radiations, from the weapons effects standpoint, are alpha and beta particles, gamma rays, and neutrons.

DL1.1.104. Nuclear Reactor Accident. An uncontrolled reactor criticality resulting in damage to the reactor core or an event such as loss of coolant that results in significant release of fission products from the reactor core.

DL1.1.105. Nuclear Safing. The prevention of a nuclear yield in the event of accidental detonation of the high explosive (HE) of a HE assembly weapon or ignition of the propellant of a gun assembly weapon.

DL1.1.106. Nuclear Weapon. . A complete assembly (i.e., implosion type, gun type, or thermonuclear type), in its intended ultimate configuration which, upon completion of the prescribed arming, fusing, and firing sequence, is capable of producing the intended nuclear reaction and release of energy.

DL1.1.107. Nuclear Weapon Accident. An unexpected event involving nuclear weapons that results in any of the following:

DL1.1.107.1. An accidental or unauthorized launching, firing, or use by U.S. forces or U.S.-supported allied forces of a nuclear-capable weapons system.

DL1.1.107.2. Accidental, unauthorized, or unexplained nuclear detonation.

DL1.1.107.3. Non-nuclear detonation or burning of a nuclear weapon.

DL1.1.107.4. Radioactive contamination.

DL1.1.107.5. Jettisoning of a nuclear weapon or nuclear component.

DL1.1.107.6. Public hazard, actual or perceived.

DL1.1.108. Nuclear Weapon Incident. An unexpected event involving a nuclear weapon, facility, or component resulting in any of the following, but not constituting a nuclear weapon(s) accident:

DL1.1.108.1. An increase in the possibility of explosion or radioactive contamination.

DL1.1.108.2. Errors committed in the assembly, testing, loading, or transportation of equipment, and/or the malfunctioning of equipment and material that could lead to an unintentional operation of all or part of the weapon arming and/or firing sequence or that could lead to a substantial change in yield or increased dud probability.

DL1.1.108.3. Any act of God, unfavorable environment, or condition resulting in damage to a weapon, facility, or component.

DL1.1.109. Nuclear Weapon Significant Incident. An unexpected event involving nuclear weapons, nuclear components, or a nuclear weapon transport or launch vehicle when a nuclear weapon is mated, loaded, or on board that does not fall into the nuclear weapon accident category but that:

DL1.1.109.1. Results in evident damage to a nuclear weapon or nuclear components to the extent that major rework, complete replacement, or examination or recertification by DOE is required.

DL1.1.109.2. Requires immediate action in the interest of safety or nuclear weapons security.

DL1.1.109.3. May result in adverse public reaction (national or international) or inadvertent release of classified information.

DL1.1.109.4. Could lead to a nuclear weapon accident and warrants that senior national officials or Agencies be informed to take action.

DL1.1.110. Nuclear Yield. The energy released in the detonation of a nuclear

weapon, measured in terms of the kilotons or megatons of TNT, required to produce an equivalent energy release.

DL1.1.111. Off Site. That area beyond the boundaries of a DoD installation or DOE facility, including the area beyond the boundary of an NDA or NSA, that has been or may become affected by a nuclear weapon accident or significant incident.

DL1.1.112. One-Point Detonation. A detonation of HE that is initiated at a single point.

DL1.1.113. One-Point Safe. The criterion for design safety that a weapon must have less than one chance in a million of producing a nuclear yield of more than 4 pounds of TNT (equivalent energy release) when the HE is initiated and detonated at any single point.

DL1.1.114. On-Scene Commander. The senior person designated to coordinate the response efforts at the accident scene prior to the arrival of the Response Task Force Commanders.

DL1.1.115. On Site. That area around the scene of a radiological accident or significant incident under the operational control of the installation commander, facility manager, DoD CRTF, or DOE SEO. The on-site area includes any area within an NDA or NSA.

DL1.1.116. Operational Exposure Guidance (OEG). Command guidance establishing radiation exposure limits for assigned or attached personnel. OEG should be established in advance of operations and included in Operations Plans (OPLANs), Contingency Plans (CONPLANs), or Functions Plans (FUNCPLANs).

DL1.1.117. Oralloy. Enriched uranium. One of the primary fissionable materials in nuclear weapons.

DL1.1.118. Particulate Radiation. Radiation in the form of particles (for example, neutrons, electrons, and alpha and beta particles) as opposed to electromagnetic radiation.

DL1.1.119. Personal Protective Clothing. Clothing consisting of coveralls, shoe covers, cotton gloves, and hood or hair caps. Personal protective clothing provides protection for the user from alpha-beta radiation but is primarily a control device to prevent the spread of contamination. A respirator can be worn with the personal protective clothing; this provides protection against the inhalation of contaminants.

DL1.1.120. Personnel Reliability Program (PRP). A program implemented for all personnel who control, handle, have access to, or control access to nuclear weapon systems. The program covers selection, screening, and continuous evaluation of the personnel assigned to various nuclear duties. The program seeks to ensure that personnel coming under its purview are mentally and emotionally stable and reliable.

DL1.1.121. Physical Security. That part of security concerned with physical measures designed to safeguard personnel; to prevent unauthorized access to equipment, facilities, material, and documents; and to safeguard them against espionage, sabotage, damage, and theft.

DL1.1.122. Plutonium (Pu). An artificially produced fissile material. The Pu-239 isotope is primarily used in nuclear weapons.

DL1.1.123. Protective Action Guide (PAG). A radiation exposure level or range established by appropriate Federal or State agencies beyond which protective action should be considered.

DL1.1.124. Protective Action Recommendation (PAR). Advice to the State on emergency measures it should consider in determining action for the public to take in order to avoid or reduce exposure to radiation.

DL1.1.125. Quantity/Distance (Q/D) Safety Standards. . Directives pertaining to the amounts and kinds of explosives that can be stored and the proximity of such storage to buildings, highways, railways, magazines, and other installations.

DL1.1.126. Radiation Absorbed Dose. RAD is an obsolete term. Commonly used unit of absorbed dose radiation. It has been replaced by CentiGray (cGy).

DL1.1.127. Radiation Emergency Assistance Center/Training Site (REAC/TS). A World Health Organization (WHO) Collaborating Center that provides 24-hour direct or consulting assistance to medical and health physics practitioners dealing with radiation-related health problems or injuries from local, national, or international radiation incidents. REAC/TS provides advice and assistance to the LFA responding to nuclear events. In addition to their operational response capabilities, REAC/TS provides extensive training opportunities for healthcare providers through their in-residence and Mobile Training Team programs.

DL1.1.128. Radioactivity. The spontaneous emission of radiation, generally alpha or beta particles, often accompanied by gamma rays from the nuclei of an unstable isotope.

DL1.1.129. Radioactivity Detection, Indication, and Computation. A term designating various types of radiological measuring instruments or equipment.

DL1.1.130. Radiological Accident. A loss of control over radiation or radioactive material that presents a hazard to life, health, property, or the environment, or that may result in any member of the general population exceeding limits for exposure to ionizing radiation.

DL1.1.31. Radiological Advisory Medical Team (RAMT). Special DoD response teams located at the Walter Reed Army Medical Center (WRAMC), Washington, DC, and the Center for Health Promotion and Preventive Medicine located in Landstuhl, FRG. The teams are specially trained to assist and furnish guidance to the CRTF or other responsible officials at an accident site and to local medical authorities concerning radiological health hazards and radiological exposure criteria.

DL1.1.132. Radiological Air Sampling and Analysis Lab (RASCAL). A mobile, self-sufficient analytical laboratory capable of supporting a large number of air samples and providing rapid air sample analyses.

DL1.1.133. Radiological Assistance. That assistance provided after an accident involving radioactive materials to:

DL1.1.133.1. Evaluate the radiological hazard.

DL1.1.133.2. Accomplish emergency rescue and first aid.

DL1.1.133.3. Minimize safety hazards to the public.

DL1.1.133.4. Minimize exposure of personnel to radiation of radioactive materials.

DL1.1.133.5. Minimize the spread of radioactive contamination.

DL1.1.133.6. Minimize damaging effects on property.

DL1.1.133.7. Disseminate technical information and medical advice to appropriate authorities.

DL1.1.134. Radiological Assistance Program (RAP) Team. Trained and equipped DOE teams available through DOE regional offices to provide first response capability in radiological emergencies.

DL1.1.135. Radiological Control Area (RCA). The control area encompassing all known, or suspected, radiological contamination at the site of a radiological accident or significant incident.

DL1.1.136. Radiological Control (RADCON) Team. Special DoD radiological team organized to provide technical assistance and advice in radiological emergencies.

DL1.1.137. Radiological Event. . Used to refer to any accident, incident, or significant incident involving radioactive materials in DoD custody or any Improvised Nuclear Device (IND) incident involving other materials. This includes BROKEN ARROW, BENT SPEAR, and EMPTY QUIVER.

DL1.1.138. Radiological Survey. The directed effort to determine the distribution of radiological material and dose rates in an area.

DL1.1.139. RANGER. A mobile, real-time mapping system that monitors large areas of land for radiological contamination.

DL1.1.140. Recovery Procedures. See Explosive Ordnance Disposal Procedures.

DL1.1.141. Re-Entry Recommendations (RERs). Advice provided to the State concerning guidance that may be issued to members of the public on returning to an area affected by a radiological emergency, either permanently or for short-term emergency actions.

DL1.1.142. Render Safe Procedures. See Explosive Ordnance Disposal Procedures.

DL1.1.143. Residual Contamination. Contamination that remains after steps have been taken to remove it. These steps may consist of nothing more than allowing the contamination to decay naturally.

DL1.1.144. Response Task Force (RTF). A DoD response force appropriately

manned, equipped, and able to coordinate all actions necessary to control and recover from a radiological accident or significant incident. The specific purpose of the RTF is to accompany weapon recovery and to provide radiological accident/significant incident assistance. RTFs are organized and maintained by those Combatant Commanders whose component commands have custody of nuclear weapons or radioactive nuclear weapon components.

DL1.1.145. Restricted Data (RD). All data (information) concerning:

DL1.1.145.1. Design, manufacture, or utilization of nuclear weapons.

DL1.1.145.2. Production of special nuclear material.

DL1.1.145.3. Use of special nuclear material in the production of energy but not including data declassified or removed from the restricted data category.

DL1.1.146. Roentgen. An obsolete unit of exposure of gamma (or x-ray) radiation in field dosimetry.

DL1.1.147. Roentgen Equivalent Man/Mammal (REM). An obsolete unit of dose replaced by the Sievert (Sv). One REM is the quantity of ionizing radiation of any type which, when absorbed by man or other mammals, produces a physiological effect equivalent to that produced by the absorption of 1 roentgen of x-ray or gamma radiation.

DL1.1.148. Safing. As applied to weapons and ammunition, the changing from a state of readiness for initiation to a safe condition.

DL1.1.149. Security Area. The area surrounding the accident site in an overseas country where a two-person security policy is established to prevent unauthorized access to classified defense information, equipment, or material. The cooperation by local authorities and host nation consent should be obtained through prior host nation agreements.

DL1.1.150. Senior Energy Official (SEO). Responsible for DOE's response organization and the focal point for interfacing with DoD and other Agencies, coordinating DOE asset deployment, integration (including identifying and coordinating logistics requirements), and operations when DOE is in a support role to DoD. When DOE is the LFA during a response, the SEO is responsible for the overall Federal response, and the DOE OSC is responsible for the DOE response organization.

DL1.1.151. Senior FEMA Official. A person appointed by the Director of FEMA, or Directors representative, to initially direct the FEMA response at the scene of a radiological emergency. Also acts as the Team Leader for the Advance Element of the Emergency Response Team (ERTA).

DL1.1.152. Sievert (Sv). International System of Units (SI) unit of any of the quantities expressed as dose equivalent. The dose equivalent in sieverts is equal to the absorbed dose in grays multiplied by the quality factor (1 Sv = 100 REMs).

DL1.1.153. Site Remediation Working Group (SRWG). An organization formed at the accident scene whose sole purpose is to focus on site remediation issues. The SRWG draws upon the expertise of the various elements who respond to the accident to form a coordinated site remediation team.

DL1.1.154 Special Nuclear Material (SNM). Plutonium and uranium enriched in the 238 or 235 isotope, and any other material that DOE, pursuant to the provisions of Section 51 of the AEA of 1954, determines to be special nuclear material. Does not include source material.

DL1.1.155. Transuranic. Being an element having an atomic number greater than that of uranium.

DL1.1.156. Tritium (T or H-3). Tritium is a radioactive isotope of hydrogen having one proton and two neutrons in the nucleus. Tritium is a low-beta emitter and poses a radiation hazard from inhalation.

DL1.1.157. Tuballoy (TU). A term, of British origin, for uranium metal containing U-238 and U-235 in natural proportions; therefore, the term is considered ambiguous, and its use is discouraged. This term is sometimes applied to depleted uranium.

DL1.1.158. Two-Person Concept. A system designed to prohibit access by an individual to nuclear weapons and certain designated components by requiring the presence at all times of at least two authorized persons capable of detecting incorrect or unauthorized procedures with respect to the task to be performed. Also referred to as the two-person rule or policy.

DL1.1.159. Two-Person Control. The close surveillance and control of materials at all times by a minimum of two authorized persons, each capable of detecting incorrect or unauthorized procedures with respect to the task to be performed and each familiar with established security requirements.

DL1.1.160. Uranium (U). Uranium is a heavy, silvery white, radioactive metal. In air, the metal becomes coated with a layer of oxide that will make it appear from a golden-yellow color to almost black. Uranium is an alpha emitter. Uranium presents chemical and radiation hazards and exposure may occur during mining, processing of ore, or production of uranium metal. Uranium and its compounds have both toxic chemical and radiation effects, depending on dose and exposure time, as well as type of exposure, such as inhalation or skin contact.

DL1.1.161. Warhead. That part of a missile, projectile, torpedo, rocket, or other munitions that contains the nuclear or thermonuclear system, HE system, chemical or biological agents, or inert materials intended to inflict damage.

DL1.1.162. Warhead Section (WHS). A completely assembled warhead including appropriate skin sections and related components.

DL1.1.163. Warning Order. A planning directive that describes the situation, allocates forces and resources, establishes command relationships, provides other initial planning guidance, and initiates subordinate unit mission planning.

DL1.1.164. Weapon Debris (nuclear). The residue of a nuclear weapon after it has exploded or burned; that is, the materials used for the casing and other components of the weapon, plus unexpended plutonium or uranium, together with fission products, if any.

DL1.1.165. Weapons Recovery. Includes a comprehensive assessment of the accident, neutralizing the weapon hazards, and removing, packaging, and shipping of the weapon hazards.

AL1. **ABBREVIATIONS AND/OR ACRONYMS**

AL1.1.	AAC	Ambient Air Concentration
AL1.2.	AB	Air Base
AL1.3.	ACC	Air Combat Command
AL1.4.	ACE	Adaptive Communications Element
AL1.5.	AE	Ammunition ship
AL1.6.	AEA	Atomic Energy Act
AL1.7.	AF	Air Force
AL1.8.	AFB	Air Force Base
AL1.9.	AFCA	(U.S.) Air Force Communications Agency
AL1.10.	AFCIC	Air Force Communications and Information Center
AL1.11.	AFFF	Aqueous Film Forming Foam
AL1.12.	AFI	(U.S.) Air Force Instruction
AL1.13.	AFOC	Air Force Operations Center
AL1.14.	AFR	Average Flow Rate
AL1.15.	AFRAT	Air Force Radiation Assessment Team
AL1.16.	AFRRI	Armed Forces Radiobiology Research Institute
AL1.17.	Am	Americium
AL1.18.	AM	Amplitude Modulation
AL1.19.	AMC	Air Mobility Command
AL1.20.	AMS	Aerial Measuring System
AL1.21.	AOC	Army Operations Center
AL1.22.	AOE	Fast combat support ship
AL1.23.	AR	(U.S.) Army Regulation
AL1.24.	ARAC	Atmospheric Release Advisory Capability
AL1.25.	ARG	Accident Response Group
AL1.26.	ASD(PA)	Assistant Secretary of Defense (Public Affairs)
AL1.27.	AT&T	American Telephone and Telegraph
AL1.28.	ATSD(NCB)	Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs
AL1.29.	AUTODIN	Automatic Digital Network
AL1.30.	AUTOSEVOCOM	Automated Secure Voice Communication System
AL1.31.	AWP	Access Work Permit
AL1.32.	Be	Beryllium
AL1.33.	Bq	Becquerel
AL1.34.	BUMED	Bureau of Medicine and Surgery

AL1.35. C2	Command and Control
AL1.36. CANTRAC	Catalog of Naval Training Courses
AL1.37. CAT	Crisis Action Team
AL1.38. CCA	Contamination Control Area
AL1.39. CCG	Combat Communications Group (U.S.)
AL1.40. CCG	Crisis Coordinating Group
AL1.41. CCL	Contamination Control Line
AL1.42. CCS	Contamination Control Station
AL1.43. CDC	Centers for Disease Control and Prevention
AL1.44. CDCE	Contamination Disposal Coordinating Element
AL1.45. CDRH	Center for Devices and Radiological Health
AL1.46. CE	Civil Engineer (Air Force)
AL1.47. CE	Corps of Engineers
AL1.48. CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
AL1.49. CF	Composite Fiber
AL1.50. CF	Conversion Factor
AL1.51. CFA	Cognizant Federal Agency
AL1.52. CFM	Cubic Feet per Minute
AL1.53. CFR	Code of Federal Regulations
AL1.54. cGy	CentiGray
AL1.55. CHPPM	Center for Health Promotion and Preventive Medicine (Army)
AL1.56. Ci	Curie
AL1.57. CIB	Combined Information Bureau
AL1.58. CINC	Commander-in-Chief
AL1.59. CJCS	Chairman, Joint Chiefs of Staff
AL1.60. CJCSI	Chairman, Joint Chiefs of Staff Instruction
AL1.61. CMAT	Consequence Management Advisory Team (formerly DNAT)
AL1.62. CNWDI	Critical Nuclear Weapon Design Information
AL1.63. CO	Commanding Officer
AL1.64. COM	Chief of Mission
AL1.65. COMNAVSTA	Commander, Naval Station
AL1.66. COMSEC	Communications Security
AL1.67. CONPLAN	Contingency Plan
AL1.68. CONUS	Continental United States
AL1.69. CP	Command Post
AL1.70. CPM	Counts per Minute

AL1.71.	CPR	Cardiopulmonary Resuscitation
AL1.72.	CPX	Command Post Exercise
AL1.73.	CRA	Contamination Reduction Area
AL1.74.	CRTF	Commander, Response Task Force
AL1.75.	CV	Aircraft carrier
AL1.76.	CVN	Aircraft carrier, nuclear powered
AL1.77.	DA	Department of the Army
AL1.78.	DAC	Derived Air Concentration
AL1.79.	DC	Data Center
AL1.80.	DCE	Defense Coordinating Element
AL1.81.	DCG	Disaster Control Group
AL1.82.	DCO	Defense Coordinating Officer
AL1.83.	DCS	Defense Communications Systems
AL1.84.	DDI	Dymeryl diisocyanate
AL1.85.	DDO	Deputy Director of Operations
AL1.86.	DECON	Decontamination
AL1.87.	DERA	Defense Environmental Restoration Act
AL1.88.	DFO	Disaster Field Office
AL1.89.	DII	Defense Information Infrastructure
AL1.90.	DNA	Defense Nuclear Agency (see DSWA and DTRA)
AL1.91.	DNAT	Defense Nuclear Advisory Team (now CMAT)
AL1.92.	DNWS	Defense Nuclear Weapons School (formerly INWS)
AL1.93.	DOC	Department of Commerce
AL1.94.	DoD	Department of Defense
AL1.95.	DoDD	Department of Defense Directive
AL1.96.	DoDG	Department of Defense Guide
AL1.97.	DoDI	Department of Defense Instruction
AL1.98.	DoDM	Department of Defense Manual
AL1.99.	DOE	Department of Energy
AL1.100.	DOE/AL	Department of Energy/Albuquerque Operations
AL1.101.	DOE/NV	Department of Energy/Nevada Operations
AL1.102.	DOI	Department of the Interior
AL1.103.	DOMS	Director of Military Support
AL1.104.	DOS	Department of State
AL1.105.	DOT	Department of Transportation
AL1.106.	DPM/m^3	Disintegrations per Minute per cubic meter
AL1.107.	DRF	Disaster Response Force
AL1.108.	DSFO	Deputy Senior FEMA Official
AL1.109.	DSN	Defense Switched Network
AL1.110.	DSWA	Defense Special Weapons Agency (formerly DNA and now part of DTRA)

AL1.111.	DTPA	Diethylenetriamine Pentaacetic Acid
AL1.112.	DTRA	Defense Threat Reduction Agency (includes what was formerly DSWA)
AL1.113.	DU	Depleted Uranium
AL1.114.	EAC	Emergency Actions Committee
AL1.115.	EACT	Emergency Action and Coordination Team
AL1.116.	ECP	Entry Control Point
AL1.117.	ECS	Exercise Control Staff
AL1.118.	EDTA	Ethylenediamine Tetraacetic Acid
AL1.119.	EEFI	Essential Elements of Friendly Information
AL1.120.	EICC	Emergency Information and Coordination Center (FEMA)
AL1.121.	E-Mail	Electronic Mail
AL1.122.	EMR	Electro-Magnetic Radiation
AL1.123.	EMT	Emergency Medical Team
AL1.124.	EO	Executive Order
AL1.125.	EOC	Emergency Operations Center
AL1.126.	EOD	Explosive Ordnance Disposal
AL1.127.	EPA	Environmental Protection Agency
AL1.128.	EPZ	Emergency Planning Zone
AL1.129.	ERT	Emergency Response Team
AL1.130.	ERT-A	Emergency Response Team-Advance Element
AL1.131.	ESC	Executive Support Center
AL1.132.	EST	Emergency Support Team
AL1.133.	FAA	Federal Aviation Administration
AL1.134.	fax	facsimile
AL1.135.	FBI	Federal Bureau of Investigation
AL1.136.	FCDTRA	Field Command, Defense Threat Reduction Agency (now Albuquerque Operations)
AL1.137.	FCO	Federal Coordinating Officer
AL1.138.	FDA	Food and Drug Administration
AL1.139.	FEMA	Federal Emergency Management Agency
AL1.140.	FIDLER	Field Instrument for the Detection of Low-Energy Radiation
AL1.141.	FLTSAT	Fleet Satellite
AL1.142.	FM	Frequency Modulation
AL1.143.	FOE	Follow-On Element
AL1.144.	FOIA	Freedom of Information Act
AL1.145.	FRC	Federal Response Center
AL1.146.	FRD	Formerly Restricted Data

AL1.147. FRERP	Federal Radiological Emergency Response Plan
AL1.148. FRMAC	Federal Radiological Monitoring and Assessment Center
AL1.149. FRMAP	Federal Radiological Monitoring and Assessment Plan
AL1.150. FRP	Federal Response Plan
AL1.151. FRPCC	Federal Radiological Preparedness Coordinating Committee
AL1.152. FTS	Federal Telecommunications System
AL1.153. FTX	Field Training Exercise
AL1.154. FUNCPLAN	Functional Plan
AL1.155. GEP	Ground Entry Point
AL1.156. GMF	Ground Mobile Force
AL1.157. GMT	Greenwich Mean Time
AL1.158. GPS	Global Positioning System
AL1.159. GSA	General Services Administration
AL1.160. Gy	Gray (unit of dose)
AL1.161. HAZMAT	Hazardous Materials
AL1.162. HE	High Explosive
AL1.163. HEPA	High Efficiency Particle Air
AL1.164. HEU	Highly Enriched Uranium
AL1.165. HF	High Frequency
AL1.166. HHS	Department of Health and Human Services
AL1.167 HICOM	High Command
AL1.168. HOTSPOT	Department of Energy Mobile Counting Laboratory
AL1.169. HPAC	Hazard Prediction and Assessment Capability
AL1.170. HQ	Headquarter(s)
AL1.171. HTO	Tritium water vapor (also TO)
AL1.172. HTPB	Hydroxyl Terminated Polybutadine
AL1.173. HUD	Department of Housing and Urban Development
AL1.174. IC	Inhaled Concentration
AL1.175. ICC	Interstate Commerce Commission
AL1.176. ICRP	International Council of Radiological Protection
AL1.177. IERA	Institute for Environment, Safety, and Occupational Health Risk Analysis
AL1.178. IHE	Insensitive High Explosive
AL1.179. IMA	Installation Medical Authority
AL1.180. IND	Improvised Nuclear Device

AL1.181.	INMARSAT	International Marine Satellite
AL1.183.	INWS	Interservice Nuclear Weapon School
AL1.184.	IRE	Initial Response Element
AL1.185.	IRF	Initial Response Force
AL1.186.	ISB	Independent Sideband
AL1.187.	IV	Intravenous; intravenously
AL1.188.	JA	Judge Advocate
AL1.189.	JACC/CP	Joint Airborne Communications Center/Command Post
AL1.190.	JCCSA	Joint Communications Contingency Station Assets
AL1.191.	JCS	Joint Chiefs of Staff
AL1.192.	JCSE	Joint Communications Support Element
AL1.193.	JCTA	Joint Controlled Tactical Communications Assets
AL1.194.	JHEC	Joint Hazard Evaluation Center
AL1.195.	JIC	Joint Information Center
AL1.196.	JLCO	Joint Legal Claims Office
AL1.197.	JMOCC	Joint Maritime Operations Command Center
AL1.198.	JNACC	Joint Nuclear Accident Coordinating Center
AL1.199.	JNAIRT	Joint Nuclear Accident/Incident Response Team
AL1.200.	JOC	Joint Operations Center
AL1.201.	JS	Joint Staff
AL1.202.	JSCC	Joint Security Control Center
AL1.203.	JSCP	Joint Strategic Capability Plan
AL1.204.	keV	Thousand Electron Volts
AL1.205.	KIWI	Ground measuring system named for a flightless bird
AL1.206.	LAC	Liquid Abrasive Cutter
AL1.207.	LAN	Local Area Network
AL1.208.	LANL	Los Alamos National Laboratory
AL1.209.	LFA	Lead Federal Agency
AL1.210.	LGX	Logistics Plans
AL1.211.	Li	Lithium
AL1.212.	LINAC	Linear Accelerator
AL1.213.	LLNL	Lawrence Livermore National Laboratory
AL1.214.	LMR	Land Mobile Radio
AL1.215.	LOS	Limit of Sensitivity
AL1.216.	uCi/m^3	MicroCuries per cubic meter
AL1.217.	iCi/m^2	MicroCuries per meter squared

AL1.218. MARD	Mobile Accident Response Development
AL1.219. MASt	Military Anti-Shock (trousers)
AL1.220. MAST	Mobile Ashore Support Terminal
AL1.221. MDS	Meteorological Data Servers
AL1.222. MET	Meteorological
AL1.223. MeV	Million Electron Volts
AL1.224. MICFAC	Mobile Integrated Command Facility
AL1.225. MILSTRIP	Military Standard Requisitioning and Issue Procedures
AL1.226. MOP	Military Operational Posture
AL1.227. MPC	Maximum Permissible Concentration
AL1.228. mph	miles per hour
AL1.229. MRAT	Medical Radiobiology Advisory Team
AL1.230. MRT	Medical Radiology Team
AL1.231. MSHA	Mine Safety and Health Administration
AL1.232. NAICO	Nuclear Accident and Incident Control Office
AL1.233. NARCL	Nuclear Accident Response Capability Listing
AL1.234. NARP	Nuclear (Weapon) Accident Response Procedures
AL1.235. NASA	National Aeronautics and Space Administration
AL1.236. NATO	North Atlantic Treaty Organization
AL1.237. NAVEDTRA	Naval Education and Training
AL1.238. NAVMED	Navy Bureau of Medicine and Surgery
AL1.239. NAVSCOLEOD	Naval School, Explosive Ordnance Disposal
AL1.240. NBC	Nuclear, Biological, Chemical
AL1.241. NCA	National Command Authority
AL1.242. NCAIC	Nuclear Chemical Accident/Incident Control
AL1.243. NCC	National Coordinating Center
AL1.244. NCC	Navy Command Center
AL1.245. NCRP	National Council on Radiation Protection and Measurements
AL1.246. NCS	National Communications System
AL1.247. NCTAMSLANT	Naval Computer and Telecommunications Area Master Station, Atlantic
AL1.248. NDA	National Defense Area
AL1.249. NDE	Non-Destructive Evaluation
AL1.250. NECC	National Emergency Coordination Center (FEMA)

AL1.251.	NESDIS	National Environmental Satellite Data and Information Service
AL1.252.	NIMA	National Imagery and Mapping Agency
AL1.253.	NIOSH	National Institute of Occupational Safety and Health
AL1.254.	NIST	National Institute of Standards and Technology
AL1.255.	NMCC	National Military Command Center
AL1.256.	NMFS	National Marine Fisheries Service
AL1.257.	NOAA	National Oceanic and Atmospheric Administration
AL1.258.	NOS	National Ocean Service
AL1.259.	NRC	National Response Center
AL1.260.	NRC	Nuclear Regulatory Commission
AL1.261.	NSA	National Security Area
AL1.262.	NSC	National Security Council
AL1.263.	NSFO	Navy Standard Fuel Oil
AL1.264.	NSN	National Stock Number
AL1.265.	NSTM	Naval Ships Technical Manual
AL1.266.	NTS	Nevada Test Site
AL1.267.	NTSB	National Transportation Safety Board
AL1.268.	NWS	National Weather Service
AL1.269.	OAR	Office of Oceanic and Atmospheric Research
AL1.270.	OASD(PA)	Office of the Assistant Secretary of Defense (Public Affairs)
AL1.271.	OATSD(NCB)	Office of the Assistant to the Secretary of Defense (Nuclear, Chemical, and Biological Defense Programs)
AL1.272.	OBA	Oxygen Breathing Apparatus
AL1.273.	OCONUS	outside continental United States
AL1.274.	ODCSOP	Office of the Deputy Chief of Staff for Operations and Plans
AL1.275.	OEG	Operational Exposure Guidance
AL1.276.	OEMT	Operational Emergency Management Team
AL1.277.	OPLAN	Operations Plan
AL1.278.	OPNAVINST	Chief of Naval Operations Instructions
AL1.279.	OPREP	Chief of Naval Operations Instructions
AL1.280.	OPSEC	Operational Security
AL1.281.	OSC	On-Scene Commander
AL1.282.	OSD	Office of the Secretary of Defense
AL1.283.	PA	Public Affairs

AL1.284.	PACAF	Pacific Air Forces
AL1.285.	PAG	Protective Action Guide
AL1.286.	PAO	Public Affairs Officer
AL1.287.	PAR	Protective Action Recommendation
AL1.288.	Pb	Lead
AL1.289.	PF	Protection Factor
AL1.290.	PHS	Public Health Service
AL1.291.	PKP	Purple K (fire extinguisher)
AL1.291.	PL	Public Law
AL1.292.	PLA	Principal Legal Advisor
AL1.293.	POC	Point of Contact
AL1.294.	POL	Petrolium, Oil and Lubricants
AL1.295.	PPE	Personal Protective Equipment
AL1.296.	PRC	Planned Requirements Conversion
AL1.297.	PRP	Personnel Reliability Program
AL1.298.	PSA	Public Service Announcement
AL1.299.	Pu	Plutonium
AL1.300.	Q/D	Quantity Distance
AL1.301.	R	Roentgen
AL1.302.	RAD	Radiation Absorbed Dose
AL1.303.	RADCON	Radiological Control
AL1.304.	RADIAC	Radioactivity Detection, Indication, and Computation
AL1.305.	RAM	Radar Absorbent Materials
AL1.306.	RAMT	Radiological Advisory Medical Team
AL1.307.	RAP	Radiological Assistance Program
AL1.308.	RASCAL	Radiological Air Sampling Counting and Analysis Lab
AL1.309.	RASO	Radiological Safety Officer
AL1.310.	RCA	Radiological Control Area
AL1.311.	RCL	Radiological Control Line
AL1.312.	RCO	Regional Coordinating Office
AL1.313.	RD	Restricted Data
AL1.314.	REAC/TS	Radiation Emergency Assistance Center/Training Site
AL1.315.	REM	Roentgen Equivalent Man/Mammal
AL1.316.	RER	Re-Entry Recommendation
AL1.317.	RF	Resuspension Factor
AL1.318.	RI/FS	Remedial Investigation/Feasibility Study
AL1.319.	ROE	Rules of Engagement

AL1.320.	RPM	Remedial Project Manager
AL1.321.	RSP	Render Safe Procedure
AL1.322.	RTF	Response Task Force
AL1.323.	RTR	Real-Time Radiography
AL1.324.	SAAM	Special Assignment Airlift Mission
AL1.325.	SCBA	Self-Contained Breathing Apparatus
AL1.326.	SCI	Sensitive Compartmented Information
AL1.327.	SECORD	Secure Cord Switchboard
AL1.328.	SEO	Senior Energy Official
AL1.329.	SFO	Senior FEMA Official
AL1.330.	SGF	Super High Frequency
AL1.331.	SITREP	Situation Report
AL1.332.	SNM	Special Nuclear Material
AL1.333.	SOFA	Status of Forces Agreement
AL1.334.	SOI	Signal Operating Instructions
AL1.335.	SR	Site Remediation
AL1.336.	SRP	Site Remediation Plan
AL1.337.	SRWG	Site Remediation Working Group
AL1.338.	SSB	Single Sideband
AL1.339.	SSN or SSAN	Social Security Number
AL1.340.	STANAG	Standard Agreement
AL1.341.	STU-III	Secure Telephone Unit Third Generation
AL1.342.	Sv	Sievert (unit of exposure)
AL1.343.	SWOP	Special Weapons Ordnance Publication
AL1.344.	T	Time
AL1.345.	TAC/LGX	Tactical Air Force Communications/Logistics Plans
AL1.346.	TACSAT	Tactical Satellite
AL1.347.	TELEX	Telephone Exchange
AL1.348.	Th	Thorium
AL1.349.	TLD	Thermo-Luminescent Dosimeter
AL1.350.	TNT	Trinitrotoluene
AL1.351.	TO	Tritium water vapor (also HTO)
AL1.352.	TP	Technical Publication
AL1.353.	T ot (HP^3)	Tritium
AL1.354.	Tu	Tuballoy

AL1.355. TWX	Teletypewriter Exchange
AL1.356. TYCOM	Type Commander
AL1.357. U	Uranium
AL1.358. UCT	Universal Coordinated Time
AL1.359. UHF	Ultra High Frequency
AL1.360. U.S.	United States
AL1.361. USA	U.S. Army
AL1.362. USACE	U.S. Army Corps of Engineers
AL1.363. USAF	U.S. Air Force
AL1.364. USAFE	U.S. Air Forces in Europe
AL1.365. USANCA	U.S. Army Nuclear and Chemical Agency
AL1.366. USC	U.S. Code
AL1.367. USCA	U.S. Code Anotated
AL1.368. USCINCACOM	U.S. Commander in Chief, Atlantic Command
AL1.369. USCINCEUR	U.S. Commander in Chief, European Command
AL1.370. USCINCPAC	U.S. Commander in Chief, Pacific Command
AL1.371. USCINCSO	U.S. Commander in Chief, Southern Command
AL1.372. USDA	U.S. Department of Agriculture
AL1.373. USFORSCOM	U.S. Army Forces Command
AL1.374. USG	U.S. Government
AL1.375. USMC	U.S. Marine Corps
AL1.376. VHF	Very High Frequency
AL1.377. WATS	Wide Area Telephone Service
AL1.378. WHO	World Health Organization
AL1.379. WHS	Warhead Section
AL1.380. WHSR	White House Situation Room
AL1.381. WRAMC	Walter Reed Army Medical Center

PART I

PLANNING, POLICY, AND RESPONSE GUIDANCE

C1. CHAPTER 1

INTRODUCTION

C1.1. REISSUANCE AND PURPOSE

This manual updates policy, responsibilities, and procedures for:

C1.1.1. Department of Defense (DoD) forces to prepare for and respond to a radiological accident or event. This manual expands and prescribes procedures found in DoD Directive (DoDD) 3150.8, DoD Response to Radiological Accidents, reference (a).

C1.1.2. Standardizing, where appropriate, DoD methods and integrating them with Department of State (DOS) responsibilities and procedures, Department of Energy (DOE) responsibilities and procedures, and the Federal Radiological Emergency Response Plan (FRERP) responsibilities and procedures, reference (b).

C1.1.3. Providing a framework for DoD elements responding to non-DoD radiological events under the FRERP or interagency support agreements.

C1.2. POLICY

It is DoD policy that:

C1.2.1. DoD take the lead in responding to an accident or incident involving radioactive materials when DoD is responsible for the material. DoD is responsible for the material when the material is or was in DoD custody at the time of the accident, incident, or loss.

C1.2.2. An Initial Response Force (IRF) be dispatched from the closest military installation having an appropriate emergency response capability at the time of the radiological event.

C1.2.3. A Combatant Commander will be designated as the supporting Commander-in-Chief (CINC) and dispatch a Response Task Force (RTF) to relieve the IRF.

C1.3. RESPONSIBILITIES

C1.3.1. There are three identifiable operational responses to a radiological accident or event: initial response, emergency actions, and site remediation. Initial response and emergency actions (Figure C1.F1.) have identifiable beginning and end points but some actions may overlap; site remediation does not have an identifiable end point. Planning for and execution of response activities covering each area mentioned will overlap. Preparations and training for responses are not addressed in this manual.

C1.3.1.1. First Responders. Initial response begins when the accident occurs. The response is comprised predominantly of actions by fire and rescue, emergency medical, and law enforcement personnel whose response actions focus on the treatment and rescue of people involved. The first responders may be civilian, military (IRF), or a combination of both.

Figure C1.F1. Accident Operational Responses

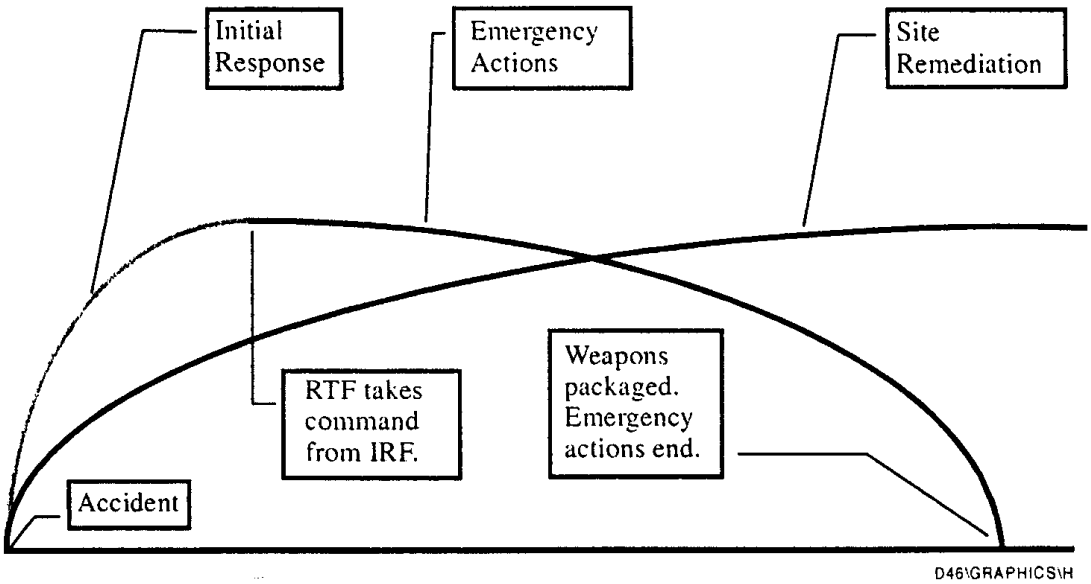


Figure C1.F2., although not all-inclusive, illustrates the interrelationship of initial response actions. When it is determined that the accident/event involves radiological materials, the preceding agencies may be joined by explosive ordnance disposal, contamination control, and other personnel with specific expertise unique to the situation. IRF procedures and responsibilities are discussed in detail in Chapter 2. Reconnaissance should be started as soon as possible after rescue and firefighting actions are completed.

C1.3.1.2. Emergency Actions. The IRF initiates emergency actions that are continued by the RTF upon arrival. The focus of activity will, over time, shift when personnel involved in the accident are rescued and weapon recovery becomes the prime concern of the Commander of the RTF (CRTF). See Chapter 2 for more on the RTF. Once the radiological materials have been safely packaged and removed, the third operational response, site remediation, becomes of primary concern. NOTE: A radiological response may not always require weapons recovery and site remediation.

C1.3.1.3. Site Remediation. Initial site remediation actions may begin soon after the accident occurs, but emergency actions take precedence. The importance of site remediation grows steadily as emergency actions resolve the imminent danger. The Site Remediation Working Group (SRWG) provides the forum within which the site remediation process is formulated. The end point of the process cannot be projected without an extended period of planning. Site remediation is discussed in detail in Part 3 of this manual.

C1.3.2. Combatant Commanders tasked with responding to radiological accidents are encouraged to supplement or modify this manual, as needed, to satisfy specific Host Nation or Status of Forces agreements.

C1.3.3. The organizational structures provided for the IRF and RTF are notional and based upon a large-scale response to a radiological accident. Specific circumstances may necessitate modifications to the organizational elements in this manual. Situational awareness and knowledge, coupled with sound professional judgment, must be utilized to tailor the notional response structure and tasks provided to accomplish the response mission. The Nuclear Weapon Accident Response Recovery Operations Flow Diagram, Figure C1.F3., depicts the various response actions and the approximate time of their occurrence. Also, Figure C1.F3. may be of assistance in accident response planning.

Figure C1.F2. Relationship of Initial Response Actions

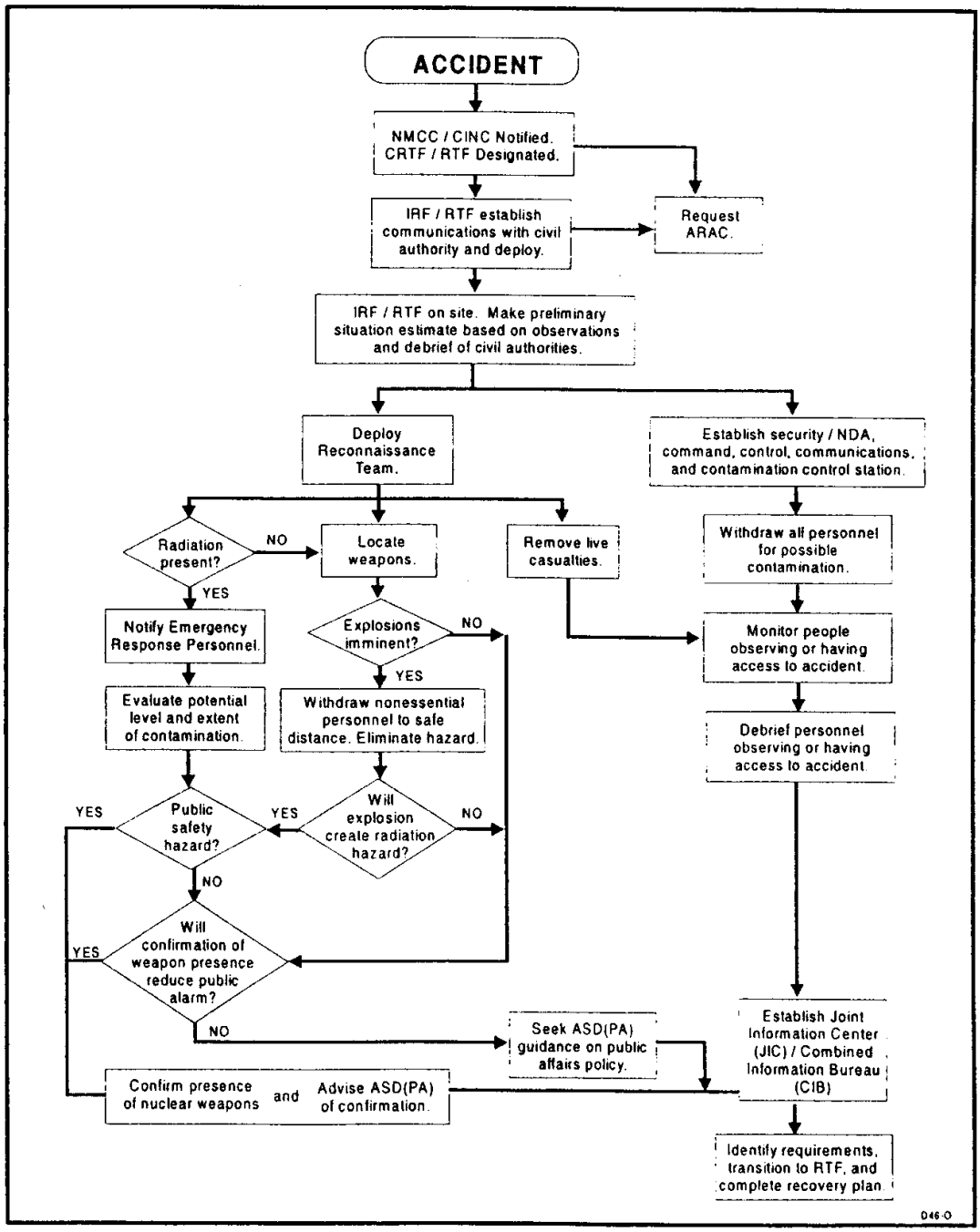
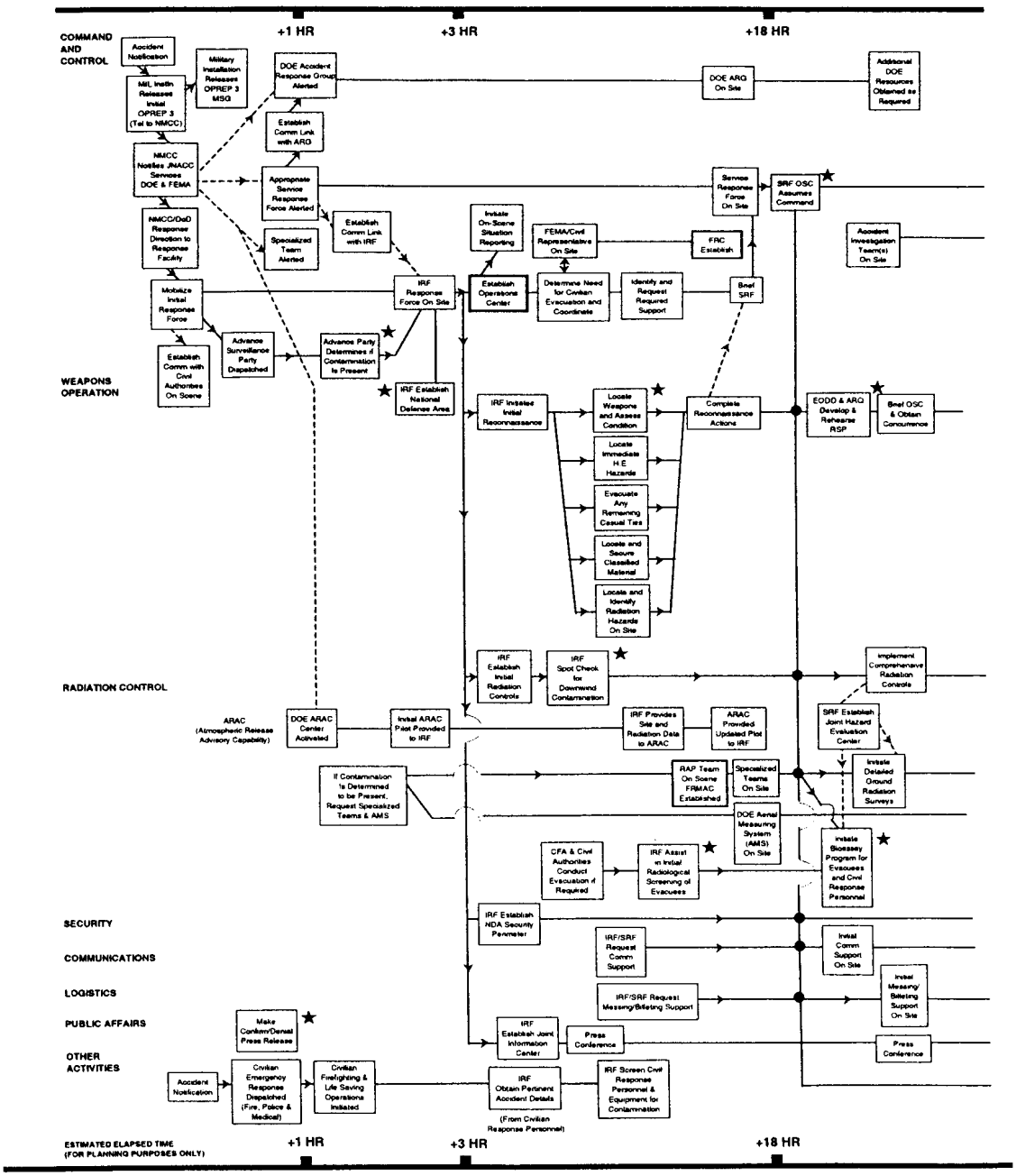


Figure C1.F3. Nuclear Weapon Accident Response Recovery Operations Flow Diagram



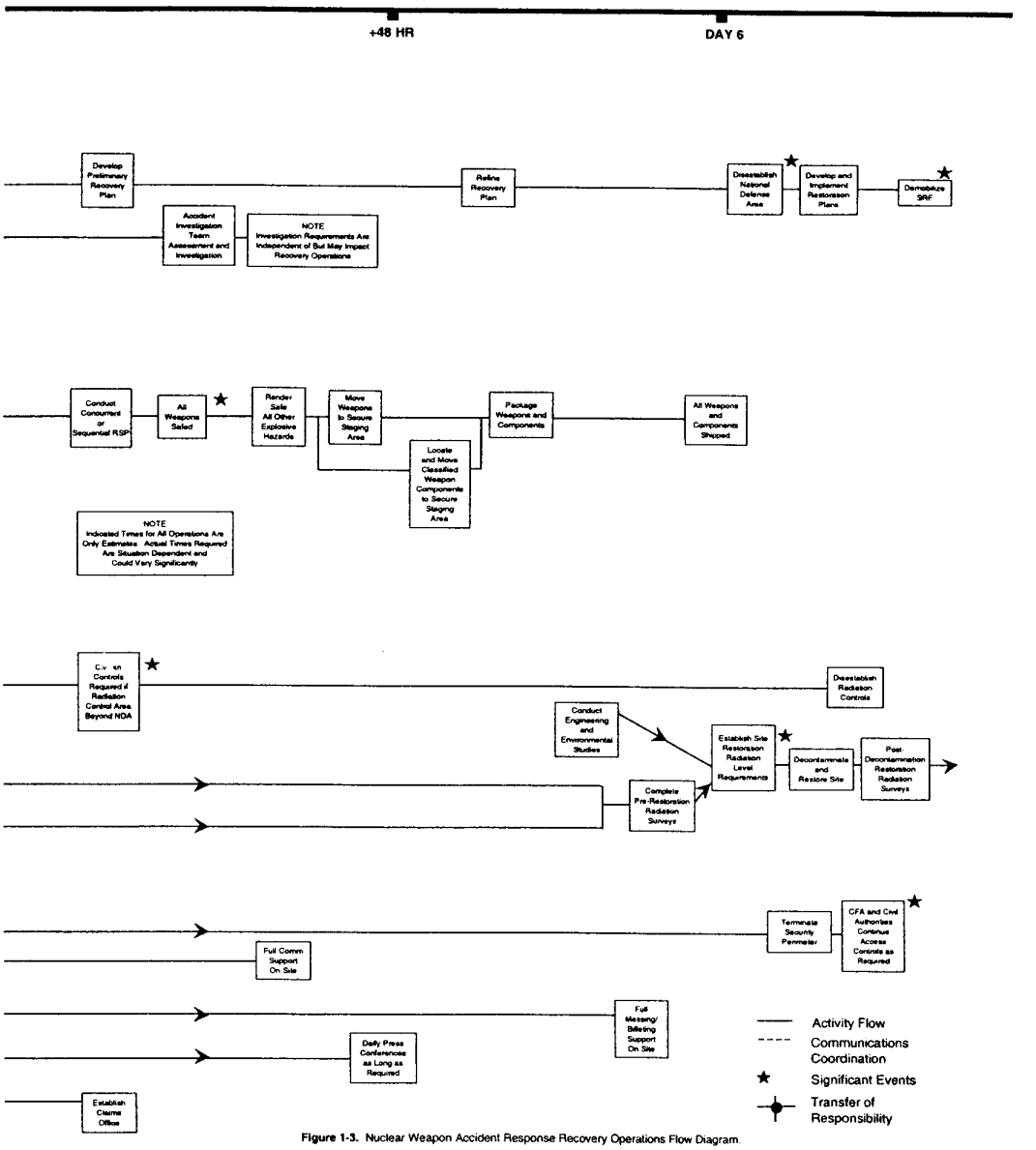


Figure 1-3. Nuclear Weapon Accident Response Recovery Operations Flow Diagram.

C1.3.4. This manual is designed to furnish a general approach to a nuclear weapon accident/event response. It is not a standalone manual. To be effective, the procedures contained in this manual must be used in conjunction with DoD Directives, Federal instructions, State/local plans, international/bilateral agreements, and theater policy.

C1.3.5. All radiological monitoring, measurement, and control forms described in this manual are operating documents. Operating documents are exempt from licensing in accordance with paragraph C4.4.2. of DoD 8910.1-M, "DoD Procedures for Management of Information Requirements," reference (c).

C1.3.6. All routine, situation, accident data, and incident reports are exempt from licensing in accordance with paragraph C4.4.3. of DoD 8910.1-M, reference (c).

C1.3.7. All information collected relative to Public Information Releases is exempt from licensing in accordance with paragraph C4.4.5. of DoD 8910.1-M, reference (c).

C1.3.8. All investigative surveys are exempt from licensing in accordance with paragraphs C3.8.2.2.4. and C4.4.8. of DoD 8910.1-M, reference (c).

C2. CHAPTER 2

NUCLEAR WEAPON ACCIDENT RESPONSE PROCEDURES

C2.1. INITIAL RESPONSE FORCE

C2.1.1. Selection. The IRF will normally be dispatched from the nearest military installation having a disaster response capability. This installation need not have a nuclear mission or radiological responsibility, but its IRF must accomplish certain minimum functions as outlined below. If more than one installation is equal distance from the accident, choose the installation most nuclear capable in accordance with DSWA 5100.52.1-L, reference (d).

C2.1.2. Decision to Deploy. An IRF may be directed to deploy as the result of:

C2.1.2.1. A request for assistance by local authorities.

C2.1.2.2. Direction to do so by a Combatant Commander or the National Military Command Center (NMCC).

C2.1.2.3. >The Installation Commander's decision.

C2.1.3. Minimum Composition. The IRF, as a minimum, should contain these specialties (preferably with knowledge and training in radiological hazards and emergency response procedures).

C2.1.3.1. Command element.

C2.1.3.2. Medical, Fire, and Rescue elements.

C2.1.3.3. Security element.

C2.1.3.4. Explosive Ordnance Disposal (EOD).

C2.1.3.5. Communications element.

C2.1.3.6. Public affairs element.

C2.1.4. Extended Composition. If available, the IRF should contain these specialties in addition to the above.

C2.1.4.1. Weapons maintenance specialists.

C2.1.4.2. Legal element.

C2.1.4.3. Engineering element.

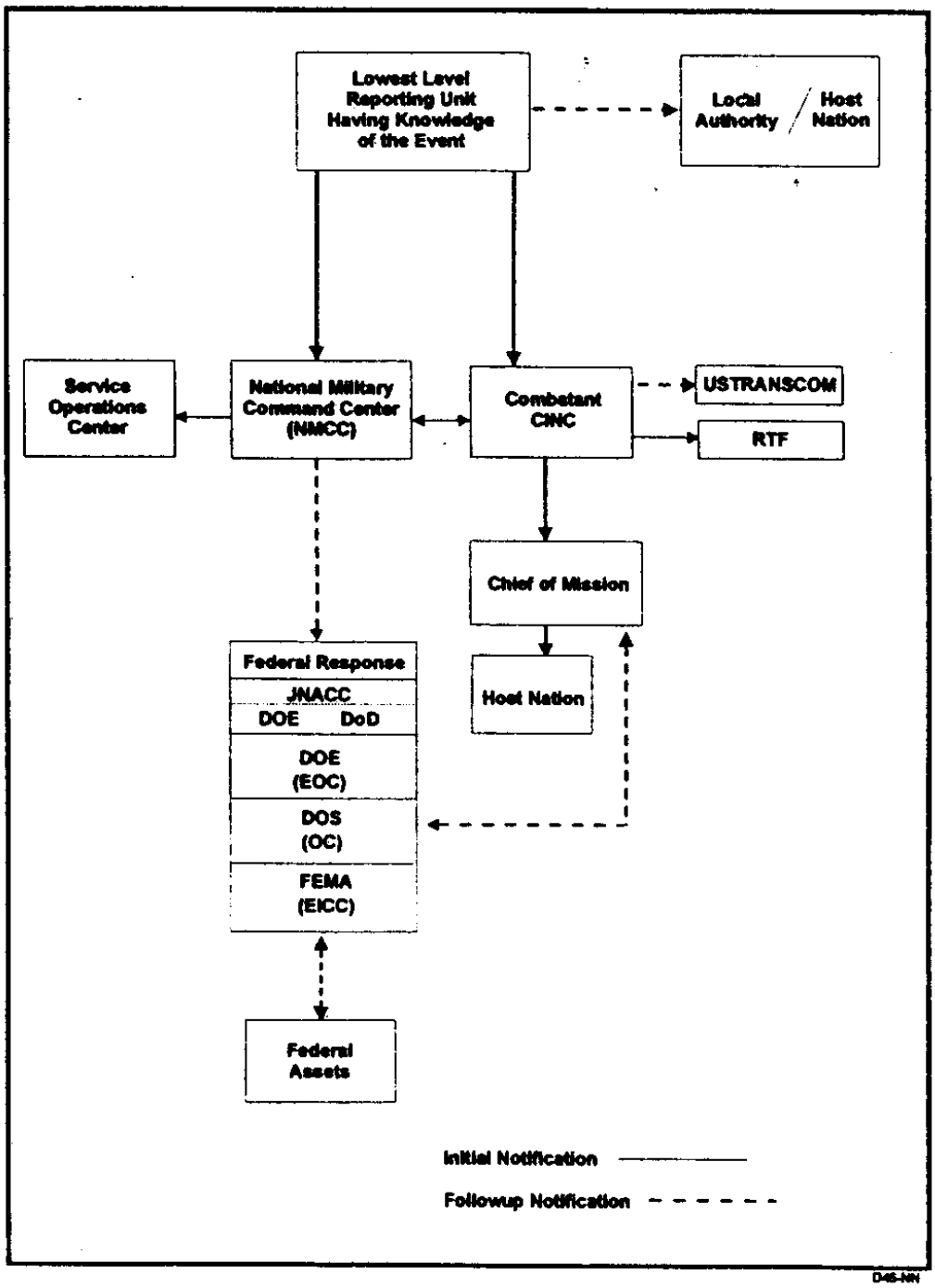
C2.1.4.4. Radiological hazard control element.

C2.1.5. Minimum IRF Functions. The IRF, as a minimum, will:

C2.1.5.1. Establish DoD command and control (C2), at the scene. This will normally be the IRF Commander and supporting elements; however, the establishment of C2 will initially be by the first military presence at the accident scene until the arrival of the IRF Commander.

C2.1.5.2. Establish contact with the NMCC and the responsible Combatant Command (Figure C2.F1.). Once notified, the NMCC will maintain open communications with the reporting unit. This link must be re-established immediately if broken. The NMCC will determine when this conference may be terminated.

Figure C2.F1. Nuclear Weapon Accident Notification Flow



C2.1.5.3. On foreign territory, establish contact with the U.S. Chief of Mission (COM) and applicable Host Nation authorities.

NOTE
During initial response, medical and firefighting responders should be given immediate and unrestricted access to the accident site.
Medical and firefighting responders should coordinate with EOD personnel to determine hazards in the accident area. The decision to withdraw medical and firefighting responders should be made by the Senior Fire Official and/or the IRF Commander and only when these responders are in immediate and excessive risk.
The evacuation and treatment of casualties are the highest priority. Security, PRP requirements should not impede these actions, but EOD initial explosive safety issues must be considered.
Firefighting activities needed to cool involved weapons or support medical response should take priority over security, PRP requirements, and EOD considerations.
Casualties need not be decontaminated prior to administration of lifesaving or other significant medical procedures, nor should evacuation or transport to medical facilities be delayed.
When the situation is stabilized, security and PRP requirements must be enforced, and EOD teams should be permitted to initiate procedures to mitigate hazards.

C2.1.5.4. Extinguish fires. Local firefighting capabilities may be used. If the weapon is exposed to high temperatures, civilian fire departments will require advice on proper cooling of the weapon.

C2.1.5.5. Rescue, stabilize, and evacuate casualties. Local ambulances and hospitals may be used. Casualties need not be decontaminated prior to evacuation, transport to medical facilities, or treatment; however, care must still be taken to minimize the spread of contamination. Decontamination (DECON) will occur once casualties are medically stabilized. Ambulances departing with casualties will not be decontaminated. Although it must be anticipated that such actions may spread contamination to a medical facility, it is unlikely to pose a significant threat to medical personnel and is appropriate whenever life threatening injuries exist. Responding medical personnel should not be denied access to the accident site for reasons of security, potential explosive hazards, or the nature of the accident, but should attempt to coordinate with EOD personnel when available. If possible, EOD should mark a clear path, or accompany emergency medical personnel into the accident site to assist in avoiding radioactive, explosive, and toxic hazards.

C2.1.5.6. Establish a National Defense Area (NDA) or Security Area in accordance with DoDD 5200.8, "Security of Military Installations and Resources," reference (e). If military security forces are unavailable or insufficient, local law enforcement personnel may be asked to restrict access to the area until an NDA, National Security Area (NSA), or Security Area is established.

C2.1.5.7. Secure the airspace over the accident site via the Federal Aviation Administration (FAA) or Host Nation.

C2.1.5.8. Assess status of weapons and report this information to the NMCC.

C2.1.5.9. If EOD assets are available, perform Initial Render Safe Procedures (RSPs) only. Beyond Initial RSP, EOD performs safing procedures on nuclear weapons only, with direct support of the DOE Accident Response Group (ARG).

C2.1.5.10. Brief the CRTF before the RTF assumes control.

C2.1.6. Extended Functions. Depending upon the originating installation, some IRFs may be capable of additional actions.

C2.1.6.1. If capabilities permit:

C2.1.6.1.1. Establish a temporary contamination control line, if required.

C2.1.6.1.2. Identify a forward operating location, staging area, and reception center for follow-on forces.

C2.1.6.2. Provide necessary operational security.

C2.1.6.2.1. Have a security element for perimeter security, entry and exit control, and protection of classified information and property.

C2.1.6.2.2. If internal resources are not available, request assistance of local law enforcement officials to secure the area, prevent unauthorized entry, and remove unauthorized personnel.

C2.1.6.2.3. Establish an operations area, base camp, and contamination control area.

C2.1.6.2.4. Provide appropriate protective equipment for perimeter guards who are posted in a contaminated area. When posting perimeter guards, consider the possibility of contamination of clean areas due to wind shift and resuspension of contaminants.

C2.1.6.3. Determine if contamination is present and the nature of the contamination. The NMCC shall be advised if contamination is or is not detected.

C2.1.6.3.1. Determine and report weather conditions.

C2.1.6.3.2. Place air samplers upwind and downwind of the accident site.

C2.1.6.3.3. Receive and use Atmospheric Release Advisory Capability (ARAC) plots or Hazard Prediction and Assessment Capability (HPAC) modeling predictions, if previously requested.

C2.1.6.3.4. Determine the status and location of all radioactive material.

C2.1.6.3.5. If no radiation was released during the accident, prepare to respond in the event of a release during recovery operations.

C2.1.6.4. Ensure that information conduits are established.

C2.1.6.4.1. Initiate and continue reporting in accordance with Chairman, Joint Chiefs of Staff Instruction (CJCSI) 3150.03, "Joint Reporting Structures, Event and Incident Reports," reference (f), until relieved by the CRTF. Reports shall not be delayed to gather more information.

C2.1.6.4.2. Initiate Public Affairs (PA) procedures and establish direct communications with the Office of the Assistant Secretary of Defense (Public Affairs) (OASD(PA)).

C2.1.6.4.3. Provide appropriate news releases.

C2.1.6.4.4. If applicable and necessary, confirm the presence of nuclear weapons in accordance with DoDD 5230.16, "Nuclear Accident and Incident Public Affairs Guidance," reference (g). DoD policy is to neither confirm nor deny the presence or absence of nuclear weapons at any specific location, but exceptions under reference (b) are allowed when it is necessary to implement public safety actions or reduce public alarm. Some Host Nation agreements may require automatic and immediate confirmation of the presence of a nuclear weapon.

C2.1.6.4.5. If on foreign territory, establish liaison with applicable Host Nation authorities and the U.S. COM.

C2.1.6.5. Protect the public and mitigate health and safety hazards.

C2.1.6.5.1. Coordinate with civil law enforcement agencies/Host Nation law agencies.

C2.1.6.5.2. Notify officials and personnel of potential hazards.

C2.1.6.5.3. Identify and decontaminate, as necessary, persons who may have been contaminated.

NOTE
Personnel entering an area that is contaminated, suspected of containing contamination, or who could be contaminated, should wear personal protective clothing and respiratory protection until contamination levels are established. Personnel may then change to the appropriate protective measures for the situation.

C2.2. TRANSITION OF INITIAL RESPONSE FORCE TO RESPONSE TASK FORCE

C2.2.1. Summary

C2.2.1.1. The CRTF and staff should receive a briefing from the IRF prior to the CRTF assuming command. The form and content of the briefing will vary depending upon the location and nature of the accident and the relative arrival times of the various response assets. The briefing may be developed and presented solely by the IRF or could be a joint product of the IRF, RTF, and other responding Federal or Host Nation staff elements. This chapter provides a template for the changeover briefing. This template may be reduced, expanded, or otherwise modified, as needed.

C2.2.1.2. Nearly simultaneously with IRF to RTF changeover, the Joint Nuclear Accident/Incident Response Team (JNAIRT) will transfer responsibility for managing the DoD response from the NMCC to the supported Commander-in-Chief's (CINC's) Command Center or other operations center.

C2.2.2. Briefing Template

C2.2.2.1. IRF Commander's introduction and general situation discussion.

C2.2.2.2. Weather

C2.2.2.2.1. Discussion of effect on recovery operations.

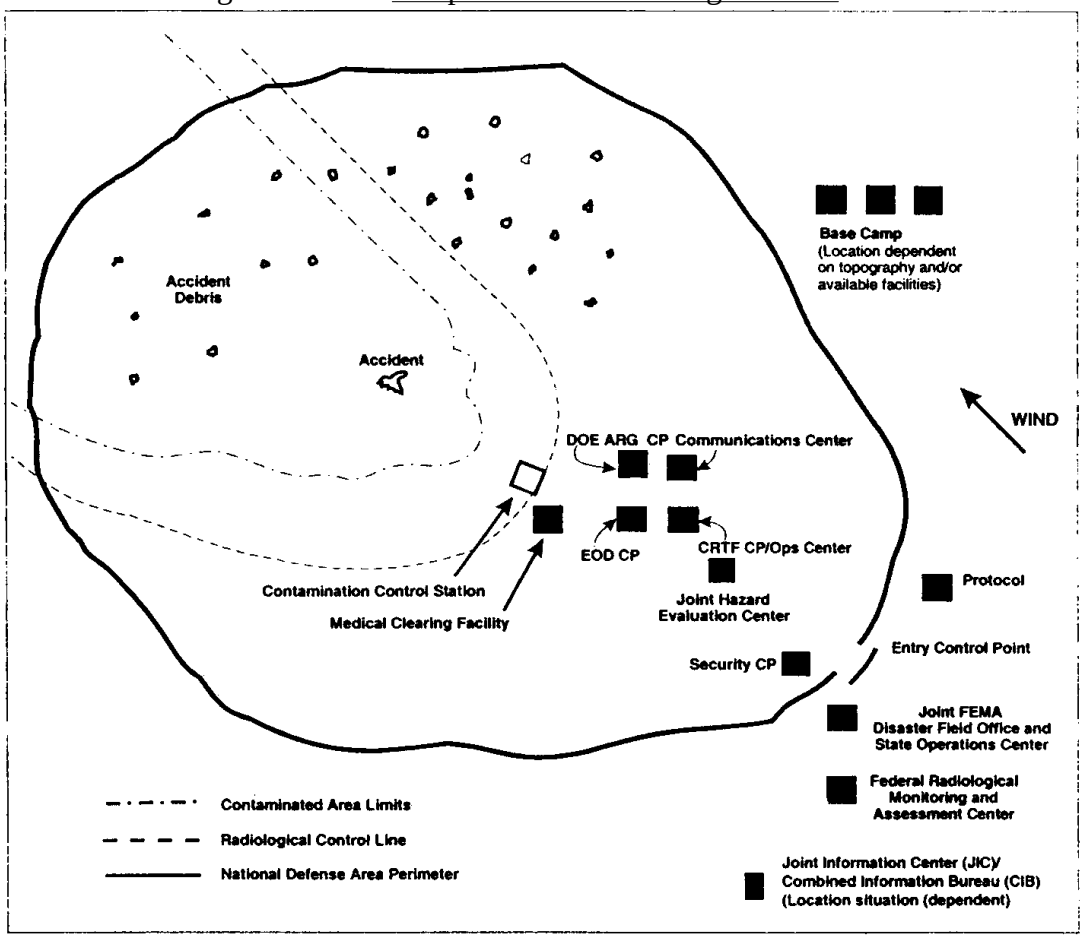
C2.2.2.2.2. Discussion of downwind contamination impact.

C2.2.2.3. Intelligence. Discussion of hostile collection or exploitation efforts.

C2.2.2.4. Operations

C2.2.2.4.1. Diagram of the accident scene layout (Figure C2.F2.).

Figure C2.F2. Sample Accident Site Organization



C2.2.2.4.2. Location of weapons.

C2.2.2.4.3. RSPs.

C2.2.2.4.4. Known or estimated contamination.

C2.2.2.4.5. Contamination control procedures in place.

C2.2.2.5. Security

C2.2.2.5.1. NDA, NSA, or Security Area established, as appropriate.

C2.2.2.5.2. Interactions with Host Nation, State, or local law enforcement.

C2.2.2.5.3. Badging and access issues.

C2.2.2.5.4. Rules of Engagement (ROE).

C2.2.2.6. Medical

C2.2.2.6.1. Casualties or injuries.

C2.2.2.6.2. Status and impact on facilities.

C2.2.2.7. Legal

C2.2.2.7.1. Significant or unusual legal activity.

C2.2.2.7.2. Relationship with Host Nation or Federal and State authorities.

C2.2.2.7.3. ROE.

C2.2.2.8. Logistics

C2.2.2.8.1. Personnel on site and expected to arrive.

C2.2.2.8.2. Status of messing and billeting.

C2.2.2.8.3. Status of support infrastructure.

C2.2.2.9. Public Affairs

C2.2.2.9.1. Media on site.

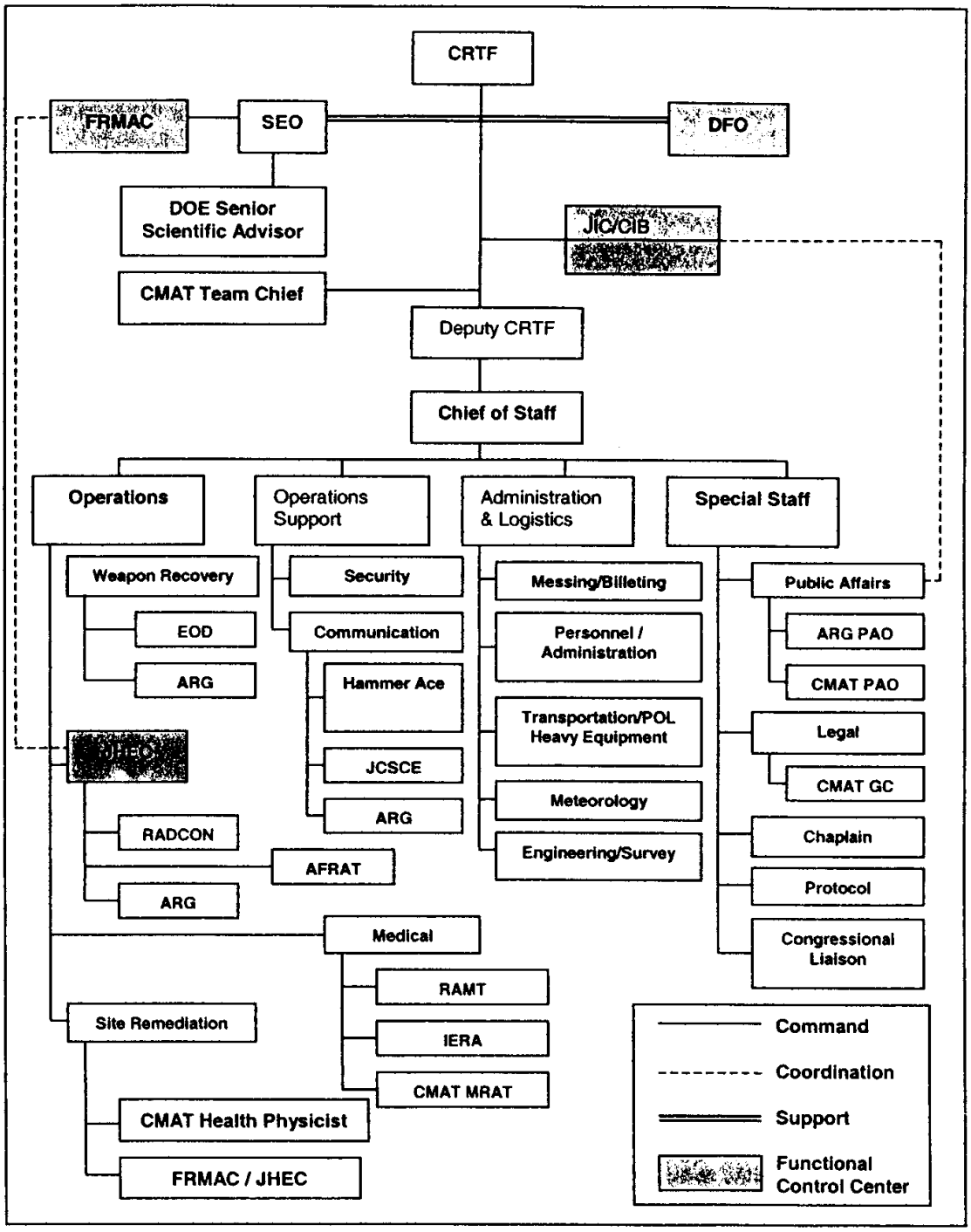
C2.2.2.9.2. Public awareness and concerns.

C2.2.2.10. Presentations by Host Nation or other Federal elements.

C2.3. RESPONSE TASK FORCE

C2.3.1. The RTF (Figure C2.F3.) is organized by the Combatant Commander having responsibility for responding to the accident in accordance with DoDD 3150.8, reference (a). The RTF may be either Joint or formed from a single Service. On U.S. territory, the RTF is responsible for DoD taskings in accordance with the FRERP, reference (b). On foreign territory, the RTF is responsible for DoD taskings in accordance with applicable Host Nation and Status of Forces Agreements (SOFAs).

Figure C2.F3. Response Task Force General Composition



C2.3.2. Responsibilities. The CRTF shall:

C2.3.2.1. If possible, establish direct communications with the IRF Commander prior to arriving at the site.

C2.3.2.2. Receive a briefing from the IRF Commander on the situation prior to assuming command.

C2.3.2.3. Establish priorities for recovery of radiological material.

C2.3.2.4. Establish priorities for all other requests for emergency support, secondary emergencies, and logistic requirements.

C2.3.2.5. Establish the Joint Operations Center (JOC).

C2.3.2.6. Establish the Joint Information Center (JIC)/Combined Information Bureau (CIB).

C2.3.2.7. Establish the Joint Hazard Evaluation Center (JHEC) (Figure C4.F1.).

C2.3.2.8. If possible, establish the Joint Legal Claims Office (JLCO).

C2.3.2.9. Establish the Joint Security Control Center (JSCC).

C2.3.2.10. Continue IRF activities, as required, and accomplish any actions normally performed by the IRF that are not yet completed.

C2.3.2.11. If needed, ensure or establish secure communications with the NMCC.

C2.3.2.12. Initiate or continue reporting in accordance with CJCSI 3150.03, reference (f).

C2.3.2.13. On U.S. territory, establish or continue liaison with the Federal Emergency Management Agency's (FEMA's) Disaster Field Office (DFO) (if the DFO is established), DOE's Federal Radiological Monitoring and Assessment Center (FRMAC), and local civil and law enforcement authorities.

C2.3.2.14. On foreign territory, establish or continue liaison with the U.S. Embassy, the Host Nation's civil emergency authorities, and local civil and law enforcement authorities.

C2.3.2.15. Integrate civilian authorities into Command and Control and response forces if the civilian community is affected. Provide necessary liaison officers.

C2.3.2.16. Coordinate actions with any accident investigation board or team. To the greatest extent possible, evidence necessary to the conduct of the accident investigation shall be preserved; however, recovery and security of weapons and safety of responders shall take priority.

C2.3.2.17. Assist the involved government (foreign, State, or local) with ensuring health and safety of civilians. On foreign territory, the U.S. Embassy representative will assist in implementing measures to satisfy Host Nation requirements under applicable treaties or agreements.

C2.3.2.18. Provide required medical, logistical, and administrative support, as needed, by follow-on Federal forces.

C2.3.2.19. If required, confirm the presence of nuclear weapons in accordance with DoDD 5230.16, reference (g). The guidelines provided in Table C2.T1. do not supplant this Directive's requirements.

Table C2.T1. Nuclear Weapon Confirmation Guidelines

Confirmation Guidelines for the CRTF	
	It is DoD policy to neither confirm nor deny the presence of nuclear weapons at any particular installation or location. There are two exceptions to this policy.
1.	The CRTF is required to confirm the presence of nuclear weapons or radioactive nuclear components in the interest of public safety if the public is, or may be, in danger of radiation exposure or other danger posed by the weapon. The OASD(PA) shall be advised of this confirmation as soon as possible.
2.	The CRTF may confirm or deny the presence of nuclear weapons to reduce or prevent widespread public alarm. The OASD(PA) shall be advised before or, as soon as possible, after such notification.
	Special Instructions for Accidents Outside the United States, its Territories, or Possessions.
1.	If the specific Host Nation agreement does not say otherwise, the CRTF must have the concurrence of the Combatant Commander and the Host Nation's government, via the U.S. COM, before making the notifications above.
2.	Some bilateral U.S.-Host Nation agreements, to conform with Host Nation statutes, may require an immediate confirmation of the presence of nuclear weapons by Host Nation officials. The CRTF shall support this notification and advise the Combatant Commander, DOS, U.S. COM, and OASD(PA), as soon as possible, of the Host Nation's notification.

C2.3.2.20. Be responsible for the operation of the RTF in accordance with the notional responsibilities below. The unique conditions of an accident shall determine specific activities and the need for any modification to the notional RTF organization. Situation awareness and sound professional judgment apply at all times.

C2.3.2.21. Initiate planning activities and actions, where possible, that address site remediation (SR), the third operational response. Appoint a CRTF representative, knowledgeable in SR matters, as personal liaison to State and local authorities and the citizenry.

C2.3.3. Organization. The RTF should include, as a minimum, the nominal elements below. Specific circumstances or applicable Host Nation agreements may require modification of the recommended response structure and organization.

C2.3.3.1. Safety. The safety element will operate the JHEC. The JHEC should:

C2.3.3.1.1. Advise the CRTF of precautionary measures for residents and other persons in potentially contaminated areas.

C2.3.3.1.2. Coordinate and integrate the capabilities of specialized teams working on site.

C2.3.3.1.3. Implement applicable health and safety standards and monitor the safety procedures of all personnel participating in weapon recovery operations.

C2.3.3.1.4. Identify and monitor potentially contaminated personnel on site, including decontamination efforts.

C2.3.3.1.5. If required, determine if contamination has been released.

C2.3.3.1.6. Recommend methods and procedures to prevent spread of radioactive contamination and advise the public of health safety issues.

C2.3.3.1.7. Establish a contamination control line that marks the approximate perimeter of the on-site contamination area.

C2.3.3.1.8. Establish and operate a Contamination Control Station (CCS) for personnel and vehicles (Figures C6.F1. and C6.F2.). If necessary, additional CCSs may be established.

C2.3.3.1.9. Initiate on-site hazard and radiation health, weapons recovery, and safety and environmental monitoring.

C2.3.3.1.10. Brief and train people prior to entering potentially contaminated areas not designated previously as radiation workers who will be working in the contaminated area on personal protective equipment (PPE), hazards, and safety measures.

C2.3.3.1.11. Establish dosimetry and documentation procedures during personnel decontamination and remediation operations.

C2.3.3.1.12. Establish a bioassay program.

C2.3.3.1.13. Monitor the tempo of the response effort and, if required, recommend safety standdown periods to preclude undue physical and mental fatigue.

C2.3.3.1.14. Determine levels of contamination present and on-site boundaries of contaminated areas through ground air samples and air surveys when appropriate or required.

C2.3.3.1.15. Consider the possibility of resuspension and dispersion of contamination in case of wind shifts.

C2.3.3.1.16. Develop and provide contamination plots and other required data to the CRTF.

C2.3.3.1.17. Consolidate all radiological assessment information for on-site recovery operations and provide it to the CRTF.

C2.3.3.1.18. Analyze and correlate all contamination data collected to identify inconsistencies requiring further investigation.

C2.3.3.1.19. Review and correlate records from CCSs and other personnel processing points to ensure bioassays or other appropriate followup actions are taken.

C2.3.3.1.20. Coordinate off site with FRMAC and civilian authorities.

C2.3.3.1.21. Be prepared to present radiological contamination findings and results at press conferences and community forums. Present data in clear, concise, and non-technical briefings, outlining hazards, precautionary measures, business recovery, and where to obtain more information and/or assistance.

C2.3.3.1.22. When the NDA, NSA, or Security Area is dissolved, transfer applicable JHEC personnel and equipment to support FRMAC operations (if on U.S. territory) or to the corresponding Host Nation authorities off site.

C2.3.3.1.23. On U.S. territory, assist the FRMAC in developing and coordinating the SR plan. On foreign territory, assist Host Nation representatives in developing and coordinating the SR plan.

C2.3.3.1.24. Refer all unofficial and media requests for information to the JIC/CIB.

C2.3.3.1.25. Coordinate environmental protection plans.

C2.3.3.2. Security. The security element should:

C2.3.3.2.1. Initiate or continue activities of the IRF security force.

C2.3.3.2.2. Maintain a Security Control Center.

C2.3.3.2.3. Recommend operational security measures.

C2.3.3.2.4. Ensure a secure perimeter for the NDA, NSA, or Security Area.

NOTE: More than one NDA, NSA, or Security Area can be established, as required.

C2.3.3.2.5. Locate the NDA, NSA, or Security Area perimeter outside of the fragmentation zone. Coordinate with the JHEC and EOD to determine the required radius.

C2.3.3.2.6. Provide for protection of exposed classified components from viewing or overhead surveillance.

C2.3.3.2.7. Establish an Entry Control Point (ECP). If necessary, multiple ECPs may be used, but should be minimized to the fewest necessary to conduct the operation.

C2.3.3.2.8. Establish a standardized access control system to the restricted area. This will include implementation and use of :

C2.3.3.2.8.1. An identification and/or badging system;

C2.3.3.2.8.2. Entry control logs; and

C2.3.3.2.8.3. A record of all personnel entering the accident areas that will be transferred to the historian when no longer needed (as defined by the CRTF).

C2.3.3.2.9. Have a security element for perimeter security, entry and exit control, and protection of classified information and property.

C2.3.3.2.10. If necessary, establish a security alert force.

C2.3.3.2.11. Protect radiological materials, weapons and components, other classified materials and information, and Government property.

C2.3.3.2.12. In case of further emergency responses into the NDA, develop procedures that ensure immediate access by fire and medical responders.

C2.3.3.2.13. Provide for special areas within the NDA, NSA, or Security Area, independently secured, for discussion of Critical Nuclear Weapon Design Information (CNWDI), TOP SECRET, Sensitive Compartmented Information (SCI), or other restricted information. Depending upon need and frequency of use, a single area may be used.

C2.3.3.2.14. Provide security for special areas, independently secured, for storage of classified documents, recovered nuclear weapons, weapon components, weapon residue, and other radiological materials.

C2.3.3.2.15. As required, debrief personnel with access to classified information.

C2.3.3.2.16. Coordinate security actions with State, local, or Host Nation officials.

C2.3.3.2.17. Coordinate use-of-force with local and Host Nation law enforcement officials.

C2.3.3.2.18. On U.S. territory, coordinate with the Principal Legal Advisor (PLA) to ensure that actions of military security personnel do not violate the Posse Comitatus Act.

C2.3.3.2.19. On foreign territory, coordinate with the PLA to ensure actions of military security personnel do not violate SOFA or Host Nation laws.

C2.3.3.2.20. On U.S. territory, notify the Senior FEMA Official (SFO) and FRMAC of personnel apprehended within the NDA or NSA. On foreign territory, notify the applicable Host Nation law enforcement authorities of personnel apprehended within the Security Area.

C2.3.3.2.21. Notify the CRTF, JHEC, JOC, and Legal element of personnel apprehended inside the NDA, NSA, or Security Area.

C2.3.3.2.22. Coordinate with the JHEC to determine procedures for handling unprotected personnel and human remains encountered in contaminated areas.

C2.3.3.2.23. Arrange for turnover of apprehended individuals to the

local law enforcement, Federal Bureau of Investigation (FBI), or Host Nation authorities, as applicable.

C2.3.3.2.24. Provide a military intelligence function.

C2.3.3.2.25. Provide advice and assistance in counterintelligence to the CRTF staff. Counter potential terrorist and/or radical group activities or intelligence collection efforts.

C2.3.3.2.26. Provide a liaison to and coordinate with Federal, Host Nation, State, and local law enforcement and security agencies on threats to response organizations and operations.

C2.3.3.2.27. Coordinate and advise the CRTF and security staff regarding operations security.

C2.3.3.2.28. Investigate and report incidents of immediate security interest to the CRTF and the security staff in cooperation with the FBI or applicable Host Nation law enforcement authorities.

C2.3.3.2.29. Advise and assist the CRTF and the security staff on matters of personnel and information security.

C2.3.3.2.30. Coordinate requests for large-scale photographic coverage of the accident site.

C2.3.3.2.31. When appropriate, coordinate disestablishment of the NDA, NSA, or Security Area with State, local, or Host Nation governments.

C2.3.3.3. Medical. The Medical element will oversee routine health maintenance of RTF personnel. The Medical element should:

C2.3.3.3.1. Assist in accident-related emergency medical treatment and in establishing health and safety programs to support response operations over an extended period of time.

C2.3.3.3.2. Promptly treat RTF personnel and other responders who are injured or become ill during recovery operations.

NOTE
Lifesaving procedures shall not be delayed or precluded due to radiation contamination.

C2.3.3.3.3. Assist in casualty DECON. Supervise the DECON of support personnel should initial DECON efforts fail to achieve desired results.

C2.3.3.3.4. Assess and report the magnitude of the accident, numbers and categories of injuries, suspected contamination, and priority for transport to a medical facility.

C2.3.3.3.5. Advise medical facilities receiving casualties, in coordination with radiological personnel, of possible contamination and measures that can be taken to prevent its spread.

C2.3.3.3.6. Implement the collection of bioassay samples from response personnel and ensure bioassay and external exposure data become part of individual health records.

C2.3.3.3.7. Establish a heat/cold exposure prevention program, if appropriate.

C2.3.3.3.8. Assist in obtaining radiation health history of all personnel involved in accident response, including civilians in the surrounding community exposed to radiation or contamination.

C2.3.3.4. Explosive Ordnance Disposal. As the primary element responsible for weapon recovery, the EOD element will:

C2.3.3.4.1. Conduct weapons damage assessment.

C2.3.3.4.2. Perform RSPs augmented by Follow-on Accident Response Group (ARG) support.

C2.3.3.4.3. Initiate systematic search to re-establish accountability of weapons and components.

C2.3.3.4.4. Stabilize the site of nuclear and conventional hazards.

C2.3.3.5. Public Affairs. The PA element should:

C2.3.3.5.1. Establish and jointly operate, with proper authorities, the JIC/CIB and a PA program.

C2.3.3.5.2. Establish direct communications with OASD(PA), any involved U.S. Embassies, and the Combatant Commander providing the RTF.

C2.3.3.5.3. Advise the CRTF and staff members on media relations and prepare them for news conferences.

C2.3.3.5.4. Prepare news releases. Emphasis should be placed on achieving public understanding and addressing public concerns about nuclear and radiological issues, including SR.

C2.3.3.5.5. Notify civilian authorities of precautions taken and other measures needed to protect public health and property. Present data in clear, concise, and non-technical briefings outlining hazards, precautionary measures, business recovery, and where to obtain more information and/or assistance.

C2.3.3.6. Legal. The Legal element will:

C2.3.3.6.1. Advise the CRTF and functional staff elements on any legal matters related to the response effort.

C2.3.3.6.2. Organize and supervise the legal functional element at the site, including establishing and operating a Claims Office.

C2.3.3.6.3. Locate in or near the JOC with direct access to the CRTF.

C2.3.3.6.4. If possible, include at least two counsels and one legal clerk that should allow for 24-hour operations in support of the JOC. The counsels must be capable of addressing complex and politically sensitive issues involving national defense policy and response operations that result from the accident.

C2.3.3.6.5. To the greatest extent possible, take immediate action to ensure preservation of factual and evidentiary information for both safety investigations and claims resolution. This includes photographs and/or videos, interviews with witnesses, documentation of radiological hazards and safety procedures, identification of responding forces and civilians at or near the accident scene, and appropriate recording and receipting of property.

C2.3.3.6.6. Be knowledgeable concerning the authority and responsibility of DoD as well as other Federal Departments and Agencies involved in a radiological accident. This includes the relationships between Federal (and as appropriate), State, local, and Host Nation authorities, as well as jurisdictional principles, security requirements, claims administration, the authority to establish an NDA, use of force, evacuation of civilians, and damage to public or private property.

C2.3.3.6.7. Establish liaison with all major functional elements of the CRTF's staff to make all elements aware of the need for coordination of planned actions. Maintain a prioritized list of planned actions and events and a record of completed actions.

C2.3.3.6.8. Identify and establish liaison with local law enforcement officials, legal authorities, and local and State emergency response organizations.

C2.3.3.6.9. Review operational plans to identify potential legal problems and to ensure they are legally sufficient, with emphasis on security, radiological safety, and documentation of factual evidence for use in resolving claims or in litigations.

C2.3.3.6.10. Coordinate on the Rules of Engagement (ROE) prior to finalization.

C2.3.3.6.11. Coordinate legal issues with the principal legal advisors of other participating Departments or Agencies, as required. For consistency, all legal advice and assistance should be coordinated jointly through the DoD primary legal advisor.

C2.3.3.6.12. Upon request, and if resources permit, provide legal advice and assistance to other Federal Agencies involved in the response effort.

C2.3.3.6.13. When required, coordinate legal issues with the Combatant Commander's and DoD's General Counsels.

C2.3.3.6.14. Ensure that personnel involved refer all queries for information to the Public Affairs Officer (PAO).

C2.3.3.6.15. Coordinate with the PAO to review proposed public statements for legal sufficiency and implications.

C2.3.3.6.16. Establish a Claims Office at a location easily accessible to the public and mutually agreeable to local officials.

C2.3.3.6.17. Ensure that any information provided to claimants is in accordance with established policies and that queries for any information other than claims procedures are referred to the PAO.

C2.3.3.6.18. When possible, collocate the Claims Office facility with the Civil Emergency Relief and Assistance Office. As soon as the claims processing facility is established, information regarding the location should be provided to the JIC/CIB for inclusion in a news release.

C2.3.3.7. Protocol. It is the responsibility of the Protocol element to provide support to any senior military or civil official visiting the accident scene.

C2.3.3.8. Financial. The Military Service having custody of the nuclear weapon or radiological materials at the time of the accident is responsible for reimbursing, upon request, the Combatant Command providing the RTF and, upon request, other Federal Agencies with a direct or supporting role in the response effort. The Financial element shall track expenditure of funds and requests for reimbursement.

C2.3.3.9. Communications. The Communications element will:

C2.3.3.9.1. Establish timely external communications to higher headquarters. The accident site may be in a remote area lacking military or civil support installations.

C2.3.3.9.2. Ensure voice connectivity with the NMCC/JNAIRT, OASD(PA), DoD Joint Nuclear Accident Coordinating Center (JNACC), and the supported CINC with conferencing capability.

C2.3.3.9.3. Coordinate frequency usage of all response organizations to prevent interference and radio operations in areas where electromagnetic emissions may create explosive hazards or affect electronic and field laboratory instruments.

C2.3.3.9.4. Provide secure field phones for EOD operations, if needed.

C2.3.3.9.5. Establish secure and non-secure voice communications.

C2.3.3.9.6. Establish local radio nets and assign call signs.

C2.3.3.9.7. Provide ultra-high frequency (UHF)/very-high frequency (VHF) nets for command (secure), weapon recovery (secure), radiological operations (secure), security, and public affairs.

C2.3.3.9.8. Provide telephone communications between fixed-site locations, such as between the JOC and JHEC.

C2.3.3.9.9. Provide multiple secure and non-secure telephones to support response force elements.

C2.3.3.9.10. Determine the need for any additional communications assets. Communication sources and capabilities are discussed in detail in Chapter 13.

C2.3.3.9.11. If required, request Chairman, Joint Chiefs of Staff (CJCS), deployable communications assets.

C2.3.3.9.12. Establish communications links with the NMCC and Defense Communications System (DCS) from remote locations.

C2.3.3.9.13. Establish access to the DCS for record communications.

C2.3.3.9.14. Provide secure voice communications via satellite, telephone, or high frequency (HF).

C2.3.3.9.15. If required, obtain leased commercial communications.

C2.3.3.9.16. If required, request frequency clearances.

C2.3.3.9.17. Coordinate communications assets and frequency requirements of response organizations and coordinate these actions with the National Communications System (NCS) Representative.

C2.3.3.9.18. Coordinate with other Federal, State, and local officials to ensure mutual communications support and eliminate interference.

C2.3.3.9.19. If required, publish a Signal Operating Instruction (SOI) for all response organizations.

C2.3.3.10. Logistics. The Logistics element should:

C2.3.3.10.1. Consist of personnel to control the materiel, administrative, and supply functions.

C2.3.3.10.2. In coordination with the JOC and Safety element, provide for medical evacuation of acute casualties.

C2.3.3.10.3. Using the Defense Threat Reduction Agency (DTRA), identify the military installations nearest the accident site, determine their support capabilities, and establish liaison to alert the base of the potential support requirements.

C2.3.3.10.4. Using Defense Special Weapons Agency (DSWA) 5100.52.1-L, "Nuclear Accident Response Capabilities Listing (NARCL)," reference (d), request assistance from DoD installations, DOE facilities, or other activities with nuclear weapon accident response and radiation detection capabilities.

C2.3.3.10.5. Request, via the CRTF and CINC, a Joint Chiefs of Staff (JCS) project code from the Joint Materiel Priorities and Allocations Board.

C2.3.3.10.6. Provide logistics support to DOE in accordance with the "Joint Department of Defense, Department of Energy, and Federal Emergency Management Agency Agreement for Response to Nuclear Weapon Accidents and Nuclear Weapon Significant Incidents," reference (h). Coordination with the DOE Support Team Coordinator should be accomplished.

C2.3.3.10.7. Plan for operations during both the Crisis Management and Consequence Management phases to involve up to 2,500 personnel. The Consequence Management, Site Remediation (SR), and recovery phase may extend to a period of 6 months or longer. As a minimum, billeting and mess services will be provided.

C2.3.3.10.8. Provide personal protective and other specialized clothing.

C2.3.3.10.9. Provide water for DECON of equipment and personnel DECON stations and temporary fixation of contaminants by sprinkling or leaching.

C2.3.3.10.10. Provide for electrical power.

C2.3.3.10.11. Provide general purpose vehicles for the response force.

C2.3.3.10.12. Provide for vehicle maintenance.

C2.3.3.10.13. Provide for petroleum, oil, and lubricants (POL).

C2.3.3.10.14. Assist in providing materials for packaging and shipping of weapons, components, contaminated waste, and other radioactive materials.

C2.3.3.10.15. Provide sanitation facilities.

C2.3.3.10.16. Provide appropriate laundry facilities for contaminated and uncontaminated clothing.

C2.3.3.10.17. Provide heavy equipment for base camp construction and recovery/remediation actions.

C2.3.3.10.18. Provide for airfield cargo support for air delivery of support equipment to remote sites.

C2.3.3.10.19. Provide for transport from the airfield or nearest military installation.

C2.3.3.10.20. Provide documentation of accident-related costs.

C2.3.3.10.21. If required, include DECON criteria and hazardous working condition clauses in any contracts awarded to assist in the recovery effort. Contractual work shall be coordinated with the RTF Legal element.

C2.3.3.10.22. Develop and disseminate procedures for requesting logistical or administrative support.

C2.3.3.10.23. Provide, as authorized, billeting, messing, and transportation support for news media.

C2.3.3.11. Contracting. Contracting support will include, but not be limited to, local purchase agreements, long-term rental of facilities and equipment, and immediate procurement of communications, computers, and transportation services. To accomplish these actions, the contracting representative will:

C2.3.3.11.1. Establish local service contracts to facilitate logistics support for the following services:

C2.3.3.11.1.1. POL

C2.3.3.11.1.2. Water

C2.3.3.11.1.3. Food

C2.3.3.11.1.4. Sanitation

C2.3.3.11.1.5. Maintenance

C2.3.3.11.1.6. Laundry

C2.3.3.11.1.7. Administration equipment

C2.3.3.11.1.8. Specialized equipment/clothing items, as needed

C2.3.3.11.1.9. Lodging

C2.3.3.11.2. Consider purchase agreements for equipment/supplies that may not be returnable following recovery operations.

C2.3.3.11.3. Document all accident response/recovery-related costs.

C2.3.3.12. Command and Control. The CRTF will establish the JOC. The manning of the C2 element will be determined by the Combatant Commander and CRTF. The JOC, which will operate 24 hours each day, should:

C2.3.3.12.1. Continue or initiate submission of reports in accordance with CJCSI 3150.03, reference (f).

C2.3.3.12.2. Develop and implement a radioactive materials recovery plan in coordination with DOE ARG, including packaging requirements, transportation from site, and final disposition.

C2.3.3.12.3. Establish coordination with applicable Service and National Transportation Safety Board (NTSB) accident investigation teams.

C2.3.4. Other Assets and Follow-On Forces. Many Federal, State, local, or Host Nation organizations will respond to an accident. These capabilities will normally be integrated into the RTF. Otherwise, arrangements must be made to keep these organizations informed of activities of the RTF.

C2.3.4.1. U.S. Department of Energy

C2.3.4.1.1. Senior Energy Official (SEO). The SEO will:

C2.3.4.1.1.1. Be operationally responsible to the Lead Federal Agency (LFA) On-Scene Commander (OSC) for provision of DOE support on scene.

C2.3.4.1.1.2. Be responsible for and serve as the point of contact for DOE support to the LFA, when DOE is not the LFA.

C2.3.4.1.2. The Accident Response Group. The DOE ARG will:

C2.3.4.1.2.1. Deploy an Advance Team consisting of a Team Leader, Senior Scientific Advisor, and other specialists to determine if any additional DOE assets are needed.

C2.3.4.1.2.2. Deploy accident equipment and additional personnel after coordination through the CRTF and DOE EOC. The request will be routed through the DoD JNACC.

C2.3.4.1.2.3. Be responsible for providing assistance to the CRTF for on-site activities.

C2.3.4.1.3. Federal Radiological Monitoring and Assessment Center. Established initially by DOE to define and monitor the radiological impact of an emergency. FRMAC will:

C2.3.4.1.3.1. Be responsible for coordinating all Federal off-site monitoring and assessment activities during a response to a radiological emergency, including response to nuclear weapons accident, to assist the LFA, State(s), and local authorities, in accordance with the provisions of the FRERP, reference (b).

C2.3.4.1.3.2. Provide various operational resources, including radiation detection and measurement equipment, communications support, and aerial monitoring capability, as appropriate.

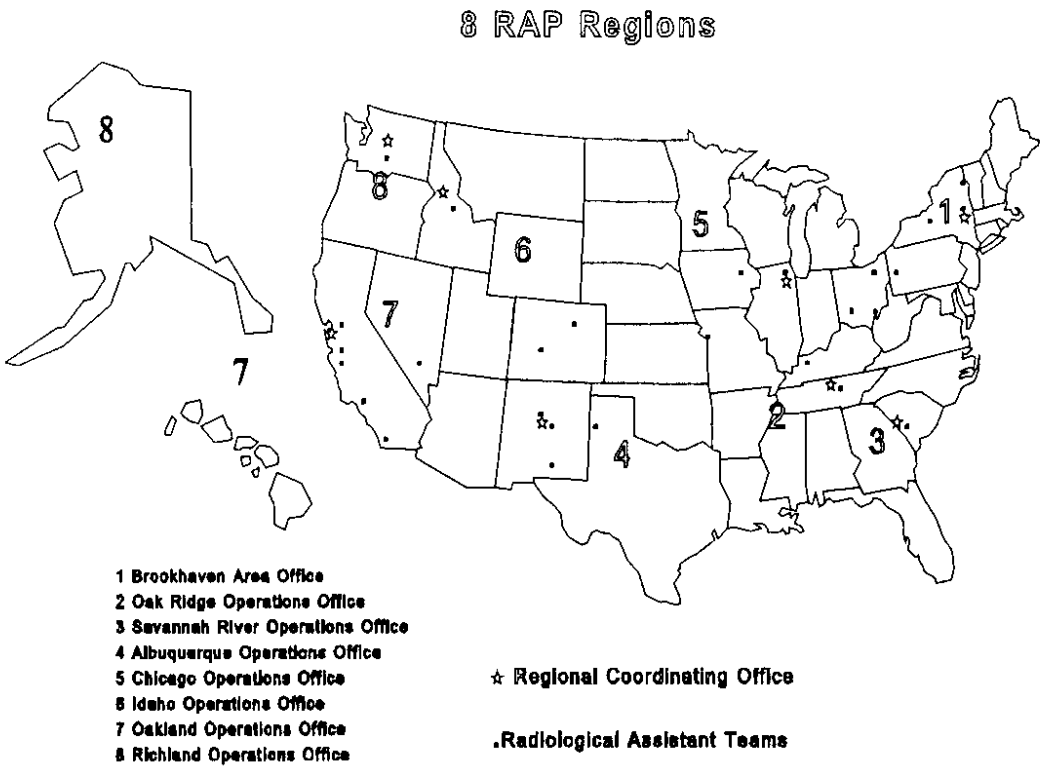
C2.3.4.1.3.3. Following the initial phase of the emergency, provide off-site support to EPA when it assumes long-term leadership/management of the FRMAC.

C2.3.4.1.4. Radiological Assistance Program (RAP)

C2.3.4.1.4.1. Request for Assistance. Requests for RAP assistance may be directed to one of the eight Regional Coordinating Offices (RCOs) or to the DOE Headquarters Emergency Operations Center (Figure C2.F4.). RAP is implemented on a geographic region basis to maintain a flexible response capability.

C2.3.4.1.4.2. Team Composition.

Figure C2.F4. Radiological Assistance Program (RAP) Locations



C2.3.4.1.5. Radiation Emergency Accident Center/Training Site (REAC/TS). Additional REAC/TS information is provided in Chapter 10, "Medical Support."

C2.3.4.1.5.1. Request for Assistance. REAC/TS may be contacted directly to request assistance or the 24-hour Methodist Medical Center Disaster Network may be contacted. Numbers are listed in the Points of Contact (POCs) section at the end of this document.

C2.3.4.1.5.2. The DOE REAC/TS will, upon request, provide worldwide consultative or direct medical and radiological assistance at the REAC/TS facility or at the accident scene. Specifically, REAC/TS has expertise in and is equipped to conduct:

C2.3.4.1.5.2.1. Medical and radiological triage.

C2.3.4.1.5.2.2. DECON procedures and therapies for external contamination and internally deposited radionuclides.

C2.3.4.1.5.2.3. Diagnostic and prognostic assessments of radiation-induced injuries.

C2.3.4.1.5.2.4. Radiation dose estimates by methods that include cytogenetic analysis, bioassay, and in vivo counting.

C2.3.4.2. Other DOE Assets, Capabilities, and Resources. Other DOE assets, capabilities, and resources are described in Chapter 4, "Radiological Hazard and Safety Environmental Monitoring," including the Aerial Measuring System (AMS) and the ARAC.

C2.3.4.3. The Federal Emergency Management Agency will:

C2.3.4.3.1. Establish a DFO at a location selected in cooperation with State and local officials.

C2.3.4.3.2. Initially staff the DFO with an Emergency Response Team (ERT).

C2.3.4.3.3. Be concerned primarily with non-radiological off-site support to State and local agencies.

C2.3.4.3.4. At FEMA's request, include a representative from the General Services Administration (GSA) to assist response forces in obtaining local services and supplies.

C2.3.4.4. The Defense Threat Reduction Agency (DTRA). DTRA provides the Defense Nuclear Advisory Team (DNAT) in accordance with reference (a). The DNAT will integrate into the RTF staff and assist the CRTF.

C2.3.4.5. Other Forces. The FRERP, reference (b), provides capabilities and responsibilities of other responding Federal elements.

C2.4. SITE REMEDIATION WORKING GROUP

C2.4.1. Overview. SR planning and actions may begin almost simultaneously with the arrival of the IRF, but formalization of the process generally comes after stabilization of the emergency situation. The CRTF will form, with representation from Federal, State, and local agencies, the SRWG, which will:

C2.4.1.1. Analyze the type and extent of the contamination.

C2.4.1.2. Develop a plan to mediate the affected area.

C2.4.1.3. Receive Federal, State, and local government approval for the plan.

C2.4.1.4. Execute the plan.

C2.4.1.5. Monitor the results.

C2.4.2. Description of the SRWG. The SRWG will expand and contract with changing conditions at the accident scene. As operations are completed, the SRWG may absorb some cells from other response organizations, or the CRTF may decide to keep those elements separate and use the SRWG as a final coordination and approval group. Membership, size, and location of the SRWG are flexible and dynamic. Coordination and approval of the long-term plan may take an extended period of time and concentrated effort, requiring a substantial SRWG membership. Once the plan is agreed upon, the SRWG's role should become that of monitor and advisor. Members will likely return to their normal responsibilities, meeting on an ad hoc basis to address issues that arise in implementing the plan.

C2.4.3. SRWG Leadership. Leadership of the SRWG will depend on several factors, such as time elapsed since the accident, scope of the remediation problem, location of remediation activity, and the desires of the State or Host Nation. Initially the SRWG will be directed by the LFA but the State/Host Nation may exercise its authority over the contaminated area and assume SRWG leadership. SRWG is discussed in detail in Part 3 of this manual.

C3. CHAPTER 3

SHIPBOARD ACCIDENT RESPONSE

C3.1. GENERAL

A shipboard nuclear weapon accident differs from land-based scenarios in several aspects. A fire or explosion associated with the accident has the potential to cause loss of the ship. Results of shipboard fires are well known and documented in repair party training and procedures manuals. Explosions, whether from a nuclear weapon or some other source (for example, petroleum fuels or conventional weapons) can cause severe damage affecting the safety and seaworthiness of the ship. Although the initial response by shipboard personnel will be the same whether an accident occurs at sea or in port, the frequent lack of immediate assistance at sea increases the importance of correct and adequate response by shipboard personnel. A significant difference is that the ship may, depending on the damage sustained, be directed to another location for weapon recovery operations and DECON.

C3.2. PURPOSE AND SCOPE

In a nuclear weapon accident, the Commanding Officer (CO) will focus attention on saving the ship and crew, protecting the public from health hazards, and keeping the chain-of-command informed of the situation. This chapter provides guidance concerning aspects of a nuclear weapon accident response unique to the shipboard environment.

C3.3. RESPONSE ORGANIZATIONS

A ship's damage control organization will provide the initial response to a shipboard nuclear weapon accident and will be augmented by the following.

C3.3.1. Explosive Ordnance Disposal Detachment. Composed of one officer and at least five enlisted EOD specialists assigned to ships in a Battle Group or detachments permanently assigned to major U.S. port facilities throughout the world trained to respond to a nuclear weapon accident.

C3.3.2. Ship/Submarine Emergency Weapon Safing Team. Composed of members of the ship's crew, this team performs emergency weapon safing procedures

in the absence of an EOD team. The team will utilize procedures outlined in the Type Commander (TYCOM) Nuclear Weapons Manual.

C3.3.3. Radiation Monitoring Team. Comprised of members of the ship's crew, this response element is trained to operate Radioactivity Detection, Indication, and Computation (RADIAC) instruments and man the contamination control stations or DECON stations.

C3.4. EQUIPMENT

The AN/PDR-73 is used to detect tritium. The AN/PDR-56 alpha survey instrument is the ship's primary RADIAC instrument used in nuclear weapons accident response. The AN/PDR-27 low range beta-gamma survey instrument is used primarily by initial entry teams to determine gamma dose rate and is carried by all ships. The functions of these instruments are discussed in Appendix C3.AP2. The availability of air monitoring equipment to a ship depends on the ship's weapons maintenance capability for airborne radioactive material detection equipment. EOD teams have equipment for detection of gaseous radioactivity.

C3.5. PRE-ACCIDENT PREPARATION

The key to responding to a nuclear weapon accident is planning, training, and adhering to precautionary measures during critical stages. In addition to possessing a well exercised shipboard Nuclear Weapon Accident Bill, ships should take the following preventive measures during weapons movements when the chance for a nuclear weapon accident is at its peak:

C3.5.1. Have Damage Control parties alerted with protective equipment, calibrated RADIAC, and firefighting equipment.

C3.5.2. Station security forces in the immediate area of the movement.

C3.5.3. Ensure that the medical department and EOD detachment (when available) are on alert.

C3.6. ACCIDENT

C3.6.1. If the ship or submarine is moored when the accident occurs, the IRF will be derived from the ship or submarine. The nearest shore installation with nuclear

accident response capability will provide assistance to the ship/submarine IRF and augmentation will be provided by an RTF. The shore installation support will be contingent upon the location of the accident and the ability to continue with the primary mission of the shore installation. These procedures have been established in previous chapters. The major differences in port lay in the flexibility provided by the ship.

C3.6.2. At sea, the possibility of augmentation by an RTF will be diminished and the action by the ship's forces in effecting the response will be critical. Some additional assistance by specialized units may be provided by ships in the vicinity. Also, EOD detachments may be deployed into the area by several transportation methods.

C3.6.2.1. Initial Response Procedures. These procedures are the most crucial in gaining control of a nuclear accident or incident. Accordingly, all ship force personnel who, by the nature of their official duties, may become directly or indirectly involved in a nuclear accident or incident, are trained to perform the following procedures:

C3.6.2.1.1. When a nuclear accident or incident occurs the senior person present shall take charge at the scene and direct available personnel to:

C3.6.2.1.1.1. Attempt to save the lives of personnel involved.

C3.6.2.1.1.2. Attempt, when required, to extinguish a fire involving weapons or radioactive material using the firefighting guidance provided in the Technical Publication (TP) 20-11, "General Firefighting Guidance," reference (i), and Appendix C3.AP1.

C3.6.2.1.1.3. Establish a security perimeter surrounding the accident scene, limiting access to authorized personnel only. The security perimeter aboard ship may be defined by securing hatches to a compartment. In all cases, once the hatches have been secured, only personnel authorized by the senior person present shall be allowed at the accident scene.

C3.6.2.1.1.4. Direct all personnel at the scene to take emergency breathing precautions. As a minimum personnel shall cover their noses and mouths with a handkerchief or similar item to minimize inhalation of HAZMAT and smoke.

C3.6.2.1.1.5. Notify the Office of the Deck (OOD) or Command Duty Officer (CDO), via the most expedient means, that an accident has occurred in a compartment.

C3.6.2.1.2. Upon notification of an accident or incident, the OOD or CDO shall:

C3.6.2.1.2.1. Initiate routine announcements over the 1MC as follows: "NO EATING, DRINKING, OR SMOKING IS ALLOWED UNTIL FURTHER NOTICE."

C3.6.2.1.2.2. Initiate standard shipboard damage control procedures including initiating a radiation plot, identifying route(s) to decontamination (DECON) station, recommend changes to ships heading to vent smoke, toxic gases, and contaminated firefighting water. Near shore releases should be done as a last resort action.

C3.6.2.1.2.3. Prepare to initiate DECON station procedures.

C3.6.2.1.2.4. Initiate initial Operations Report (OPREP)-3.

C3.6.2.1.2.5. Make preparation, if in an in-port status, for assisting the IRF or RTF Commander.

C3.6.2.1.2.6. Continue OPREP-3 situation reports, as required.

C3.6.2.1.2.7. Request if required, helicopter/parachute insertion of nearest EOD Detachment.

C3.6.2.2. Follow-On Response Procedures. These procedures are an extension of the initial response procedures; however, they include more detailed procedures for providing positive control of an accident scene. The responsibility of executing these procedures rests with the senior person on board or, in the case of an in-port accident, the shore establishment's designated IRF.

C3.6.2.2.1. As soon as practicable after notification of an accident or incident, damage control radiological control (RADCON) should conduct beta/gamma detection operations. RADCON AN/PDR-27 monitors should then proceed to the extremities of the accident scene, maintaining constant surveillance of the instrument to detect increases in gamma radiation. Any radiation reading above normal

background shall be reported immediately in accordance with standard TYCOM procedures.

C3.6.2.2.2. In the absence of EOD personnel, the ship or submarine's emergency weapon surfing team may perform emergency procedures outlined in the TYCOM Nuclear Weapons Manual, as directed by the CO, providing the weapons are not too severely damaged.

C3.6.2.2.2.1. Enter the compartment where the accident occurred and render the weapons/materials safe using approved procedures and equipment.

C3.6.2.2.2.2. Report completion of EOD procedures to the OOD or CDO and be available to assist in the DECON of affected areas.

C3.6.2.2.3. Public Affairs. At sea, PA will be the responsibility of the Fleet Commander. The CO is responsible for informing the ship's crew regarding PA releases and prior to their debarking or using any non-official off-ship communications, on procedures for responding to requests for information from the press or from families. When the ship is in port, PA will be coordinated by the Fleet Commander or his designated area coordinator.

C3.6.2.2.4. Security. Unless accident damage to the ship and/or weapon(s) has destroyed the normal security provisions for the weapon(s), additional security will not be needed. Additional security is provided, if required, to ensure continued weapon protection and to prevent unauthorized access.

C3.6.2.2.5. Debriefings. All ship's crew members with information as to the cause of the accident, and particularly those personnel who observed the extent of damage to the weapon(s), should be identified to assist in the accident investigation and debriefed to assess potential internal damage to the weapon.

C3.6.2.2.6. Follow-On Response at Sea. Weather and sea conditions, the extent of damage to the ship, remaining hazards to the ship and crew, and the time required to get either expert assistance on board or move the ship to suitable facilities, will all affect the specific follow-on response actions that the CO might direct while at sea. Also, guidance will be provided by the Fleet Commander, and the higher authority must have estimates of damage to the ship and weapon(s). Moreover, the ship must be provided information on the estimated time of arrival, the nature of any technical assistance being sent, and be directed to an appropriate port. Much of the technical assistance discussed in Chapter 2 may be airlifted to the accident ship, or a

suitable ship in the vicinity for direct assistance at sea, when dictated, due to damage, contamination, or other conditions.

C3.6.2.2.6.1. Logistics. Resources will be limited to those on board. Priority should be given to performing operations to minimize any hazards to ship's personnel and damage to critical equipment, including RADIACs.

C3.6.2.2.6.2. Ship DECON. The amount of DECON ship's personnel will be able to perform will be limited by the number of RADIACs available to monitor and remonitor surfaces being decontaminated and to operate the Decontamination Station. Simple cleaning techniques are frequently effective in reducing, if not removing, contamination from many of the surfaces on a ship. DECON techniques are described in Appendix C3.AP2.

C3.6.2.2.7. Follow-On Response in Port. The follow-on response in port will be the responsibility of the shore establishment, and will follow procedures described in Chapter 2.

C3.6.2.3. Claims. Any contaminated personal property belonging to ship's personnel should be collected and marked with the owner's identification. In general, DECON of high value items, or items that the owner cannot easily replace, must not be attempted by ships personnel. Replacement of personal property that cannot be decontaminated shall be processed in accordance with applicable claims regulations.

C3.AP1. APPENDIX 1 OF CHAPTER 3

SHIPBOARD FIREFIGHTING

C3.AP1.1. GENERAL

C3.AP1.1.1. Normal shipboard firefighting and damage control procedures will apply to fires involving nuclear weapons with the following provisions:

C3.AP1.1.1.1. Extinguishing the fire has priority.

C3.AP1.1.1.2. Cooling of any weapons involved in the fire or in close proximity should be performed to the maximum extent that fire hoses permit.

C3.AP1.1.1.3. Cooling should be continued after the fire is extinguished until the weapon is at ambient temperature.

C3.AP1.1.2. The primary suppressant for a fire involving a nuclear weapon is narrow angle fog (wide angle fog for submarines). The propellants used in any weapon, conventional or nuclear, produce oxygen once ignited. They cannot be extinguished with smothering agents, and some may cause the retention of heat within the weapon. This factor does not preclude the use of foam, CO_2, Purple K (fire extinguisher) (PKP), Aqueous Film Forming Foam (AFFF), or other suppressants on aircraft fuel, Navy Standard Fuel Oil (NSFO), or other petroleum fuel fires that involve a nuclear weapon.

C3.AP1.1.3. Narrow angle fog or a firefighting agent should be sprayed over the complete length of the weapon(s) and/or both sides in a sweeping motion to cool the weapon and its HE contents until the weapon is at ambient temperature. When using foam to fight a fire surrounding an intact weapon, water should not be used to cool the weapon because water will float the foam away, which could allow reignition of the fire.

C3.AP1.1.4. For below deck fires, all response personnel going below decks will wear a Self-Contained Breathing Apparatus (SCBA) (for example, Oxygen Breathing Apparatus (OBA) and Scott Air Pack); top side personnel will wear gas masks. Any firefighters responding initially without respiratory protection should be relieved as soon as possible. Repair party personnel will wear protective clothing as specified in NSTM 079, Volume II, "Damage Control - Practical Damage Control," reference (j). Involvement of a nuclear weapon does not require additional protective clothing for

firefighting personnel. A backup firefighting team, with appropriate respiratory protection, will be prepared to relieve, or rescue, teams at the scene.

C3.AP1.1.5. During firefighting actions, the flow of potentially contaminated water should be noted and the wetted surfaces considered contaminated until monitoring can be performed. The flow of potentially contaminated water should be controlled to the extent possible, and dewatering operations should not be performed in port until testing determines if the water is contaminated. The best method of controlling the potentially contaminated water will be ship and situation unique.

C3.AP1.1.6. Fires involving nuclear weapons in enclosed shipboard spaces should be vented to the atmosphere as soon as practical to deplete the presence of toxic, caustic, and radioactive gases. When venting shipboard spaces, care should be taken to minimize the possible contamination of the exterior of the ship. In the event of a magazine accident, the normal exhaust system shall be secured and emergency ventilation procedures used. Portable blowers (for example, Red Devil Blowers) should be used if there is no installed blowout system. Recommend use of "snorkel hosing" with high capacity filters in conjunction with portable blowers to reduce possible contamination to portable blowers and ensure contamination in smoke exhausted is directed outside the skin of the ship. In all cases, the exhaust vent should be on the leeward side of the ship. After the fire is extinguished and when in port, unfiltered venting should not be done if it results in contamination being spread to nearby shore establishments or communities.

C3.AP1.1.7. Upon extinguishing a fire involving a nuclear weapon, a reflash watch will be set to provide an immediate response to any recurrence of the fire.

C3.AP1.1.8. Potentially contaminated equipment used to fight the fire should be placed in a designated area until monitoring and necessary DECON can be performed.

C3.AP2. APPENDIX 2 OF CHAPTER 3

SHIPBOARD RADIOLOGICAL MONITORING AND CONTROL

C3.AP2.1. GENERAL

Monitoring for radioactivity is performed initially to identify radioactive material. If radioactivity is found, monitoring continues to determine the extent of the contaminated area. Personnel monitors are to identify contaminated personnel who require DECON, and to prevent the spread of radioactive material to uncontaminated parts of the ship.

C3.AP2.1.1. Control of Contamination. Standard damage control procedures should be used to limit damage and the spread of contamination. Fire boundaries shall be set and maintained to prevent the spread of fire. Additionally, at the outset of an accident, the ship should be maneuvered, if possible, so the wind is on the beam and carrying any contamination away from the ship.

C3.AP2.1.1.1. Ship Monitoring. If contamination was released during the accident, it should be confirmed that portions of the ship thought to be uncontaminated are in fact "clean." Monitors should be directed initially to check passageways at hatches, doors, ladders, and other locations where most personnel would place their hands or feet. If contamination is found, its location should be marked for DECON and remonitoring. Contamination tracked, or carried, onto hard surfaces can be usually removed with soap and water, or by wiping with a clean, damp cloth. Then monitors should be directed toward the expected contaminated area. The boundaries of the contaminated area should be defined. Then personnel should be advised of these boundaries and the procedures for crossing them, if required, for essential ship operations.

C3.AP2.1.1.2. Air Monitoring. Airborne radiological monitoring shall be conducted to the extent instrumentation will allow; however, many ships are not equipped with air samplers. Monitoring surfaces for loose surface contamination will be the most reliable indicator of airborne contamination. If Table C5.T2., "Protective Devices for Emergency Workers as a Function of Surface Contamination," is used, table values should be divided by 100 to correct for the higher resuspension factors (0.001 vice the 0.00001 used to develop the table) that can be expected from shipboard surfaces.

C3.AP2.1.2. Decontamination Station. The DECON Station will be normally

located at a compartment entrance. Most ships will have insufficient RADIAC instruments to support more than one DECON Station. If potentially contaminated personnel are both above and below decks, routes to minimize their movement through clean areas should be established. Access to the DECON Station must be possible from both contaminated and uncontaminated areas. A shower and wash basin should be designated for use in DECON procedures. The wash facilities need not be in the immediate vicinity of the DECON Station, although such a location is preferable.

C3.AP2.1.2.1. Until the absence of gamma radiation is confirmed by monitoring at the accident site, personnel should be monitored at the DECON Station with the AN/PDR-27 and the AN/PDR-56. Once the absence of gamma radiation is confirmed, use of the AN/PDR-27 is no longer necessary. The use of earphones with RADIACs is required. This practice results in easier, more accurate monitoring. The user's attention is not focused on the RADIAC's meter movement, lessening the possibility of damage or inadvertent probe contamination during the monitoring process.

C3.AP2.1.2.2. Personnel monitoring should include the front and backs of hands, forearms, torso, and legs; a thorough check of the forehead, cheeks, nose, and mouth area; and finally, the ankles and feet. The preliminary readings in the areas most likely to be contaminated (for example, the hands and feet) should be made with the probe 1/8 to 1/16th inches from the monitored surface. If the person is not obviously contaminated, contact readings may be used for the remainder of the monitoring. If clothing is damp, inaccurate alpha contamination evaluation and detection is probable. Damp clothing should be removed, assumed contaminated, and the person's skin dried prior to evaluation for the presence of alpha contamination.

C3.AP2.1.2.3. To conserve the expenditure of protective clothing, initial personnel monitoring must be performed prior to the removal of the clothing. If no contamination or contamination below the acceptable emergency remaining levels of contamination is found on the protective clothing, it should be removed and placed in containers for clothing to be reused. Booties and gloves should be kept separate. If contamination levels greater than the acceptable levels are found, the protective clothing should be removed and placed in a container marked for contaminated clothing.

C3.AP2.1.2.4. Personnel who had contamination on their protective clothing should be remonitored after removing the protective clothing. If contamination is also on their personal clothing, the clothing should be removed, placed in a plastic bag labeled as contaminated clothing, and the fact noted in the DECON Station log. If

contamination is on the skin, it can normally be removed by washing with nonabrasive soap and water. When washing, be sure not to puncture or abrade the skin through excess scrubbing. Following each washing, the skin should be thoroughly dried before monitoring to determine if the procedure removed the alpha contamination. Shampoo contaminated hair several times. Final monitoring should be made with the probe in contact with the skin. If two washings do not reduce contamination levels on the skin or hair, individuals should be referred to the Medical Department for further DECON under medical supervision. Bureau of Medicine and Surgery Instructions (BUMEDINST) 6470.10A, reference (k), provides detailed guidance on personnel DECON procedures and should be available to the Medical Department. When all contamination cannot be removed, the residual level should be recorded in medical records, the DECON Station log, and the CO should be advised. Disposition of the contaminated individual(s) will be determined by the Medical Department cooperating with the Bureau of Medicine and Surgery (BUMED).

C3.AP2.1.3. Protective Clothing. Any close-knit clothing should prevent contamination of the skin and provide protection from alpha contamination. If personal protective clothing is unavailable, coveralls are recommended for personnel entering the contaminated area to repair damage or perform DECON operations. Openings in the clothing should be taped. When working in a wet environment, waterproof clothing should be used for personal protective clothing, if possible. Much of the protection provided by coveralls will be lost if the material becomes soaked. Liquids soaking the clothing can carry contamination from the outer surface of the clothing. When removing contaminated clothing, care should be taken to prevent the outside of the clothing from contacting the skin.

C3.AP2.1.4. Clothing Decontamination. The limited stock of protective clothing on board a ship may be exhausted rapidly during DECON operations at sea. At sea, protective clothing and other launderable equipment can be laundered, if necessary, without damage to the equipment or the washing machine. Automatic washing machines should be clean and free of soap scum to prevent deposition of contamination. If DECON agents are used, they will aid in keeping washers free of contamination. After laundered items have completely dried, they must be checked for any remaining contamination. Items contaminated above acceptable emergency levels and that do not show any appreciable contamination reduction after three successive launderings should be packaged for disposal as radioactive waste. Machines used to launder contaminated clothing should not be used for normal laundry until after they have been fully cycled empty, allowed to dry, and monitored to ensure they are free from contamination.

PART II

TECHNICAL AND ADMINISTRATIVE ISSUES OF RADIOLOGICAL ACCIDENT RESPONSE

C4. CHAPTER 4

RADIOLOGICAL HAZARD AND SAFETY ENVIRONMENTAL MONITORING

C4.1. GENERAL

A nuclear weapon accident is different from other accidents due to the possibility of radioactive contamination at the immediate accident site and extending beyond the accident vicinity. The complexities of a nuclear weapon accident are compounded further by general lack of public understanding regarding radiological hazards. The CRTF must, therefore, quickly establish a vigorous and comprehensive health physics program to manage the health and safety aspects of a nuclear weapon accident. A good health physics program provides for civil authority/official involvement in the cooperative development of response efforts and an SR plan.

C4.2. PURPOSE AND SCOPE

This chapter provides information on health physics and guidance concerning the radiological safety and other hazards associated with a nuclear weapon accident. Also included is information on the radiological control resources available, the hazards and characteristics of radioactive materials present, and suggested methods for detecting these hazards and protecting personnel from them. This information assists the CRTF in the operations under his control. The JHEC is the CRTF's organizational means to task on-site hazard and radiological data collection and analyze data collected for the most accurate and complete hazard/radiological assessment. The chapter furnishes recommendations, advice, sample forms, and assistance to civil authorities with jurisdiction over areas affected by the accident. Also, weapon systems contain nonradioactive toxic materials, such as beryllium, lithium, lead, propellants, high explosives, oxidizers, and plastics. These hazards are discussed later in this volume. The JHEC coordinates closely with the FRMAC. The FRMAC supports the CRTF with off-site monitoring and assessment.

C4.3. SPECIFIC REQUIREMENTS

DoD has an obligation to protect response force personnel and the public from on-site hazards associated with a nuclear weapon accident and to mitigate potential health and

safety problems. To accomplish this, DoD establishes a JHEC with the following objectives:

C4.3.1. Determine if radioactive contamination has been released.

C4.3.2. Advise the CRTF of precautionary measures for residents and other persons in potentially contaminated areas. Convey risk assessment information.

C4.3.3. Identify and monitor potentially contaminated personnel on site, including decontamination efforts, and establish a bioassay program.

C4.3.4. Determine levels of contamination present and on-site boundaries of the contaminated areas through ground and air surveys.

C4.3.5. Establish dosimetry and documentation procedures during personnel decontamination and remediation operations.

C4.3.6. Recommend methods and procedures to prevent resuspension and spread of radioactive contamination.

C4.3.7. Assist the LFA in remediation planning with assistance from EPA, which will likely have a larger role during the recovery phase, and assistance from DOE, if necessary.

C4.3.8. Manage and advise for actual and potential medical casualties.

C4.4. RESOURCES

C4.4.1. Response Force Resources. Response forces should have a full complement of operable and calibrated radiological monitoring equipment. Sufficient quantities of materials should also be available for replacement or repair of critical or high failure rate components such as mylar probe faces. Replacement plans are necessary because RADIAC equipment available to IRFs will not meet initial operational needs after a large release of contamination. Though IRFs are equipped and trained to conduct radiation surveys for low levels of radioactive contamination, it is difficult to accomplish over rough surfaces like rocks, plants, and wet surfaces. Specialized DoD and DOE teams are better equipped to conduct low-level contamination monitoring, and monitoring should wait until the teams arrive. Appendix C4.AP1. contains a list of radiological monitoring equipment used by the Services, with a summary of their capabilities and limitations. Additionally, personnel

should be cognizant of the various units in which contamination levels might be measured or reported and the method of converting from one unit to another. A conversion table for various measurements is provided in Chapter 9.

C4.4.2. Specialized Teams. Several specialized teams are available within DoD and DOE with substantial radiological monitoring, hazard assessment, and instrument repair capabilities; moreover, they can provide field laboratories and analytical facilities. Specialized teams, when integrated into the RTF, provide adequate technical resources to make a complete assessment of the radiological hazards. Additionally, specialized DOE teams, which have off-site responsibilities, should be integrated into the RTF. The DTRA runs the DoD portion of the JNACC at its Alexandria, VA, Telegraph Road facility. Hazards Prediction and Assessment Capability (HPAC) development support is located here as well as the CMAT, which is an established and trained specialized team of senior advisors deployed to assist the IRF and RTF in the management of all phases following a nuclear weapon accident. Integration of specialized team operations is accomplished best through establishment of a JHEC, as discussed in paragraph C4.3., above. When not required on site, DoD specialized teams should assist in the off-site radiological response efforts. Specialized teams are:

C4.4.2.1. The following specialized teams or resources are discussed in detail in the remaining chapters.

C4.4.2.1.1. U.S. Army (USA) Radiological Advisory Medical Team (RAMT).

C4.4.2.1.2. USA RADCON Control Team.

C4.4.2.1.3. U.S. Air Force (USAF) Radiation Assessment Team (AFRAT).

C4.4.2.1.4. DOE AMS.

C4.4.2.1.5. DOE ARAC.

C4.4.2.1.6. DOE Mobile Accident Response Group Unit (DOE Mobile Counting Laboratory [HOT SPOT]).

C4.4.2.1.7. DOE Ranger Environmental Monitoring Capability.

C4.4.2.1.8. DOE Radiological Air Sampling Counting and Analysis Lab (RASCAL).

C4.4.2.1.9. DOE Mobile Decontamination Station.

C4.4.2.1.10. CMAT.

C4.4.2.1.11. DoD EOD Teams.

C4.4.2.1.12. DTRA HPAC.

C4.5. CONCEPT OF OPERATIONS

This concept of operations assumes that an accident has resulted in release of contamination to areas beyond the immediate vicinity of the accident site. The distinction between on site and off site is significant for security and legal purposes; however, for effective collection and meaningful correlation of radiological data, the entire region of contamination must be treated as an entity. The on-site and off-site distinction should be considered only when assigning areas to monitoring teams. Possible response force actions are addressed first in this concept of operations. Only limited equipment and expertise may be available to the IRF.

C4.5.1. Initial Response Force Actions. Within the constraints of available resources, the IRF should determine the absence or presence of any radiological problem and its nature, minimize possible radiation hazards to the public and response force personnel, identify all persons who may have been contaminated and decontaminate them as necessary, provide appropriate news releases, and notify officials/personnel of potential hazards.

C4.5.1.1. Pre-Deployment Actions

C4.5.1.1.1. Prior to departing for the accident site, delivery arrangements should be made for hazard plots, if available, to assist in determining possible areas of contamination and avoid contamination of response teams and equipment. ARAC and HPAC plots will provide theoretical estimates of the radiation dose to personnel downwind at the time of the accident. Also, plots will provide the expected location and level of maximum contamination deposition on the ground. A detailed discussion of ARAC and HPAC is in Appendix C4.AP4. As it becomes

known, specific accident data described in the appendices should be provided to the ARAC facility at the Lawrence Livermore National Laboratory (LLNL).

C4.5.1.1.2. If an advance party is deployed, at least one trained person should have radiation detection instruments to determine if alpha emitting contamination was dispersed and to confirm that no beta and/or gamma hazard exists. The sooner that confirmation of released contamination is established, the easier it will be to develop a plan of action and communicate with involved civil authorities.

C4.5.1.2. Initial Actions

C4.5.1.2.1. If the CRTF, or an advance party, deploys by helicopter to the accident site, an overflight of the accident scene and the downwind area can provide a rapid assessment of streets or roads in the area and the types and uses of potentially affected property. During helicopter operations, flights should remain above or clear of any smoke and at a sufficient altitude to prevent resuspension from the downdraft when flying over potentially contaminated areas. The landing zone should be upwind, or crosswind, from the accident site.

C4.5.1.2.2. After arrival at the site, a reconnaissance team consisting of EOD and/or other specialties should enter the accident site to inspect the area for hazards, determine the type(s) of contamination present, measure levels of contamination, mark a clear path, mark hazards, perform initial site stabilization and emergency procedures, and assess weapon status. The approach to the scene should be from an upwind direction, if at all possible. The accident situation indicates whether PPE or respiratory protection is required for the initial entry team. PPE and respiratory protection should always be donned before entering a suspect area. Every consideration should be given to protecting the initial entry team and preventing undue public alarm. Until the hazards are identified, only essential personnel should enter the possible contamination or fragmentation area of the specific weapon(s). The generally accepted explosive safety distance for nuclear weapons is 770 meters (2,500 feet); however, the contamination may extend beyond this distance. Explosive safety distances may be found in classified EOD publications and in explosive safety instructions and manuals. At this point, a temporary contamination control line should be considered. Later, when the boundary of the contaminated area is defined and explosive hazards are known, the control line may be moved for better access to the area. Contamination, or the lack of it, should be reported immediately to the CRTF.

C4.5.1.2.3. If radiation detection instruments are not yet on scene, observations from firefighters and witnesses and the condition of the wreckage or debris may give an indication of the possibility of contamination. Anticipated questions that may be asked to evaluate the release of contamination are:

C4.5.1.2.3.1. Was there an explosive detonation?

C4.5.1.2.3.2. Has a weapon undergone sustained burning?

C4.5.1.2.3.3. How many intact weapons or containers have been observed?

C4.5.1.2.3.4. Do broken or damaged weapons or containers appear to have been involved in an explosion or fire?

C4.5.1.2.4. If no contamination was released by the accident, the remaining radiological action becomes preparation for response in the event of a release during weapon recovery operations.

C4.5.1.3. Actions to be taken if contamination is detected. Authorities should be notified and the assistance of specialized radiological teams and the DOE AMS requested. The highest priority should be action to initiate general public hazard abatement. Do not delay or omit any lifesaving measures because of radioactive contamination. If precautionary measures have not been implemented to reduce the hazard to the public, civil authorities/officials should be advised of the situation and consider possible actions. Actions that should be initiated include:

C4.5.1.3.1. Dispatch monitor teams, with radios if possible, to conduct an initial survey of the security area.

C4.5.1.3.2. Prepare appropriate news releases.

C4.5.1.3.3. Determine if medical treatment facilities with casualties have a suitable radiation monitoring capability. If not, dispatch a monitor to determine if the casualties were contaminated. Initiate notification of monitoring teams available in the private sector. Also assist in ensuring that contamination has not spread in the facility. Procedures that a medical treatment facility may use to minimize the spread of contamination are described in Chapter 10.

C4.5.1.3.4. Initiate air sampling.

C4.5.1.3.5. Identify, in conjunction with civil authorities/officials, of witnesses, bystanders, and others present at the accident scene.

C4.5.1.3.6. Establish a CCS and a personnel monitoring program. If available, civil authorities/officials should have monitoring assistance provided at established personnel processing points.

C4.5.1.3.7. Make arrangements to have the contamination fixed as soon as possible so that it does not get resuspended and inhaled.

C4.5.1.3.8. Implement procedures to protect response personnel. Protective coveralls (personal protective clothing), hoods, gloves, and boots are necessary to protect response personnel from contamination and prevent its spread to uncontaminated areas. If airborne contamination exists, respiratory protection is required. Respiratory protection can be provided in most instances by using Service-approved protective masks. If extremely high contamination levels of tritium are suspected in a confined area, firefighting and other special actions require a positive pressure SCBA. Unless an accident is contained within an enclosed space, such as a magazine, only those personnel working directly with the weapon need take precautions against tritium.

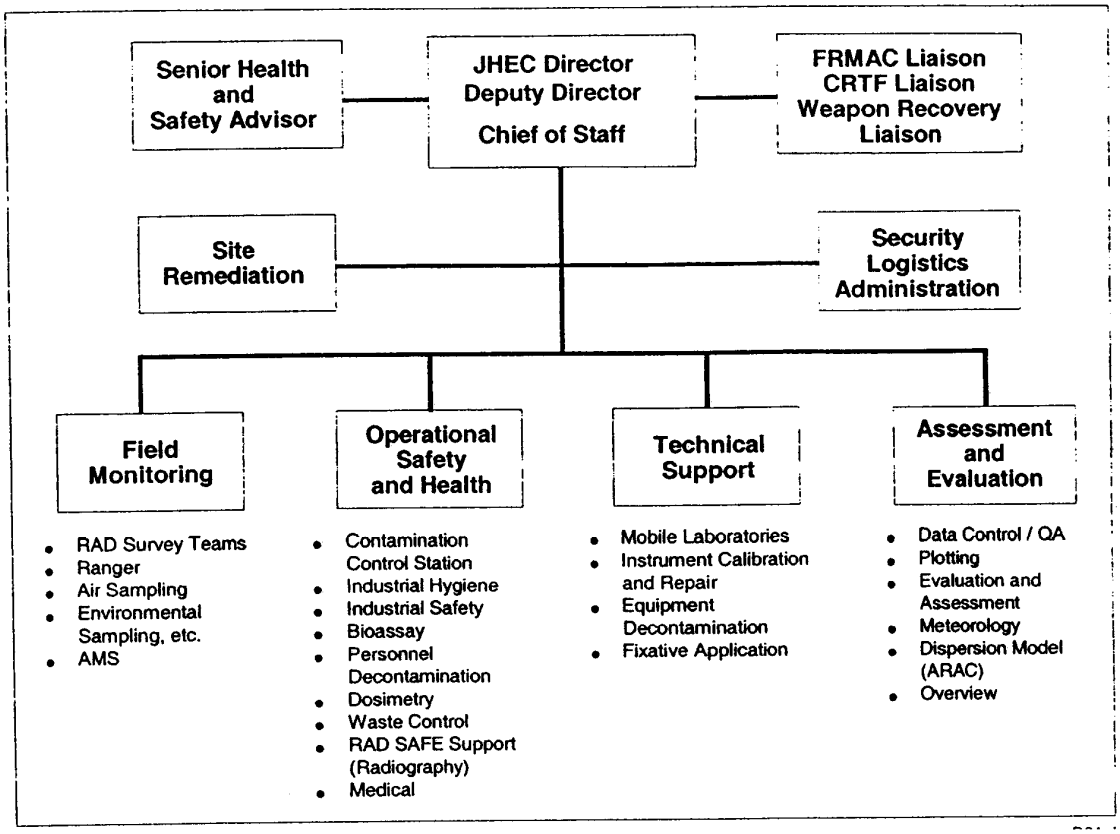
C4.5.1.3.9. Develop and implement plans for controlling the spread of contamination. Administrative controls must stop contamination from being spread by personnel or equipment and protect response force personnel and the general public. This control is usually established by determining a control area and limiting access and exit through a CCS. The perimeter of the contamination control area will be in the vicinity of the line defined by the perimeter survey; however, early in the response before a full perimeter survey is completed, a buffer zone may be considered. If the control area extends beyond the NDA or security area, the assistance of civil authorities/officials will be required to establish and maintain the control area perimeter. Personnel and equipment should not leave the control area until monitored and decontaminated. Injured personnel should be monitored and decontaminated to the extent their condition permits. A case-by-case exception to this policy is necessary in life threatening situations.

C4.5.1.3.10. Establishing the location and initial operation of the Command Post, Operations Area, JHEC, and Base Camp is discussed in Chapter 2.

C4.5.2. Response Task Force Actions. Upon arrival on scene, the RTF personnel review the IRF actions. Actions include the status of identification and care of potentially contaminated people, casualties, and fatalities; the results of radiation surveys and air sampling or ARAC and/or HPAC-calculated assessment if survey is not completed; radiological response assets on scene or expected; logs and records; and the location for the JHEC. Representatives from DOE, FEMA, and EPA will be on scene within a few hours after the response force. They, and civil officials, are the primary off-site health and safety interface with the public; however, the RTF should continue to provide assistance and radiation monitoring support, as necessary. During those periods early in the response when EOD operations limit access to the accident site, radiological survey teams should only support the weapon recovery efforts. Off-site radiological surveys require coordination with civil authorities. This arrangement can be understood by explaining the role of the JHEC and FRMAC, and by inviting the civil government-approved radiological response organization to participate in FRMAC operation. DoD specialized teams and the DOE ARG are integral parts of the RTF. The CRTF should integrate DOE ARG radiological assets into the JHEC organization.

C4.5.2.1. Joint Hazard Evaluation Center. The JHEC is the organization that oversees the on-site hazard and radiological data collection and assessment efforts. By analyzing data, it provides accurate and complete on-site hazard/radiological recommendations. The JHEC Director should be knowledgeable about data on site and how to best employ the technical resources available. The recommended functional organization is shown in Figure C4.F1.

Figure C4.F1. Joint Hazard Evaluation Center Functional Organization



C4.5.2.1.1. On-site monitoring data is processed through and further distributed by the JHEC to the FRMAC.

NOTE: Appropriate COMSEC should be exercised in the exchange of on-site data/information because of it potentially being classified.

C4.5.2.1.2. JHEC is the single control point for all hazard/radiological on-site data and will provide the most rapid information available to both military and civil users. Data provided to the JHEC for analysis, correlation, and validation include all hazard data on site. After the initial response, the JHEC establishes a radiation and dosimetry program that meets the needs and requirements for personnel working in or entering the on-site contamination control area. The JHEC should:

C4.5.2.1.2.1. Collect radiological and hazard data required by the CRTF on site. Refer all unofficial requests for contamination information to the JIC.

C4.5.2.1.2.2. Run HPAC for an initial contamination plot and make it available to the CRTF. Correlate plot with survey results for confirmation/validity. Rerun the model, as required.

C4.5.2.1.2.3. Analyze and correlate all contamination data collected to identify inconsistencies that require further investigation.

C4.5.2.1.2.4. Provide contamination plots and other required data to the CRTF.

C4.5.2.1.2.5. Review and correlate records from CCSs and other personnel processing points to ensure bioassays or other appropriate followup actions are taken.

C4.5.2.1.2.6. Implement CRTF's health and safety standards and monitor the safety procedures of all participating in weapon-recovery operations.

C4.5.2.1.2.7. Brief and train people not designated previously as radiation workers who will be working in the contaminated area on PPE, hazards, and safety measures.

C4.5.2.1.3. Consolidate all radiological assessment information for on-site recovery operations and provide it to the CRTF.

C4.5.2.1.4. When the NDA is dissolved, JHEC personnel and resources may be integrated into FRMAC operations.

C4.5.2.2. Materials Sampling

C4.5.2.2.1. Environmental Sampling

C4.5.2.2.1.1. Air sampling is conducted to determine if airborne contamination is present. Also, it provides a basis for estimating the radiation dose/exposure that people without respiratory protection may have received since the air sampling instruments were emplaced.

C4.5.2.2.1.2. Soil, water, vegetation, and swipe sampling of hard surfaces are required. Sampling should be initiated in the contaminated area soon after the accident. Samples must also be taken at locations remote from the contaminated area to verify background readings. After this, samples are required periodically during the recovery process to determine radioactive material migration and dispersion and to substantiate DECON/recovery completion. The JHEC in cooperation with FRMAC will determine on-site sampling parameters, such as, sample location(s), method, frequency, volume of sample, and size.

C4.5.2.2.2. Bioassay Program

C4.5.2.2.2.1. Bioassay methods estimate the amount of radioactive material deposited in the body. The methods use either direct measurement, e.g., sensitive x-ray detectors placed over the chest (lung counting) and/or other organs, or detection of radioactivity in the excrete (nasal mucous, feces, or urine).

C4.5.2.2.2.2. A bioassay program for potentially affected individuals is recommended to determine if an internal uptake occurred. Implementation of a bioassay program and the documented results will be important in the equitable settlement of any legal actions that may occur in the years following a nuclear weapon accident. Personnel monitoring and bioassay programs are discussed in this paragraph and bioassay techniques in Chapter 7.

C4.5.2.3. Work Force Protection. Standard radiation accident and incident response procedures provide guidance for personnel protection during the first few days. As conditions stabilize, regulations governing work in radiation areas should be implemented. Consideration must be given to participating organizations' or Services' methods and previous doses, and whether their procedures do not jeopardize health

and safety or unduly impair operations. The JHEC is responsible for implementing the CRTF's health and safety standards and closely monitoring the safety procedures of all participating organizations. Personnel entering the contaminated areas, if not trained to work in a contamination environment, should be given specific guidance.

C4.5.2.4. Radiological Surveys. Radiological surveys and other radiological data are required by the CRTF and civil authorities/officials to identify actions to minimize hazards to the response force and the public. Site characterization and DECON and remediation planning will also need this information. Radiological survey and data requirements must be given to the FRMAC for implementation to meet this requirement in an expeditious manner. Prior to extensive survey initiation, the following must be completed: select appropriate detection equipment, calibrate instruments, and determine the background readings. Surveys include NDA perimeter, area, and resource/facility surveys. The survey process can require days to weeks to complete. Survey procedures are located in Appendix C4.AP5. and forms in Appendix C4.AP6.

C4.5.2.5. Radiological Advisory to the Joint Information Center/Combined Information Bureau. All public release of information will be processed in accordance with DoDD 5230.16, reference (g), and made through the JIC/CIB. Public interest in the actual or perceived radiological hazard resulting from a nuclear weapon accident will produce intense public concern and media scrutiny of response operations. The JIC/CIB requires assistance from the JHEC and FRMAC in preparing press releases to minimize and allay these concerns. Any portion of the public that may have been advised to take precautionary measures will seek clear, understandable explanations of methods to protect their health and property. The public must be provided information through the JIC/CIB and the Community Emergency Action Team (CEAT) explaining the potential hazards, in terms that recognize the populace's knowledge level and understanding of radiation and its effects.

C4.5.2.6. Fixing of Contaminants. Fixatives should be used to reduce resuspension and the spread of contamination. If water is readily available, it may be used as a temporary fixative to reduce resuspension. Other more permanent fixatives may be used to reduce the spread of contamination by resuspension and runoff from highly contaminated areas. The use of fixatives in areas of low-level contamination is usually inappropriate. Fixatives may enhance or hinder DECON and remediation operations and affect radiation survey procedures, and in fact may generate mixed waste or be in conflict with EPA regulations. The DOE ARG can provide information on the advantages and disadvantages of different types of fixatives and methods of application. They should be consulted prior to application of permanent fixatives.

C4.5.2.7. Recovery/Remediation

C4.5.2.7.1. Recovery. This activity includes the initial reconnaissance, the render safe procedures, hazard removal, and disposition of the weapons and components. The two-person concept must be enforced strictly when working with nuclear weapons. In the early stages of accident response, following all of the required security measures may be difficult; however, the CRTF should implement necessary security procedures as soon as possible. The initial entry will determine the preliminary weapon(s) status and hazards in the area. In the process of determining the weapon condition, a search may be required to find the weapon(s). The CRTF directs the initiation of the render safe procedures. The EOD team advises the CRTF of the safest and most reliable means for neutralizing weapon hazards.

C4.5.2.7.2. Site Remediation. Procedures/methods to return the accident scene to a technically achievable and financially acceptable condition begin early in the response effort. SR becomes a major issue after classified information, weapons, weapon debris, and other hazards are removed. Several factors have significant influence on SR decisions and procedures, such as size of the contaminated area and topographical, geological, hydrological, meteorological, and demographic information. Other important aspects are utilization of the area and civil authorities/officials prerogatives for the area. Remediation will include those measures to remove or neutralize the contamination. A component of the CMAT is capable of analyzing options and providing the on-site commander with costs.

C4.5.2.8. Disposal of Contaminated Waste. CCS operations and JHEC field laboratory operations create considerable quantities of contaminated waste. Provisions are required, therefore, to store this waste temporarily in the contaminated area until it can be moved to a disposal site. Procedures for the disposal of contaminated waste are addressed as part of SR. The SRWG will develop a plan to dispose of contaminated waste as part of SR.

C4.5.2.9. Logistics Support for Recovery/Radiological Operations. Radiological response assets arrive with sufficient supplies to last a few days. High use items that soon require resupply include hundreds of sets of personal protective clothing each day, 2-inch masking or duct tape, varied sizes of polyethylene bags, marking tape for contaminated materials, and respirator filters. Personal protective clothing may be laundered in special laundry facilities (discussed in Appendix C16.AP1.) and reused. The turnaround time, when established, determines the approximate amount of anti-contamination clothing required. Close liaison will be

required between the JHEC and the RTF supply officer. Disposable personal protective clothing may prove more logistically feasible in some circumstances. See C16.AP1.

C4.5.3. Radiological Hazards. The primary radiological hazard associated with a nuclear weapon accident is from fissile material, particularly alpha emitters. Sufficient quantities of beta/gamma emitters to pose a significant health problem will not normally be present at a nuclear weapon accident.

C4.5.3.1. Radiological Hazard Assessment. From the outset, concern exists about the potential health hazard to the general public, particularly to those residing near the accident site. Consideration of possible radiation exposures is the primary method of estimating the potential health hazard. If no beta/gamma radiation is present, the primary risk is inhalation of alpha emitters that may cause a long-term increase in the probability of radiation-related diseases. Initial hazard assessments will, of necessity, be based on limited information, assumptions, and worst case projections of possible radiation doses received. ARAC and HPAC, described in Appendix C4.AP4., provide theoretical projections of the maximum internal radiation dose people may have received if outdoors without respiratory protection from the time of release to the effective time of the predictive plot. Exposure to resuspended contaminants normally results in doses that are a small fraction of that dose that would be received from exposure to the initial release for the same time period. Contamination released by the accident should not normally affect the safety of public water systems with adequate water treatment capability.

C4.5.3.2. Reduction of Public Exposure. The hazard assessment must be followed quickly by recommended precautionary and safety measures to protect the public from exposure. To control and minimize exposure, radioactive contaminants must be prevented from entering the body and confined to specific geographic areas so that the contamination can be removed systematically. Methods for reducing the exposure to the public should be implemented by, or through, civil authorities/officials. Although political and possibly international issues are likely to be involved, the ultimate decisions on measures to be taken should be based on health and safety considerations.

C4.5.3.2.1. The IRF may need to advise civil authorities/officials of recommended actions and provide technical assistance until appropriate civilian assets arrive. When contamination has been released, or when probable cause exists to believe that contamination was released, the implementation of precautionary measures

to reduce exposure to radiation or contamination are appropriate, even though the RTF personnel may not arrive for some time.

C4.5.3.2.2. Protective measures include:

C4.5.3.2.2.1. Establishing a Contamination Control Area (CCA). This operation requires identifying people in the area at the time of the accident/incident and/or restricting access to the area. Any vehicles or people exiting the area should be identified and directed to go to a monitoring point immediately.

C4.5.3.2.2.2. Sheltering. Sheltering is used to minimize exposure to the initial release of contamination as it moves downwind and to minimize exposure to resuspended contamination prior to an evacuation. Sheltering is implemented by advising the people to seek shelter and the procedures to follow. The effectiveness of sheltering depends on following the procedures provided. Pets should be gathered and sheltered as well to prevent spread of contamination. Livestock can continue to range free since they have little intimate contact with the general public.

C4.5.3.2.2.3. Evacuation. Contaminated areas must be defined and an evacuation procedure developed and implemented by civil authorities. Civil authorities will be responsible for the evacuation but may require radiological advice and assistance. Immediate evacuation of downwind personnel should be discouraged since the probability of inhalation of contaminants may increase. Explosive or toxic materials may present an immediate hazard to people near the accident site and immediate evacuation would then be required.

C4.5.3.2.2.4. Fixing Areas of High Contamination. Areas of high contamination must be controlled to prevent spread by resuspension, water runoff, or movement of personnel. Although fixing of contamination is part of the SR process, some fixing procedures may be necessary long before SR plans are implemented.

C4.5.4. Respiratory and Whole Body Protection. Protection of the general public, response force members, and workers in the accident area from exposure through inhalation is extremely important. Refer to Chapter 5 for additional guidance.

C4.5.5. Radiation Surveys. Extensive radiation surveys will be required to identify and characterize the area so that DECON and remediation plans may be developed and the results evaluated. Determining that contamination was released by the accident is very important; if release occurred, priority must be given to the actions to identify and minimize the hazards to people. These actions are included in Appendix C4.AP5.

C4.5.6. Site Remediation. SR involves negotiating cleanup levels and fixing or removing contamination. The removal is time consuming and requires an extensive workload to collect, remove, decontaminate, if appropriate, and replace the top soil. Monitoring is required during the removal process to verify that cleanup has been achieved.

C4.5.7. Verification. The DECON effectiveness will be verified by remonitoring/resurveying the accident scene to determine that the cleanup levels are achieved.

C4.5.8. Protective Action Recommendations (PARs) and Re-Entry Recommendations (RERs) provide appropriate protective action and re-entry recommendations to the public. PARs are generally provided to the State through the LFA. The State then has the final determination in what PARs are issued/enacted. The PARs and RERs will have been coordinated/reviewed by the cognizant Federal authority (DoD) and responsible civilian authorities/officials. The PARs and RERs will consider Protective Action Guides (PAGs) issued by EPA and State agencies. In an accident, PARs for initial notification or evacuation would likely not be prepared formally. The notification in the accident area would occur via visual means or word of mouth. Evacuation of approximately a 600-meter disaster cordon might occur automatically or at the direction of civilian law enforcement personnel. A PAR for a controlled evacuation could be formalized in anticipation of a subsequent release of HAZMAT or radioactive contamination. The PAR/RER format may include, as a minimum, problem, discussion, action, coordination, and approval sections (the format should be site and situation specific). A sample PAR for controlled evacuation is shown in Figure C4.F2., below.

Figure C4.F2. Sample Protective Action Recommendation (PAR) Form

(Sample PAR)

Protective Action Recommendation

For

Major Accident _____ at (location)

Issued by:

Problem. An accident involving a propane truck and two SST (T1 and T2) vehicles carrying _____*(type)*_____ nuclear weapons occurred at (time, date, and location). The propane truck sideswiped T1 and collided with T2. A fire erupted causing the propane truck to explode. Shortly afterwards, the weapon in T2 experienced a conventional high explosive detonation, resulting in widespread contamination. The T1 vehicle sustained damage and skidded into a ditch, preventing access through its doors to the stored weapon inside.

Discussion. Actions to gain access into T1 and remove the weapon have been hampered. It is still possible, though highly improbable, that a second explosion could occur during access and removal of the weapon in T1. In the unlikely event of an explosion, debris could be thrown 4,000 feet with additional contamination released. As a result, an evacuation of (outline the specific area) has been ordered by the (civilian authority office).

Action. With the possibility of an explosion during access and removal operations involving the weapon in T1, the following area will be evacuated. (Indicate the specific area to be vacated and a schedule indicating evacuation start, completion, verification of evacuation, work start, work completion, and return to the area.) NOTE: All personnel are required to sign in at a specific location(s) during evacuation to help local law enforcement/RTF personnel verify that all personnel are out of the area prior to start of access and removal procedures. A holding area, for example, a gymnasium or school, may be a temporary area for evacuees. Also, the evacuees could be released for shopping or other activities outside the area. Upon successful completion of access and removal procedures, the civil authorities will determine when evacuees may return to their houses/businesses, if outside the contaminated area.

NOTE: Release of this "Protective Action Recommendation" cannot precede confirmation of the presence of a nuclear weapon by the CRTF and should be coordinated with local officials and the RTF Public Affairs Officer (PAO) prior to release.

C4.6. ACCIDENT RESPONSE PLAN ANNEX

Procedures and information appropriate for inclusion in the Radiological Hazard Safety Annex to the accident response plan include:

C4.6.1. A description of the JHEC organization and responsibilities.

C4.6.2. Procedures for operation of the JHEC.

C4.6.3. Procedures for establishing and maintaining the Contamination Control Line (CCL).

C4.6.4. Procedures for ensuring that all indigenous personnel possibly exposed to contamination are identified, screened, and treated. This function is an ARG (on-site) and/or FRMAC (off-site) responsibility initially.

C4.6.5. Guidelines for determining radiation survey and DECON priorities.

C4.6.6. Procedures for ensuring that response force personnel working in the contaminated area are properly protected.

C4.6.7. Procedures for recording and maintaining pertinent data for the radiological safety of response force personnel.

C4.6.8. Procedures for recording, correlating, and plotting the results of radiological surveys and data collection instrumentation (i.e., air samplers).

C4.6.9. Procedures for JHEC and FRMAC interfacing.

C4.6.10. Procedures for JHEC incorporation into the FRMAC.

C4.AP1. APPENDIX 1 of CHAPTER 4

RADIOLOGICAL MONITORING EQUIPMENT

C4.AP1.1. INSTRUMENTS AND INSTRUMENT SETS

Alpha Survey Instruments				
Instrument	**Type**	**Scale**	**Indicator**	**Description**
AN/PDR-56	Scintillation	0 to 1000K, 4 ranges	CPM/17 cm^2	Small auxiliary probe provided for monitoring irregular objects. Mylar probe face is very fragile; a puncture disables the instrument. Accompanying x-ray probe is calibrated for 17 keV with associated meter scale from 0 to 10/m^2 in four ranges.
AN/PDR-77	Scintillation	0 to 999K cpm Digital Auto Ranging	100cm^2	See Instrument Sets.
AN/PDR-60 (PAC-IS) (See beta and gamma capabilities, below)	Scintillation	0 to 2,000K, 4 ranges	CPM/60 cm2	Intermediate and high-range alpha survey. Mylar probe face is very fragile; a puncture disables the instrument.
PRM-5	Scintillation	0 to 500K, 4 ranges	CPM	Portable, high-, and low-range instrument for detecting plutonium contamination through measurement of associated x-rays and low energy gamma radiation. Effective in inclement weather and much less subject to damage during field use.
Ludlum Model 3 (See beta and gamma capabilities, below)	Scintillation	0 to 400K	CPM	Portable, high- and low-range instrument. Similar in operation and function to the AN/PDR-60.
Ludlum Model 2220	Scintillation	0 to 500K, 4 ranges	CPM	Liquid crystal display and integral digital readout.

Beta and Gamma Survey Instruments				
Instrument	**Type**	**Scale**	**Indicator**	**Description**
AN/VDR-2	Geiger-Muller	Digital Auto Ranging 0 to 9.99Gy/hr	Gy/hr	Portable Beta/Gamma Survey Instrument. Displays total accumulated dose or dose rate. (Replaces the AN/PDR 27 for Army applications.)
AN/PDR-60 (PAC-ISAGA) (See alpha capabilities, above)	Geiger-Muller	0 to 2,000K; 4 ranges	R/hr	Measures intermediate gamma using the 2R range. May use Pu-gamma detector (PG-1) for inclement weather. Also measures alpha (see PAC-IS above). Gamma probe still operates if alpha probe is damaged.
Ludlum Model 3 (See alpha capabilities, above)	Geiger-Muller	0 to 200 mR/h	mR/h	Portable high- and low-range analyzer similar to AN/PDR-60. Probe 44-6 uses a G-M tube to detect beta and gamma. Probe 44-9 detects low-energy gamma, 0 to 200 mR/h.
AN/PDR-27	Geiger-Muller	0 to 500; 4 ranges	mR/h	Low range; suitable for personnel monitoring for beta/gamma emitters only. Not useful for alpha emissions. May saturate and read 0 in high radiation fields above 1,000 R/hr.
AN/PDR-43	Geiger-Muller	0 to 500; 3 ranges	R/h	High range; will not saturate in high radiation area. Readings in gamma fields other than Co-60 may be inaccurate to greater than 20 percent.
IM-174/PD (Gamma)	Integrating ion chamber	0.1 to 10; 0 to 500	R/h	High range. Logarithmic scale. Temperature sensitive.
ADM-300A	Geiger-Muller	Gamma: 10 to 10,000 Beta: 10 to 5	 uR/hr R/hr uR/hr R/hr	Portable Beta/Gamma Survey Instrument (with BP-100 or BGP-100 Beta/ Beta Gamma Probe). Built in Beta Gamma detection/monitoring capability without additional probes. High range. BGP-100 can be located up to 300 feet from the ADM-300. Saturation level of 100000R/h.
Ludlum Model 19 (Gamma)	Scintillation	0 to 5 mR/hr	uR/h	(To Be Provided.)

Instrument Sets	
Instrument	**Description**
AN/PDR-77 RADIAC Set	The AN/PDR-77 will accept a maximum of eight different probes. Each probe is automatically recognized and has unique calibration information stored in non-volatile memory. The AN/PDR-77 comes with three probes. A 100cm^2 ZnS Alpha probe, a two Geiger tube beta/gamma probe, and a 5-inch NaI low-energy x-ray probe capable of measuring and determining surface contamination levels of Pu and Am-241 in µCi/m^2. An accessory kit is available that contains a GM pancake probe and 1" x 1.5" NaI micro-R probe.
Violinist II - FIDLER Instrument Set	Includes the Field Instrument for the Detection of Low Energy Radiation (FIDLER), high-voltage power supply, and pre-amplifier and Violinist II. The Violinist II consists of a battery operated 256-channel analyzer and a pre-programmed microprocessor. When calibrated appropriately, measures and determines surface contamination levels of Pu and Am-241 in µCi/m^2.
Ranger	Includes the FIDLER/Violinist II and a position determining system. The microwave ranging system uses a base station, fixed repeaters, and mobile units. The mobile units transmit FIDLER radiation data to the repeaters and base station. Readings, contamination density, and isopleths are developed in near real-time. The microwave ranging system is limited to near line of sight. Dense vegetation, buildings, and hills may affect the ranging signal.

Tritium Survey Instruments			
Instrument	**Scale**	**Indicator**	**Description**
T-446	0 to 10	µCi/m3	Portable; automatic scale switching; trickle charger for NiCad F cells. With adapter kit, has urinalysis capability with 5-minute response. Filters particulate to .3 microns; not sensitive to smoke and paint fumes.
T-290A	0 to 1,000; 3 ranges	µCi/m3 concentration of gas in chamber	Portable air sampler. Must be rezeroed after 15 minutes of operation; hourly thereafter. Sensitive to smoke and paint fumes. Battery pack available for cold weather operation.
AN/PDR-73	0 to 10K; 4 ranges	µCi/m3	Portable air monitor comprising radiacmeter IM-245/PDR, designed to detect gaseous radioactive contamination in the ambient air. The instrument is capable of continuous air sampling and is calibrated to read directly the level of tritium. Powered by (12) internal rechargeable "C" cell batteries or it may be powered by 115 VAC, 60 Hz when in continuous use.
AN/PDR-74	0 to 100K; 3 ranges	µCi/m3	The portable radiation detection, indication, and computation (RADIAC) set contains an IM-246 air monitor to detect gases. Calibrated in terms of tritium activity but can be used to monitor other radio gases. Powered by D-cells. Alarm sounds at preset meter reading.

Dosimeters	
Instrument	**Capability and Limitations**
Self-Reading Ionization Chamber Dosimeter	Reusable device for measuring exposure to x-ray and gamma radiation. Can provide false positive readings due to charge leakage and sensitivity to mechanical shock.
Non-Self- Reading Ionization Chamber Dosimeter	Reusable device for measuring exposure to x-ray and gamma radiation. Can provide false positive readings due to charge leakage and sensitivity to mechanical shock. Requires separate reading device.
Film Badge	Provides measurement and permanent record of beta and gamma doses over a wide dosage range. Special neutron films are available. Ten-percent dose accuracy depending upon quality control during development. Sensitive to light, humidity, aging, and exposure to x-rays. Delay between exposure and dose reading due to processing time.
Thermo-Luminescent Dosimeter(TLD)	Measures gamma radiation dose equivalents up to 10,000 Roentgen Equivalent Man/Mammal (REM). Accurate to within a factor of two when the energy of the neutrons is unknown. After long periods of exposure, damaged or bent cards delay processing, static electric discharge causes spurious readings, and temperatures greater than 115 °F reduce sensitivity. Delay between exposure and dose reading due to central processing of TLDs.

C4.AP2. APPENDIX 2 OF CHAPTER 4

RADIATION DETECTION AND MEASUREMENT

(The Inference of Plutonium Contamination using the Field Instrument for the Detection of Low Energy Radiation [FIDLER])

C4.AP2.1. OVERVIEW

C4.AP2.1.1. Quantitative measurements of radioactive contamination in the field are extremely difficult. Particles having short ranges, such as alpha and low energy beta radiation, are significantly and incalculably affected by minute amounts of overburden, for example, dust or precipitation; therefore, detection rather than measurement is a more realistic goal for alpha-beta surveys. More penetrating radiations, such as gamma and higher energy x-rays, are affected less by such overburden; however, these elements require special attention to field calibration techniques in order to convert meter readings to contamination estimates.

C4.AP2.1.2. Field survey of uranium is best accomplished through measurement of x-rays in the 60 to 80 kilo electron volt (keV) range emitted by uranium isotopes and daughters. For plutonium, the best technique is to detect the accompanying contaminant Am-241, which emits a strong 60 keV gamma ray. Knowing the original assay and the age of the weapon, the ratio of plutonium to americium can be calculated accurately and thus the total plutonium contamination determined.

C4.AP2.1.3. Many of the factors that cannot be controlled in a field environment can be managed in a mobile laboratory that can be brought to an accident/incident site. Typically, the capabilities include gamma spectroscopy, low background counting for very thin alpha- and beta-emitting samples, and liquid scintillation counters for extremely low energy beta emitters such as tritium.

C4.AP2.2. GENERAL

C4.AP2.2.1. Scope. This appendix provides detailed information on the instrumentation and associated techniques used to perform radiological monitoring at an incident/accident involving the release of radioactive material. This appendix is not intended to serve as a "user's manual" for the various instruments; however, it includes sufficient detail to provide an understanding of the limitations of field measurement techniques and thus provides for proper application and the use of

techniques in case of an emergency. For completeness, some elementary characteristics of different kinds of radiation are included. Throughout this appendix the word "radiation" will refer only to nuclear radiation found at a nuclear incident/accident.

C4.AP2.2.2. Detection Versus Measurement

C4.AP2.2.2.1. Nuclear radiation cannot be easily detected. Thus, radiation detection is always a multi-step, highly indirect process. For example, in a scintillation detector, incident radiation excites a florescent material that de-excites by emitting photons of light. The light is focused onto the photocathode of a photomultiplier tube that triggers an electron avalanche. The electron shower produces an electrical pulse that activates a meter read by the operator. Not surprisingly, the quantitative relationship between the amount of radiation actually emitted and the reading on the meter is a complex function of many factors. Since control of those factors can only be accomplished well within a laboratory, only in a laboratory setting can true measurements be made.

C4.AP2.2.2.2. On the other hand, detection is the qualitative determination that radioactivity is or is not present. Although the evaluation of minimum levels of detectability is a considerable quantitative challenge for instrumentation engineers, the task of determining whether a meter records anything is considered much easier than the quantitative interpretation of that reading.

C4.AP2.2.2.3. The above discussion suggests that the same equipment can be used for either detection or measurement. In fact, generally, detectors have meters from which numbers can be extracted; however, to the extent that the user is unable to control factors that influence the readings, those readings must be recognized as indications of the presence of activity (detection) only and not measurements.

C4.AP2.2.2.4. In the discussions that follow, personnel must be aware of the limitations imposed by field conditions and their implications on the meaning of readings taken; therefore, instructions are careful to indicate the extent to which various instruments may be used as measurement devices or can be used only as detectors.

C4.AP2.3. TYPES OF RADIATION

C4.AP2.3.1. General. Four major forms of radiation are commonly found emanating from radioactive matter: alpha, beta, gamma, and x-radiation. The

marked differences in the characteristics of these radiations strongly influence their difficulty in detection and, consequently, the detection methods used.

C4.AP2.3.2. Alpha. An alpha particle is the heaviest and most highly charged of the common nuclear radiations. As a result, alpha particles very quickly give up their energy to any medium through which they pass, rapidly coming to equilibrium with and disappearing in the medium. Since nearly all common alpha radioactive contaminants emit particles of approximately the same energy, 5 million electron volt (MeV), some general statements can be made about the penetration length of alpha radiation. Generally speaking, a sheet of paper, a thin layer (a few hundredths of a millimeter) of dust, any coating of water or less than 4 centimeters of air are sufficient to stop alpha radiation. As a result, alpha radiation is the most difficult to detect. Moreover, since even traces of such materials are sufficient to stop some of the alpha particles and thus change detector readings, quantitative measurement of alpha radiation is impossible outside of a laboratory environment where special care can be given to sample preparation and detector efficiency.

C4.AP2.3.3. Beta. Beta particles are energetic electrons emitted from the nuclei of many natural and manmade materials. Being much lighter than alpha particles, beta particles are much more penetrating. For example, a 500 keV beta particle has a range in air that is orders of magnitude longer than that of the alpha particle from plutonium, even though the latter has 10 times more energy; however, many beta-active elements emit particles with very low energies. For example, tritium emits a (maximum energy) 18.6 keV beta particle. At this low an energy, beta particles are less penetrating than common alpha particles, requiring very special techniques for detection (see Chapter 8).

C4.AP2.3.4. Gamma and X-Radiation. Gamma rays are a form of electromagnetic radiation and, as such, are the most penetrating of the four radiations and easiest to detect. Once emitted, gamma rays differ from x-rays only in their energies, with x-rays generally lying below a few 100 keV. As a result, x-rays are less penetrating and harder to detect; however, even a 60 keV gamma ray has a typical range of a hundred meters in air and might penetrate a centimeter of aluminum. In situations in which several kinds of radiations are present, these penetration properties make x-ray/gamma ray detection the technique of choice.

C4.AP2.3.5. Radiations from the Common Contaminants. Table C4.AP2.T1. lists some of the commonly considered radioactive contaminants and their primary associated radiations.

Table C4.AP2.T1. **Commonly Considered Radioactive Contaminants and Their Primary Associated Radioactive Emissions**

	Alpha	Beta	Gamma	X-rays
Am-241	X		X	X
H-3		X		
Pu-239	X			X
Th-228	X			X
Th-230	X			X
Th-232	X			X
U (nat.)	X	X		X
U-235	X			X
U-238	X	X		X

C4.AP2.4. ALPHA DETECTION

C4.AP2.4.1. Because of the extremely low penetration of alpha particles, special techniques must be employed to allow the particles to enter the active region of a detector. In field instruments such as the AN/PDR-56 and -60, an extremely thin piece of aluminized mylar film is used on the face of the detector probe to cover a thin layer of florescent material. Energy attenuation of the incident alpha radiation by the mylar is estimated to be less than 10 percent; however, use of this film makes the detector extremely fragile. Thus, contact with literally any hard object, such as a blade of hard grass, can puncture the film, allowing ambient light to enter the detection region and overwhelm the photomultiplier and meter. (Even sudden temperature changes have been shown to introduce stresses that can destroy a film.) In addition, contact with a contaminated item could transfer contamination onto the detector; thus, monitoring techniques must be used that keep the detector from contacting any surface (however, recall that the range of the alpha radiation is less than 4 centimeters in air). This requirement to be within a few centimeters of monitored locations without ever touching one makes use of such detectors impractical except for special, controlled situations (for example, monitoring of individuals at the hot line or air sampler filters).

C4.AP2.4.2. As discussed above, the sensitivity (minimum detectability) of an alpha detector is not dictated by the ability of the active region of the detector to respond to the passage of an alpha particle; counting efficiency for alpha detectors is 25 to 60 percent of the alpha particles from a distributed source that reach the detector probe. Fortunately, alpha detectors in good repair normally have a fairly low background: there are few counts from cosmic and other spurious radiation sources

and the elimination of most electronic noise is easy with state-of-the-art instruments. As a result, count rates in the order of a few hundred counts per minute are easily detectable on instruments such as the AN/PDR-60. However, the detectability is dominated by the ability of the alpha particles to get into the active region of the detector, which depends upon such factors as overburden (amount of dust and/or moisture lying between the alpha emitters and the detector), and the proximity of the detector to the emitters.

C4.AP2.4.3. In demonstrations conducted in the laboratory, a sealed alpha source (Am-241) was monitored with a well maintained AN/PDR-60 alpha probe and meter. Dust and water were sprinkled onto the source and changes noted. It was found that a drop of water, a heavy piece of lint, or a single thickness of tissue paper totally eliminated all readings. A light spray of water, comparable to a light dew, reduced readings by 40 to 50 percent. A layer of dust that was just visible on the shiny source had minimal effect on the count rate; however, a dust level that was only thick enough to show finger tracks reduced readings by 25 percent. These simple demonstrations reinforced the knowledge that detection of alpha particles in any but the most ideal situations is most problematical. The leaching or settling of contaminants into a grassy area or the dust stirred up by vehicular traffic on paved areas will significantly decrease or eliminate alpha detection.

C4.AP2.5. BETA/GAMMA DETECTION

C4.AP2.5.1. Gamma rays and high energy (>1 MeV) beta particles are highly penetrating radiations. As a result, the major problems listed for alpha detection do not apply. Furthermore, at the energies of concern in nuclear weapon accidents/incidents, detection efficiency for most detectors is relatively high. Thus, beta/gamma detection is relatively easy.

C4.AP2.5.2. From a detection standpoint, unfortunately, high energy beta and gamma radiation are not produced in the most likely radioactive contaminants (for example, plutonium, uranium, or tritium). Rather, the major potential source of beta/gamma emitters is from fission product radioelements that could be produced in the extremely unlikely event of a partial nuclear yield. Beta/gamma detection, therefore, has no quantitative use in determining the extent of plutonium or uranium contamination but is used as a safety precaution to determine any areas containing hazardous fission products.

C4.AP2.5.3. Common gamma detectors are scintillation detectors (using scintillation media different from that described above for alpha detection) or gas

ionization type detectors (ion chambers, proportional counters, or Geiger-Mueller counters). In either case, the high penetrability of the radiation allows the detector to have reasonably heavy aluminum, beryllium, or plastic windows and to be carried at a 0.5 to 1.0m height. Dimensions of the active region of the detector (for example, the thickness of a scintillation crystal) can be made larger to increase sensitivity. Because the detection efficiencies are reasonably insensitive to energies in the energy regions of interest, the detectors can be calibrated in terms of dosage (RAD or REM), rather than in terms of activity. This practice reflects the common use for beta/gamma detectors.

C4.AP2.5.4. Typical of a beta/gamma detector is the Ludlum Model 3 with a Ludlum 44-9 "pancake" (Geiger-Mueller) probe. Minimum detectability for such a detector is a radiation field that produces readings two to three times greater than the background (no contaminant, natural radiation plus electronic noise) reading. Customarily, this corresponds to a few hundredths of a millirem per hour.

C4.AP2.6. X-RAY DETECTION

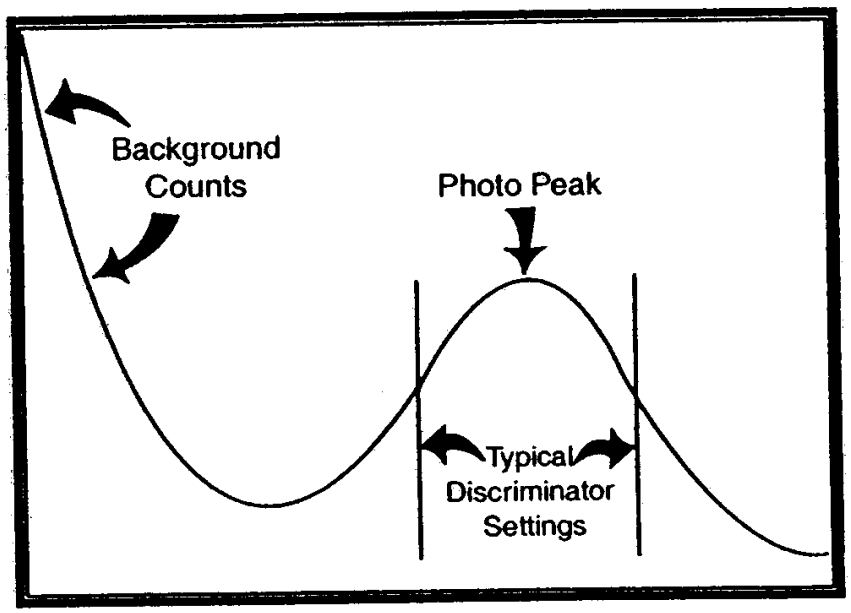
C4.AP2.6.1. For low energy (l7 to 100 keV) x-rays, the scintillation detector is again the instrument of choice. Window thickness is again a factor, though not as much as with alpha particles. For example, the half-thickness for absorption of 17 keV x-rays in aluminum is 0.4 mm and in air is about 4 meters. These factors increase rapidly with energy. For 60 keV x-rays, the distances become 2.5 cm and 190 m, respectively. Thus, for x-rays above 15 keV, an x-ray detector can be held at a comfortable height (0.5 m) above the contaminated surface.

C4.AP2.6.2. The size of an electronic pulse produced by an x-ray in a scintillation-type detector is proportional to the energy of the x-ray. This has a most important application, commonly called pulse-height discrimination. Because of the relatively low (10s of keV) energy of the x-rays of interest, an x-ray detector and its electronics must be quite sensitive. Unfortunately, such a detector is sensitive also to the myriad radiations from natural sources and to common low-level electronic noise. The result is a deluge of signals that overwhelm the pulses from sought after x-rays. To remove the unwanted signals, circuitry is installed in the meter to ignore all pulses whose size lies below a user selectable lower level (threshold). In cases of high (natural) background, it is also useful to discard all pulses whose size is greater than a user selectable upper level. The accepted pulses, therefore, are only those from the desired x-rays and that small amount of background that happens to fall in the same pulse size region.

C4.AP2.6.3. Unfortunately, pulse-height discrimination is not as "easy" as

described above. In fact, the signals from the detection of identical x-rays will not be identical in size; rather, a large number of such detections will produce a distribution of pulse sizes that cluster about a mean pulse size. If one sets the lower-level discriminator slightly below and the upper level slightly above the mean pulse size, a large fraction of the desired pulses will be eliminated, resulting in a significant decrease in detector response; however, setting the discriminator levels far from the mean will admit too much background, thereby masking the true signals. See Figure C4.AP2.F1. Thus, the setting of discriminator levels requires a qualitative judgment that can significantly affect the readings from a given contamination. Furthermore, since the width of the pulse size distribution depends in a most complicated way upon the condition and age of the detector, it is impossible to specify one setting for all similar instruments. Rather, techniques have been developed to establish the sensitivity of a given detector, with its electronics, in a field environment. This technique is described in the following section.

Figure C4.AP2.F1. Spectral Plot (Showing Normal Spread of Pulses from a Mono-Energetic Source Mixed with aTypical Background Spectrum and Indicating Typical Discriminator Settings)



C4.AP2.6.4. In spite of the above complications, the scintillation detector remains the instrument of choice for detection of x-ray emitting radioactive contamination. One such detector is the FIDLER. A FIDLER (4" x 1 mm. NaI [T1]) probe, in good condition, mated to a Ludlum 2220 electronics package, can detect 60 keV activity as

low as 0.2 microcuries per meter. In a typical weapon grade mix for a medium aged weapon, this mix would correspond to about 1 microcurie of plutonium per square meter. Furthermore, since the x-rays are much less affected by overburden than are alpha particles, the radiation monitor has much better control of the factors that influence its meter readings. As a result, the monitor can make quantitative measurements of the amount of radiation and infer the actual amount of contamination with far greater confidence than with any other field technique.

C4.AP2.7. DETECTION OF URANIUM AND PLUTONIUM

C4.AP2.7.1. Although uranium and plutonium are alpha emitters, they and their daughters also emit x-radiation; therefore, as discussed above, the instrument of choice for detection of these elements is a scintillation detector.

C4.AP2.7.2. The detection of uranium contamination is fairly straightforward. Among the radiations emitted in the decay of Uranium-235 and its daughters is an 80 keV x-ray. Setup and field calibration of the detector as described in this chapter allows measurement of the x-ray activity per square meter and thus evaluation of the uranium contamination. Confidence in the accuracy of these measurements is in the 11- to 25-percent range.

C4.AP2.7.3. The detection of plutonium is somewhat more complicated. Plutonium-239 and its daughters emit a 17 keV x-ray that can be detected with a FIDLER detector. However, absorption of that relatively low energy x-ray by overburden plus interference by background signals in the same range as the desired x-ray make measurement of the 17 keV a highly uncertain technique. The determination of plutonium contamination can be made more confidently through the following, indirect technique.

C4.AP2.7.3.1. Weapons grade plutonium contains several isotopes: in addition to the dominant Pu-239, there is always a trace amount of Pu-241. Pu-241 beta decays, with a half-life of 14.35 years, to Am-241. Am-241 subsequently decays with the emission of a 60-keV x-ray which, like the 80-keV x-ray of uranium, is relatively easy to detect under field conditions. Thus, a most sensitive technique for the detection of weapons grade plutonium is to detect the contaminant Am-241 and infer the accompanying plutonium.

C4.AP2.7.3.2. Clearly, this technique requires more information than the direct detection of radiation from the most plentiful isotope, such as knowledge of the age and original assay of the weapon material; however, decay times, weapon age, and

assay are known or controllable quantities, whereas overburden and its effect on alpha and low energy x-radiation are not. Thus, the safeguards community has standardized upon the detection of plutonium via its americium daughter.

C4.AP2.7.4. To facilitate the calculations and calibration needed to measure plutonium contamination by x-ray detection in the field, the LLNL has produced a series of utility codes called the Hotspot Codes[1], available for IBM-compatible computers in both DOS and Windows 95/98NT4 versions. The Hotspot Codes include an interactive, user-friendly utility routine called FIDLER that steps a user through the process of calibrating an x-ray detector. The FIDLER code is applicable to any x-ray detector if the full calibration technique, involving a known americium calibration source, is used.

C4.AP2.7.5. Particularly useful in the FIDLER code is the provision to aid in the measurement of the geometric factor for any specific detector. Measurements made at the Ballistic Research Laboratory and the LLNL[2] have shown that the value of K(h) for h = 30 cm can vary from less than 0.4 m^2 to more than 1.0 m^2, apparently depending upon external configuration and subtle internal details of a particular FIDLER probe. For this reason, the FIDLER code contains both a detailed laboratory procedure and a field expedient procedure for determining K(h) for a given detector. The code provides also a default value of 0.5 m^2. This value was chosen to give a relatively conservative reading indication of contamination per count rate.

C4.AP2.8. LABORATORY TECHNIQUES

As discussed above, laboratory procedures are necessary to make quantitative measurements of radiation contamination. For this reason, mobile laboratories are available within DoD and DOE for deployment to an accident site. Although specific instrumentation will vary, the types of laboratory analyses fall into three categories: gamma and x-ray spectroscopy, alpha-beta counting, and liquid scintillation.

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1 Steven G. Homann, Hotspot Health Physics Codes for the PC. Laurence Livermore National Laboratory UCRL-MS-106315 (March 1994).

2 Steven G. Homann, Hazard Control Department, Laurence Livermore National Laborator, private communication.

C4.AP2.8.1. Gamma and X-Ray spectroscopy. The major tools involved in gamma and x-ray spectroscopy are a reasonably high-resolution gamma/x-ray detector (such as an HPGe or selectively high resolution NaI) and a multi-channel analyzer. With this equipment it is possible to accurately determine the energies of the gamma and x-radiation emitted by a contaminated sample. Generally, spectroscopic techniques are not used for absolute measurements of amount of contamination (i.e., microcuries) in a sample; however, by adjusting for the energy dependence of detection efficiencies and using standard spectral unfolding techniques, the relative amounts of various isotopes present in the contaminant may be determined accurately. Recalling the discussions in the preceding sections, immediate application can be seen for such information: for example, spectroscopy allows determination of the relative abundance of Am-241 to Pu-239, resulting in accurate calibration of the most sensitive (FIDLER) survey techniques.

C4.AP2.8.2. Alpha/Beta Counting

C4.AP2.8.2.1. Another laboratory technique, alpha/beta counting, results in a reasonably accurate determination of the absolute amount of contamination in a sample. Two types of counters are common and both are fairly simple in principle. In one, a reasonably sensitive alpha/beta detector, such as a thin layer of ZnS mated to a photomultiplier tube, is mounted in a chamber that is shielded to remove background radiation. A sample, made very thin to minimize self-absorption, is inserted into the chamber under the detector. In some apparatus, air is evacuated from the chamber to eliminate air absorption of the radiation. The count rate is then measured. Knowing the geometry of the experiment permits translating the count rate to an absolute evaluation of sample activity.

C4.AP2.8.2.2. Another alpha/beta technique involves gas-flow proportional counters. In these devices, a sample is inserted into the chamber of a proportional counter. Any emitted radiation causes ionization of the gas in the counter that is electronically amplified and counted.

C4.AP2.8.2.3. In both types of alpha/beta counter, the most difficult, sensitive part of the experiment is the sample preparation. To achieve absolute measurements of activity, absorption of the radiation must be minimized by the overburden caused by the sample itself. Techniques used include dissolution of the sample onto a sample holder; evaporation of the solvent leaves a very thin, negligibly absorbing sample. Clearly, quantitative alpha/beta counting is a difficult, time-consuming process.

C4.AP2.8.3. Liquid Scintillation

C4.AP2.8.3.1. In a few cases, notably in the detection of beta radiation from tritium, the energy of the radiation is so low--and the resultant absorption is so high--that solid samples cannot be used for quantitative analysis. In these cases, dissolving the contaminant in a scintillating liquid may be possible. Glass vials of such liquid can then be placed in a dark chamber and the resulting scintillation light pulses counted using photomultipliers.

C4.AP2.8.3.2. Again, the outstanding difficulty with this process is in the sample preparation. Scintillation liquids are extremely sensitive to most impurities that tend to quench the output of light pulses. As a result, the most common technique for liquid scintillation sample gathering is to wipe a fixed area (typically 100 square centimeters) of a hard surface in the contaminated area with a small piece of cloth. The cloth can then be immersed totally in scintillation liquid in such a way that subsequent light emission will be visible to one of the photomultipliers in the analysis chamber. Alternatively, the cloth can be replaced by a special plastic material that dissolves in scintillation liquid without significantly quenching light output. In either case, the technique works best when the contamination can be gathered without large amounts of local dirt, oil, etc.

C4.AP3. APPENDIX 3 OF CHAPTER 4

ENVIRONMENTAL SAMPLING

C4.AP3.1. GENERAL

The collection and analysis of samples provides numerical data that describe a particular situation. The JHEC will provide direction for sampling procedures. The sampling criteria will be situation and site dependent. The results then may be used for the formulation of a course of action. This appendix addresses air, soil, vegetation, water, and swipe samples.

C4.AP3.1.1. Air Sampling. Air sampling is conducted to determine if airborne contamination is present. It provides a basis for estimating the radiation dose that people without respiratory protection may have received. The time required to respond to an accident and initiate an air sampling program will result normally in little or no data being obtained during the initial release of contamination when the highest levels of airborne contamination are expected. Most air sampling data obtained during an accident response will reflect airborne contamination caused by resuspension. Even though this discussion is directed primarily at airborne contamination caused by resuspension, the recommended priorities and procedures will permit as much information as possible to be collected on the initial release if air samplers are positioned soon enough. Priority should, therefore, be given to initiation of an air sampling program as soon as possible after arrival on scene. Whether or not data is obtained on the initial release, air sampling data will be needed immediately to assess the hazard to people still in the area, to identify areas and operations that require respiratory protection, and to identify actions required to fix the contaminant to reduce the airborne hazard and spread of contamination. When using filtration to collect particulate samples, the selection of filter medium is extremely important. The filter used must have a high collection efficiency for particle sizes that will deposit readily in the lung (5 microns or less).

C4.AP3.1.2. Response plans should include provisions for establishing an air sampling program. This plan would include sufficient air monitors (battery powered or a sufficient number of portable electric generators), air monitor stands, filter paper, personnel to deploy samplers and collect filters, analysis capability, and a method to mark and secure the area monitors against tampering. Also important is a means to ensure that air samplers are properly calibrated (see Table C4.AP3.T1.) Staplex air samplers use the CKHV calibrator for a 4-inch filter and CKHV-810 calibrator for the

8-inch x 10-inch filters. Normally, 1,000 cubic feet per minute (CFM) of air must be sampled for accurate results.

Table C4.AP3.T1. **Air Sampler Calibration**

Filter Type	Calibration Kit	Flow Rate	Operation Time
4" TFA #41	CKHV	18 CFM	55 min
4" TFA #2133	CKHV	36 CFM	28 min
4" TFA "S"	CKHV	70 CFM	15 min
8" x 10" TFA-810	CKHV-810	50 CFM	20 min

C4.AP3.2. AIR SAMPLING TIME

The period of time over which an air sample is collected determines the volume of air sampled. Variables that affect the accuracy of air sampling results include the type of sampling equipment used, the accuracy with which contaminants on the filter can be measured, and the size of the sample. The sum of the errors can be offset, in part, by increasing the total volume of the sample collected. Increasing sample time presents no real difficulty when the interest is in long-term average concentrations, precision of results, or in detection of very low levels of contamination, as will be the case during DECON and remediation operations. During the initial response, when the interest is in rapid evaluation of air contamination to identify areas where high concentrations of airborne contamination could pose a hazard to unprotected persons in relatively short periods of time, short sampling times are appropriate. When taking samples for rapid evaluation, samplers should be operated long enough to sample a minimum of 1,000 cubic feet of air. Once that data required for prompt evaluation is obtained, an air sampling program should be established to obtain 24-hour samples (equipment permitting), or high volume samples on a regular basis.

C4.AP3.3. AIR SAMPLER PLACEMENT

Sampler positioning is directed toward the first 24 to 48 hours following an accident, or until an air sampling program tailored to the specific situation can be implemented. During this period, the number of air samplers available will be limited and should be placed to obtain the maximum amount of information possible.

C4.AP3.3.1. The amount of airborne contamination caused by resuspension will vary from location to location as a function of surface type, physical activity, surface wind patterns, and the level of contamination on the ground. Recommendations on

the initial placement of samplers assume that the mix of surface types is relatively constant throughout the area, that air samplers will be placed to minimize any localized wind effects, and that the location of physical activity in the area (for example, response actions or evacuation) will be known and controlled. The main variables in determining the amount of airborne contamination will be ground contamination levels and wind speed. To provide the quickest and most accurate estimate of the maximum concentrations of airborne contamination, priority should therefore be given to placing an air sampler at or near the most highly contaminated area that is accessible.

C4.AP3.3.2. Figure C4.AP3.F1. shows the recommended placement of air samplers. The sampler number indicates the priority that should be given to placement. All air sampling locations should be marked with a unique number or symbol on a stake so that data may be correlated with other information in the following days. During the initial response, sampler No. 1 is placed downwind from the accident site to determine the hazard in the immediate area of the accident and should operate continuously. The distance should be modified in a downwind direction, if necessary, to permit access by a clear path for placement and periodic readings and filter changes. The time of readings and/or filter changes should be coordinated with EOD personnel. Sampler No. 2 is placed downwind from the accident at a distance dependent upon the wind velocity (see Table C4.AP3.T2.). Modifications to this location should be considered based on accessibility, the location of nearby populated areas, and microclimatology. Downwind samplers should be operated until it can be determined that no airborne contamination exists at their locations and that actions taken upwind of the location or changes in meteorological conditions will not result in airborne contamination. Sampler No. 3 is placed approximately 610 meters upwind of all contamination and outside the contamination control area to obtain simultaneous background air samples for use in interpretation of other readings. Background samples should be collected concurrently with the sample of interest, if possible, since the amount of naturally occurring airborne radioactive particulates may vary as a function of time due to wind changes. Air sampler No. 4 is placed at the CCS and operated continuously during CCS operations, since personnel leaving the contaminated area may carry and resuspend contaminants. The amount of contamination resuspended in this manner is expected to be small. During the initial phases of response, consideration should be given to using all additional samplers, if available, in downwind locations to supplement sampler No. 2, particularly when populated areas are in or near the contaminated area.

Figure C4.AP3.F1. Air Sampler Placement

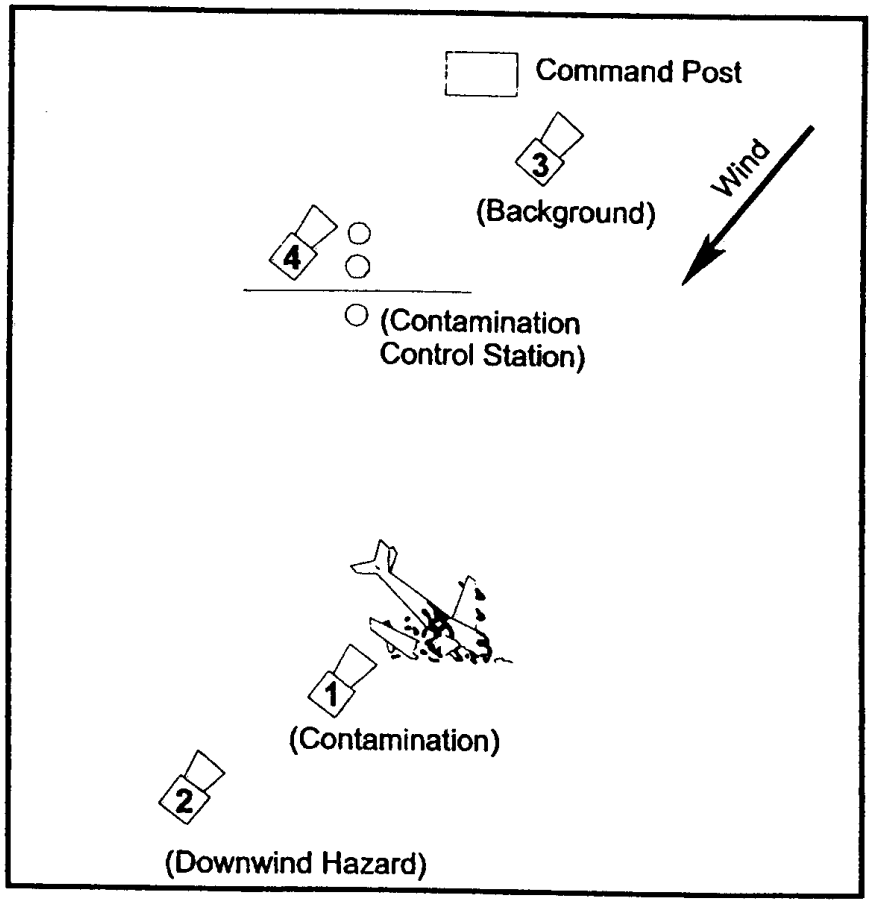

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Table C4.AP3.T2. **Air Sampler Placement (No. 2) Distance**

Wind Speed		Approximate Downwind Distance	
(MPH)	(Knots)	(Meters)	(Feet)
6 to 10	4 to 9	1,000	3,300
11 to 15	10 to 13	1,500	5,100
16 to 20	14 to 17	2,000	6,600
Above 20	Above 17	2,500	8,200

C4.AP3.4. AIR SAMPLE DATA RECORDING

For air sampling data used in the overall radiological assessment and confirmation of field calculations and confirmed or validated later by laboratory analysis, all pertinent data must be recorded. An air sampling log containing all of the following data should

be maintained. When filters are changed, they should be placed in a plastic bag for laboratory analysis and annotated with the following information:

C4.AP3.4.1. Type and serial number of sampler.

C4.AP3.4.2. Location of sampler, including identification of field marking (stake) used to mark location.

C4.AP3.4.3. Average flow rate and/or volume of air.

C4.AP3.4.4. Date.

C4.AP3.4.5. Start and stop time of sample.

C4.AP3.4.6. Wind direction and weather conditions.

C4.AP3.4.7. Type of filter.

C4.AP3.4.8. Field readings on filter and time made, particularly if readings were taken without changing filter, including radiation detection instrument type and serial number as well as designation of attached probe used to monitor the filter.

C4.AP3.4.9. Laboratory facility to which the filter was sent for processing.

C4.AP3.5. AIR SAMPLE ANALYSIS

Air sampler filters can be analyzed using radioanalytical techniques by DOE, RADCON, and AFRAT personnel, or by using a calculation method. The calculations shown below are for field use in calculating gross activity on the filter. Any background radiation from naturally occurring radionuclides (i.e., radon, thoron, and their daughters) should be subtracted when applying the calculated results to protection standards. This calculation is done by subtracting the gross activity of the background sampler (No. 3) from the gross activity of the sampler of interest when making rapid evaluations. Background corrected results may also be obtained by letting the naturally occurring radon, thoron, and their daughters decay to background. The radon chain may be considered completely decayed after almost 4 hours, and the thoron chain after almost 3 days. Remeasurement after these times permits identification of the amount of sample activity caused by these elements. During rapid field calculations early in the response, the check for radon is appropriate if, or when, levels of airborne contamination detected are at or slightly above the

established levels. The 3-day decay time precludes checking for thoron during the initial response.

C4.AP3.5.1. The following equation may be used for initial field evaluation of air sampling data to obtain rough estimates of airborne contamination utilizing the AN/PDR-60 or AN/PDR-56 (with the large probe attached) and 8 x 10-inch or 4-inch (round) Whatman #41 filters. Results measured in Disintegration's per minute per cubic meter (dpm/m^3).

$$dpm/m^3 = \frac{cpm \times CF}{AFR \times T\ (min)} - \text{Background Reading}$$

where cpm = Alpha meter reading on air filter in counts per minute

CF = Conversion factor (1,000 for AN/PDR-60; 4,000 for AN/PDR-56) includes unit conversions, area correction factors, and other constants, assuming use of 8 x 10-inch Whatman #41 filter paper. For 4-inch, (round) filter paper, the conversion factors are 200 and 800 for the AN/PDR-60 and AN/PDR-56, respectively.

AFR = Average Flow Rate of the air sampler in cubic feet per minute

T = Time in minutes the air sampler was running

C4.AP3.5.2. If other alpha instruments or filters are being used, the following equation should be used for field evaluation of air sampling data. Results measured in dpm/m^3.

$$dpm/m^3 = \frac{cpm \times A_f}{0.5 \times m^3 \times F \times E_f \times E_c \times A_c}$$

where cpm = Alpha meter reading on air filter in counts per minute

A_f = Area of filter used (any units)

m^3 = Total volume of sampled air in cubic meters

F = Alpha absorption factor for filter used (from manufacturer's specifications)

E_f = Collection efficiency of filter used (from manufacturer's specifications)

E_c = Efficiency of counting instrument

A_c = Area of filter actually counted by the instrument (same units as A_f)

C4.AP3.6. ENVIRONMENTAL SAMPLES

C4.AP3.6.1. Soil. Soil sampling procedures depend on the purpose of the sampling program. In all cases, careful selection of control (background) samples is required to allow interpretation of results. The following minimum quantities are necessary for analysis.

C4.AP3.6.1.1. Gamma spectrometry plus gross alpha and/or gross beta--2 kilograms of soil (approximately 1 square-foot area 3 inches deep).

C4.AP3.6.1.2. Gross alpha and/or gross beta only--100 grams.

C4.AP3.6.1.3. For a specific alpha and/or beta radionuclide, particularly Pu-239 (plutonium)--consult the appropriate Service laboratory.

C4.AP3.6.2. Water

C4.AP3.6.2.1. Surface and/or waste discharge sources--2 liters.

C4.AP3.6.2.2. Drinking water sources--1 liter.

C4.AP3.6.3. Vegetation. The minimum sample volume is 3 liters of densely packed sample and should be double plastic bagged or packed in a 1-gallon widemouth plastic jar.

C4.AP3.6.4. Swipes. Filter paper discs are used for taking swipe tests. Whatman #41 filter paper, 4.25 cm, FSN 6640-00-836-6870, is recommended for swipes. If this is unavailable, other filter paper with a maximum diameter of 1 3/4 inches may be substituted. Place a small "x" **IN PENCIL ONLY** on the outer edge of the filter paper on the side that is to touch the radioactive source or area being tested for contamination. Each swipe should be taken from an area of about 100 cm^2 by gently rubbing two or three times with the dry filter paper disc. The swipe is then placed, unfolded, in a properly completed Service form for a Swipe Container. If forms are unavailable, a plain envelope containing the required collection information may be substituted.

C4.AP4. APPENDIX 4 OF CHAPTER 4

SPECIALIZED RADIOLOGICAL MONITORING, RADIAC REPAIR, AND HAZARD ASSESSMENT/CAPABILITIES TEAMS

C4.AP4.1. GENERAL

C4.AP4.1.1. This appendix provides information on Service radiation monitoring teams (health physics, bioassay specialists, and a radiation equipment repair team) and on DOE and related monitoring and assessment capabilities.

C4.AP4.1.2. The detection/measurement of different types of radiation and the inherent difficulties have been enumerated; however, in the event of an incident/accident, radiation detection/measurement must be completed. The need of preliminary data on the absence/presence of radiation for the CRTF is imperative. Many military units and some civilian firms/agencies possess alpha and gamma detection capabilities. These units/firms have equipment and individual monitor capabilities that can provide radiation measurements and preliminary survey data; however, a finite definition of the accident area is needed to plan, initiate, and complete SR.

C4.AP4.1.3. The radiological characterization of the accident site is an iterative process involving the systematic integration of data produced by several assessment techniques. The following describes those resources available to enable theoretical, preliminary, and definitive site characterization for the CRTF.

C4.AP4.2. DEPARTMENT OF DEFENSE

C4.AP4.2.1. DTRA Hazard Prediction and Assessment Capability. HPAC is a forward deployable modeling capability available for Government, Government-related, or academic use. This software tool assists in emergency response to hazardous agent releases. Its fast running, physics-based algorithms enable users to model and predict hazard areas and human collateral effects in minutes. HPAC provides the capability to accurately predict the effects of HAZMAT releases into the atmosphere and its impact on civilian and military populations. The following paragraphs provide information regarding the HPAC modeling prediction shown in Figures C4.AP4.F1. and C4.AP4.F2.

C4.AP4.2.1.1. HPAC provides the capability to accurately predict the effects

of HAZMAT releases into the atmosphere and its impact on populations. The software uses integrated source terms, high-resolution weather forecasts, and particulate transport to model hazard areas produced by accidents. One of HPAC's strengths is fast access to real-time weather data via Meteorological Data Servers (MDS). HPAC also has embedded climatology or historical weather for use when real weather is not available.

Figure C4.AP4.F1. HPAC Modeling Prediction - Surface Dose

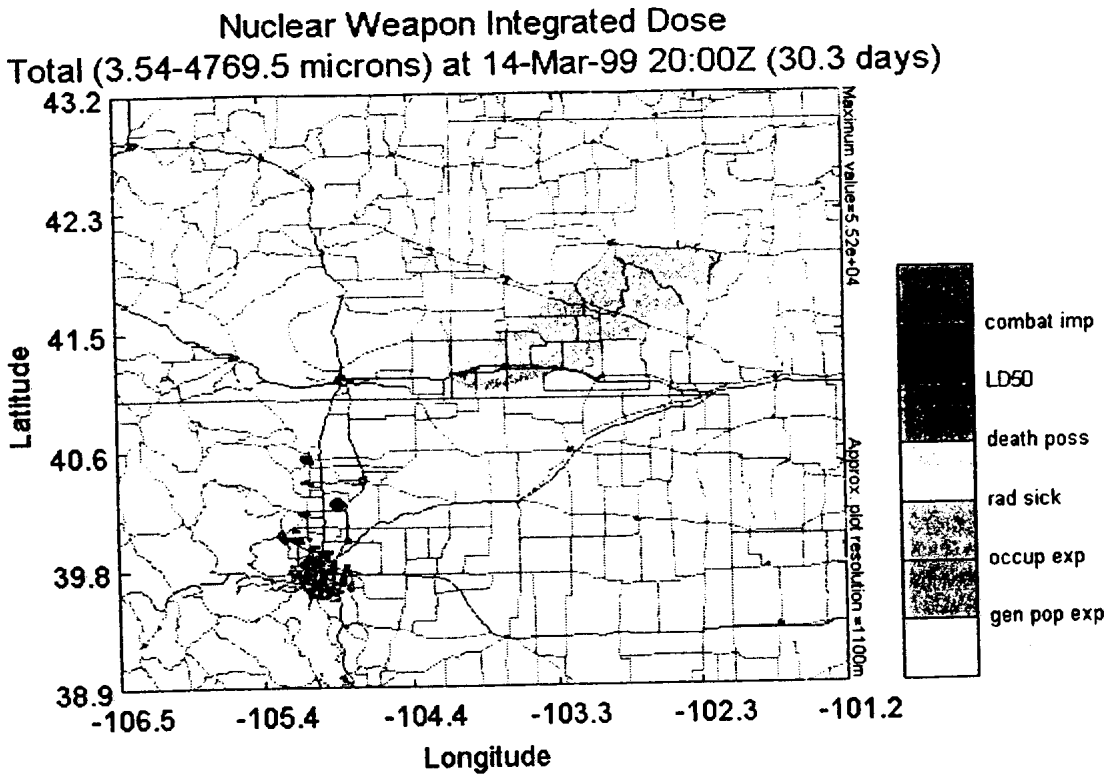
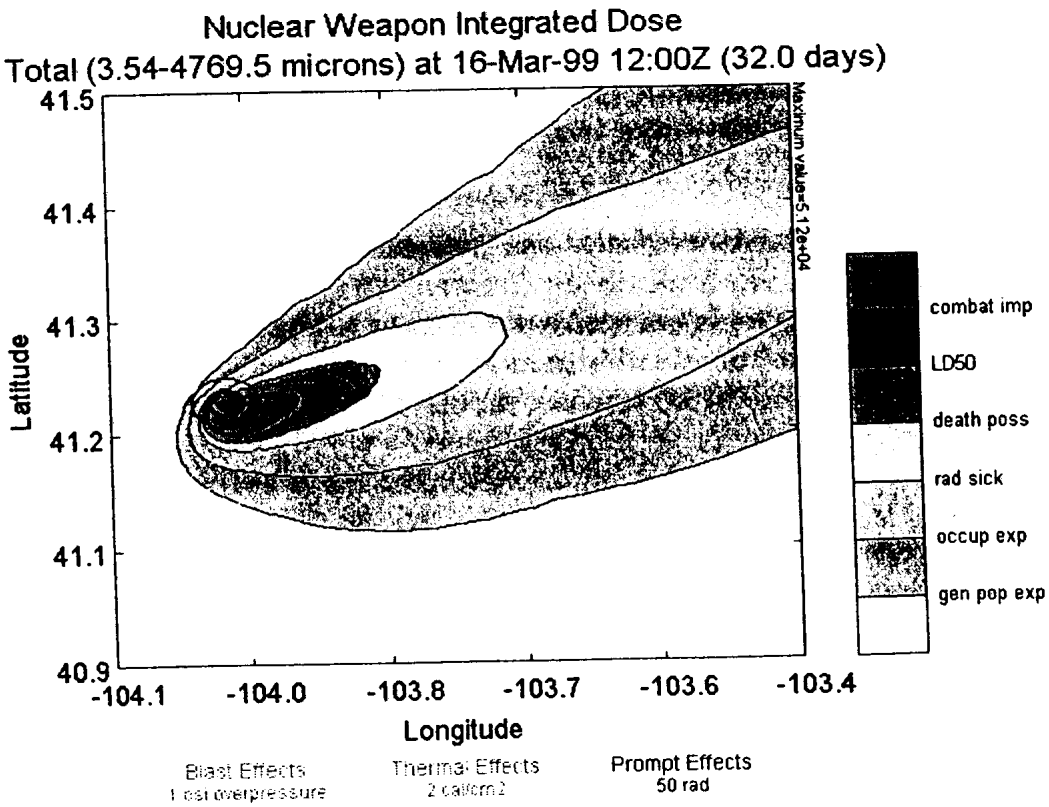


Figure C4.AP4.F2. HPAC Modeling Prediction - Hazards Area Effects



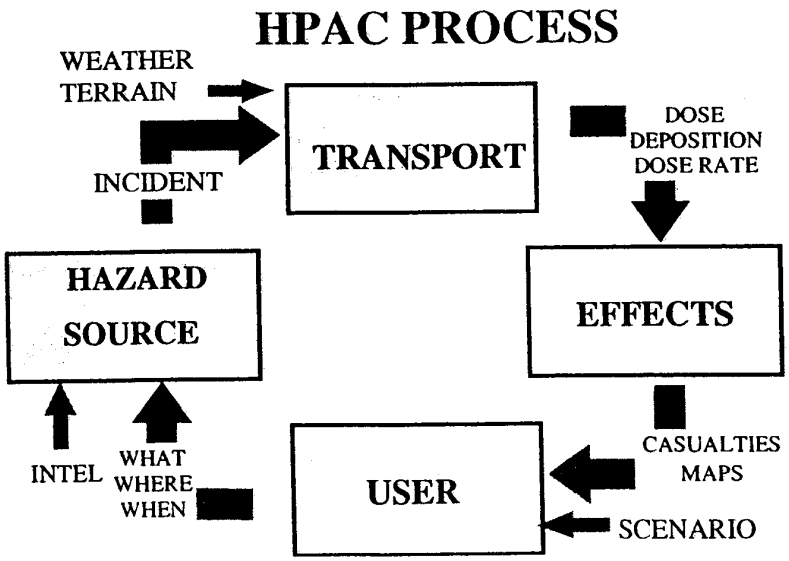
C4.AP4.2.1.2. HPAC models nuclear collateral effects of concern that may result from military or industrial accidents. HPAC provides source information on potential radioactive releases from nuclear weapons or reactor accidents.

C4.AP4.2.1.3. HPAC includes the SCIPUFF model for turbulent transport, a new and advanced technology that provides a highly efficient and accurate prediction for a wide range of hazard scenarios. HPAC can also help answer the question--"How good is the prediction?"--providing probabilistic solutions to the atmospheric transport problem. HPAC builds source terms for hazardous releases for input to the atmospheric transport model, SCIPUFF. The current code hosts operator-friendly "incident" setup capability. Sample HPAC projects are provided that may be edited to suit a wide range of user requirements or incidents. Additional improvements in the software are planned, but user feedback will ensure that these improvements include a user's perspective, not just a scientist's.

C4.AP4.2.1.4. The HPAC Process. The overall process starts first with the need to assess a hazard, then the statement of the problem in detail, followed by the

definition of the hazardous incident or source in HPAC. Meteorological data must be available. Then the SCIPUFF code transports the hazardous cloud (or "puffs") in the turbulent atmosphere. Effects of the HAZMAT at geographical locations are calculated, and the results are provided to the user on a map or as a cross-section of the atmosphere. The overall process is summarized in the following illustration (Figure C4.AP4.F3.).

Figure C4.AP4.F3. HPAC Process



(The wide arrows indicate the major steps in the HPAC process. The narrow arrows indicate critical inputs to the process. The weather, terrain, and hazard particle size primarily determine where a HAZMAT goes. The accuracy of the effects of the hazard depends on such details, as well as the detailed knowledge of the hazard itself.)

C4.AP4.2.1.5. Weather and Terrain. Weather is a key ingredient to the HPAC process. Although SCIPUFF is an accurate and efficient transport model, the results of a hazardous release are first and foremost affected by weather and how well the meteorology is defined. There are two types of inputs: observations and gridded numerical model data. Meteorological (MET) data are time sensitive. To keep the level of understanding required to use HPAC and logistics to a minimum, the simpler MET inputs to SCIPUFF (surface and upper air observations) will be presented here. More advanced and accurate capabilities, such as very high resolution mesoscale weather models, are available on DTRA's MDS.

C4.AP4.2.1.5.1. In general, meteorological observations are very representative of the real world at the time and location where the data are taken.

Assuming the weather does not change, reasonable results can be obtained for a period of 2 to 4 hours after the surface observations are taken. Upper air observations may be representative of a somewhat longer period of time. Observations at more locations, over a longer time period are needed to accurately assess longer duration, longer range, and more lethal releases.

C4.AP4.2.1.5.2. Forecasts and/or updated observations are needed for longer duration releases, but gridded forecast data are sometimes difficult to obtain and often are not accurate for transport applications. A single set of meteorological observations becomes less representative with distance from the observation site, with time from which the data are taken, around complex terrain, near sunrise and sunset, near weather fronts, urban areas, and land/water interfaces.

C4.AP4.2.1.5.3. Fast access to weather data for HPAC users became highly advanced with the introduction of the DTRA MDS. Obtaining weather data is as easy as a click on a mouse with HPAC's weather request generator, which provides access to forecast model and observation data in minutes.

C4.AP4.2.1.5.4. Terrain may have a large effect on where HAZMAT are transported. In addition to working with a variety of weather data types, HPAC works with two types of terrain data. By default, HPAC assumes a flat earth for the terrain, and this may be a reasonable approximation for small spatial domains; however, users may choose to use complex, 3-D terrain data describing the topographic variations. When the complex terrain option is used, it automatically invokes a mass consistent wind and turbulence model that is embedded within HPAC. The digital terrain data files contained in HPAC were developed using DTED® Level 0, a product of the National Imagery and Mapping Agency (NIMA). HPAC terrain models include an urban setting to closely approximate the effects of high-rise buildings.

C4.AP4.2.2. U.S. Army Radiological Control Team. The RADCON Team is a specialized response force located at Fort Monmouth, NJ, and organized to provide technical assistance, support, and advice to the CRTF in radiological emergencies.

C4.AP4.2.2.1. The USA RADCON Team is organized to:

C4.AP4.2.2.1.1. Provide a 4-hour response capability to any nuclear accident or radiological emergency.

C4.AP4.2.2.1.2. Perform detailed radiological surveys for alpha, beta, and gamma radiation.

C4.AP4.2.2.1.3. Maintain a mobile radiological analysis laboratory capable of providing on-site analysis of virtually every type of swipe or sample that may be taken as a result of nuclear materials accident or incident.

C4.AP4.2.2.1.4. Supervise and provide technical advice for DECON operations.

C4.AP4.2.2.1.5. Provide NIST traceable calibration and repair services for portable radiation detection equipment.

C4.AP4.2.2.1.6. Provide a team of health physicists and specialists to serve as the radiological component of the Department of the Army (DA) Service Response Force. This team provides the On-Scene Commander with technical assistance and advice necessary to make comprehensive assessments on all radiological aspects of accidents or incidents. The team provides advice and management regarding radiological safety, operational support, and radiological control and containment of the accident site.

C4.AP4.2.2.2. Requests for additional information should be directed to USA RADCON personnel. RADCON team assistance may be requested through the USA Operations Center or the JNACC. Phone numbers are listed in Appendix C22.AP1.

C4.AP4.2.3. <u>USAF Institute for Environment, Safety, and Occupational Health Risk Analysis (IERA)</u>. The IERA, Brooks Air Force Base (AFB), TX, 78235, provides many radiation protection services as follows:

C4.AP4.2.3.1. Conducts calibration, traceable to the National Institute of Standards and Technology (NIST), and minor repair services for portable instruments used and owned by the USAF Medical Service for the detection and measurement of electromagnetic and ionizing radiation.

C4.AP4.2.3.2. Maintains the USAF stock of low energy photon field survey instruments with trained operators to support disaster operations.

C4.AP4.2.3.3. Deploys a field-qualified team of health physicists, health physics technicians, and equipment called the AFRAT. This team is capable of responding worldwide to radiation accidents with air transportable equipment for detecting, identifying, and quantifying any type of radiation hazard; radioisotope analysis of selected environmental, biological, and manufactured materials; and on-site equipment maintenance and calibration.

C4.AP4.2.3.4. Conducts special projects dealing with long- and short-term evaluations of radiation exposures.

C4.AP4.2.3.5. Requests for additional information should be directed to IERA personnel. IERA services may be requested through the USAF Operations Center or the JNACC.

C4.AP4.3. DEPARTMENT OF ENERGY

Services of DOE capabilities will be requested by the DOE SEO.

C4.AP4.3.1. Hotspot Health Physics Codes

C4.AP4.3.1.1. The Hotspot Health Physics Codes were developed for the DOE's ARG to provide emergency response personnel and emergency planners with a fast, field-portable set of software tools for evaluating incidents involving radioactive material. Hotspot codes are a first-order approximation of the radiation effects associated with the atmospheric release of radioactive materials. The Hotspot atmospheric dispersion models are designed for a short-term (less than 24 hours) release duration. Users requiring radiological release consequences for release scenarios over a longer time period or more sophisticated modeling capabilities, e.g., complex terrain; multi-location real-time wind field data; etc., are directed to such capabilities as the Department of Energy's ARAC computer codes. The Hotspot codes have been completely revised to take advantage of the Windows® 95/98/NT operating system environment. The DOS version of Hotspot will also be supported.

C4.AP4.3.1.2. Four general programs--Plume, Explosion, Fire, and Resuspension--estimate the downwind radiological impact following the release of radioactive material resulting from a continuous or puff release, explosive release, fuel fire, or an area contamination event. Additional programs deal specifically with the release of plutonium, uranium, and tritium to expedite an initial assessment of accidents involving nuclear weapons.

C4.AP4.3.1.3. The FIDLER program is a tool for calibrating radiation survey instruments for ground-survey measurements and initial screening of personnel for possible plutonium uptake in the lung.

C4.AP4.3.1.4. The Nuclear Explosion program estimates the effects of a surface-burst nuclear weapon. These include prompt effects (Neutron and gamma, blast, and thermal), and fallout information. Fallout includes arrival time, dose rate at arrival time, and integrated dose contours for several time periods (e.g., first 6 hours, first day, first week, etc.).

C4.AP4.3.1.5. Hotspot is a hybrid of the well-established Gaussian plume model, widely used for initial emergency assessment or safety-analysis planning. Virtual source terms are used to model the initial atmospheric distribution of source material following an explosion, fire, resuspension, or user-input geometry.

Figure C4.AP4.F4. Hotspot Fire Model Geometry

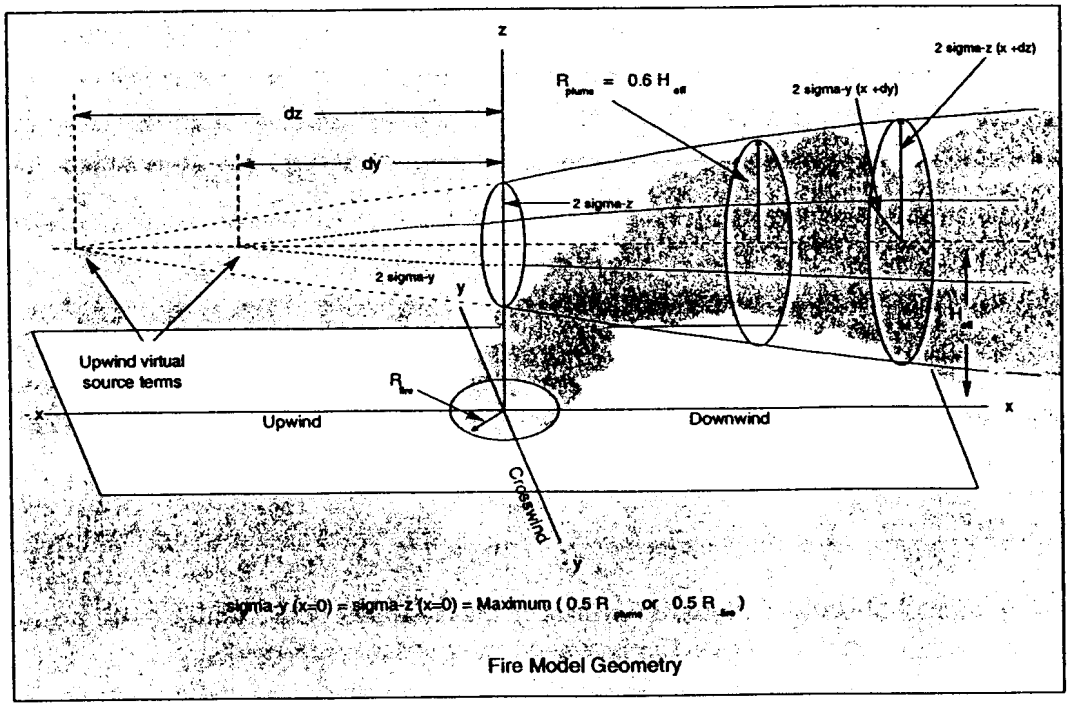
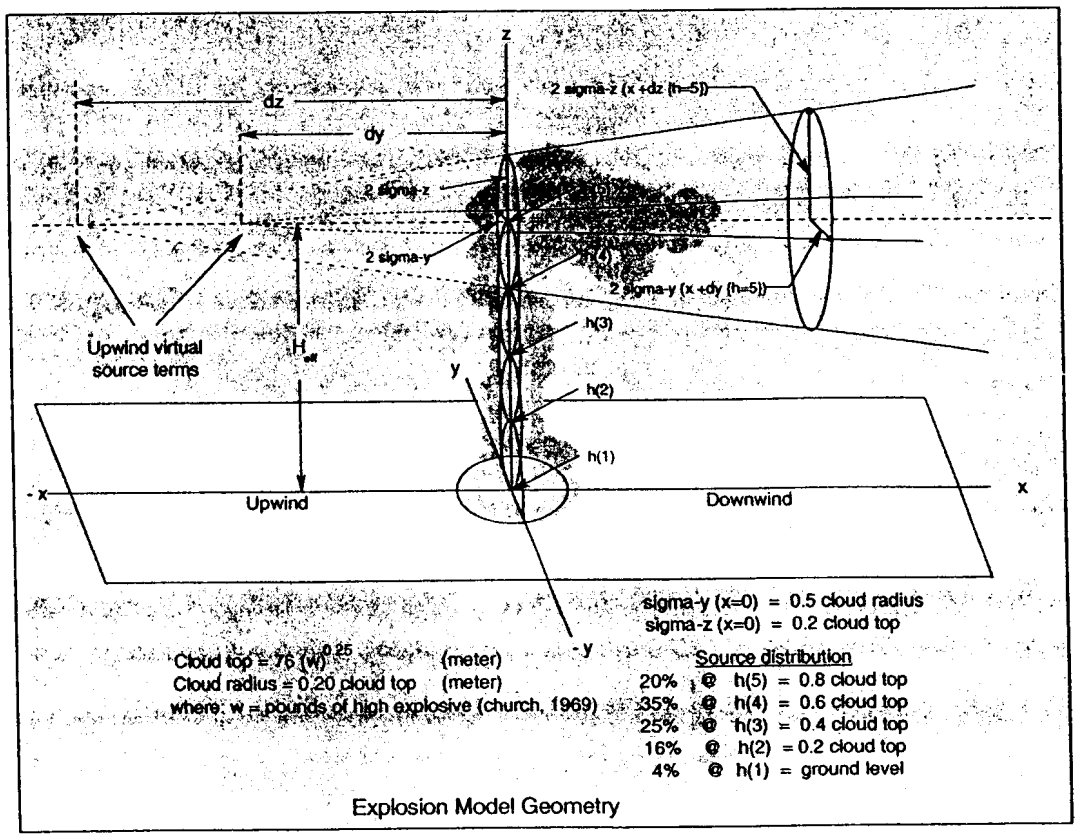


Figure C4.AP4.F5. Hotspot Explosion Model Geometry



C4.AP4.3.1.6. Hotspot incorporates a full International Commission on Radiological Protection, Part 30 (ICRP-30) library. The library contains Dose Conversion Factors (DCFs) for inhalation, submersion, and ground shine. In addition to the inhalation 50-year Committed Effective Dose Equivalent DCFs, acute (24-hour) DCFs are available for estimating non-stochastic effects. This acute mode can be used for estimating the immediate radiological impact associated with high acute radiation doses (applicable target organs are the lung, small intestine wall, and red bone marrow).

C4.AP4.3.1.7. The ICRP Publication 30 Respiratory Tract and ICRP-30 Part IV Systemic models are the basis for the DCFs. A one micrometer activity median aerodynamic diameter (1 AMAD), and ICRP-26/30 tissue weighting factors are assumed. Hotspot supports both classic units (rem, rad, curie) and SI (Sv, Gy, Bq) units. Users can add radionuclides and custom mixtures (up to 50 radionuclides per mixture).

C4.AP4.3.1.8. Tables and graphical output can be directed to the computer screen, printer, or a disk file. The graphical output consists of dose and ground contamination as a function of plume centerline downwind distance, and radiation dose and ground contamination contours. Users have the option of displaying scenario text on the plots.

Figure C4.AP4.F6. Hotspot Downwind Plume Centerline (Stability A-F)

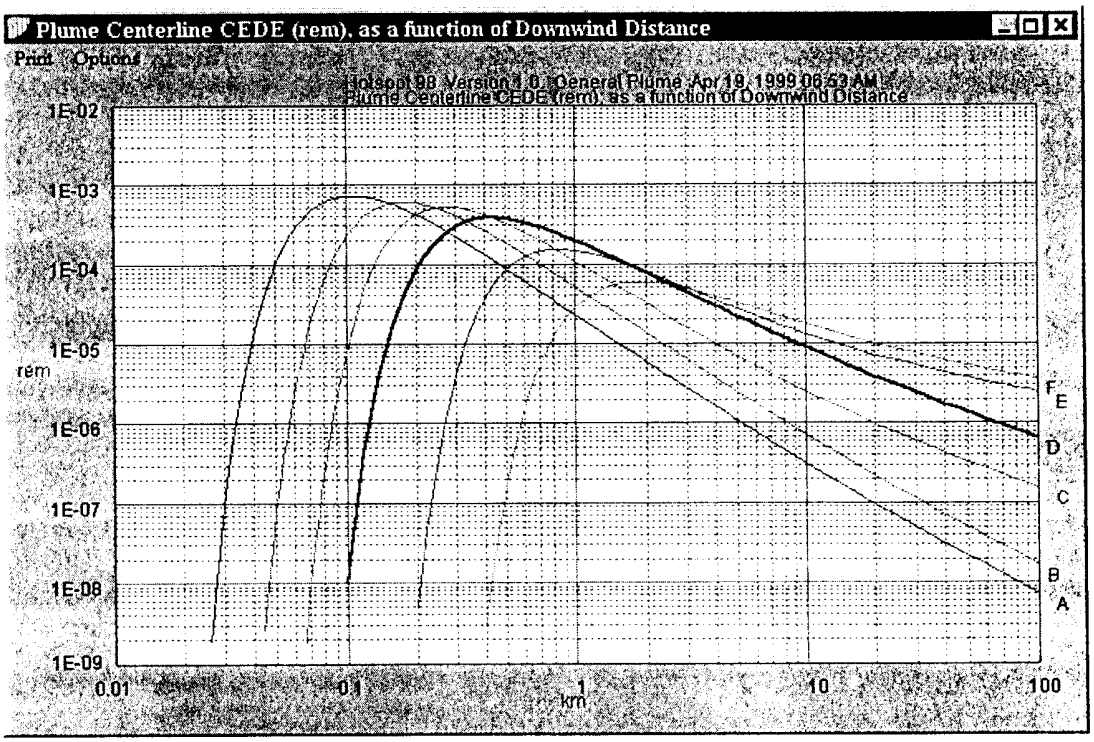
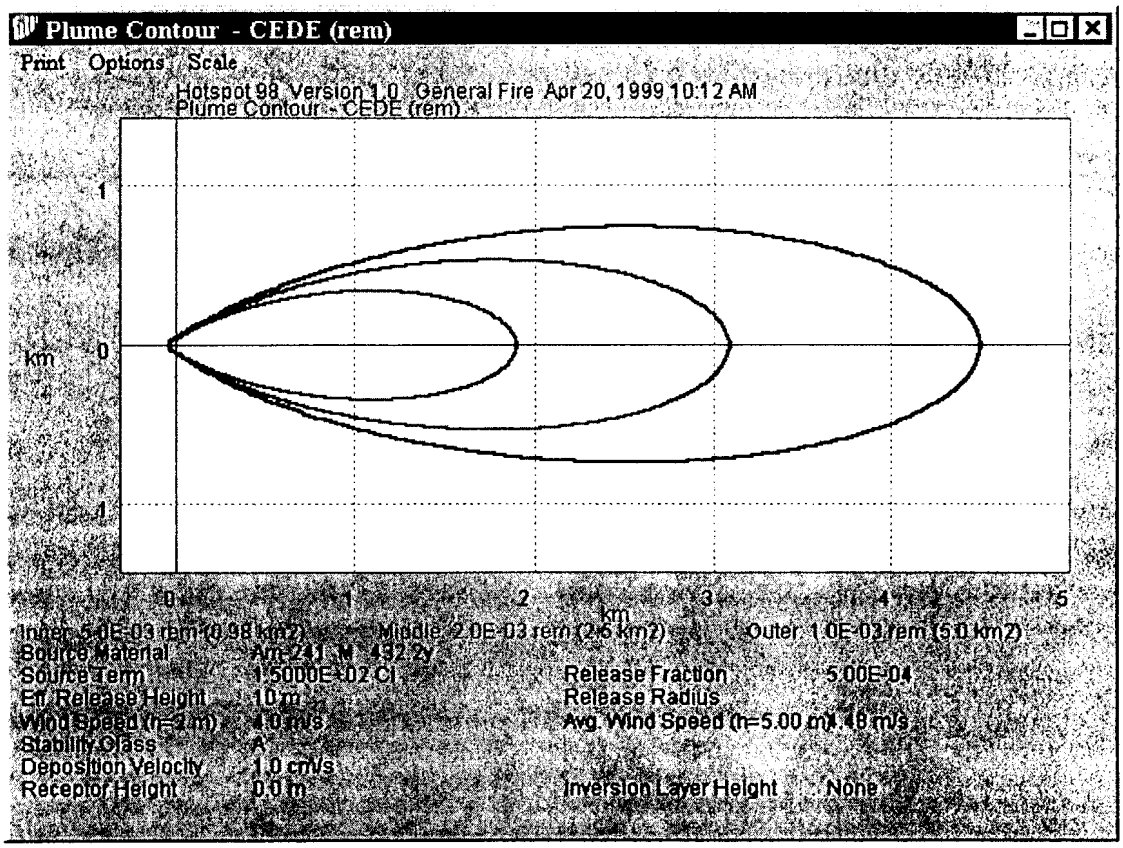
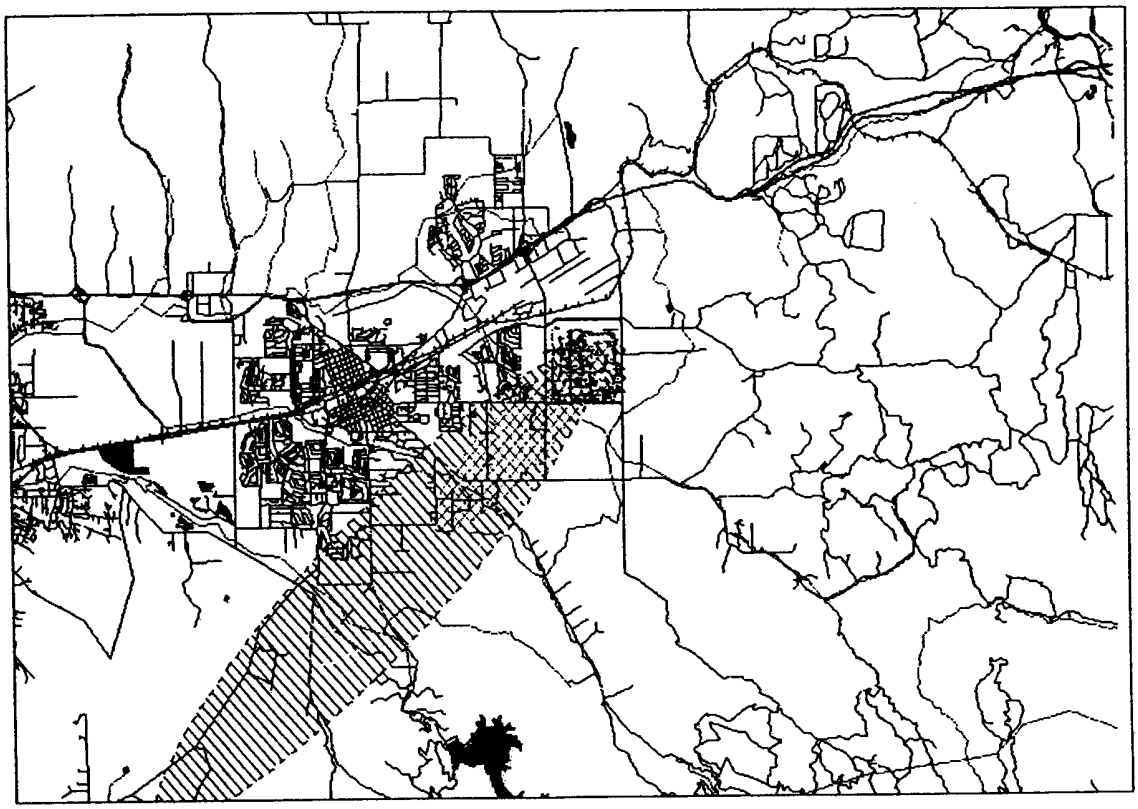


Figure C4.AP4.F7. Hotspot Plume Contour Plot



C4.AP4.3.1.9. Radiation dose and ground contamination contours can also be saved as mapping files for display on geographical maps. Latitude and Longitude, Universal Transverse Mercator (UTM), and Military Grid Reference System (MGRS) geographical coordinate systems are supported for interfacing Hotspot dispersion contours with commercial mapping systems.

Figure C4.AP4.F8. Hotspot Plume Contours Displayed on Geographical Map



C4.AP4.3.1.10. Hotspot strictly follows the well-established Gaussian model, and does not use any "black-box" techniques. All algorithms are presented and referenced in the documentation. Operating instructions for the Windows version are located on the extensive onboard help feature.

C4.AP4.3.2. Atmospheric Release Advisory Capability. ARAC is a DOE and DoD resource, directed by LLNL, that provides support to emergency response teams during accidents involving radioactive materials.

C4.AP4.3.2.1. ARAC provides the user with computer model estimates of the contamination distribution resulting from a nuclear weapon accident. ARAC products include computer-generated estimates of the location and contamination levels of deposited radiological material and radiation dosage to exposed population in the surrounding areas. Until time and equipment permit completion of extensive radiation surveys and bioassays, ARAC projections will assist in assessing the potential impact of an accident and in identifying areas for initial investigation by response force radiological teams.

C4.AP4.3.2.2. In the event of a nuclear weapon accident at or near an ARAC-serviced facility, the ARAC Center will be alerted by the facility's personnel using the ARAC site system computer located at the installation, immediately after the initial report to the NMCC is completed. If the accident occurred in a continental United States (CONUS) area, remote from an ARAC-serviced DoD installation, notification of ARAC will come through the NMCC's JNAIRT; however, ARAC may be contacted directly by the installation initiating the OPREP-3 by calling ARAC's emergency number: commercial (925) 422-9100.

C4.AP4.3.2.3. During normal working hours (currently 0730 to 1615 Pacific Time), initial estimates of the extent of contamination can be ready for transmission from ARAC approximately 30 minutes after ARAC has received notification of the:

C4.AP4.3.2.3.1. Accident location.

C4.AP4.3.2.3.2. Time of accident.

C4.AP4.3.2.3.3. Type and quantity of weapons involved in the accident (weapon information should be transmitted using the line number(s) contained in reference (h)).

C4.AP4.3.2.4. Responses outside the hours listed above are subject to an additional 60- to 90-minute delay.

C4.AP4.3.2.5. Every effort should be made to provide updated or supplementary information to the ARAC Center as soon as it is available. Desired information includes:

C4.AP4.3.2.5.1. Observed wind speed and wind direction at the time of the accident and subsequent weather changes.

C4.AP4.3.2.5.2. Description of accident particulars, including line numbers for the specific weapon(s) releasing contamination, type and amount of fuel involved (ARAC has typical values for DoD aircraft and other transport vehicles), and measured contamination at specific locations with respect to the contamination source, if available.

C4.AP4.3.2.5.3. Specific details of accident fire or explosion, such as mechanism of the release (HE detonation or fire), duration of any fire, and height and size of the plume or cloud (if available from reliable observers).

C4.AP4.3.2.6. Approximately 30 minutes after the ARAC facility has been notified of the necessary accident information, a computer-generated estimate of maximum credible ground-level contamination spread and projected whole-body effective dose to exposed persons in the downwind area will be available. Conservative assumptions are made in calculating the amount of radiological material released so that these initial projections place an upper bound on levels of resulting contamination and dose. Weapons at risk, when exposed to unusual stress during the accident, may undergo a nonnuclear high explosive detonation. It is assumed that all the nuclear material at risk will be released in an aerosolized form. Similar conservative assumptions are made where specific accident information is missing or unknown. If the accident location is not close to an ARAC-serviced CONUS site, the initial projections will probably not include geographic features (roads, city boundaries, etc.). ARAC-projected doses will assist initial response efforts in evaluating the potential hazard to the general public until comprehensive radiation measurements and bioassays can be performed. Projected deposition patterns will assist estimates of SR efforts.

C4.AP4.3.2.7. Approximately 60 to 90 minutes after notification of ARAC, a more refined projection will be available if somewhat less conservative assumptions are made in estimating the actual amount of material at risk released during the accident. (Estimates are now based on only those weapons known to have undergone an HE detonation). For consequence analyses, ARAC can generate a calculation based on a meteorological forecast to give projected contamination patterns in case of dispersal during a weapon safing operation. Although the initial projections are shown typically on a 30 by 30-kilometer grid, these refined projections may cover either a larger or smaller area depending on the downwind extent of the contamination. Note that ARAC can generate projection plots to match a given map scale (for example, 1:50,000) for ease of overlaying the projected deposition pattern.

C4.AP4.3.2.8. When available, ARAC may be transmitted to the ARAC site system computer located at most ARAC-serviced sites. If the site does not have a site system computer, the projections can be telefaxed. The following paragraphs provide information regarding the ARAC example "initial" projections shown in Figures C4.AP4.F4. and C4.AP4.F5.

C4.AP4.3.2.8.1. Geographic Contour Display. Release location is centered in this area (refined projections may have release location offset from center) with a 2,000-foot fragmentation circle drawn around the release point. The display is always oriented with north toward the top. A maximum of three contoured areas will

be shown emanating from the release point that will, in most cases, overlay a geographic representation, showing road networks and waterways, etc., of the area around the accident site. Printed across the top of each graphic display area will be the title of the underlying computer estimation denoting either a "50-Year Whole Body Effective Dose" or "Cumulative Deposition" plot.

Figure C4.AP4.F9. ARAC PLOT - Lung Dose

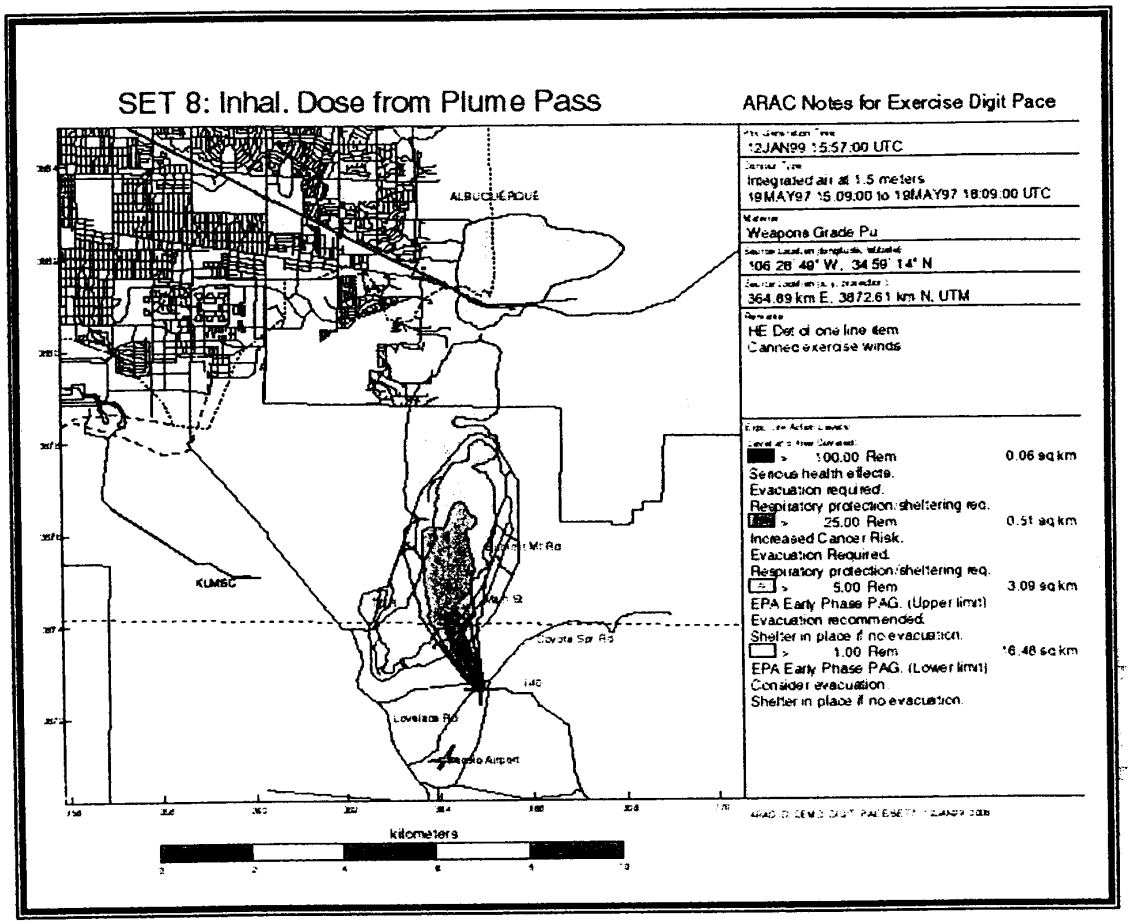
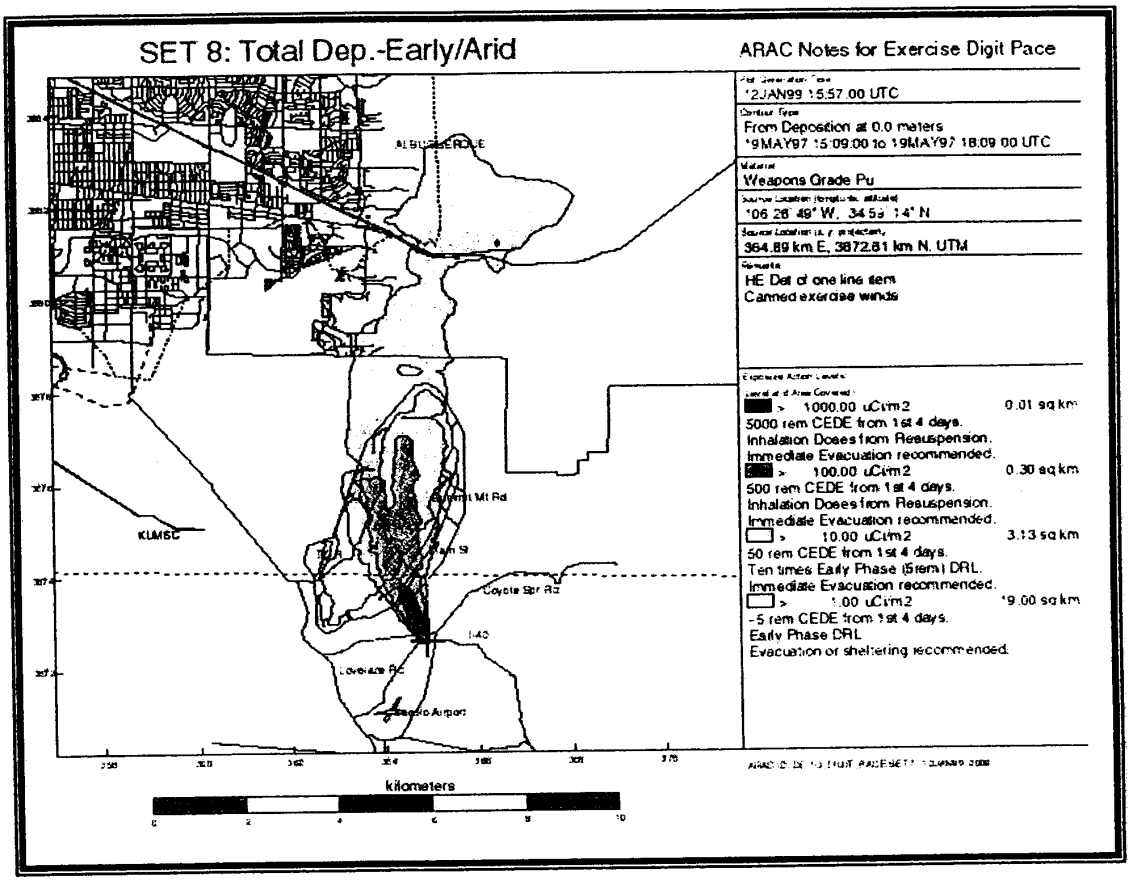


Figure C4.AP4.F10. ARAC PLOT - Deposition



C4.AP4.3.2.8.2. Descriptive Notes. To the right of the contour display will be a legend. The first line is a title line for these notes. The second line will denote the date and time that the specific computer model estimation was produced. Lines three through six will be reserved for general amplifying remarks about the computer estimation. Line seven identifies either the dose integration period or total deposition period time, as appropriate. (NOTE: All times will be shown as "Z" time. "Z" is equivalent to Universal Coordinated Time [UCT], which has replaced the more familiar Greenwich Mean Time [GMT]). Line nine shows the radiological material modeled, and the height above ground level at which the contour levels are calculated and displayed. Lines 10 through 22 will show the specific computer estimation action levels as calculated for that particular plot. The next several lines (down to the scale of the display shown in both kilometers and feet) comprise three separate blocks of information. Within each block is an area showing a particular contour cross-hatch pattern used to mark areas in the contour display where the dose or deposition is greater than the stated value, the area covered by this particular pattern in square

kilometers, and abbreviated, generalized actions that may be considered within this area. Note that the area given will encompass the area of all higher levels shown (for example, the area given for exceeding 25 Roentgen Equivalent Man/Mammal (REM) is the sum of the area covered by the 25 and 150 REM contour patterns). There are a maximum of three cumulative deposition and four dose exposure levels for which projections are made. Only the areas with the three highest projected levels will be shown on any ARAC plot. Projected cumulative depositions are for levels greater than 600, 60, and 6 microCuries per square meter ($\mu Ci/m^2$). Dose exposures are projected for levels greater than 150, 25, 5, and 0.5 REM, which refer to a 50-year whole body effective dose via the inhalation pathway.

C4.AP4.3.2.9. The wording that accompanies the action levels in the legend follows:

C4.AP4.3.2.9.1. 50-Year Whole Body Effective Dose "Exposure Action Levels." Projected doses apply only to people outdoors without respiratory protection from the time of the accident until the valid time of the plot, and recommended actions are to reduce the projected dose to those people exposed.

C4.AP4.3.2.9.1.1. Greater than 50 REM--Immediate respiratory protection and evacuation recommended.

C4.AP4.3.2.9.1.2. Greater than 25 REM--Prompt action required; respiratory protection required; consider sheltering or evacuation.

C4.AP4.3.2.9.1.3. Greater than 5 REM--Respiratory protection required; recommend sheltering; consider evacuation.

C4.AP4.3.2.9.1.4. Greater than 0.5 REM--Consider sheltering.

C4.AP4.3.2.9.2. Cumulative Deposition "Exposure Action Levels"

C4.AP4.3.2.9.2.1. Greater than 600 $\mu Ci/m^2$--Immediate action may be required until the contamination is stabilized or removed; issue sheltering instructions; recommend controlled evacuation.

C4.AP4.3.2.9.2.2. Greater than 60 $\mu Ci/m^2$--Supervised area; issue sheltering instructions; recommend controlled evacuation 2 to 14 days.

C4.AP4.3.2.9.2.3. Greater than 6 $\mu Ci/m^2$--Restricted area; access on need only basis; possible controlled evacuation required.

C4.AP4.3.2.9.3. The wording of the preceding deposition action levels was contracted because of space limitations on the ARAC plots. The full wording follows:

C4.AP4.3.2.9.3.1. Greater than 600 μCi/m²--Immediate action required. Urgent remedial action may be needed from within a few hours up to 2 days. Full personal protective clothing and respiratory protection required by all emergency staff in this area. Residents should remain indoors with doors and windows closed. HVAC and room air conditioners should be turned off. Controlled evacuation of children and adults should be considered urgent. All work on, or the use of, agricultural products and/or meat and poultry must be controlled and further action regarding them assessed.

C4.AP4.3.2.9.3.2. Greater than 60 μCi/m²--Supervised area. Controlled evacuation should be considered and may have to occur, lasting between about 2+ days and 2+ weeks or more. All activities should be considered carefully and supervised. Full anti-contamination clothing and respirators required for all personnel engaged in heavy work or dusty, windy operations. Residents should remain indoors with windows closed unless evacuation is in progress or there is no significant airborne hazard and none forecast to occur via resuspension.

C4.AP4.3.2.9.3.3. Greater than 6 μCi/m²-Restricted area. Entry restricted to those who live, work, and/or have a need to be there. DECON personnel and public health and safety staff should wear limited personal protective clothing. Controlled evacuation of residents, especially children, is possible during DECON if there is a possibility of airborne contamination via resuspension.

C4.AP4.3.3. Aerial Measuring System

C4.AP4.3.3.1. General. The DOE AMS has four capabilities available to support a weapon accident: aerial radiological mapping, aerial search for weapons and/or weapon components, multispectral/hyperspectral/thermal imagery, and aerial photography.

C4.AP4.3.3.2. Aerial Radiological Mapping. Aerial radiological surveys provide rapid assessment and thorough coverage of large areas and yield average ground concentration of the contaminant. The system can also be used to quickly prepare lower sensitivity, but appropriately scaled, incident site maps. Instrumentation includes large volume, sodium-iodide gamma-ray detectors, data

formatting and recording equipment, positioning equipment, meteorological instruments, direct readout hardware, and data analysis equipment. A variety of DOE-owned aerial platforms (fixed-wing and helicopter) are dedicated to supporting this mission. Also, equipment capable of being mounted on a variety of DoD helicopters is available to perform survey missions, as needed. The availability of NATO-standard pods reduces the time required for airframe preparation.

C4.AP4.3.3.2.1. In a nuclear weapon accident, a preliminary radiological survey would establish whether radioactive materials had been dispersed from the weapon. Dispersion patterns and relative radiation intensities, immediately available from the initial survey, may be used to guide radiation survey teams to the areas of heaviest contamination. AMS personnel will assist interpreting and correlating their information with other radiological survey data through the FRMAC. Additional data processing will establish the identity and concentration of the isotopes involved. Subsequent surveys could provide data on the progress of cleanup operations.

C4.AP4.3.3.2.2. The first radiological survey conducted after a weapon accident is likely to follow this protocol and timeframe:

C4.AP4.3.3.2.2.1. The fixed-wing aircraft would arrive 6 to 12 hours following notification.

C4.AP4.3.3.2.2.2. The fixed-wing aircraft would then be refueled and the crew would obtain instructions within 2 hours.

C4.AP4.3.3.2.2.3. A survey would then be conducted in a serpentine pattern of survey lines 0.5 to 5 miles apart to determine:

C4.AP4.3.3.2.2.3.1. Radiological deposition outline.

C4.AP4.3.3.2.2.3.2. Direction of the plume centerline.

C4.AP4.3.3.2.2.3.3. Approximate radiation levels along the plume centerline.

C4.AP4.3.3.2.2.3.4. Dominant isotopes.

C4.AP4.3.3.2.2.4. The survey information would then be transmitted by radio or satellite telephone to the FRMAC during the survey.

C4.AP4.3.3.2.2.5. The analysis laboratory would arrive 4 hours (plus driving time) after notification.

C4.AP4.3.3.2.2.6. Full analysis of flight results would be available 6 to 12 hours after the flight is completed or after the analysis laboratory arrives.

C4.AP4.3.3.2.3. After the first broad survey is completed, a series of smaller area surveys would be initiated with the AMS helicopter. The flight altitude would likely be 100 to 150 feet with 200-foot line spacings and has a detector field of view around 300 feet in diameter. The purpose of these surveys would be to map the contaminated area in detail. The length of time required to complete this series of surveys may be from 1 to 5 days, depending upon the area to be surveyed and the weather.

C4.AP4.3.3.2.4. Another survey that could be initiated is called KIWI. KIWI uses the same system used on a helicopter, but is mounted on a four-wheel drive vehicle instead. Unlike the AMS helicopter, the KIWI is approximately 3 feet above the ground and has a detector field of view around 10 feet in diameter. KIWI gives a high-spatial resolution mapping of contamination.

C4.AP4.3.3.2.5. The results of an aerial survey to produce early phase radiological data and radiological data measurements are shown in Figures C4.AP4.F11., C4.AP4.F12., and C4.AP4.F13.

Figure C4.AP4.F11. Aerial Survey Results - Early Phase Radiological Data

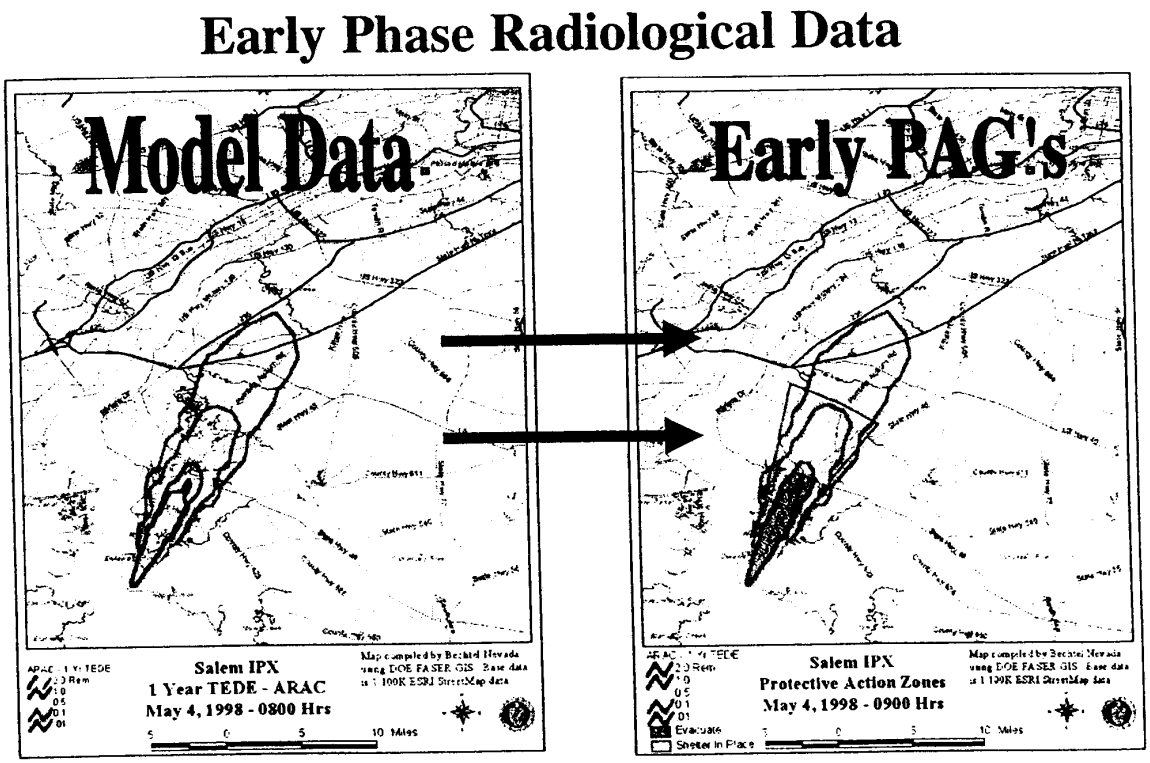
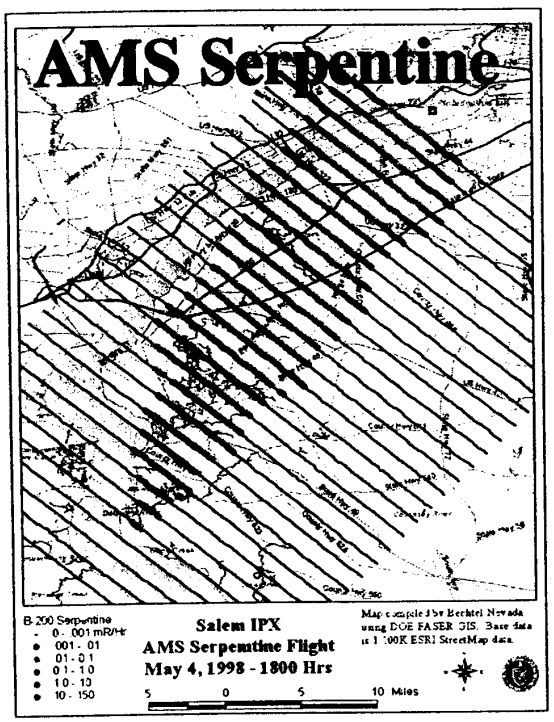


Figure C4.AP4.F12. Aerial Survey Results - Radiological Data Measurements, AMS Serpentine, and Field Measurements

Radiological Data - Measurements



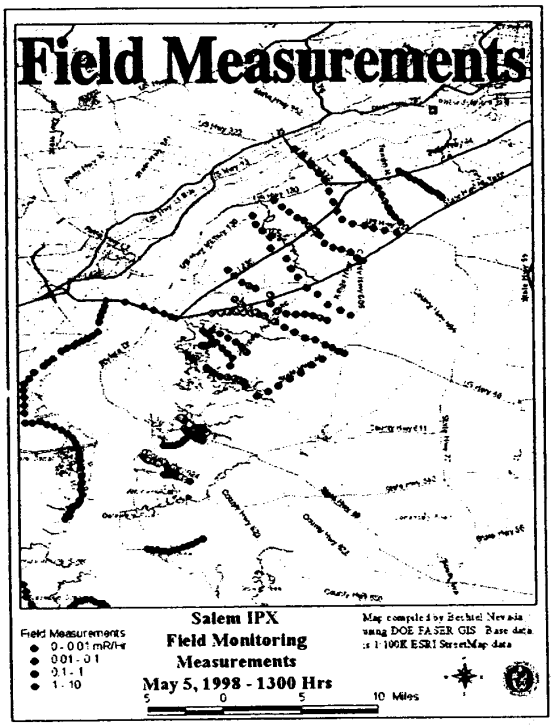
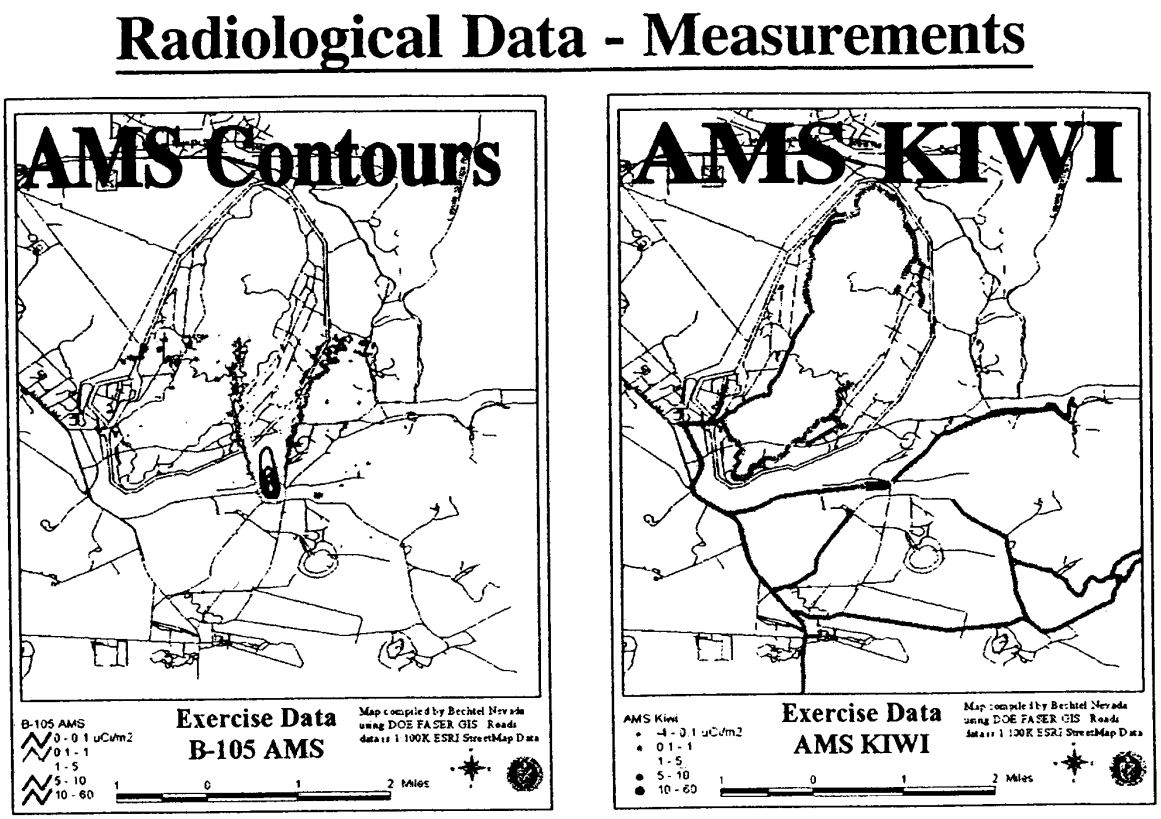


Figure C4.AP4.F13. Aerial Survey Results - Radiological Data Measurements, AMS Contours, and AIMS KIWI



C4.AP4.3.3.2.5. The sensitivity of the system depends upon the flight altitude, area of contamination, and the interference of other isotopes (both natural and manmade). Experience has shown that the lower level of detectability of Am-241 can be expected to be 0.03 to l.0 μCi/m², and 0.03 to 0.3 μCi/m² for both Cs-137 and I-131. The americium concentrations indicated represents on the order of 1 to 10 μCi/m² of plutonium.

C4.AP4.3.3.2.6. Comparison with ground-based survey and sample results should be done with caution. The area sampled in a single aerial measurement is on the order of 1,000 times the area sampled by a FIDLER-type instrument at 1 foot above the ground and 1,000,000 times larger than the area sampled by an alpha probe or a soil sample. The aerial survey results average scale averages and take into account the overall effect of roads, ditches, water bodies, vegetation cover, and terrain effects.

C4.AP4.3.3.3. Aerial Search. In certain scenarios, the aerial search

capabilities available from AMS capabilities may need to be employed. These consist of gamma and neutron detector modules designed for the DOE-owned B0-105 or Bell 412 helicopters or portable modules that can be used in helicopters, such as the UH-60 and UH-1 with appropriate modifications. This capability may be useful only for certain sources of known detectability and normally requires low altitudes (100 feet or less) and slow speeds (approximately 60 knots). Aerial search personnel will be able to determine the appropriate flight parameters when notified of the particular scenario.

C4.AP4.3.3.4. Aerial Multispectral/Hyperspectral/Thermal Imagery. Aerial imagery using a variety of sophisticated sensor suites can be used to locate debris that has scattered around the accident site. Rigorous analyses allows for specific georeferences to be applied to each pixel of an image.

C4.AP4.3.3.5. Aerial Photography. Two major photographic systems are used to acquire detailed aerial photos over a site. One system consists of a large format aerial mapping camera operated in fixed-wing aircraft, which produces detailed aerial photographs. A second system operates out of helicopters, utilizing the Hasselblad 70mm cameras to produce color photographs. Film from the Hasselblad system can be produced and printed under field conditions. Large prints up to 20 x 24 inches produced to map scales can be printed on site generally within hours of the completion of the flight. Digital photography is also available.

C4.AP5. APPENDIX 5 OF CHAPTER 4

AREA AND RESOURCE SURVEYS

C4.AP5.1. SURVEYS

C4.AP5.1.1. General. Extensive radiation predictions and surveys will be required to identify and characterize the area for decontamination and to develop and evaluate remediation plans. During the initial hours of the response, available radiation survey instruments and monitoring personnel for survey operations will be limited. Determining whether contamination was released by the accident must be done immediately. If a release occurred, priority must be given to those actions required to identify and minimize the hazards to people. These actions include identification of the affected area (perimeter survey) to permit identification of potentially contaminated people. Each successive survey operation will be based in part on the information gained from earlier operations. Initial radiation surveys may be based on ARAC information, if available, or only on the knowledge that contamination will be dispersed downwind. Later surveys will be based on the initial survey data and AMS plots. Days will be required to complete comprehensive contamination characterization.

C4.AP5.1.2. General Survey Procedures. Selection of instrumentation, identification of the edge of contamination, determination of the location of measurements made, and data recording procedures are similar for most survey operations.

C4.AP5.1.2.1. Selection of Instrumentation

C4.AP5.1.2.1.1. Alpha Instruments. nstruments that detect Alpha radiation can detect lower levels of contamination than instruments that detect low energy gamma radiation. Under field conditions, however, alpha radiation has an extremely short detection range and its detection may be blocked by nothing more than surface moisture. Alpha surveys are possible only under dry conditions, for example, after any morning dew has evaporated. The fragility of the Mylar probe face on most alpha instruments combined with the short detection range of alpha radiation results in a high rate of instrument failure when field use requires measurement of contamination on rough ground or other irregular surfaces. Alpha instruments should therefore be used primarily for personnel and equipment monitoring at the hot line. Field use should be limited to only smooth surfaces like pavement and buildings.

C4.AP5.1.2.1.2. Low Energy Gamma Instruments. Instruments capable of detecting the low energy gamma ray and x-ray radiations from plutonium, and its americium daughter, may be used to detect contamination. Low energy gamma/x-ray instruments are not subject to damage by surfaces being monitored and field surveys can be rapidly conducted. Low energy gamma instruments are, therefore, the recommended instruments for field surveys of plutonium contamination, whereas the SPA 3 probe is more useful for measuring the medium energy gamma radiation from uranium. For the best detection efficiency, low energy x-ray surveys should be conducted prior to any rainfall, and during the first 5 days after the accident before part of the measurable low energy radiation present is screened by the plutonium migrating into the soil. The best instrumentation for low energy gamma/x-ray surveys uses FIDLER probes, which will not normally be available until the specialized teams arrive. The type and amount of low energy gamma and x-ray radiation present depends on the age of the plutonium. Many weapons will contain plutonium more than 10 years old, resulting in higher signal strengths for the same level of contamination as that produced by a "new" weapon; therefore, the age of the plutonium and projected signal strength should be determined as soon as possible. The age of the plutonium in a weapon can be obtained from the DOE ARG.

C4.AP5.1.2.2. Perimeter Contamination Levels. When alpha instruments are used to establish the perimeter, readings of 500 counts per minute (CPM) are recommended for instruments with 60-cm probe area and 105 CPM for instruments with 17-cm probes be used to mark the perimeter. When low energy gamma/x-ray instruments are used to establish the perimeter, a reading of twice the background is recommended to mark the perimeter. FIDLERs are recommended to perform perimeter surveys, with alpha instruments the second choice. If FIDLERs are unavailable, and if weather or field conditions preclude the use of alpha instruments, the AN/PDR-56F, with the x-ray probe attached, may be used. If fission products were caused by the accident, priority should be given to establishing a 10 mR/hr perimeter.

C4.AP5.1.2.3. Fixing Survey Points

C4.AP5.1.2.3.1. For radiation monitoring data to be useful, the point where it is collected must be identifiable on a map or aerial photo of the area. Global positioning equipment may be unavailable to determine precise positions in the early phases of response, or the immediate need for radiological data may outweigh the time required to determine precise positions.

C4.AP5.1.2.3.1.1. Data points should be marked in some manner so that the point can be later relocated for other actions, or the position determined precisely for later correlation of the data with other information.

C4.AP5.1.2.3.1.2. A numbered or uniquely identified stake may be used to mark the location on soil, and a similar unique identification painted or otherwise marked on pavement or other hard surfaces for later reference. When engineering survey equipment is not being used, the monitoring log, or data collection record, should show the identification marking used at each point, and an estimated position to use immediately following data collection.

C4.AP5.1.2.3.1.3. Estimated positions may be street addresses in urban areas, the estimated distance down a street or road from an identifiable intersection, compass bearings taken on two or more identified reference points, or any other reference that can be located on the maps being used. If a vehicle is used during the initial perimeter survey, the odometer mileage from an intersection or other known point may be adequate for identifying positions in sparsely populated areas.

C4.AP5.1.2.4. Recording Survey Data

C4.AP5.1.2.4.1. If an engineering survey is being performed concurrently with the radiological survey, recording procedures must ensure that positional data being recorded at the transit position and radiological data being recorded by the monitors can be correlated. Monitoring and survey teams' records should include the following information:

C4.AP5.1.2.4.1.1. Team member names.

C4.AP5.1.2.4.1.2. Type instrument and serial number.

C4.AP5.1.2.4.1.3. Date and start/stop time of survey.

C4.AP5.1.2.4.1.4. Data location mark (stake number or other marking) when used.

C4.AP5.1.2.4.1.5. Estimated or surveyed position.

C4.AP5.1.2.4.1.6. Instrument reading indicating if the reading is "Gross," meaning background radiation reading has not been subtracted or "Net," meaning the background radiation reading has been subtracted from the instrument reading.

C4.AP5.1.2.5. Perimeter Surveys

C4.AP5.1.2.5.1. Initial Perimeter Survey. Rapid identification of the perimeter of the contaminated area is required to prevent undue alarm, to aid in identifying affected people, and to establish controls to prevent the spread of contamination. The CRTF and civil authorities will need at least a rough plot of the perimeter as soon as possible upon which to base their actions. The urgency of perimeter definition is directly related to the population in the area. Streets and roads will normally provide rapid access to populated areas, although the location of rivers or other terrain features that may hinder access to portions of the potentially contaminated area must be considered when directing the perimeter survey. The contaminated area may be a mile or more wide and several miles long, therefore use of widely separated monitoring points and a vehicle to move between monitoring points should be considered when directing the initial perimeter survey. ARAC projections, if available, will assist in determining the area and distance the perimeter survey teams may be required to cover, and perimeter survey procedures may be adjusted accordingly. If perimeter survey teams are equipped with a radio, a position report at the perimeter locations on each traverse will provide an immediate location of the perimeter to the command center and permit team progress to be tracked. While not classified, transmission of radiation readings should be discouraged on unsecured nets. Results of the perimeter survey (measurement data, pattern sketch, etc.), should be sent to ARAC, which can then be used to refine the source team and the disposition pattern.

C4.AP5.1.2.5.2. Full Perimeter Survey. FIDLERs should be used when performing a full survey of the perimeter. This may not be possible until after the specialized teams arrive and may take weeks to complete. The procedure most likely to be used will consist of monitoring in and out along the edge of the area with readings being taken about every 50 feet. If weather or terrain require the use of the AN/PDR-56 x-ray probe on the initial perimeter survey, the full perimeter survey can result in an expansion of the perimeter. If an alpha instrument was used for the initial perimeter survey, the perimeter established by the full perimeter survey should be about the same size or slightly smaller.

C4.AP5.1.2.6. Area Surveys. Radiological surveys of the contaminated area are required to identify areas requiring the replication of fixatives, to support decontamination and remediation planning, and to determine DECON effectiveness. The first survey covering the entire area will be provided most times by the AMS. The initial AMS helicopter data will be available 4 to 5 hours after completion of survey flights. Fixed-wing survey results are normally available 1 hour after completion of the flight. The AMS plot requires interpretation by trained analysts. Ground survey data is required to validate and support analysis of the plot. Some of the supporting ground data may be provided by the initial perimeter survey. Ground surveys to support DECON planning will be performed with FIDLERs. Usually some form of grid survey will be used with the grid size determined by the desired accuracy of estimated activity between grid points and measurement errors associated with the instruments. From several days to over a week may be required to complete a ground survey of the entire area. Ground surveys validating DECON effectiveness may require several months to complete due to the low levels of contamination remaining, and the desired precision.

C4.AP5.1.2.7. Building Surveys

C4.AP5.1.2.7.1. Radiological surveys of buildings within the contaminated area will be required to determine the appropriate DECON actions. Alpha instruments may be used on most building surfaces; however, use of FIDLERs may be necessary on surfaces that may damage alpha instruments, or on materials such as carpets, where contamination may be below the surface and screened from alpha instruments. The amount of removable contamination present must be determined by wiping surfaces with a piece of material, or swipe, which is then monitored for contamination it adsorbed. Laboratory counting equipment should be used to determine the amount of removable contamination absorbed by the swipe. Initial building surveys should be performed only on the exterior unless the building is in use.

C4.AP5.1.2.7.2. Civil authorities should establish procedures for either building owners and/or tenants, or an appropriate civil authority, such as a policeman, to accompany monitors when surveying building interiors. If interiors are surveyed before the surrounding area has been decontaminated, methods that minimize tracking of contamination into buildings should be used (for example, cover shoes with plastic bag immediately before entering buildings and ensure gloves are uncontaminated). Interior contamination levels will vary because of the time of year, the type of heating or cooling system used, and whether or not people were in the building at the time of, or following the accident. Interior contamination levels will be only a fraction of the

exterior levels at the same location. The primary source of interior contamination is expected to be airborne contaminants entering the building through heating or cooling systems, and doors, windows, or other openings during the initial cloud passage; or contamination tracked or carried into the building by people or animals. The sealing of doors, windows, chimneys, and ventilators on evacuated buildings in highly contaminated areas may minimize further contamination of the interior during DECON of the surrounding area. When monitoring the interior of a building, initial monitoring should be on the floor in the main traffic pattern (doorways, halls, and stairs), and on top of horizontal surfaces near heating or cooling duct outlets, windows, and other openings into the building. If no contamination is found at these locations it is very likely no contamination entered the building. If contamination is found, additional monitoring should be performed. Monitoring results from furnace and air-conditioning filters should be included in building survey records.

C4.AP6. APPENDIX 6 OF CHAPTER 4

RADIOLOGICAL MONITORING, MEASUREMENT, AND CONTROL FORMS

Accurate records should be maintained of exposure times and levels of exposure for all personnel entering and exiting the accident area. Additionally, a complete radiological history should be made for each individual who is actually contaminated. This appendix contains examples of forms used by DOE ARG and other responders to document and record this information. Forms can be obtained from the JHEC Data Center (DC).

Form 1 - **Access Work Permit**

This form contains data that must be obtained for access of personnel entering/exiting through the CCS. Forms 2 and 3 accompany this form to the CCS.

Form 2 - **Team Dress Requirements - CCS**

This form lists PPE and dosimetry items required to be worn at the accident site.

Form 3 - **Team Entry/Exit Permit - CCS**

This form is used to document hotline (CCS) entry/exit values.

Form 4 - **Analysis Data**

This form is used to record sample analysis data that can be sent to the JHEC.

Form 5 - **Personnel Sample**

This form is used to document the collection of a personnel sample bioassay.

Form 6 - **Geographic Location**

This form is to be used to document the connection between a location ID and the geographic coordinates for the location ID.

Form 7 - **Field Sample Data**

This form is used to document a field sample collected at a specific location.

Form 8 - **Field Measurement Data**

This form is used to document a field measurement performed at a specific location.

Form 9 - **JHEC Equipment Data**

This form is used to document equipment used at an accident site.

Form 10 **Air Sample Data**

This form is used to document the collection of an air sample filter.

Figure C4.AP6.F1. Access Work Permit Form

ACCESS WORK PERMIT

AWP Number: 9

Team Leader: Allen Treadaway Organization: LANL

Work Location: Chetan Annex Perimeter

Team Work Assignment: Perimeter Road Survey

Work/Rest Requirements: 45 min. work 15 rest or more if needed

Hazard Information: Heat Stress, possible HE

Hazard Stay Time Requirements: 1.5 hour max

Personal Protective Equipment Requirements: see attached

Fred Bolton
I.H./Safety Representative (Print Name)

Richard Stump
H.P. Representative (Print Name)

Fred Bolton

Richard Stump

Team Members

Organization	Name (Last, First)	Individual Work Assignment	* Initials
LANL	Allen Treadaway	Team Leader	AT
LLNL	Bill Shea	Surveyor	BS
NAVY	Derwin Hill	Surveyor	DH

* Initials signify that training/briefing has been received and understood for this AWP and work assignment.

ACCESS WORK PERMIT PROCEDURE

Overview:

The Access Work Permit (AWP) Procedure covers the access of personnel through the Contamination Control Station (CCS). The procedure consists of the following main steps.

1. Planning an entry into the controller area.
2. Filling out the AWP.
3. Dressing out into Personal Protective Equipment (PPE).
4. Entry through the CCS.
5. Exit through the CCS.
6. Returning the paperwork to the Forward Data Center (DC).

General Requirements and Guidelines:

1. All teams entering the CCS must have an AWP completed. This includes personnel working the CCS. Personnel will not be allowed to cross the Hotline unless the "ACCESS WORK PERMIT," "TEAM DRESS REQUIREMENTS - CCS," and "TEAM ENTRY/EXIT PERMIT - CCS" forms with the appropriate information are presented to CCS personnel.
2. All personnel crossing the hotline shall be entered into the Personnel Database. Pre-entry of this information is planned to speed up the AWP process.
3. AWP paperwork stays at the CCS until the team exits.
4. Once the team crosses the hotline a runner or radio message will inform the Forward JHEC Data Center. The AWP number is all that must be transmitted.
5. A team leader will be assigned for each team. This person is responsible for making sure the paperwork is completed and returned to the Forward JHEC Data Center.

Steps to be Followed:

Instructions:	**Comments or Explanation:**
1. Planning the Entry a. HP/IH personnel need to review with the dress out station personnel what PPE is available. b. HP/IH personnel assist in the planning phase. Take notes or fill out a hardcopy of "ACCESS WORK PERMIT" and "TEAM DRESS REQUIREMENTS - CCS" forms. c. Bring information to Forward DC personnel as soon as possible for data entry. Early entry of information will speed up the AWP process.	In real life or an exercise, some planning will occur on what the team will try to accomplish. This planning may occur many hours before the team enters the controlled area.
2 Filling out the AWP a. The team leader, work location, team assignment, work/rest requirements, and hazard information and stay time requirements are entered.	The HP, IH, and team leader need to be present when this occurs. The information will be given and/or read to the data entry person.
b. Team members are assigned with their work assignment.	
c. PPE is assigned to the team members.	The PPE is assigned to the whole team. If there are any exceptions please note them on the form.

ACCESS WORK PERMIT PROCEDURE
(Continued)

d. Three forms are printed out for the team: "ACCESS WORK PERMIT," "TEAM DRESS REQUIREMENTS - CCS," and "TEAM ENTRY/EXIT PERMIT - CCS" forms.
e. The HP and IH print their name on the "ACCESS WORK PERMIT" form indicating these are the ES&H requirements for the team (please make it legible).
f. The team obtains training/briefing on assignment(s). This can happen any time prior to leaving the Forward Operations Area. Each team member initials the "ACCESS WORK PERMIT" form indicating they have received and understood training/briefing and their assignment.
g. The team leader takes ALL three forms to the PPE station and then on to the CCS where they are given to the CCS personnel.

3. Dress out into PPE

A dress out station will be available with people there to help the team dress out.

a. The team leader brings ALL three forms to the PPE station.
b. The team dresses out in the required PPE designated on the "TEAM DRESS REQUIREMENTS - CCS" form and receive dosimetry, if required.
c. The person verifying that all team members are wearing the correct PPE and have appropriate dosimetry will print their name on the appropriate space near the bottom of the form, 'TEAM DRESS REQUIREMENTS - CCS."
d. The team leader brings ALL three forms to the CCS, "ACCESS WORK PERMIT," "TEAM DRESS REQUIREMENTS - CCS," and "TEAM ENTRY/EXIT PERMIT - CCS."

4. Entry through the CCS
a. The team leader brings ALL three forms to the CCS, "ACCESS WORK PERMIT," "TEAM DRESS REQUIREMENTS - CCS," and "TEAM ENTRY/EXIT PERMIT - CCS." The team leader should make every attempt to keep his/her team together while entering/exiting the CCS.
b. The date and time of entry for each team is recorded by CCS personnel on the "TEAM ENTRY/EXIT PERMIT - CCS" form.

ACCESS WORK PERMIT PROCEDURE
(Continued)

c. If applicable, record the WBGT onto the "TEAM ENTRY/EXIT PERMIT - CCS" form.
d. All three forms stay at the CCS and are maintained by CCS personnel.
e. Once the team crosses the hotline, CCS personnel will notify the Forward DC personnel by runner or radio. The only information that must be transmitted is the AWP number.

5. Exit through the CCS

The team members follow the CCS procedures for getting out of PPE. CCS personnel fill out the paperwork for each team and hand it back to the team leader.

a. The team members need to remove their PPE and be surveyed for contamination
b. CCS personnel will record the date and time of exit on the "TEAM ENTRY/EXIT PERMIT - CCS" form for each team.
c. The CCS personnel will record the WBGT if applicable on the "TEAM ENTRY/EXIT PERMIT - CCS" form.
d. If any team member is contaminated, CCS personnel will fill out the "BODY SURVEY - RAD" form. This form will be located at the CCS, if not personnel at the Forward Data Center will have copies. Once completed, the form must be taken to the Forward Data Center personnel for data entry. Instructions for filling out the "BODY SURVEY - RAD" form are below.
   (1) Enter the AWP number, name, and date/time on the "BODY SURVEY - RAD" form.
   (2) The person doing the monitoring for gross alpha and/or gross beta/gamma prints their name and enters the instrument serial number used (please make it legible) in the appropriate space.
   (3) Enter the units (probably DPM).
   (4) Mark the location(s) of the contamination on the radman picture and indicate the instrument reading in the appropriate column.
   (5) Describe any treatment/removal in the appropriate space.
   (6) Use another sheet for each subsequent survey of the person.

ACCESS WORK PERMIT PROCEDURE
(Continued)

d. If any team member sustains an injury, CCS personnel will fill out the "PHYSICAL/ CHEMICAL INJURY" form. This form will be located at the CCS, if not personnel at the Forward DC will have copies. Once completed, the form must be taken to the Forward DC personnel for data entry. Instructions for filling out the "PHYSICAL/ CHEMICAL INJURY" form are below.
   (1) Enter the AWP number and person's name on the "PHYSICAL/CHEMICAL INJURY" form.
   (2) Mark the chemman where the injury(s) occurred.
   (3) Circle whether it was a chemical or physical injury.
   (4) Describe the location, injury, and treatment.
   (5) The person assessing the injury prints their name (please make it legible) and the date/time.

e. If required, the "PERSONNEL VITAL SIGNS" form will be filled out and returned to the Forward DC personnel.

6. Return of AWP Paperwork

The team leader is responsible for making sure the paperwork for their team gets back to the Forward DC.

a. The CCS personnel give ALL three form, "ACCESS WORK PERMIT," "TEAM DRESS REQUIREMENTS - CCS," and "TEAM ENTRY/EXIT PERMIT - CCS," back to the team leader.
b. The team leader takes ALL three forms back to the Forward DC personnel for data entry and storage of paperwork.
c. The team proceeds to get dressed and report back to their JHEC management.

Figure C4.AP6.F2. Team Dress Requirements - CCS Form

TEAM DRESS REQUIREMENTS - CCS

AWP Number: 9

Team Leader: Allen Treadway

Personal Protective Equipment (PPE)

PPE and Dosimetry Items	Quantity
Boots: Rubber	1
Coveralls: Cotton	1
Gloves: Cotton	1
Gloves: Rubberized	1
Hood: Cotton	1
Resp Equipment: Full Face	1

Exceptions to Above PPE List: Team Leader only needs surgeons gloves

PPE Checked by (Print Name): Patrick Giraulf

Figure C4.AP6.F3. Team Entry/Exit Permit - CCS Form

TEAM ENTRY/EXIT PERMIT - CCS

AWP Number: 9

Team Leader: Allen Treadaway

Hotline (CCS) Entry Values

Date/Time: 28-Aug-96 12:17 WBGT: NA

Hotline (CCS) Exit Values

Date/Time: 28-Aug-96 1358 WBGT: NA

Comments:

Figure C4.AP6.F4. Analysis Data Form

Analysis Data

Date: (dd-mmm-yy) 19-Sep-95 Analyte Lab: Hotspot Analyst: Tracey Simpson

Instrument Number: 7 Detector Number: 6 Analyis Method: Gamma Spec

Radionuclide: Am 241 Fraction Used: Measurement Units: uCi/g Count Time (sec): 600

BKG Measurement: NA BKG Measurement Units: NA

Calibration Factor: NA Calibration Factor Units: NA

Sample Number	Time (hh:mm)	Sample Quantity	Sample Quanity Units	Measurement	Measurement Error (+/- 1 sigma)	Measurement MDA	Comments
391	0911	365.2	g	0.0001	0.0000005	0.00000051	Soil counted 118 g

ANALYSIS DATA FORM

Sample Analysis data can be sent to the JHEC DC either on paper or electronically. The expected route for the majority of data is electronically since it comes from the mobile analysis laboratories. The data fields that are transferred are the same in either case. This guideline first describes the data fields, then details specific to the electronic transfer of analysis results, and finally details specific to the paper transfer of analysis results. This process is written from the perspective of the mobile analysis labs and the Sample Control Station.

Field Measurements are a special case of sending analysis results to the JHEC DC via paper. The guideline for the "Field Measurements Data" form should be consulted.

Sample Analysis Data Fields

The following table describes all of the data field that can be sent to the JHEC DC for a sample analysis. The Field Name is the name of the field as it appears in the database. This is needed when the data is being transferred electronically. For each data field, the data type and whether the field is required are given. Description and Formatting information are also given.

Field Name	Data Type Required	Description and Format
SAMP_NUMBER	integer Yes	Desc: Sample Number copied from the sample package.
ANALYSIS_DT	datetime Yes	Desc: Date and time of the analysis. Format: d-Mon-yy hh:mm is preferred using a 24-hour clock.
RADIONUCLIDE	char(20) Yes	Desc: Radionuclide or energy line. Format: Upper/lower case as shown; 60 keV, 17 keV, AM-241, Pu-238, Pu-239, GROSS ALPHA, GROSS BETA, GROSS GAMMA.
INSTR_NUMBER	integer Yes	Desc: JHEC number from the instrument. Format: The number, and nothing but the number.
DETECTOR_NUMBER	integer Yes	Desc: JHEC number from the detector. Format: See above.
SAMP_QTY	float No	Desc: Sample quantity.
SAMP_QTY_UNIT	char(15) No	Desc: Sample quantity unit. Format: Mixed case; 'g' = gram, 'kg' = kilogram, 'cc' = cubic centimeter, 'liter' = liter, 'c2' = square centimeter, 'm2' = square meter, 'ft2' = square feet.
INDIVIDUAL	char(20) No	Desc: Who performed the analysis, the analyst. Format: Uppercase; FIRSTNAME LASTNAME.
TEAM_ORG	char(20) Yes	Desc: The analysis lab, Team or Organization, prefer Team. Format: Uppercase; 'AFRAT,' 'ARMY RADCON,' 'RASCAL,' 'RASO,' 'HOTSPOT,' 'LLNL,' 'LANL,' etc.

MEAS_GEOMETRY	char(20) No	Desc: Normally applies only to air analysis results. Format: Uppercase; CONTACT FILTER, FOLDED FILTER, IMPACTOR, PTFA.
ANALYSIS_METH	char(50) No	Desc: Procedure number or other description. Equals "FIELD MEASUREMENT" for Sample Type = FLDMEAS. Format: Uppercase.
FRAC_USED	float No	Desc: Fraction Used. Primary use is for Air analysis. Note, the measurement value should already be corrected for the fraction used by the mobile lab. Format: Decimal number, range 0.01 to 1.00.
MEAS	float Yes	Desc: The actual measurement. If the measurement is a count then a count time is Required. The **only time** we expect a count is for a Field/Ground Measurement.
MEAS_UNIT	char(15) Yes	Desc: Measurement Unit. Format: Mixed case; e.g., uCi, uCi/cc, uCi/m2, kBq, etc.
MEASCNT_TIME	integer Yes	Desc: Measurement count time **in seconds**.
MEAS_ERROR_2S	float Yes	Desc: Two sigma error for the measurement.
MEAS_MDA	float Yes	Desc: Minimum detectable activity for the measurement. Discussions will be held with E&A to see if a standard calculation can be defined.
BKGMEAS	float No	Desc: The background used for the actual measurement.
BKGMEAS_UNIT	char(15) No	Desc: Background measurement unit. Format: Mixed case; e.g., uCi, uCi/cc, uCi/m2, kBq, etc.
BKGMEASCNT_TIME	integer No	Desc: Background measurement count time **in seconds**.
CALIB_FACTOR	float No	Desc: This includes geometry, efficiencies, etc., to get from raw counts to activity.
CALIB_FACTOR_UNIT	char(15) No	Desc: Calibration factor unit. Format: Mixed case; e.g., uCi/cpm, etc.
COMMENTS	char(100) No	Desc: Comments related to the sample, a recovery fraction, or any special processing can be very helpful. Format: Mixed case or Uppercase is fine.

Electronic Transfer of Analysis Results

1. The mobile labs will transfer their analysis results to the JHEC via an ASCII comma delimited file. The data should be placed on a 3.5-inch DOS formatted floppy disk. It can be either 720 KB or 1.4 MB. The first line of the file must specify the names of the data fields present and indicate their sequence. The names of the data fields to be used are given in the above table together with formatting directions. Lines 2 to the end of the file are the actual analysis results.

2. Any textual data values (e.g., the radionuclide field or the measurement unit) must be enclosed in double quotes. The date/time does not need to be enclosed in quotes. The data lines should not have any spaces that are not actually part of the data. Text data fields should not be padded with blanks out to the length shown. If a data field has no value in a line, a comma should be put in its place to indicate a Null value for the field.

3. The sequence of fields in the data file does not matter. Obviously, all rows of data in a single data file must have the same sequence of fields. The sequence shown in the above table is suggested as a standard in order to make manual reviews of the data files easier.

4. The only data fields that must be included in what you transfer to the JHEC are those labeled as Required. One reason for having a Line 1 that lists the data fields actually present is to allow this flexibility. Another reason is so the archived copies of the data files will be self documenting.

5. Any background values used in an analysis must be documented in the analysis results file sent to the JHEC.

6. The analysis results can be exported to a single or multiple files.

7. Each time a mobile lab sends analysis results to the JHEC, it will send only new results accumulated since the last time a transfer took place. Sending us duplicates will cause the E&A people an immense headache.

Paper Transfer of Analysis Results

The "Sample Analysis Data" form is used to send hard copy analysis results to the JHEC DC. A copy of this form is attached. The fields listed as Required in the above table are shaded on the form to indicate they are required.

Figure C4.AP6.F5. Personnel Sample Form

PERSONNEL SAMPLE FORM

Last Name: Cohen First Name: Thomas Middle Initial R

S.S.N./P.I.N. 123-64-6789 Organization: Civilian

Address: Mary Imac Hospital

Date (dd-mm-yy): 19-Sep-95 AWP Number: _____

Urine: Sample Number: [ ] Time (hh:mm): _____

Comments: _____

Fecal: Sample Number: [ ] Time (hh:mm): _____

Comments: _____

Nose Swipe: Sample Number : [ ] Time (hh:mm): _____

Comments: _____

Lung Count: Sample Number: [ ] Time (hh:mm): 0340

Comments: _____

Wound Count: Sample Number: [ ] Time (hh:mm): _____

Comments: _____

WBC: Sample Number: [ ] Time (hh:mm): _____

Comments: _____

Thyroid Count: Sample Number : [ ] Time (hh:mm): _____

Comments: _____

Other (specify): _____

Sample Number: [ ] Time (hh:mm): _____

Comments: _____

PERSONNEL SAMPLE FORM

The "Personnel Sample Form" is used to document the collection of a personnel sample (bioassay). It is critical to complete the form correctly and completely. The entire effort of collecting and analyzing a sample may be wasted if the sample is not documented as required by law. This guideline is written from the perspective of the individual or team responsible for collecting the sample.

General Guideline

1. Blank forms are collected from the Sample Control Station. Instructions on the use of the form can also be obtained at that time.

2. The form is filled out when the sample is collected. See the sections below on the data fields and completing the form. A single form can be used for multiple samples from the same person.

3. The Sample Type is indicated by which part of the form is completed.

4. The form is returned to the Sample Control Station together with the sample(s). Sample Control will assign a Sample Number to each sample and assign the sample to one of the mobile labs or a fixed lab for analysis. Sample Control will forward the Personnel Sample Form to the JHEC DC for data entry.

Personnel Sample Data Fields

The following table describes all of the data fields present on the Personnel Sample Form. The Field Name is the name as it appears on the form. For each data field, whether the field is required is indicated. A Description is given where appropriate.

Field Name	Required	Description
Last Name	Yes	Please be as accurate and legible as possible.
First Name (or Initial)	Yes	Please be as accurate and legible as possible.
Middle Name (or Initial)	No	Please be as accurate and legible as possible. If only an initial is given for the first name, please try to get the full middle name.
SSN or PIN	No	Social Security Number or other Personal Identification Number. If the person is a U.S. citizen, **get their SSN**. If not, try to get some other identification code. It does not have to be a number, anything will help!
Organization	No	If the person is not a member of the Accident Response Group please get information on what Organization they worked for at the accident. If they are a private citizen try to indicate their involvement in the accident (e.g., victim, bystander).
Address	No	Generally the Street Address, City, State, and Zip Code. This is only needed for non-ARG personnel. This information may be critical for later identifying or locating the person.
Date	Yes	Please format dd-mm-yy if possible.

AWP Number	No	If the sample was collected during or immediately after the person was assigned to an Access Work Permit, write in the AWP Number.
Sample Type	No	This is automatically indicated by which part of the form is completed.
Sample Number	NO!	The Sample Collection Station will assign the sample number. Leave blank, also see Comments field.
Time	Yes	Please format hh:mm if possible.
Comments	No	Use for any relevant information. If some type of sample or control number is assigned by the collecting agent, please put it here. For example, a hospital may have their own control number for the sample.

Completing the Personnel Sample Form

A copy of this form is attached. The fields listed as Required in the above table are shaded on the form to indicate they are required. **It is critical to get some type of unique identifier for the person (SSN or PIN).** Names are a very imprecise way of identifying a person. In this case, "imprecise" means the sample may be ruled worthless because you cannot guarantee the identity of the contributor.

1. The form should be filled in when the sample is collected, not several hours later.
2. The form can be used for multiple samples from the same person. Indicate the Time for each sample.
3. Fill in the appropriate part of the form depending on the sample type (Urine, Nose Swipe, Whole Body Count, ect.)
4. If the Sample Type does not fit with any of the standard types shown on the form, please use the blank line at the bottom of the form on the left. Write in a description of the Sample Type.
5. Return the form and samples to the Sample Control Station. Personnel in Sample Control will assign a sample number to each sample and collect the sample from you for analysis.
6. If you think or know that another sample(s) from the same person is being analyzed by another organization, please tell the personnel in Sample Control.

Electronic Transfer of Personnel Sample Data

There are currently no plans to electronically transfer the sample collection data for bioassay samples to the JHEC DC.

Figure C4.AP6.F6. Geographic Locations Form

GEOGRAPHIC LOCATION

Team / Team Leader Defining Location: TEAM 2

Location ID: 293

Date (dd-mm-yy): 19-Sep-95 Time (hh:mm): 1723

Location Coordinates:

(UTM) North: _____ East: _____ Zone: _____

OR

Longitude (decimal): -76.615527 Latitude (decimal): 37.275830

OR

(Misc.) North: _____ East: _____ Offset: _____

Source of Coordinates:

- ☐ GPS Differential
- ☐ Guess
- ☐ Precision Survey
- ☒ GPS Standalone
- ☐ Map
- ☐ RANGER

Surface Type:

- ☐ Asphalt
- ☐ Concrete
- ☒ Grass
- ☐ Rock
- ☐ Bare Ground
- ☐ Gravel
- ☐ Rock
- ☐ _____

Description of Location: 0.6 mile NE of Col. Pkwy. & 199 intersection

Function of Location:

- ☐ Accident Site
- ☒ Field Measurement / Sampling Site
- ☐ Facility (Name) _____
- ☐ Other (Explain): _____

GEOGRAPHIC LOCATIONS FORM

The "Geographic Locations" form is used to document the connection between a Location ID and the geographic coordinates for the Location ID. The expectation is that all locations will be staked or otherwise marked. It must be possible for subsequent field teams or other authorities to unambiguously identify the location. It is expected that the Location ID will be on the stake or permanently attached to the stake (e.g., written on a flag attached to the stake). **Once a physical location is staked and a Location ID assigned, the stake is never moved and the Location ID is never, repeat never, assigned to a different location!** Please note that the Location ID can be assigned by one team (Team A below) with the coordinates being determined at a later time by a separate team (Team B below). Obviously, both functions can also be performed by the same team.

This process is written from the perspective of the field team(s) completing the form.

General Guideline

1. Blank forms are collected from the Sample Control Station. Instructions on the use of the form can also be obtained at that time. One form is used for each location.
2. Most of the form is filled out when the location is first identified (Team A). If Team A also determines the coordinates of the location, the form can be immediately returned (go to step 4). Otherwise, the form is turned over to Team B (go to step 3).
3. Team B uses the information provided by Team A to find the location. They then use the best available means to determine the geographic coordinates of the location.
4. The form is returned to the Sample Control Station. Sample Control will forward the form to the JHEC DC for data entry.
5. Please note that the coordinates for a location can be determined more than once. For example, a rough estimate of the coordinates could be done by a field sampling or measurement team and turned in on the form. The Field Monitoring Coordinator could then have a specialized team do a very exact determination of the coordinates at a later time. When these coordinates are turned in, they would be used to replace the earlier set of coordinates.

Geographic Locations Data Fields

The following table describes all of the data fields present on the Geographic Locations Data Form. The Field Name is the name as it appears on the form. For each data field, whether the field is required is indicated. A Description is given where appropriate. "Team A" or "Team B" at the start of the Description field indicates which team would normally complete the field. As noted above, Team A has the option of completing all fields.

Field Name	Required	Description
Team ID/Team Leader	Yes	Team A: Name of the Team and the Team Leader.
Location ID	Yes	Team A: The Location Identification number or code assigned to the location.
Date (dd-mm-yy)	Yes	Team A:
Time (hh:mm)	Yes	Team A: If possible, use a 24 hour clock.
Locations Coordinates:	Yes	Team B: The location coordinates can be given in either the Universal Transverse Mercator (UTM) projection, or Longitude and Latitude, or some other Miscellaneous coordinate system.

UTM North, East, and Zone		Team B: The UTM North, East, and Zone values. All three must be given.
Longitude and Latitude		Team B: Longitude and Latitude specified as a decimal value. For example: 113.3389506 degrees (113.3389506°) instead of 113 degrees 20 minutes and 20.2222 seconds (113° 20' 20.2222").
Misc. North, East and Offset		Team B: Any other coordinate system. These often consist of a North component, an East component, and sometimes an Offset.
Source of Coordinates	Yes	Team B: Indicate the method of determining the coordinates by checking one of the boxes.
Surface Type	Yes	Team A: Indicate the **general** surface type at the location by checking one of the boxes or writing in any other type.
Description of Location	Yes	Team A or B: If a separate Team B will need to later find the location in order to determine the coordinates, it may be especially important to describe the location.
Function of Location	No	Team A: The intent is to tell why this location was marked. The most common will be a Field Measurement and/or Sampling site. We will also need to record the accident site or sites and location of facilities used by the accident response organization.

Completing the Geographic Locations Form

A copy of this form is attached. The fields listed as Required in the above table are shaded on the form to indicate they are required.

1. Please see the General Guideline above. In general, the Geographic Location form should go with any team that will be defining new locations. The Team A part must be completed when the location is defined/staked.
2. The Team B parts of the form can be completed immediately or at a later time by a specialized geographic locations team.
3. Each form can be used for one location only.
4. Return the form to the Sample Control Station. Personnel in Sample Control will check the form and forward it to the JHEC DC.

Electronic Transfer of Air Sample Data

There are currently no plans to electronically transfer the geographic location data to the JHEC DC.

Figure C4.AP6.F7. Field Sample Data Form

FIELD SAMPLE DATA

Date (dd-mm-yy): 21-Sep-95 Team / Team Leader: Team 2

Sample Number	Time (hh:mm)	Location I.D.	Sample Type*	Sample Size	Sample Size Units (kg, g, m^2, ft^2, c^2, cc, liters, etc.)	Description / Comments
	1622	1099	S	320	g	foot off pier A
	1655	1101	S	250	g	50 ft off Sunlin Rd & Point Rd intersection

* A = Animal, S = Soil, V = Vegetation, W = Water, M = Milk, R = Smear, O = Other

FIELD SAMPLE DATA FORM

The "Field Sample Data" form is used to document a Field Sample collected at a specific location. The location is documented on the separate "Geographic Locations" form if it has not already been documented. The minimum amount of information needed for the accurate interpretation of the sample is requested. It is critical to complete the form correctly and completely. With the exception of Sample Size and Sample Size Units, all fields on the form are required. This process is written from the perspective of the field team completing the form.

Note 1: It is highly recommended that the field team use this form in the field. The transfer of data from some other form to this one will require a considerable expenditure of time by the Team Leader when they return to the Sample Control Station. It is also very error prone. If required data has not been recorded the Field Samples will usually have to be discarded.

Note 2: This form is not used for Personnel Samples. A special Personnel Sample Form is provided for personnel samples.

Note 3: The Mobile Laboratory Working Group has developed standards on the approximate sample size and the information needed for the various sample types. The Mobile Laboratory Working Group can provide a hardcopy of these standards to the field teams for use in training. The Field Sample Data form includes their information needs.

General Guideline

1. Blank forms are collected from the Sample Control Station. Instructions on the use of the form can also be obtained at that time. One form can be used for multiple samples.
2. The first line of the form is completed before going into the field. This records the Date and Team.
3. One line of the form is completed for each sample. The field team does not put in a Sample Number for the sample. This will be done by Sample Control. The Location ID is discussed in item 5 below.
4. The form is returned to the Sample Control Station. Sample Control will assign a Sample Number to each sample. Sample Control will forward the Field Sample Data Form to the JHEC DC for data entry. The JHEC DC will send the data to the Evaluation and Assessment section.
5. The Location ID for the sample location is assigned when the sample is taken. The exception is when a Location ID has already been assigned to the location. In this case, use the existing Location ID. If a Location ID has already been assigned, a new Location ID should never repeat never be assigned to the same position. The coordinates for the Location ID need be recorded only once on a Geographic Location form. This can be done separately from taking the sample. However, the sample data cannot be interpreted until the coordinates for the Location ID are determined and sent to the JHEC Data Center.

Field Sample Data Fields

The following table describes all of the data fields present on the Field Sample Data Form. The Field Name is the name as it appears on the form. For each data field, whether the field is required is indicated. A Description is given where appropriate.

Field Name	Required	Description
Date	Yes	The date in dd-mmm-yy format.
Team/Team Leader	Yes	These should be names which will allow determination of the team personnel (for example, from a duty roster).
Sample Number	NO	The Sample Number will be assigned by the Sample Control Station. Do not put anything in this field.

Time	Yes	The sampling time in hh:mm format on a 24 hour clock.
Location ID	Yes	The (usually staked) Location ID for the sample.
Sample Type	Yes	Fill in one of the sample type abbreviations shown at the bottom of the form. If a sample type of "Other" is entered write in the Description/Comments column what the Other type is.
Sample Size	No	This is intended as an indication of the **approximate** sample size collected. The sample size unit goes in the next column.
Sample Size Unit	No	The most common values should be kg = kilogram, g = gram, m2 = square meter, ft2 = square foot, c2 = square centimeter, cc = cubic centimeter, and liter = liter.
Description/Comments	No	

Completing the Field Sample Date Form

A copy of this form is attached. The fields listed as Required in the above table are shaded on the form to indicate they are required.

1. The "Date" and "Team/Team Leader" should be completed before the team enters the field.
2. Record a single sample on each line of the form. For each sample, the Time, Location ID, and Sample Type must be recorded. If possible, also record the approximate sample size.
3. If a Location ID has not been assigned to the sampling position: Follow the normal field team guideline for staking a location and assigning a Location ID. Put the Location ID on the Field Sample Data form. The Location ID will need to be documented at the same or a later time using the Geographic Location form (see attached).
4. After checking all forms for accuracy and completeness, the Team Leader returns them to the Sample Control Station. Personnel in Sample Control will assign a sample number to each sample. Sample Control will forward the form to the JHEC DC for data entry.
5. If the Location ID needs to be documented, notify the Field Monitoring Coordinator so the appropriate steps can be taken.

Electronic Transfer of Field Sample Data

There are plans to develop a program that would be used in the field to collect the Field Sample data. This program would run on some type of notepad computer that must be highly water and dust resistant. The use of the notepad computer would eliminate the need to take any paper into the field and should simplify the collection of the necessary data.

Figure C4.AP6.F8. Field Measurement Data Form

FIELD MEASUREMENT DATA

Date: 21-Sep-95 (dd-mm-yy) Team/ Team Leader: Blue 53

Radionuclide / Energy: 60 keV ☒ Other _____

Instrument Number: 88 Detector Number: 87

Source Check:

Source Serial #: Smoke detector Source Activity (uCi): 1 uCi

Entry: 6140 Units: CPM Time (hh:mm): 1000

Exit: 6999 Units: CPM Time (hh:mm): 1300

Instrument Type:
- ☒ FIDLER (XRM610)
- ☐ Gross Alpha
- ☐ Ion Chamber
- ☐ Micro-R Meter

Sample Number	Time (hh:mm)	Location I.D.	BKG (B) or Field (F)	Measurement	Meas. Units (CPM, uCi, uCi/m², etc.)	Count Time (sec)	Comments
	10:30	538	B	2461	CPM	60	
	10:42	605	F	6098	CPM	60	

FIELD MEASUREMENT DATA FORM

The "Field Measurement Data" form is used to document a field measurement performed at a specific location. The location is documented on the separate "Geographic Locations" form if it has not already been documented. The minimum amount of information needed for the accurate interpretation of the measurement is requested. It is critical to complete the form correctly and completely. With the exception of Count Time and Comments, all fields on the form are required. This process is written from the perspective of the field team completing the form.

Note: It is highly recommended that the field team use this form in the field. The transfer of data from some other form to this one will require a considerable expenditure of time by the Team Leader when they return to the Sample Control Station. It is also very error prone. If required data has not been recorded the field measurements will usually have to be discarded and redone.

General Guideline

1. Blank forms are collected from the Sample Control Station. Instructions on the use of the form can also be obtained at that time. One form can be used for multiple measurements done by the same instrument under the same source check. Additional forms for the same instrument under the same source check can be attached to the first form as needed for additional measurements.
2. The top of the form is completed before going into the field. This area documents the Team, type of measurement, instrument being used, and the **entry** source check value.
3. One line of the bottom portion of the form is completed for each field measurement. The field team does not put in a Sample Number for the measurement. This will be done by Sample Control. The Location ID is discussed in item 6 below.
4. When the team leaves the field, the exit source check value is recorded on the upper part of the form.
5. The form is returned to the Sample Control Station. Sample Control will assign a Sample Number to each measurement. Sample Control will forward the Field Measurement Data Form to the JHEC DC for data entry. The JHEC DC will send the data to the Evaluation and Assessment section.
6. The Location ID for the field measurement location is assigned when the field measurement is taken. The exception is when a Location ID has already been assigned to the location. In this case, use the existing Location ID. **If a Location ID has already been assigned, a new Location ID should never repeat never be assigned to the same position.** The coordinates for the Location ID need be recorded only once on a Geographic Location form. This can be done separately from taking the field measurement. However, the field measurement data cannot be interpreted until the coordinates for the Location ID are determined and sent to the JHEC Data Center.

Field Measurement Data Fields

The following table describes all of the data fields present on the Field Measurement Data Form. The Field Name is the name as it appears on the form. For each data field, whether the field is required is indicated. A Description is given where appropriate.

Field Name	Required	Description
Date	Yes	The date in dd-mmm-yy format.
Team/Team Leader	Yes	These should be names which will allow determination of the team personnel (for example, from a duty roster).
Radionuclide/Energy	Yes	The default energy line is 60 keV. Write in any other Radionuclide or Energy Line being measured.
Instrument Number	Yes	The JHEC Number assigned to the instrument.

Detector Number	Yes	The JHEC Number assigned to the detector.
Instrument Type	Yes	Check the type of instrument being used. The expected instrument for most measurements is a FIDLER.
Source Serial #	Yes	A Source Check must be done before and after the set of measurements. Record the source being used here.
Source Activity (uCi)	Yes	Specify the activity in microcuries.
Entry	Yes	The Entry source check reading.
Units	Yes	Units for the Entry source check reading.
Time (hh:mm)	Yes	Time for the Entry source check reading.
Exit	Yes	The Exit source check reading.
Units	Yes	Units for the Exit source check reading.
Time (hh:mm)	Yes	Time for the Exit source check reading.
Sample Number	NO	The Sample Number will be assigned by the Sample Control Station. Do not put anything in this field.
Time	Yes	The measurement time in hh:mm format on a 24 hour clock.
Location ID	Yes	The (usually staked) Location ID for the measurement.
BKG (B) or Field (F)	Yes	Record if this is a Background or Field measurement.
Measurement	Yes	The sampling stop date in dd-mmm-yy format.
Meas. Units	Yes	Measurement Units. The most common values should be CPM, uCi, uCi/m 2. If the measurement is a count put "count" in this column.
Count Time	No	This value is required only if the measurement is given as a count. The time must be in seconds.
Comments	No	Use for any relevant information. For example, environmental conditions.

Completing the Field Measurement Date Form

A copy of this form is attached. The fields listed as Required in the above table are shaded on the form to indicate they are required.

1. The form should be filled in down to "Source Check Entry Time" before the team enters the field.
2. A Source Check on the Instrument Detector combination must be done before entering the field.
3. Each form can be used for one Radionuclide/Energy Line only. If multiple Radionuclide/Energy Lines are being measured, use a separate form for each.
4. If a JHEC Number has not been assigned to the Instrument and Detector: Please write down the Manufacturer, Model, Serial Number, and Owner of each on the back side of the form. When you return to the Sample Control Station fill out a JHEC Equipment Data form (see attached) so the JHEC Numbers can be assigned. The JHEC number bar-code will also need to be placed on the equipment so later teams can put it on their Field Measurement Data sheets.
5. Record a single field measurement on each line in the lower part of the form.
6. If a Location ID has not been assigned to the measurement position: Follow the normal field team guideline for staking a location and assigning a Location ID. Put the Location ID on the Field Measurement Data form. The Location ID will need to be documented at the same or a later time using the Geographic Location form (see attached).
7. When you exit the field, a Source Check must be done on the Instrument Detector combination. Record the results in the upper part of the form.
8. After checking all forms for accuracy and completeness, the Team Leader returns them to the Sample Control Station. Personnel in Sample Control will assign a sample number to each measurement. Sample Control will forward the form to the JHEC DC for data entry.
9. If the Location ID needs to be documented, notify the Field Monitoring Coordinator so the appropriate steps can be taken.

Electronic Transfer of Field Measurement Data

There are plans to develop a program that would be used in the field to collect the field measurement data. This program would run on some type of notepad computer that must be highly water and dust resistant. The use of the notepad computer would eliminate the need to take any paper into the field and should simplify the collection of the necessary data.

Figure C4.AP6.F9. JHEC Equipment Data Form

JHEC EQUIPMENT DATA

Equipment Type:

- [ ] Air Sampler
- [x] FIDLER Detector
- [ ] HpGe Detector
- [ ] Ion Chamber
- [ ] Micro R Meter
- [ ] Proportional Counter
- [ ] Phoswich Detector
- [ ] NaI Detector (thick)
- [ ] Liquid Scintillation Detector
- [ ] FIDLER Electronics Package (E-600, ESP-2, Violinist III, etc.)
- [ ] _____

JHEC Number: 485
Barcode goes here

Manufacturer: ALPHA SPECTRA

Model: FIDLER

Serial Number: 052496D

Owner: LANL

JHEC EQUIPMENT DATA FORM

The "JHEC Equipment Data" form is used to document equipment used at a weapon accident site. "Equipment" includes all instruments, meters, detectors, and air samplers used in the generation of data related to the radiological, chemical, and physical characteristics of the site. The minimum amount of information needed for the accurate indentification of the equipment is requested. It is critical to complete the form correctly and completely. A unique ID is assigned to each piece of equipment (the JHEC Number). This allows any piece of data to be unambiquously linked to the equipment which generated the data.

Note 1: The ARG has determined that the unique identification of all data related equipment is critical both during and after the accident. The cooperation of all responding elements is requested. The three types of equipment that must be identified most rapidly are FIDLERs, equipment used in the mobile analysis labs, and Air Samplers.

Note 2: Many types of equipment undergo periodic calibrations. Copies of the calibrations for all equipment used at the accident site must be turned in to the JHEC DC before the equipment owner leaves the site.

Note 3: FIDLERs used for ground measurements are a special calibration case. The calibration values must be known during the accident recovery in order to determine ground concentrations. Separate arrangements have been made to report FIDLER calibrations to the JHEC DC in an electronic format. They may also be reported manually on the "FIDLER CALIBRATION" form.

General Guideline

1. Blank forms are collected from the JHEC Data Center or the Sample Control Station. Instructions on the use of the form can also be obtained at that time. One form is used for each piece of equipment. The JHEC DC will hand out sticky labels to be placed on the equipment and the form.
2. A detector is considered a separate piece of equipment since it can be attached to various electronic packages.
3. The form is completed. The sticky labels come in sets of two. One label should be placed on the piece of equipment. The label with the same number should be placed on the form.
4. The form is returned to the JHEC Data Center.

JHEC Equipment Data Fields

The following table describes all of the data fields present on the JHEC Equipment Data Form. The Field Name is the name as it appears on the form. For each data field, whether the field is required is indicated. A Description is given where appropriate.

Field Name	Required	Description
Equipment Type	Yes	Check one of the boxes to indicate the equipment type. If none of the types provided applies, fill in the type on the blank line.
JHEC Number	Yes	Place the label here with the same number as used on the piece of equipment.
Manufacturer	Yes	
Model	Yes	
Serial Number	No	The term "serial number" is not used on all equipment but there is usually something which corresponds to this.
Owner	Yes	Please be specific. For example, AFRAT is better than U.S. Air Force.

Completing the JHEC Equipment Date Form

A copy of this form is attached.

1. One form is used for each piece of equipment. The data fields are explained above.
2. The blank forms and labels should be taken to where the equipment is stored and completed there.
3. One sticky label is placed on the equipment. The label with the same number is placed on the form. The fields on the form are completed to document the equipment.
4. After checking all forms for accuracy and completeness, the equipment owner returns them to the JHEC Data Center. The JHEC DC will add the item(s) to the ARG equipment log.

Electronic Transfer of JHEC Equipment Data

There are currently no plans to electronically transfer equipment data to the JHEC DC. FIDLERs are an exception. When the Hotspot program (LLNL) is used to calibrate a FIDLER the file contains all of the above identification information. This information is sent in an ASCII file to the JHEC DC along with the calibration data.

Figure C4.AP6.F10. Air Sample Data Form

AIR SAMPLE DATA

Sample Number

Team/Team Leader: TEAM 4

Location (#): 372

Air Sample Number: 27

Filter Manufacturer: HI-Q

Filter Model: FPAE-810

Filter Type: ☐ Impactor ☐ 2-inch Filter ☐ 4-inch Filter ☒ 8X10-inch Filter

Sampling Start:

Date (dd-mm-yy): 20 Sep 95 Time (hh:mm): 0230

Flow Rate (m³/m): _____ or Flow Rate (cfm): 55

Sampling Stop:

Date (dd-mm-yy): 20 Sep 95 Time (hh:mm): 0525

Flow Rate (m³/m): _____ or Flow Rate (cfm): 55

Comments: _____

AIR SAMPLE DATA FORM

The "Air Sample Data" form is used to document the collection of an air sample filter. The minimum amount of information needed for the accurate analysis and interpretation of the filter is requested. It is critical to complete the form correctly and completely. With the exception of Comments, all fields on the form are required. This process is written from the perspective of the field team completing the form.

General Guideline

1. Blank forms are collected from the Sample Control Station. Instructions on the use of the form can also be obtained at that time. One form is used for each filter.
2. Most of the form is filled out when the filter is placed in the air sampler. See the sections below on the data fields and completing the form. The "Sampling Stop" fields are completed when the filter is collected. Various mechanisms can be used to keep the partially completed Air Sample Data form together with its filter until the filter is collected. The mechanism used is up to the Field Team Monitoring Group.
3. The form is returned to the Sample Control Station together with the filter. Sample Control will assign a Sample Number to each filter and assign the filter to one of the mobile labs or a fixed lab for analysis. Sample Control will forward the Air Sample Data Form to the JHEC DC for data entry.
4. Please note: **The same Location ID must be recorded on the Air Sample Data form for all filters collected from the same location.** Also, the Location ID identifies the location, not the air sampler which is currently placed at the location. Air samplers are often moved. Equating a specific air ampler with the Location ID quickly leads to confusion in the interpretation of the results.
5. The Location ID for the air sampling location can be assigned either when the sampler is positioned or when the first filter is inserted. The coordinates for the Location ID need be recorded only once on a Geographic Location form. This can be done separately from positioning of the sampler or insertion of the first filter. However, data from the analysis of a filter cannot be interpreted until the coordinates for the Location ID are determined and sent to the JHEC Data Center.
6. If the field team is instructed to do an initial screening of the filter in the field, the results of that screening **should not be placed** on the Air Sample Data form. The Field Monitoring Supervisor or your Team Leader will have given you instructions on using the screening results.

Air Sample Data Fields

The following table describes all of the data fields present on the Air Sample Data Form. The Field Name is the name as it appears on the form. For each data field, whether the field is required is indicated. A Description is given where appropriate.

Field Name	Required	Description
Sample Number	NO	The Sample Number will be assigned by the Sample Control Station. Do not put anything in this field.
Team/Team Leader	Yes	These should be names which will allow later determination of the personnel making up the team (for example, from a duty roster).
Location ID	Yes	The (usually staked) Location ID for the air sampler location.
Air Sampler Number	Yes	The unique JHEC Instrument Number on the sampler. If a number has not been assigned please fill in a JHEC Equipment Data form so a number can be assigned.
Filter Manufacturer	Yes	Manufacturer of the filter placed in the sampler.
Filter Model	Yes	The model of filter (e.g., Whatman 41???)
Filter Type	Yes	Mark the appropriate box to indicate the type of filter.

Sampling Start:		
Date	Yes	The sampling start date in dd-mmm-yy format.
Time	Yes	The sampling start time in hh:mm format on a 24 hour clock.
Flow Rate	Yes	Fill in one of the two fields (with the starting flow rate) depending on whether the flow is measured in cubic meters per minute (m3/m) or cubic feet per minute (cfm).
Sampling Stop:		
Date	Yes	The sampling stop date in dd-mmm-yy format.
Time	Yes	The sampling stop time in hh:mm format on a 24 hour clock.
Flow Rate	Yes	Fill in one of the two fields (with the ending flow rate) depending on whether the flow is measured in cubic meters per minute (m3/m) or cubic feet per minute (cfm).
Comments	No	Use for any relevant information. For example, environmental conditions.

Completing the Air Sample Date Form

A copy of this form is attached. The fields listed as Required in the above table are shaded on the form to indicate they are required.

1. The form should be filled in down to "Sampling Stop" when the filter is placed in the sampler, not several hours later.
2. The Sampling Stop fields should be filled in when the filter is collected.
3. Each form can be used for one filter only.
4. If a JHEC Instrument Number has not been assigned to the air sampler: Please write down the Manufacturer, Model, Serial Number, and Owner of the sampler on the back side of the form. When you return to the Sample Control Station fill out a JHEC Equipment Data form (see attached) so the JHEC Instrument Number can be assigned. The JHEC number bar-code will also need to be placed on the sampler so later teams can put it on their Air Sample Data sheets.
5. If a Location ID has not been assigned to the air sampler location: Follow the normal field team procedure for staking a location and assigning a Location ID. Put the Location ID on the Air Sample Data form. The Location ID will need to be documented at the same or a later time using the Geographic Location form (see attached).
6. After checking all forms for accuracy and completeness, the Team Leader returns them and the filters to the Sample Control Station. Personnel in Sample Control will assign a sample number to each filter and collect the filter from you for analysis.
7. If the Location ID needs to be documented, notify the Field Monitoring Coordinator so the appropriate steps can be taken.

Electronic Transfer of Air Sample Data

There are currently no plans to electronically transfer the air filter collection data to the JHEC DC.

C5. CHAPTER 5

RESPIRATORY AND PERSONNEL PROTECTION

C5.1. GENERAL

During a radiological emergency, health officials must act to protect the public and response forces from potential health hazards associated with the emergency. This chapter addresses protective clothing and respiratory protection including protection factors, protective action guide, and resuspension factors.

C5.2. RESPIRATORY PROTECTION

Plutonium and uranium particulates are the most serious source of airborne radioactivity at an accident site unless fusion has occurred. These particulates may be present in the cloud and smoke from a breached or burning weapon, but settle to the ground shortly thereafter. The radioactive particles may become resuspended in the air by surface winds and by soil disturbing operations, including vehicular traffic. Resuspension is highly dependent upon specific conditions (for example, type and condition of soil or surface, vegetation, moisture present, and time since deposition) and is difficult to measure and predict. Respiratory protection prevents airborne contamination from entering the lungs and is provided by SCBA, or respirators that filter particulates out of the ambient air. Respiratory protection devices adversely affect productivity and effectiveness and their use is not recommended except when airborne contamination is present or expected. In hot climates, respiratory protection devices can result in heat injuries, including death, and a heat injury prevention program, as discussed in Chapter 10, should be implemented when temperatures exceed 70 °F.

C5.2.1. Protection Factors (PFs). The amount of protection from inhaling airborne particulate contaminants provided by a given device is called its PF. PFs vary primarily as a function of anthropometrical data, mask fit, and mask design. PFs are determined by dividing the Ambient Air Concentrations (AAC) of a contaminant by the Inhaled Concentration (IC) or amount of contaminant that enters the mask; thus PF = AAC/IC. A test facility/chamber using probe equipped test masks in a chamber containing a nontoxic contaminant is required for quantitative tests to determine the PF for each individual. A deployable fit test facility may be obtained through JNACC. PFs of up to 2,000 can be achieved with properly fitted respirators. If the mask passes a qualitative smoke test around the edges of the mask it is assumed a PF above the

nominal value is achieved. Demand type SCBAs (air supplied on inhalation) cause negative mask pressure during inhalation and provide no more protection from contaminants than a respirator. Pressure demand SCBAs (i.e., always under positive pressure) provide a nominal PF of 10,000.

C5.2.2. Protective Action Guidelines. Protective action guidelines are developed to identify protective devices to limit exposure to the lungs from inhalation of contaminants to agreed-upon limits. Since most responders are not radiation workers, i.e., they are not formally trained nor medically examined, the appropriate Derived Air Concentration (DAC), should be that in the Federal Guidance Report, No. 11, reference (l). The DAC for Pu-239 is 3×10^{-7} microbequerel/m^3 for plutonium in non-chemically active forms that would be expected after a fire. This corresponds to 18 dpm/m^3 as the lower level in Table C5.T1. The guidelines provided are intended for use until health physics personnel at the scene can develop situation-specific instructions. In deriving the guidelines, a PF of 100 was assumed and the Maximum Permissible Concentration (MPC) of activity in the air being inhaled was based on an MPC for radiation workers of 40 picocuries/cubic meter (pCi/m^3) per 40-hour week. This calculation assumes possible exposures at this rate over the period of a year and is approximately 10 times greater than the 1 pCi/m^3/168-hour week MPC for the general public. Radiation dose is a function of level of activity and exposure time; therefore, if exposure time of workers is being tracked, a person could be permitted to enter an area of higher activity without adequate respiratory protection for a shorter period of time without exceeding dose limits. In many areas, especially during thermal inversions, radon daughter products will be detected in air samples. A background sample of the same length and counted the same time after collection as the on scene sample allows proper background subtraction; however, typical radon concentrations completely mask 18dpm/m^3. Samples should be recounted at approximately 20-minute intervals, the rough half-life of radon daughter products. When the measured activity remains approximately constant, the residual activity consists of actual contamination and a possible, but generally small, contribution from thoron daughter products that is easily subtracted by background measurements. The time versus dose approach should be applied in emergencies, as appropriate; that is, if a person suffers heat stroke the respirator should be removed immediately to meet the urgent medical requirement to cool the person, since the short unprotected exposure during evacuation from the area for treatment will limit the amount of contaminant that is inhaled. Table C5.T1. provides respiratory protection guidelines to use when air sampling data provides a basis for assessing airborne contamination levels. Calculated activity levels should be corrected for background activity before entering the table.

Table C5.T1. **Recommended Respiratory Protection Levels for Emergency Workers as a Function of Airborne Contamination**

Airborne Alpha Activity dpm/m^3 above background	**Respiratory Protection**
Below 100 dpm/m^3	No respiratory protection needed.
100 to 10,000 dpm/m^3	Full-face respiratory protection required (M-series Protective Mask or NIOSH/MSHA approved HEPA respirator).
Above 10,000 dpm/m^3	Pressure demand SCBA or limited entry restricted to essential personnel wearing full-face respiratory protection. Source of contamination should be fixed as soon as possible.

Air sampling data is unavailable until some time after response personnel have arrived on scene. During the initial response, and when working in areas where available air sampling data may not be applicable, the use of Table C5.T2. is recommended. Table C5,T2. provides guidelines for protective requirements based on measurements of surface contamination levels. These recommendations in Table C5.T2. provide guidelines for personal protective measures that may be taken by first responders until the situation can be evaluated by health physics personnel. Conversion from microcuries per meter squared μCi/m^2) to CPM were made using the equation in Chapter 9 conversion factor charts for measurements on soil. Using Table C5.T2. is appropriate during the initial approach to the area when using respirators in uncontaminated areas may create undue public alarm. If contamination levels detected during the initial approach indicate high levels of contamination, wearing of respirators by people entering the contaminated area is recommended until air sampling data is available to assess the actual airborne hazard. Table C5.T2. guidelines should not be used in the downwind area until after the contamination cloud released by the accident has dispersed (several hours after the fire is extinguished or after the explosion).

C5.T2. **Protective Devices for Emergency Worker as a Function of Surface Contamination**

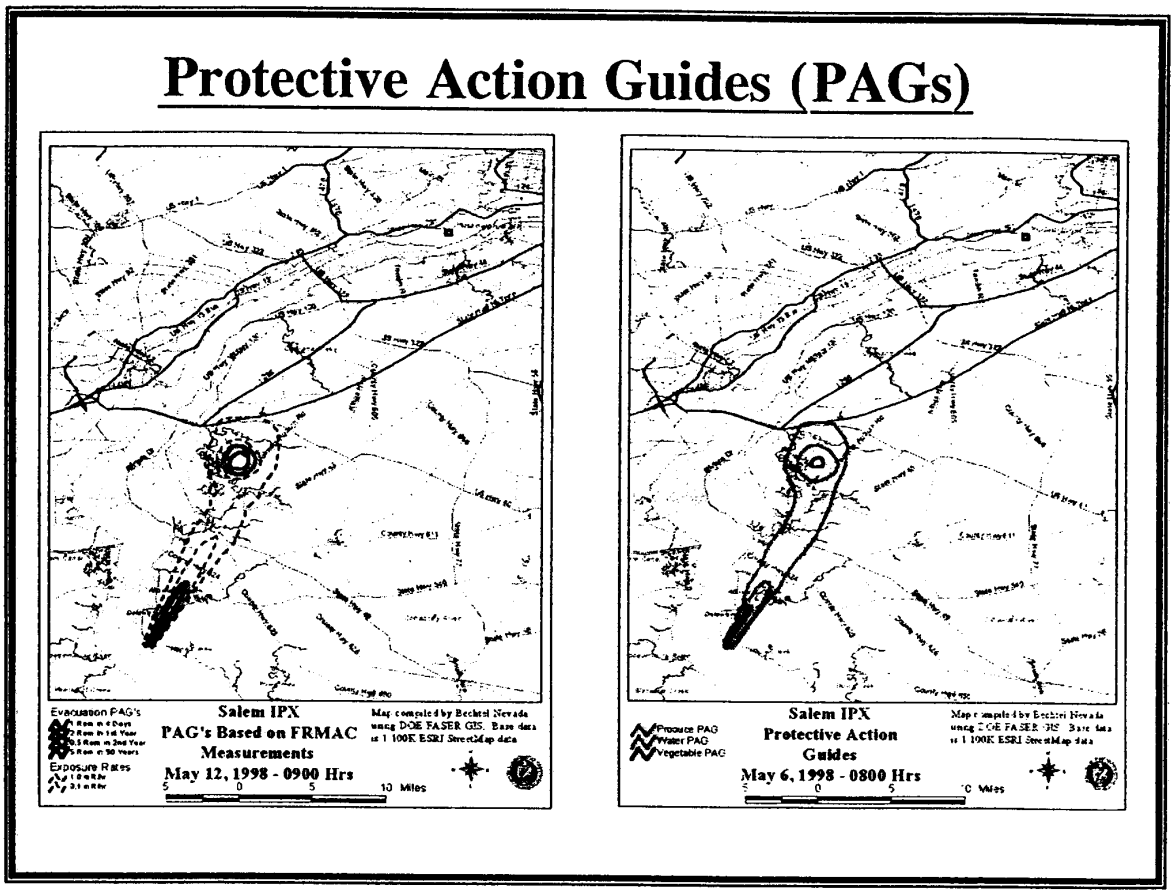
Surface Contamination mCi/m^2	**Respiratory Protection**
< 6	No respiratory protection or protective clothing.
6 to < 60	No respiratory protection for limited entries of up to 4 hours. Full protective clothing.
60 to < 600	Air purifying respirator and full protective clothing.
Above 600	Wear pressure demand SCBA and full protective clothing. Source of contamination should be fixed as soon as possible.

C5.2.3. Protective Action Guides. In order to facilitate decision making during

radiological emergencies, the EPA and FOA have developed PAGs to guide the actions (e.g., sheltering, evacuation, food embargoes, etc.) taken to mitigate the health consequences of an accident/emergency. These guides allow for various actions to be taken to protect human health, and for State and local officials to develop emergency response plans. A PAG is the projected dose (to a reference individual) from an unplanned release of radioactive material at which a specific protective action to reduce or avoid that dose is warranted. It is important to note that PAG dose values include only the future dose that can be avoided by taking the specific protective action considered. An example of PAGs are shown in Figure C5.F1. Not all PAGs are the same as in Figure C5.F1; some may be depicted as charts, graphs, tables, etc.

C5.2.4. Air Sampler Equipment. TF-1A Air Particles. Commonly referred to as a STAPLEX, the TF-1A is capable of sampling air for particles down to 0.01 microns in diameter, depending on the filter paper used. A flow meter is used to determine rate of air flow. Cellulose filters are used normally and retained for laboratory analysis. Field estimates of airborne contamination can be derived from measurement of filter contamination with field survey instruments.

Figure C5.F1. Aerial Survey Results - Protective Action Guides (PAGs), Evacuation PAGs, and Quarantine Areas



C5.2.5. Resuspension Factors (RFs). Other than during the initial release of contamination, airborne radioactivity is caused by resuspension. One means of estimating the potential airborne hazard caused by a given level of surface contamination is by using RFs. The RF is defined as the activity in the air (µCi, psi, dpm, etc.) per unit volume (usually m^3) divided by the activity on the ground below expressed in the same activity unit per unit area. The dimension of the RF is then inverse length, usually m^{-1}.

$$RF = \frac{\text{airborne activity}}{\text{ground activity}} = \frac{dpm / m^3}{dpm / m^2} = m^{-1}$$

The method of computing airborne contamination levels is contained in the air sampling appendix. In theory, the surface is assumed to have an infinite plane of uniform texture with a uniform level of contamination. In practice, the contaminated area has varied levels of contamination, is finite in size, and may contain a variety of

surfaces with different resuspension characteristics. For wind speeds below 20 miles per hour (mph), only those surfaces within approximately 200 meters can contribute to the airborne contamination. For wind speeds of more than 30 mph, surfaces as much as 900 meters away may contribute. Averaging of ground activity levels from these areas may be considered when computing RFs. RFs may provide a method of roughly estimating airborne contamination levels for use with Table C5.T1. in areas where air sampling data is unavailable. When using RFs to estimate airborne contamination levels, the types and levels of contamination on surfaces in the area where the RF was computed and those in the area of interest should be considered. RFs may vary from 10^{-5} to 10^{-7} for plutonium newly deposited on soil and up to 10^{-3} on pavement. RFs are affected by the following:

C5.2.5.1. Soil Disturbing Operations. Mechanical disturbance, such as vehicular traffic may increase RFs by as much as 100 times in the vicinity of the disturbance.

C5.2.5.2. Wind. RFs vary proportionally to the cube of the wind speed.

C5.2.5.3. Rain or Moisture. Leaching of plutonium into the soil by rain or sprinkling may reduce RFs by 10 to 100 times or more. Surface and airborne alpha contamination levels may not be measurable with an alpha meter for some time after rain or sprinkling due to the shielding action of the moisture.

C5.3. PROTECTIVE CLOTHING

Protection from contamination can be provided by any close weave cotton material or disposable suits. The outfit includes the standard anti-contamination coveralls, boot covers, gloves, mask, and hood. The outfit openings should be taped using masking or other appropriate adhesive tape. Disposable suits or the battle dress uniforms or equivalent with a hood and mask may be used provided the outfit openings are taped. For identification, the person's name and team should be written on tape and placed on his/her back and chest.

C5.4. PERSONNEL SAFETY PRECAUTIONS

C5.4.1. Do not eat, chew, smoke, or drink in areas where radioactive materials are handled.

C5.4.2. Handle radioactive material only when necessary and keep handling time

as short as possible. Health hazards are increased by extended exposure. Flaking, scratches, and fractures of radioactive material are sources of contamination. Do not handle radioactive materials with bare hands.

C5.4.3. If wounded by a contaminated item or while in a contaminated area, take the following steps:

NOTE: Steps (d), (e), (f), and (g) do not apply to tritium exposure or contamination.

a. Leave contaminated area.

b. Remove contaminated clothing or contaminated material at DECON line.

c. Obtain medical assistance as soon as possible.

d. Irrigate the wound with copious amounts of water. Do not induce bleeding. Pack the wound with gauze and wrap tightly with Curlex or ace bandage. Remove the dressing at medical treatment facility and check the dressing for contamination. You will not detect the presence of contamination in the wound without swabbing it with a cotton-tipped applicator, drying the applicator, and monitoring it in a counting chamber. The liquids present in the wound will mask almost all emissions.

e. Wound debridement should not be attempted outside of a medical treatment facility. The wound should only be irrigated, packed loosely with sterile gauze, and wrapped. Debridement must take place in an emergency room or operating room. An appropriate survey instrument and technician must be available during treatment to confirm the wound has been decontaminated prior to closure. Wound debridement must not be continued to the point of functional compromise. If contamination is still suspected, again, pack the wound with sterile gauze, wrap, and redress the wound in 24 hours. The wound should not be sutured closed but should be allowed to heal by second intention (tissue granulation).

f. You cannot check the wound for contamination without a cotton-tipped applicator or gauze swab. It must be allowed to dry and then counted.

g. Any metallic particles must be assumed to be radioactive unless confirmed otherwise. Handling tongs and a lead pig should be standing by during wound debridement to receive a "hot particle" or metal foreign body.

C5.4.4. If any form of internal contamination is suspected, immediately report to a medical authority.

C6. CHAPTER 6

CONTAMINATION CONTROL

C6.1. CONTAMINATION CONTROL

C6.1.1. General. Contamination control minimizes the spread of contamination; therefore, rigid, established operating procedures must be followed to achieve the objective of contamination control. Procedures consists of:

C6.1.1.1. Initial monitoring upon arrival to determine the preliminary site characterization and personnel contamination.

C6.1.1.2. Anti-contamination procedures to minimize the spread of contamination.

C6.1.1.3. Strict contamination control line procedures to control contamination spread during response/recovery/remediation operations.

C6.1.1.4. A contamination control capability must be available on site beginning with the IRF initial reconnaissance through to RTF final recovery operations. It is imperative to personnel safety that a CCS is established and operating while personnel are in the contaminated area.

C6.1.2. Personnel Monitoring and Decontamination. Personnel who were potentially exposed during the accident, subsequent cloud passage, or post-accident entry into the contaminated area should be given a high priority in response actions. People to be considered include casualties, bystanders and sightseers, military and civilian response personnel, and residents, business employees, and customers in the contaminated area. Initial definition of the perimeter of the contaminated area was discussed previously. Early definition of the perimeter is important so that potentially contaminated people may be identified and measures taken to prevent the contamination of additional people. Initially, the military may have the only effective radiation detection instruments at the scene and may monitor potentially contaminated civilians. Responsibility for monitoring civilians will shift to DOE, State radiation control personnel, or civilian authorities/representatives as they arrive on scene with appropriate instruments. Monitoring of personnel is normally done at a CCS; however, during the initial response when the number of radiation detection instruments and monitoring personnel is limited, alternative procedures must be devised if large numbers of people are involved. Depending on resources and

requirements, the IRF and/or RTF Commander may decide to establish more than one CCS. If sufficient resources exist to support multiple stations, processing contaminated or potentially contaminated civilian residents may be desirable through a station separate from that used for response force personnel.

C6.1.2.1. Monitoring and Decontaminating Potentially Exposed Medical Treatment Facilities. Immediately following an accident, injured personnel may be removed for medical treatment, or fatalities may be moved to a hospital or morgue without being monitored for contamination. The potential contamination of a medical treatment facility, morgue, or ambulance could present a health problem for the staff and other patients. Therefore, judgments must be made as to whether casualties have been removed from the contaminated area and, if so, what facilities are involved. Those facilities and the transportation resources used should be notified of the potential problem. Paragraph C10.5. describes procedures a medical facility may use to control the spread of contamination. Dispatch of a radiological monitoring team to check the vehicles and facilities involved for contamination, and to assist in DECON or other measures, as appropriate, to prevent the spread of contamination should be given the highest priority.

C6.1.2.2. Contamination Control Station

C6.1.2.2.1. The CCS is used to ensure radioactive contamination is not transferred from an area that is already contaminated to an area that is not contaminated through the orderly processing of personnel, equipment, and vehicles entering and leaving the contaminated area. The quantities of material, manpower requirements, and physical layout of the CCS discussed in this chapter are notional and are provided for information only. The actual amounts of material used and physical location of CCS elements will depend upon conditions on scene at an actual accident.

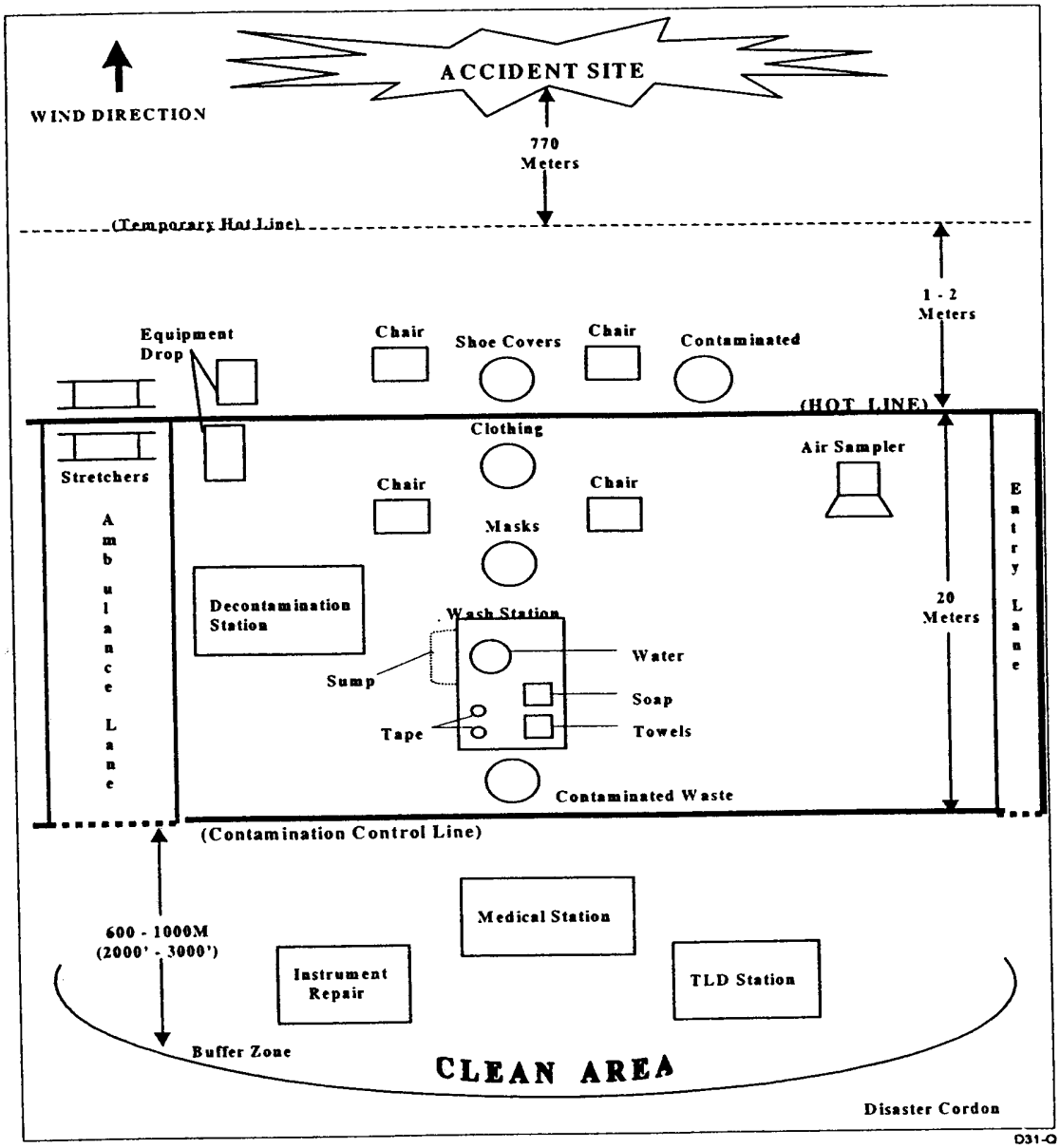
C6.1.2.2.2. Persons present at the accident site or in known contaminated areas must be identified and screened to determine whether decontamination or other corrective action is required. Normally this action is done at a CCS. Casualties should be monitored and decontaminated to the extent injuries permit; however, urgent medical treatment has priority and exceptions may be necessary. Procedures for handling contaminated casualties are outlined in Chapter 10. An example of a CCS is shown in Figure C6.F1. When processing a large group of people, this type of station will process a person about every 4 minutes if no contamination is found. If equipment and monitors are available, additional lines should be established in the station to process large numbers of people. When processing people whose personal clothing is contaminated, the clothing should be

bagged separately and a receipt issued for those articles retained. A priority system should be established to permit immediate processing of EOD personnel, monitoring team leaders, and others whose presence or information is needed to facilitate other response operations. The location of the CCS should be governed by the following constraints:

C6.1.2.2.2.1. It must be located in an area free of contamination.

C6.1.2.2.2.2. Ideally, it will be located directly upwind of the accident, but terrain or other considerations may dictate another location. If not upwind, it must be far enough away to prevent airborne or resuspended contamination from entering the CCS.

Figure C6.F1. Personnel Contamination Control Station (Example)



C6.1.2.2.2.3. Initially, it should be located outside the fragmentation zone as well as beyond the perimeter of the contaminated area. After all explosives have been rendered safe, the CCS may be moved closer to the accident site, if appropriate.

C6.1.2.2.2.4. It should be in an area relatively free of weeds, bushes, and rocks. A paved or flat compacted surface is recommended.

C6.1.2.3. Materials and Manpower

C6.1.2.3.1. The materials listed in Table C6.T1. are necessary to establish a CCS. Some items are expendable and will need replacement over time. Suitable items may be substituted, as necessary. Frequency and volume of personnel and equipment processing will determine if additional items are needed. Use of National Stock Numbers (NSNs) when ordering will expedite process.

Table C6.T1. **Contamination Control Station Materials List**

Equipment	Quantity
Alpha particle monitoring equipment	4
Low-level beta/gamma monitoring instrument	4
Dosimeters	as needed
2-inch or wider masking tape	3 rolls
Nuclear, biological, or chemical (NBC) marking kit or substitute	1
Stools or chairs	4
55-gallon drums or equivalent for storing contaminated items	4
Plastic bags; sized to fit the barrels/drums used	20
Brushes	4
Whisk brooms	4
Shovels	4
Traffic cones, ropes, and stakes	as needed
Protective masks (SCBA, if available)	as needed
Personal Protective suits	as needed
Cotton gloves	as needed
Booties or footcovers	as needed
Water container; 5 gallons or larger	1
Paper towels or substitute	as required
Liquid soap; 1 gallon or more	1
Tables	5
Craft paper, butcher paper, or substitute	1 roll
Rain suits, ponchos, or substitute	as needed
Surgical masks	1 box
Organic solvents; 1 gallon or more	1
Large tent (20 or 40 men) or trailer w/popup sun covers	as needed
Portable generator (as needed)	1
Portable heaters, air-conditioners, fans	as needed
Blankets	as needed
Litters	4
Plastic sheeting	1 roll
Bar Soap - Dozen	as needed
Towels	as needed
Cotton Swabs	as needed
Bioassay Containers	as needed
Hair Brushes	as needed
Shampoo	as needed

C6.1.2.3.2. Each shift of the CCS must have the personnel listed in Table C6.T2. All should be dressed in personal protective suits and masks. Volume and frequency of equipment and personnel processing will determine if more are needed.

C6.T2. **CCS Personnel**

Position	Function
One medical doctor and health physicist	Monitor general health and treat personnel injuries.
One CCS supervisor	Monitor supply levels and control flow through the CCS.
One security guard	Monitor for unauthorized or unprocessed access/egress.
Eight assistants	Accomplish activities as directed by the CCS supervisor.
One RADIAC repair person	Repair any RADIAC equipment from the CCS.
One TDL/dosimeter monitor	Issue dosimetry, log out/in personnel that go to/from site.

C6.1.2.4. Procedures for Personnel Entering the Contaminated Area

C6.1.2.4.1. Dressout procedures:

C6.1.2.4.1.1. Don personal protective suits or coveralls.

C6.1.2.4.1.2. Using masking tape, write the individual's name and team name or function on the front and back of each suit.

C6.1.2.4.1.3. Put on shoe covers and tuck suit legs into shoe covers.

C6.1.2.4.1.4. Using masking tape, tape the openings at the top of the shoe covers.

C6.1.2.4.1.5. Don and adjust mask; then remove.

NOTE
All equipment will be functionally checked prior to donning gloves.

C6.1.2.4.1.6. Don gloves and tuck sleeves into the glove tops.

C6.1.2.4.1.7. Using masking tape, tape the openings at the top of the gloves.

C6.1.2.4.1.8. Put on mask.

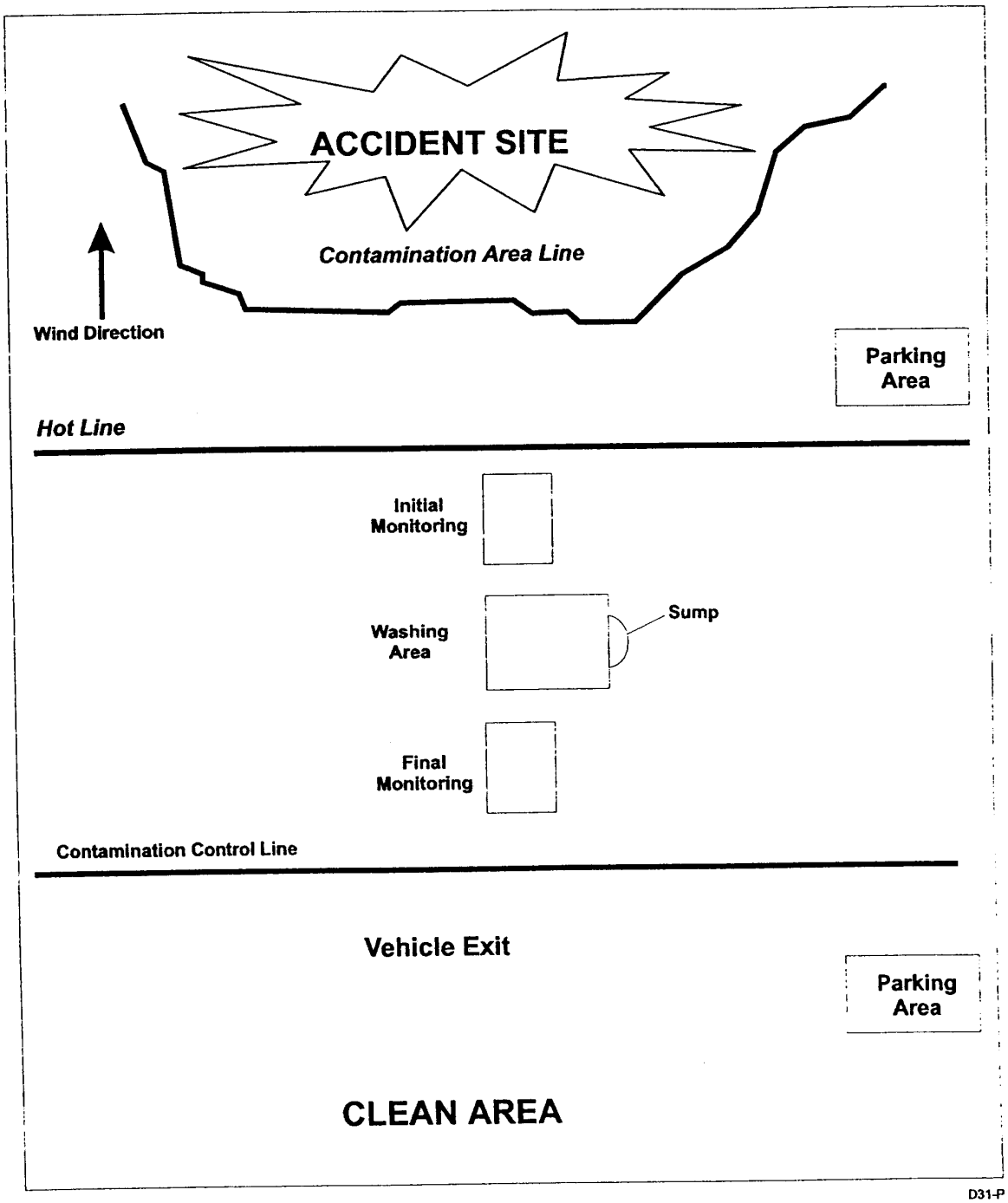
C6.1.2.4.1.9. Don hood and tape the bottom of the hood to the coveralls.

C6.1.2.5. CCS Processing. If an accident occurs near a populated area and several hundred people are potentially contaminated, available radiation detection instruments and monitoring personnel may be inadequate to process the people fully and quickly. The assumption is that the potentially contaminated people are not response personnel. If only a few radiation detection instruments are available, use of an abbreviated monitoring procedure may be considered to expedite processing. Contamination of the hands, seat, and shoes or lower legs may be caused by handling contaminated objects or moving and sitting in contaminated areas. Contamination of the upper chest or neck and head area is indicative of exposure to airborne contamination. Contamination around the nose or mouth is an indicator of internal contamination. Nasal swipes should be used to follow up on individuals with positive indications of contamination around the nose and mouth. If radiation detection instruments are unavailable to monitor the people involved, procedures to decontaminate all people coming from the contaminated area should be used immediately. Provisions should be made to monitor them later when instruments are available. Such a procedure would require provisions to collect and receipt for clothing, shower and shampoo the people, and issue replacement clothing. Each article of clothing should be bagged separately, if feasible, and all clothing placed in a single large bag and a receipt issued. Watches, jewelry, and the contents of pockets and pocketbooks should not be highly contaminated, if at all, and should be retained by the individual. If those items are highly contaminated they should be inventoried, bagged, and an itemized receipt issued. Although the contamination may be retained with the clothing, an overriding need exists to assure the people that they are being cared for; therefore, a gym or other facility with dressing rooms and high-capacity showers may be appropriate for processing people. Soap, shampoo, towels, and stocks of replacement clothing must be obtained. People processed in this manner, and their collected clothing, should be monitored as soon as possible. Uncontaminated clothing should be returned at the earliest possible time.

C6.1.3. Vehicle Monitoring. Vehicles used by the response force in the contaminated area will remain there for future use and not require immediate monitoring or DECON. If members of the public in the contaminated area are sent, or go, to the CCS or other processing points using their own vehicles, the vehicle should be monitored before being moved away from the area. An example of a vehicle CCS is shown in Figure C6.F2. All outer surfaces and the air filter may have been contaminated by airborne contamination, while wheel wells, tires, and the rear end

may be contaminated from driving across contaminated areas. Unless the windows were down, or ventilators open, detectable contamination of the interior is most likely on those surfaces in contact with the vehicle occupants, for example, floorboards and seats. If only external surfaces of a vehicle are contaminated, DECON should be relatively easy to perform, if done before bonding between the contaminant and the vehicle paint occurs. Also, rapid DECON and return of private vehicles may reassure the public that consideration is being given to their interests and property. Monitoring and decontamination of vehicles is time consuming and may not yield a "clean" vehicle. Recommend individuals drive to multiple collection sites, park, and transfer to commuter buses for transport to CCS areas. The vehicles can be monitored, time permitting, without the spread of contamination.

Figure C6.F2. Vehicle Contamination Control Station (Example)



C7. CHAPTER 7

BIOASSAY PROCEDURES

C7.1. BIOASSAY

C7.1.1. Bioassays are procedures that estimate the amount of radioactive material deposited in the body, either by direct measurement, using sensitive x-ray detectors placed over the chest (lung counting) and/or other organs, or by detection of radioactivity in excreta (feces and urine). Therefore, a number of factors must be known in addition to the quantity and isotopic distribution of the material to make an accurate estimate of the dose.

Chemical form
Route of intake
Elapsed time from intake
Organ(s) containing the material
Distribution pattern
Organ(s) mass(es)
Biological half-life
Particle size of the original material
Decay scheme of the radioisotope

Complex mathematical models have been developed that take each of these into account.

C7.1.2. Three methods are used to determine the amount of material present in the body. Each method has specific advantages and disadvantages and the specific methods in any given situation will be determined by the health physicists.

C7.1.2.1. Fecal Sampling. Fecal sampling can be an effective means of detecting inhaled insoluble material that has been transported from the lungs to the GI tract and excreted. Fecal samples can be quickly screened using low energy gamma detectors such as the FIDLER to estimate the plutonium or americium content. For more definitive results, chemical separation and low-level counting techniques (which may take days or weeks) must be used. Fecal samples should not be collected until at least 48 hours after exposure to permit passage of the contamination through the GI tract. (Samples collected sooner than this may not be representative and may, in fact, give a false sense of security.) The optimal time for sampling is between 2 and 3 days

after the inhalation, however, samples collected weeks or months after an intake may still be useful, depending upon the size of the intake. Samples should be collected in well-sealed bags. Local medical supply houses or medical facilities should have collection kits (which fit onto a standard toilet seat), which may make sample collection easier. Figure C7.F1. may be used to roughly estimate the committed effective dose equivalent from inhalation of weapons grade plutonium based on contamination detected in a single fecal sample.

C7.1.2.2. Urine Sampling. Urine sampling is a less sensitive indicator of plutonium exposure; only a tiny fraction of the amount inhaled is excreted through urine. This fraction also depends on solubility of the plutonium in the original aerosol. Samples taken during the first 5 days after the exposure may not reflect the quantity of plutonium inhaled due to the time required for movement through the body. Urine samples must be processed in a chemistry laboratory before quantification is possible, but screening for very high levels (by gamma scanning for Am-241) can sometimes be done in the field. Samples should be submitted in plastic or glass bottles with well sealed tops. Figure C7.F1., below, may be used to roughly estimate the committed effective dose equivalent from inhalation of weapons grade plutonium based on contamination detected in a single urine sample. Samples taken for several years after exposure can be used since plutonium is insoluble in the lung. Material is generally released from the lung into the bloodstream over a very long period of time. Some material may be so insoluble, it may not even show up in the urine for several years. Single voiding urine samples should be collected from all personnel suspected of being exposed (via inhalation) to significant quantities of uranium. The optimal time for such samples is from 24 to 48 hours after exposure, although samples collected for days or weeks after an intake may be useful depending upon the size of the intake. Such samples must be processed by a radiochemical laboratory -- these analyses typically take several days to several weeks. Since uranium from normal environmental sources will always be present in the urine, care must be taken to determine whether the level of uranium detected is significantly greater than this "background" level. Single voiding urine samples should be collected from all personnel suspected of being exposed to significant quantities of tritium. The optimal time for such samples is from 4 to 8 hours after exposure, although samples collected for days or weeks after exposure may still be useful. Sample collected sooner than 4 hours after exposure may not be representative. Normally such samples must be processed in a radiochemistry laboratory (using liquid scintillation counters) but portable liquid scintillation counters are available in some emergency response organizations. Urine sampling is the main way of determining tritium uptake.

C7.1.2.3. Lung Counting. Lung counting is the direct measurement of

emitted x-rays and gamma radiation (typically Am-241 in a weapons accident) from the body with a sensitive low energy photon detector. Lung counters are used at National Laboratories, commercially, and at some hospitals and universities. Most lung counters are immobile systems using large shielded rooms (special trailer mounted systems can be obtained through DOE in a few days), and the patient must be sent to the facility. Inhaled plutonium remains in the lungs for extended periods of time. Portable FIDLER (or similar) detectors can be used for rough screening measurements. However, such measurements can be easily distorted by small amounts of surface contamination, and should only be performed by experienced and qualified personnel. Figure C7.F1. may be used to roughly estimate the committed effective dose equivalent from inhalation of weapons grade plutonium based on the results of a lung scan for Am-241.

C7.1.3. Interpretation of Single Bioassay Results - Weapons Grade Plutonium. Figure C7.F1. may be used to make a rough initial estimate of the dose significance of a single bioassay measurement (Am-241 gamma scan) obtained after acute inhalation of weapons grade plutonium. The curves represent the 50-year committed effective dose equivalent (CEDE) implied by a 24-hour urine or fecal sample result of 1 (one) microcurie of Am-241, or a lung count of 1 (one) microcurie of Am-241, on a given day after inhalation. Note that these curves are using the Am-241 result from a gamma count as a "marker" for the entire mix of plutonium and americium found in weapons grade plutonium. Accordingly, these curves cannot be used directly for plutonium results -- they must be used with Am-241 results. Note also that this figure cannot be used for interpretation of uranium or tritium bioassay results.

The following steps are used:

1. Move right along the horizontal (X-axis) to the number of days between inhalation and sample collection. (Note the logarithmic axis.)
2. Move up to the curve of interest (urine sample, fecal sample, or lung count).
3. Move left to read the dose-per-microcurie on the vertical (Y-axis).
4. Multiply this dose-per-microcurie by the actual sample or measurement result.

Example of Use:

A fecal sample was collected about a week after a person was exposed to a fire involving weapons grade plutonium. The plutonium involved in the fire is known to be about 30 years old. A "screening" gamma scan was performed on this sample -

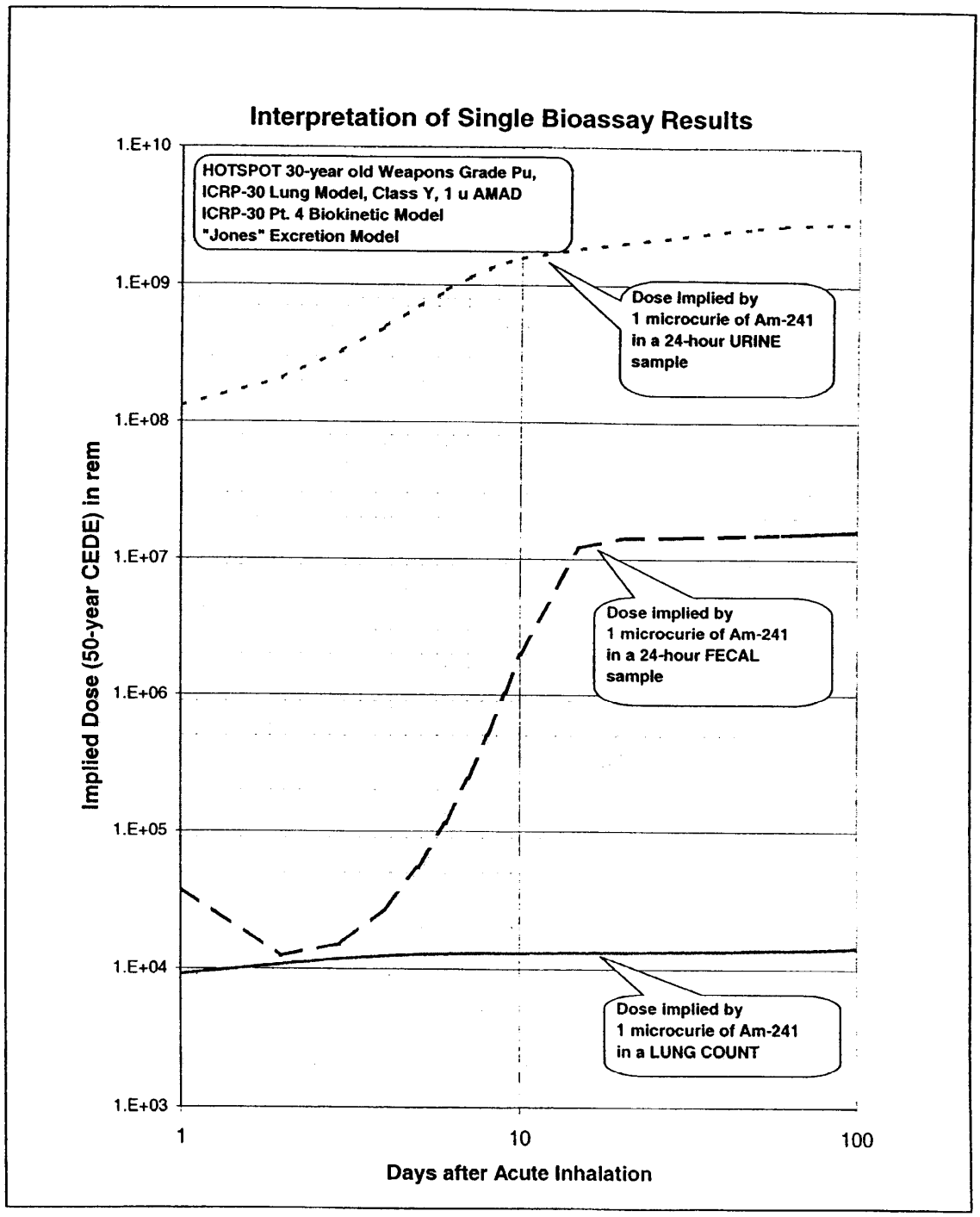
giving a result of 5.0×10^{-5} microcuries (about 110 dpm) of Am-241. What is the approximate dose implied by this single result?

The fecal sample dose-curve is represented by the heavy dashed line. At 7 days after inhalation, the dose-per-microcurie value is about 2×10^{5} rem. Multiplying this value by the actual fecal sample result of 5.0×10^{-5} microcuries gives an implied 50-year committed effective dose equivalent of about 10 rem.

Cautions about Use:

There are many potential sources of uncertainty and error in using a single bioassay measurement to estimate dose. Different exposure or intake scenarios, individual biological differences, sample collection and analysis uncertainties all contribute to this overall uncertainty. Accordingly, such "single-point" dose estimates should be viewed as rough indicators, at best.

Figure C7.F1. Estimated 50-Year Committed Effective Dose



Technical Notes for Figure C7.F1.

These curves are generated by estimating the fraction of an inhaled intake that would be excreted via the urine or feces, or retained in the lungs, on any particular day after intake. Dividing the actual bioassay result by these "intake excretion fractions" or "intake retention fractions" gives an estimate of the initial intake. Multiplying this estimated intake value by a "dose conversion factor" (dose per unit intake) gives an estimate of the dose.

The material inhaled is assumed to be a 30-year old mixture of "weapons grade" plutonium, as characterized by the LLNL "Hotspot" Health Physics Computer Programs. (The Am-241 concentration is about 4,300 parts per million.) The material is assumed to have "Class Y" (very insoluble) lung solubility characteristics and to have a particle size distribution of 1 micron AMAD. Since the Am-241 is assumed to have "grown-in" to the plutonium matrix, the Am-241 is assumed to have the same lung solubility characteristics as the plutonium. It is also assumed that this Am-241 will have the same systemic retention and excretion characteristics as the "parent" plutonium. These assumptions are somewhat simplistic, but are likely to provide a conservative estimate of dose.

For consistency with current guidelines and regulations, the following models were used to generate the intake excretion and retention fractions used in Figure C7.F1.:

ICRP-30 Respiratory Tract Model
ICRP-30 GI Tract Model
"Jones" Plutonium Excretion Model

The intake excretion and retention fractions were calculated, but are essentially the same as those published in Lessard, et al.

Dose conversion factors were taken directly from Federal Guidance Report 11, reference (l). This report uses the ICRP-30 Respiratory Tract and GI Tract Models, the ICRP-48 Systemic Model for Plutonium and Americium, and the tissue weighting factors of ICRP-26.

Note on newer biokinetic models: The ICRP has recently introduced a new Respiratory Tract Model (ICRP-66) and new biokinetic models for plutonium and americium (ICRP-67). Use of those models, coupled with corresponding dose conversion factors (ICRP-71) produces dose estimates that are generally from 2 to 5

times lower than those of Figure C7.F1. Thus, the curves of Figure C7.F1. probably provide a conservative estimate of doses from such an intake.

C7.2. BIOASSAY PROCEDURES

C7.2.1. Administration of a bioassay program for affected civilians may be the responsibility of the State or Federal agency or affected country. The guidelines in Table C7.T1. are provided to assist the response force or civilian authorities conducting initial screening in advising individuals contaminated when requested to provide urine or fecal samples for analysis. Advisors explain that sample analysis will determine if the individual received a detectable radiation dose when contaminated. The bioassay procedures used will be established by health physicists responding to the accident. If possible, all follow-up bioassay monitoring or sampling protocols should be established by a health physicist who has specific experience and expertise in the internal dosimetry of plutonium and/or uranium. The Department of Energy's Accident Response Group normally has such dosimetry assets available. When bioassay samples are collected, every effort should be made to keep samples and their containers free of contamination from the environment, clothing, or skin. Since tritium contamination cannot be detected by CCS monitoring, anyone suspected of having been exposed to tritium should follow the guidelines in Table C7.T1. A bioassay program is recommended for all individuals without respiratory protection and found to be contaminated. This program will determine if any dose was received, and provides assurance to those who did not receive a dose, that their health was not affected. To provide similar assurance to all people in the contaminated area, bioassays may be appropriate even for people who were not found to be contaminated; moreover, some people never in contaminated areas will request tests to ensure they were not affected by the accident.

C7.T1. **Guidelines for Bioassay Sampling**

Suspected Radioactive Material	Feces Optimum Sampling Time After Exposure	Urine Optimum Sampling Time After Exposure	Sample Quantity
Plutonium	2 to 3 days	2 to 3 weeks	24 hours total
Uranium	2 to 3 days	24 hours	24 hours total
Tritium	N/A	4 to 8 hours	1 voiding

C7.2.1.1. Bioassay Priorities. If a nuclear weapon accident occurs near a populated area, obtaining bioassay samples from large numbers of people may be necessary. Accurate identification of all bioassay samples (full name, ID and/or Social Security number, age, gender, address, phone number, date and time of

collection) is imperative. The specific reason for sampling (e.g., "facial contamination: 50,000 cpm alpha" or "1 mile downwind during initial plume passage" should also be included to aid in later prioritization of processing. Considering the potential for public concern for their possible exposures, it would probably be better to err on the side of collecting too many samples, rather than too few samples). Note that samples can be collected from large numbers of people during the optimal collection time period, and then stored for later analysis on a prioritized basis. Fecal samples should be frozen, and urine samples should be refrigerated (not frozen.)

NOTE: Since it is very difficult for a significant amount of plutonium to be incorporated into the body without gross contamination of skin or clothing also occurring, initial alpha monitoring that identifies contaminated personnel also can provide a method for assuring that those with the greatest possibility of radiation exposures (that may affect their health) are given priority treatment.

Table C7.T2., applicable only to people not wearing respiratory protection; provides recommended guidelines for the assignment of priorities for bioassay analysis. Response force personnel will normally be equipped with protective clothing and respirators, when required. Bioassays for response force personnel will be performed in accordance with Service regulations and as directed by the CRTF.

C7.T2. **Guidelines for Assignment of Priorities for Collection and Processing of Bioassays**

Alpha Contamination Level on Clothing or Skin

Priority	60 cm^2	17 cm^2 probe
HI	Above 300,000 cpm	Above 75,000 cpm
MED	50,000-300,000 cpm	12,500-75,000 cpm
LO	Below 50,000 cpm	Below 12,500 cpm

Personnel falling in the HI priority category in Table C7.T2. may have had a substantial plutonium intake. Conversely, exposure to airborne contamination that produces a surface contamination level in the LO category will be less likely to result in a significant deposition in the lungs. To ensure alpha meter readings provide a valid guide for assignment of priorities, individuals should be asked, during screening, if they have bathed or changed clothes since the time of possible contamination. A record must be made and retained for future reference of all personnel screened and the results of both alpha meter screening and bioassays. Use of the Radiation Health History and Bioassay Screening Forms contained in Appendix C4.AP6. should be considered.

C7.2.1.2. Nasal Smears. Contamination on a wipe (e.g., a cotton swab) from inside the nasal passage is a possible indicator of plutonium inhalation. If initial alpha meter screening indicates probable plutonium or uranium inhalation, a nasal smear shall be collected for analysis by specialized teams when they arrive on site. However, due to the biological half-life of nasal mucus, a nasal smear is a reliable indicator only if collected during the first hour after the exposure. Accordingly, prompt nasal samples can be collected by any personnel, as long as they are taken carefully and labeled appropriately. Great care must be taken to avoid cross-contamination from the face, hands, or other sources during collection of nasal smear samples. Ideally, separate swabs should be taken from each nostril. Each of these should be bagged separately, then placed in another bag labeled with name, ID number (as applicable) and collection date and time. After collection, the swabs must not be placed into any gels or liquids since this would prohibit alpha particle counting.

C7.2.2. Personnel Exposure and Bioassay Records. Documentation should be maintained on all personnel who enter the Radiological Control Area (RCA), or who may have been contaminated prior to establishment of an RCA. Examples of forms used for recording data on personnel working in the RCA, or who may have been exposed to contamination downwind from the accident, are contained in Appendix C4.AP6. To ensure appropriate followup actions are completed on all exposed, or potentially exposed people, a copy of all CCS logs, other processing station records, bioassay data, and other documentation identifying people who were or were not contaminated should be provided to the JHEC for consolidation into a single data file. This data file is subject to Privacy Act Regulations, and must be retained as part of the permanent accident records; therefore, procedures for handling data obtained on non-DoD personnel should be coordinated with the CRTF's legal officer. Data obtained on DoD personnel will be needed to satisfy Service-specific requirements contained in (U.S.) Army Regulation (AR) 40-14, "Control and Recording Procedures for Occupational Exposure to Ionizing Radiation;" Naval Bureau of Medicine and Surgery (NAVMED) P-5055, "Radiation Health Protection Manual;" (U.S.) Air Force Instruction (AFI) 48-125, "The USAF Personnel Dosimetry Program," references (m), (n),and (o). These records shall be retained and become part of the individual's permanent medical record.

C8. CHAPTER 8

RADIOACTIVE MATERIALS, CHARACTERISTICS, HAZARDS, AND HEALTH CONSIDERATIONS

C8.1. RADIOACTIVE MATERIALS

C8.1.1. General. The characteristics and hazards and health considerations of plutonium, uranium, tritium, and thorium are provided. This chapter assumes that the elements are in their pure, weapons-grade form and no fission has occurred.

C8.1.2. Plutonium (Pu) and Americium (Am). Plutonium is a heavy metal with a shiny appearance similar to that of stainless steel when freshly machined. After short exposure to the atmosphere, it will oxidize to a dark brown or black color. Americium is a daughter product of plutonium decay and is not considered as a separate element in this manual.

C8.1.2.1. Radiological Characteristics. Plutonium and americium are primarily alpha emitters except Pu-241, which is primarily a beta emitter.

Isotope	Primary Particle Emitted	Half-Life in Years
Plutonium 239	alpha	24,100
Plutonium 240	alpha	6570
Plutonium 241	beta	14.4
Plutonium 242	alpha	376,000
Americium 241	alpha	432

C8.1.2.1.1. Weapons-grade plutonium (including americium) emits two detectable photons: a 17 keV x-ray and a 60 keV gamma ray. The 17 keV x-ray may be shielded after 5 days of dry weather or after a rain as the contamination migrates into the ground. The 60 keV gamma ray (provided by Am-241) continues to be detectable.

C8.1.2.1.2. A critical mass can be obtained from several hundred grams or more of plutonium, depending upon the geometry of the container and the material surrounding or near the mass. Recovery personnel should consult EOD technical publications and with the DOE ARG to ensure that the possibility of aggregating a critical mass of recovered material is considered and avoided.

C8.1.2.2. Hazards and Health Considerations

C8.1.2.2.1. When dispersed in an accident, plutonium is considered the most significant radiological hazard. The primary hazard results from inhalation and subsequent deposition in the lungs. From the lung, plutonium enters the bloodstream and is deposited in the bone and liver. Bone deposition may produce bone diseases many years later. Due to its extremely long physical and biological half lives, plutonium is held within the body for a lifetime. The hazards from americium are comparable to those of plutonium.

C8.1.2.2.2. The elimination of plutonium from the body is extremely slow. If a person contaminated internally is given prompt medical treatment with a chelating agent, plutonium retention may be significantly reduced.

C8.1.2.2.3. A properly fitted respirator and standard personal protective clothing can provide adequate protection for plutonium contamination expected at an accident site.

C8.1.2.2.4. Smoke from a fire or explosion involving plutonium can carry particles of plutonium into the air, causing an inhalation hazard.

C8.1.3. Uranium (U). Uranium is a heavy metal that occurs in nature in significant quantities. When newly machined, it has the appearance of stainless steel. After short exposure to the atmosphere, it will oxidize to a golden-yellow color and from that into black.

C8.1.3.1. Radiological Characteristics

Isotope	Primary Particle Emitted	Half-Life in Years
Uranium 238	alpha	4,500,000,000
Uranium 235	alpha	710,000,000
Uranium 234	alpha	2,150,000

C8.1.3.1.1. Types of Uranium. Three forms of uranium have been used in nuclear weapons: natural uranium, depleted uranium (DU), and enriched uranium.

C8.1.3.1.1.1. Natural Uranium. When uranium is separated from its ore, the resulting mixture of uranium is natural uranium. It is almost pure U-238. Natural uranium in metal form is called tuballoy.

C8.1.3.1.1.2. Depleted Uranium. Uranium with some amount of its U-235 extracted is DU. It is also called U-238.

C8.1.3.1.1.3. Enriched Uranium. Enriched uranium contains more than the naturally occurring amount of U-235. It is enriched through chemical and metallurgical processes, and can be used in nuclear weapons to produce a yield.

C8.1.3.1.2. A critical mass can be obtained from several hundred grams or more of uranium, depending upon the geometry of the container and the material surrounding or near the mass. Recovery personnel should consult with EOD technical publications and with the DOE ARG to ensure that the possibility of aggregating a critical mass of recovered material is considered and avoided.

C8.1.3.2. Hazards and Health Considerations

C8.1.3.2.1. Radiological hazards associated with any uranium isotope are generally less severe than those of plutonium. If uranium is taken internally, a type of heavy metal poisoning may occur. Lung contamination due to inhalation may cause a long-term hazard.

C8.1.3.2.2. When involved in fire, uranium will melt and form a slag, with only a portion of it oxidizing; however, the possibility of hazardous airborne contamination exists, and protective measures must be taken to prevent inhalation or ingestion. A protective mask and standard personal protective clothing will protect personnel against levels of uranium contamination expected at an accident site. If multiple weapons were involved in a severe fire in which the warheads may have melted, there is a potential for critical geometry to be achieved if the U-238 melted and pooled.

C8.1.4. Tritium (T or H3). Tritium is a radioactive isotope of hydrogen and diffuses very rapidly in the air. The diffusion rate is measurable even through very dense materials such as steel. Tritium combines chemically with several elements. This chemical reaction produces heat. Like normal hydrogen, tritium can combine combustively with air, forming water and releasing large amounts of heat. Metals react with tritium in two ways: plating, the deposition of a thin film of tritium on the surface of the metal; or hydriding, the chemical combination with the metal. In either case, the surface of the metal becomes contaminated. In a fire, tritium combines spontaneously with oxygen in the air and will also replace ordinary hydrogen in water or other hydrogenous material (grease or oil), causing these materials to become radioactive. Metal tritides deposit in the lung. The tritium involved is bound with the metal. Only after an extended period of time will the tritium be available for absorption and elimination via the urine. The low energy betas continue to deposit energy in lung tissue until the material is removed from the lung.

C8.1.4.1. Radiological Characteristics. Tritium emits a weak beta particle and decays into a stable helium-3 atom.

Isotope	Primary Particle Emitted	Half-Life in Years
tritium	beta	12.26

C8.1.4.2. Hazards and Health Considerations

C8.1.4.2.1. Tritium is a health hazard when personnel are engaged in specific weapon render safe procedures, when responding to an accident that occurred in an enclosed space, and during accidents that occurred in rain, snow, or a body of water.

C8.1.4.2.2. In its gaseous state, tritium is not absorbed by the skin to any significant degree. The hazardous nature of tritium is due to its ability to combine with other materials. Tritium water vapor (TO or HTO) is readily absorbed by the body by inhalation and absorption through the skin. The radioactive water entering the body is chemically identical to ordinary water and is distributed throughout the body tissues. Tritium that has plated upon a surface or combined chemically with a material is a contact hazard.

C8.1.4.2.3. The body normally eliminates and renews 50 percent of its water in about 8 to 12 days. This biological half-life varies with the fluid intake. Since tritium oxide is water, its time in the body may be significantly reduced by increasing the fluid intake. Under medical supervision, the biological half-life may be reduced to 3 days. Without medical supervision, a recommended procedure is to have the patient drink 1 quart of water within 1-half hour of exposure. Thereafter, maintain the body's water content by imbibing the same amount excreted until medical assistance is obtained.

C8.1.4.2.4. A SCBA and protective clothing will protect personnel against tritium for a short time. A filter mask offers no protection.

C8.1.5. Thorium (Th). Thorium is a heavy, dense gray metal that is about three times as abundant as uranium. Thirteen isotopes are known, with atomic masses ranging from 223 through 235.

C8.1.5.1. Radiological Characteristics. Thorium 232 is the principal isotope. It decays by a series of alpha emissions to radium 225. Thorium 232 is not fissionable, but is used in reactors to produce fissionable U-233 by neutron bombardment. A non-nuclear property of thorium is that when heated in air, it glows with a dazzling white light.

Isotope	Primary Particle Emitted	Half-Life in Years
thorium 223 to 235	alpha	14,100,000,000

C8.1.5.2. Hazards and Health Considerations. Thorium presents both a toxic and radiological hazard.

C8.1.5.2.1. Toxicologically, thorium causes heavy metal poisoning similar to lead or the uranium isotopes.

C8.1.5.2.2. Biologically, thorium accumulates in the skeletal system where it has a biological half-life of 200 years.

C8.1.5.2.3. A properly fitted respirator and standard personal protective clothing will protect personnel against levels of thorium contamination expected at an accident site.

C8.2. FISSION PRODUCTS

The materials considered thus far are used in weapons in pure forms and in combinations with other elements. Due to weapon design, the probability of a nuclear detonation as a result of an accident is unlikely. If fission occurs, the products of the reaction may pose a severe hazard. In general, fission products are beta and gamma emitters and are hazardous, even when external to the body. To predict and estimate the quantity of fission products is difficult since the amount of fission is unknown, and to further complicate the situation, the relative isotopic abundances will change with time as the shorter lived radioisotopes decay. An estimate of the hazard may be obtained by beta and gamma monitoring.

C8.3. GAMMA MONITORING

When approaching a nuclear weapon involved in an incident/accident, always monitor to ascertain all possible radiation hazards.

C8.3.1. Always survey for gamma radiation because some fission products may be present. Observe maximum permissible exposure (MPE) in paragraph C8.3.1.4.

C8.3.1.1. OFF SCALE GAMMA SURVEY. If the gamma survey instrument being used has a meter capable of indicating a maximum of 3 roentgens per hour (or less) and the meter goes offscale, do not enter the area because the actual radiation level is unknown.

C8.3.1.2. SATURATED GAMMA SURVEY INSTRUMENT. Many gamma survey instruments will become saturated when placed in a strong field. A saturated instrument may indicate a false low or zero reading.

C8.3.1.3. INVERSE SQUARE LAW. The radiation intensity emitted from a given point source is inversely related to the distance from that source. If a dose rate, Rl, is taken at distance, D1, from the source, a second unknown dose rate, R2, can be calculated for a second (different) distance, D2, using the following equation:

R2 - R1 X (D1/D2) squared)

R1	=	Dose rate at distance D1 from a point source of GAMMA.
R2	=	Unknown dose rate at distance D2 from a point source of GAMMA.
D1	=	Known distance from point source of GAMMA where R1 was measured.
D2	=	Known distance from point source of GAMMA for which R2 will be calculated.

C8.3.1.4. STAY TIME. The MPE for an individual in a given radiation field before reaching a predetermined maximum cumulative dose is computed as follows:

NOTE: Use highest maximum reading to determine stay time.

$$T = D/R$$

T	=	Time of exposure to ionizing radiation expressed in hours or decimal fractions thereof.
R	=	Dose rate expressed in R/hr or mR/hr as determined from the BETA/GAMMA instrument.
D	=	The predetermined maximum yearly cumulative dose:
		(0.5 rem) per year
		500 mrem - non-occupational (general public)
		5 rem - accident/incident response
		25 rem - to save valuable property
		100 rem - to save lives
		Other - as determined by the on-scene commander (OSC) consistent with operational military consideration.

NOTE: No individual less than 18 years of age or women known to be pregnant shall be occupationally exposed to radiation in excess of that allowed to any individual in the general population.

C8.3.1.5. CUMULATIVE DOSE. The dose an individual receives over a specific period of time in a given radiation field is computed as follows:

$$D = R(T)$$

D	=	Cumulative dose received expressed in roentgens or milliroentgens.
R	=	Dose rate expressed in R/hr or mR/hr as determined from the BETA/GAMMA instrument.
T	=	Time of exposure to ionizing radiation expressed in hours or decimal fractions thereof.

C9. CHAPTER 9

CONVERSION FACTORS FOR WEAPONS GRADE PLUTONIUM

Assumptions:

1. Conversions are for weapons grade plutonium only, with no americium.
2. Density of soil 1.5 g/cm^3.
3. Specific activity (alpha only) 0.075 Ci/g.
4. Contamination of soil is to the depth of 1 cm.

Table C9.T1. **Conversion Factors for Weapons Grade Plutonium**

To Convert	Into	Multiply by
µCi/m^2	µg/m^2	13
µCi/m^2	dpm/m^2	2.2×10^{-6}
µCi/m^2	dpm/cm^2	220
µCi/m^2	dpm/g	150
µCi/m^2	µCi/g	6.7×10^{-5}
µCi/m^2	pCi/g	67
µg/m^2	µCi/m^2	0.075
µg/m^2	dpm/m^2	1.7×10^{5}
µg/m^2	dpm/cm^2	17
µg/m^2	dpm/g	11
µg/m^2	µCi/g	5×10^{-6}
µg/m^2	pCi/g	5
dpm/m^2	µCi/m^2	4.5×10^{-7}
dpm/m^2	µg/m^2	6.1×10^{-6}
dpm/m^2	dpm/cm^2	10^{-4}
dpm/m^2	dpm/g	6.7×10^{-5}
dpm/m^2	µCi/g	3.0×10^{-11}
dpm/m^2	µCi/g	3.0×10^{-5}
dpm/cm^2	µCi/m^2	4.5×10^{-3}
dpm/cm^2	µg/m	6.l x 10^{-2}
dpm/cm^2	dpm/m^2	10^{4}
dpm/cm^2	dpm/g	0.67
dpm/cm^2	µCi/g	3.0×10^{-7}

Table C9.T1. **Conversion Factors for Weapons Grade Plutonium--Continued**

To Convert	Into	Multiply by
dpm/cm^2	pCi/g	0.3
dpm/g	μCi/m^2	6.8 x 10^3
dpm/g	μg/m^2	0.091
dpm/g	dpm/m^2	1.5 x 10^4
dpm/g	dpm/cm^2	1.5
dpm/g	μCi/g	4.5 x 10^{-7}
dpm/g	pCi/g	0.45
μCi/g	μCi/m^2	1.5 x 10^4
μCi/g	μg/m^2	2 x 10^5
μCi/g	dpm/m^2	3.3 x 10^{10}
μCi/g	dpm/cm^2	3.3 x 10^6
μCi/g	dpm/g	2.2 x 10^6
μCi/g	pCi/g	10^6
pCi/g	μCi/m^2	1.5 x 10^{-2}
pCi/g	μg/m^2	0.20
pCi/g	dpm/m^2	3.3 x 10^4
pCi/g	dpm/cm^2	3.3
pCi/g	dpm/g	2.2
pCi/g	μCi/g	10^{-6}
μ units	units	10^{-6}
units	μ units	10^6

The conversion of alpha instrument readings in cpm into quantifiable units is affected by the type of surface and meter efficiency. For accurate conversions, a surface sample from the area measured should be analyzed with laboratory equipment and the conversion factor for that area computed. The table below provides approximate factors for conversion of alpha readings in cpm into μg/m^2 for various surfaces using the following equation:

$\mu g/m^2$ - correction factor x cpm

Type of Surface	**Correction Factor**
Soil	.006
Concrete	.005
Plywood	.004
Stainless Steel	.0025

The correction factors consider unit and area conversions, nominal instrument efficiency during field use, and assume a 60-sq-cm probe area (AN/PDR-60 or PAC-1S). Correction factors should be multiplied by 4 for use with the AN/PDR-56. Tables C9.T2. and C9.T3. were prepared from the preceding conversion table and equation for users of the AN/PDR-56 and AN/PDR-60, respectively.

Table C9.T2. **Conversion Table (CPM to mg/m² or mCi/m²)**
AN/PDR-56 Alpha Meter

CPM	SOIL		CONCRETE		PLYWOOD		STAINLESS STEEL	
AN/PDR-56	mg/m² Pu-239	mCi/m² Pu-239	mg/m² Pu-239	mCi/m² Pu-239	mg/m² Pu-239	mCi/m² Pu-239	mg/m² Pu-239	mCi/m² Pu-239
50	1.2	.09	1.0	.075	.8	.06	.5	.038
100	2.4	.18	2.0	.15	1.6	.12	1.0	.075
200	4.8	.36	4.0	.30	3.2	.24	2.0	.15
400	9.6	.72	8.0	.60	6.4	.48	4.0	.30
600	14.4	1.08	12.0	.90	9.6	.72	6.0	.45
800	19.2	1.44	16.0	1.20	12.8	.96	8.0	.60
1,000	24.0	1.80	20.0	1.50	16.0	1.20	10.0	.75
1,200	28.8	2.16	24.0	1.80	19.2	1.44	12.0	.90
1,500	36.0	2.70	30.0	2.25	24.0	1.80	15.0	1.13
2,000	43.2	3.24	36.0	2.70	28.8	2.16	18.0	1.35
2,200	52.8	3.96	44.0	3.30	35.2	2.64	22.0	1.65
2,500	60.0	4.50	50.0	3.75	40.0	3.00	25.0	1.88
2,800	67.2	5.04	56.0	4.20	44.8	3.36	28.0	2.10
3,000	72.0	5.40	60.0	4.50	48.0	3.60	30.0	2.25
4,000	96.0	7.20	80.0	6.00	64.0	4.80	40.0	3.00
5,000	120.0	9.00	100.0	7.50	80.0	6.00	50.0	3.75
8,000	192.0	14.40	160.0	12.00	128.0	9.60	80.00	6.00
10,000	240.0	18.00	200.0	15.00	160.0	12.00	100.0	7.50
11,000	264.0	19.80	220.0	16.50	176.0	13.20	110.0	8.25
12,000	288.0	21.60	240.0	18.00	192.0	14.40	120.0	9.00
25,000	600.0	45.00	500.0	37.50	400.0	30.00	250.0	18.75
50,000	1,200.0	90.00	1,000.0	75.00	800.0	60.00	500.0	37.50
75,000	1,800.0	135.00	1,500.0	112.50	1,200.0	90.00	750.0	56.25
100,000	2,400.0	180.00	2,000.0	150.00	1,600.0	120.00	1,000.0	75.00
150,000	3,600.0	270.00	3,000.0	225.00	2,400.0	180.00	1,500.0	112.50
200,000	4,800.0	360.00	4,000.0	300.00	3,200.0	240.00	2,000.0	150.00
300,000	7,200.0	540.00	6,000.0	450.00	4,800.0	360.00	3,000.0	225.00

NOTE: To convert $\mu Ci/m^2$ to Becquerels/m^2 (Bq/m^2), multiply by 3.7×10^4.

Table C9.T3. **Conversion Table (CPM to mg/m² or mCi/m²) AN/PDR-60**

CPM	SOIL		CONCRETE		PLYWOOD		STAINLESS STEEL	
AN/PDR-60	**mg/m² Pu-239**	**mCi/m² Pu-239**	**mg/m² Pu-239**	**mCi/m² Pu-239**	**mg/m² Pu-239**	**mCi/m² Pu-239**	**mg/m² Pu-239**	**mCi/m² Pu-239**
50	0.3	.023	.25	.019	.2	.015	.125	.009
100	0.6	.045	.50	.38	.4	.03	.25	.019
200	1.2	.09	1.0	.075	.8	.06	.5	.038
400	2.4	.18	2.0	.15	1.6	.12	1.0	.075
600	3.6	.27	3.0	.23	2.4	.18	1.5	.113
800	4.8	.36	4.0	.30	3.2	.24	2.0	.15
1,000	6.0	.45	5.0	.38	4.0	.30	2.5	.19
1,200	7.2	.54	6.0	.45	4.8	.36	3.0	.23
1,500	9.0	.68	7.5	.56	6.0	.45	3.8	.28
1,800	10.8	.81	9.0	.68	7.2	.54	4.5	.34
2,200	13.2	.99	11.0	.83	8.8	.66	5.5	.41
2,500	15.0	1.13	12.5	.94	10.0	.75	6.3	.47
2,800	16.8	1.26	14.0	1.05	11.2	.84	7.0	.53
3,000	18.0	1.35	15.0	1.13	12.0	.90	7.5	.56
4,000	24.0	1.80	20.0	1.50	16.0	1.20	10.0	.75
5,000	30.0	2.25	25.0	1.88	20.0	1.50	12.5	.94
8,000	48.0	3.60	40.0	3.00	32.0	2.40	20.0	1.50
10,000	60.0	4.50	50.0	3.75	40.0	3.00	25.0	1.88
11,000	66.0	4.95	55.0	4.13	44.0	3.30	27.5	2.06
12,000	72.0	5.40	60.0	4.50	48.0	3.60	30.0	2.25
25,000	150.0	11.25	125.0	9.38	100.0	7.50	62.5	4.69
50,000	300.0	22.50	250.0	18.75	200.0	15.00	125.0	9.38
75,000	450.0	33.75	375.0	28.13	300.0	22.50	187.5	14.06
100,000	600.0	45.00	500.0	37.50	400.0	30.00	250.0	18.75
150,000	900.0	67.50	750.0	56.25	600.0	45.00	375.0	28.13
200,000	1,200.0	90.00	1,000.0	75.00	800.0	60.00	500.0	37.50
300,000	1,800.0	135.00	1,500.0	112.50	1,200.0	90.00	750.0	56.25

NOTE: To convert $\mu Ci/m^2$ to Becquerels/m^2 (Bq/m^2), multiply by 3.7×10^4.

Table C9.T4. **Conversion Table (MBq to mCi and mCi)**

MBq	mCi	MBq	mCi
7,000	189.	30	810
6,000	162.	20	540
5,000	135.	10	270
4,000	108.	9	240
3,000	81.	8	220
2,000	54.	7	189
1,000	27.	6	162
900	24.	5	135
800	21.6	4	108
700	18.9	3	81
600	16.2	2	54
500	13.5	1	27
400	10.8	0.9	24
300	8.1	0.8	21.6
200	5.4	0.7	18.9
100	2.7	0.6	16.2
90	2.4	0.5	13.5
80	2.16	0.4	10.8
70	1.89	0.3	8.1
60	1.62	0.2	5.4
50	1.35	0.1	2.7
40	1.08		

Table C9.T5. **Conversion to SI Units**

1 Ci = 3.7×10^{10} Bq
1 Bq = 2.7×10^{-11} Ci

1 REM = 10^{-2} Sv
1 Sv = 100 REM

1 RAD = 10^{-2} Gy
1 Gy = 100 RADs

SI Units:
Becquerels (Bq)
Sieverts (Sv)
Gray (Gy)

C10. CHAPTER 10

MEDICAL

C10.1. GENERAL

C10.1.1. Radioactive contamination may be a result of a nuclear weapon accident. In instances when radioactive contamination is not dispersed (for example, the September 1980 TITAN II explosion at Damascus, AR), the medical requirements are greatly simplified. Specifically, emergency lifesaving procedures in any major disaster are applicable to a nuclear weapon accident. Even without the presence of radioactive contamination, other weapon specific non-radioactive toxic hazards may exist; however, lifesaving procedures should not be delayed or omitted due to radiation contamination. The presence of radioactive contamination should not by itself delay emergency medical response although other weapon-specific non-radioactive hazards should be considered prior to emergency care being rendered.

C10.1.2. If radioactive contaminants are dispersed, difficult problems result, and medical personnel must now treat people who may be contaminated. Treatment of contaminated patients requires special techniques and training. In some instances, these special techniques can be applied by the accident response force medical personnel. On other occasions, sophisticated treatment available only at special medical facilities will be required. As with any response function, training must be conducted prior to an accident.

C10.2. PURPOSE AND SCOPE

This chapter provides guidance concerning the medical requirements resulting from a nuclear weapon accident. In addition to recommended procedures, available resources, their location, and how to obtain them are discussed also.

C10.3. SPECIFIC REQUIREMENTS

Medical personnel will assist in accident-related emergency medical treatment and in establishing health and safety programs to support response operations over an extended period of time. To accomplish this, medical personnel will be required to:

C10.3.1. Promptly treat accident casualties and injuries or illnesses.

C10.3.2. Assess and report the magnitude of the accident; for example, numbers and categories of injuries, suspected contamination, and priority for transport to a medical facility.

C10.3.3. Advise medical facilities receiving casualties, in coordination with radiological personnel, of possible contamination, and measures that can be taken to prevent its spread.

C10.3.4. Implement the collection of bioassay samples from personnel that were in the area as well as response personnel and ensure that bioassay and external exposure data becomes part of the health records.

C10.3.5. Establish a heat/cold exposure prevention program and other environmental prevention measure programs.

C10.3.6. Assist in casualty DECON and supervise the DECON of personnel when initial external DECON efforts fail to achieve desired results.

C10.3.7. Manage remediation of internal contamination.

C10.3.8. Assist in obtaining radiation health history of all personnel involved in accident response, including civilians in the surrounding community exposed to radiation or contamination as a result of the accident.

C10.4. RESOURCES

Medical support assistance, specialized in radiological health matters, is available from DoD and DOE through the DoD JNACC. Although numerous resources are available, all may not be required for response to a given accident. Resources discussed in the following paragraphs should be studied and reviewed in advance. When an accident occurs, assets should be requested when needed.

C10.4.1. Armed Forces Radiobiology Research Institute (AFRRI). The AFRRI maintains a Medical Radiobiology Advisory Team (MRAT) to provide state-of-the-art medical radiobiology advice supporting a nuclear accident response. This team consists of physicians and scientists working in radiobiology research. Their mission is to provide the medical groups responding to radiobiological emergencies with the most current medical guidance regarding the treatment of radiation casualties. This advice is derived from validated, military relevant radiobiology research and is within

reasonably accepted standards of care. Subject areas of expertise include, for example, hematology, biological response modifiers, infectious disease, dosimetry, and behavioral analyses. If needed, liaison with other medical centers and laboratories specializing in radiobiology can be facilitated. Through means of telephone communications (available 24 hours a day), the MRAT provides radiobiology advice to medical staffs and CRTFs within a response time of 4 hours. In addition, within 24 hours, the team is prepared to deploy and provide advice at an accident site or medical treatment facility. Upon request of the CRTF, or responsible medical officials, the physician members of the MRAT supplement the designated primary medical treatment teams in the treatment of radiation injuries. Additional information about the MRAT can be obtained by contacting the Director, Armed Forces Radiobiology Research Institute, Bethesda, MD 20814-5145. The MRAT is deployed with the DNAT.

C10.4.2. U.S. Army Radiological Advisory Medical Team. Special DoD response teams are located at Walter Reed Army Medical Center (WRAMC), Washington, DC, and the Center for Health Promotion and Preventive medicine located in Landstuhl, FRG. The teams are specially trained to assist and furnish guidance to the CRTF or other responsible officials at an accident site and to local medical authorities concerning radiological health hazards and radiological exposure criteria.

C10.4.2.1. The RAMT provides the following functions:

C10.4.2.1.1. Providing guidance relative to the potential health hazards to personnel from radiological contamination or exposure to ionizing radiation, DECON procedures, medical treatment, medical surveillance, and radiation exposure control.

C10.4.2.1.2. Evaluating survey data to provide technical medical guidance to the responsible officials utilizing radiologically contaminated areas.

C10.4.2.1.3. Monitoring potentially contaminated medical facilities, equipment, casualties, and advise on the proper techniques for radiological contamination control.

C10.4.2.1.4. Advising the commander regarding the potential health hazards from exposure to sources of ionizing radiation and the DECON of personnel, medical treatment facilities, and medical equipment.

C10.4.2.1.5. Advising on early, and followup, laboratory and clinical procedures.

C10.4.2.1.6. Assisting the CRTF with the bioassay program.

C10.4.2.2. Each RAMT is comprised of as a minimum, a team leader, who is a nuclear medical science officer with training in radiological monitoring and radiation dose estimation, and a medical officer with appropriate training and experience with the treatment of patients contaminated with radioactive materials. Also, as a minimum, two qualified health physics technicians are on the team with experience and training in radiation detection and measurement techniques. All team members have a minimum security clearance of SECRET and attend required training. The RAMT can be augmented for extended operations.

C10.4.2.3. Additional information can be obtained from the Commander, WRAMC, MCHL-HP/RAMT, Washington, DC, 20307-5001. The RAMT will normally be alerted by the U.S. Army Operations Center (AOC) and may be alerted by the Joint Nuclear Accident Coordinating Center (JNACC) or National Military Command Center (NMCC). The U.S. RAMT will deploy CONUS on request of the AOC, U.S. Army Material Command (AMC) Operations Center, U.S. Army Medical Command (MEDCOM), or the depot commander. The U.S. RAMT will deploy OCONUS on direction of the AOC or MEDCOM. The Europe RAMT will deploy within theater on requests from the JNACC, AOC, Europe Nuclear Accident Coordinating Center, or OSC. Either RAMT will deploy outside their theater on direction of the AOC.

C10.4.3. Department of Energy. Major DOE installations have medical, health physics, and monitoring support capabilities that may be able to assist. Additionally, DOE facilities that handle radiological material routinely are equipped to administer medical treatment for radiological casualties. The REAC/TS, Oak Ridge, TN, is prepared to deal with all types of radiation exposure and can provide expert advice and assistance. REAC/TS personnel will normally deploy to the accident site with an initial stock of medications capable of lessening the effects of internalized radioactive particles as a part of the DOE ARG. Until REAC/TS personnel arrive, advice on the treatment of contaminated patients may be obtained through the REAC/TS Center. Additional REAC/TS assistance can be requested through either the DOE Team Leader, or JNACC.

C10.5. CONCEPT OF OPERATIONS

Medical problems resulting from a nuclear weapon accident vary in complexity depending primarily on the presence, or absence, of radioactive contamination. Other factors such as a delayed initial response time (that is, a remote accident) or nonavailability of medical personnel can add to the difficulty of proper medical response. This concept of operations is directed toward the medical response function, and is applicable to both the IRF and RTF.

C10.5.1. Pre-Accident Preparation. Before an accident occurs, the response forces (IRF or RTF) medical officer is identified, supporting medical personnel assigned and equipment identified. Generally, the IRF is equipped and manned to provide emergency medical treatment, while the RTF should be equipped and manned to support a long-term response effort. The proximity of existing medical treatment facilities to the accident site is a factor in determining the size and capabilities of the medical support element actually deployed. All medical personnel at the accident site shall be trained on the hazards and procedures for treatment of radiation accident victims. In addition to radioactive materials, several other weapon-specific substances may be present that are toxic hazards to personnel. Of primary concern are beryllium (Be), lithium (Li), lead (Pb) and smoke or fumes from various plastics. A discussion of the general characteristics, hazards, and health considerations associated with these substances is presented in Appendix C10.AP1.

C10.5.2. Emergency Rescue and Treatment. A high priority at any accident is the rescue and treatment of casualties. The probability of response force involvement in the initial rescue and treatment procedures depends on response time. The longer it takes to get to the accident, the greater the probability that casualties will have been treated and removed by civilian authorities. If possible, EOD personnel and/or radiation monitors should mark a clear path, or accompany emergency medical personnel into the accident site to assist in avoiding radioactive, explosive, and toxic hazards. However, weapon render safe operations may preclude EOD personnel from accompanying medical personnel into the accident site. Protective clothing, appropriate for the medical risk to the patient and radiological risk to the provider, shall be worn by emergency medical personnel. Respiratory protective devices shall be worn based on the nonradiological hazards (smoke or fumes) or as required by the guidelines in Chapter 4 when entering the accident area. Respiratory protection should not be required when treating patients outside the contaminated area, but care should be exercised in removing and handling patient's clothing. Suggested casualty handling procedures for emergency response to a nuclear weapon accident follow.

C10.5.2.1. Assess and assure an open airway, breathing, and circulation of

the victims. Administer cardiopulmonary resuscitation (CPR), if necessary, using a bag-mask, positive pressure ventilator, or, mouth-to-mouth resuscitation.

C10.5.2.2. Move victims, if possible, away from the contaminated area. Take routine precautions. Do not delay customary lifesaving procedures (drugs, Military Anti-Shock (MAS) trousers) because of radiological contamination.

C10.5.2.3. Administer intravenous (IV) fluids.

C10.5.2.4. Control hemorrhage and stabilize fractures.

C10.5.2.5. If a victim is unconscious, consider medical or toxic causes, since radiation exposure does not cause unconsciousness or immediate visible signs of injury.

C10.5.2.6. Triage or sort the casualties by priority of life or limb threatening injury. Categories for emergent or immediate evacuation, delayed and dead should be utilized by the on-site medical team.

C10.5.2.7. After the immediate medical needs are met, coordinate with available RADCON personnel to monitor the victims for possible contamination before transporting to the hospital. Note and record the location and extent (in cpm) of the contamination, and the instrument used, on a field medical card, then place this card in a plastic bag and attach to the patient's protective mask or in another fashion that will prevent loss. Also, ensure that open wounds are covered with a field dressing to keep out contamination if the wound is uncontaminated or to contain the contamination if the wound is contaminated. Removal of contaminated clothing is advisable provided the medical authority decides that their removal is not contraindicated. Finally, wrap the patient in a clean sheet to contain any loose contamination during evacuation. Casualty decontamination, particularly wound decontamination, of seriously injured patients is best performed in a medical treatment facility.

C10.5.2.8. Determine if corrosive materials were present at the accident scene, since these materials can cause chemical burns. Take all possible precautions to prevent introduction of contaminated materials into the mouth.

C10.5.2.9. No medical personnel or equipment should leave the contaminated area without monitoring for contamination; however, transporting the seriously injured victim should not be delayed for monitoring or DECON.

C10.5.2.10. Attendant medical personnel will then process the patients

through the CCL. AS LONG AS THE PATIENT REMAINS WRAPPED IN THE SHEET, HE/SHE DOES NOT POSE A THREAT OF SPREADING CONTAMINATION AND COMPROMISING THE CONTAMINATION CONTROL LINE. Hence, these patients should be evacuated without DECON. The patient will then be transferred to the "clean" side of the hot line and placed in the charge of "clean" medical personnel residing on the uncontaminated side of the CCL. The patient can then be loaded into the ambulance or evacuation vehicle and be transported to the receiving medical facility.

C10.5.2.11. To ensure that the receiving facility is prepared for the arrival of the victims, notify the facility of the following:

NOTE: Procedures listed in above paragraphs C10.5.2.11.3., C10.5.2.11.4., and C10.5.2.11.5. may be determined en route to the medical facility if radiation detection instruments are available, but not at the expense of medical care. Use of a single medical facility for contaminated casualties should be considered if a facility has sufficient capacity.

C10.5.2.11.1. Number of victims.

C10.5.2.11.2. Area of injuries, vital signs (if known), and triage category.

C10.5.2.11.3. Extent of contamination, if known.

C10.5.2.11.4. Areas of greatest contamination.

C10.5.2.11.5. Any evidence of internal contamination.

C10.5.2.11.6. The radionuclide and the chemical form, if known, and by what instrument it was measured.

C10.5.2.11.7. Any exposure to nonradiological toxic materials.

C10.5.2.12. Upon arrival at the hospital, take patients immediately to the area designated for the receipt of contaminated patients. If no such area exists then take the patients to the emergency room. Prior to entry of the patient into the hospital, attendant medical personnel will ensure that the hospital has instituted the proper precautions. These precautions include, but are not limited to:

C10.5.2.12.1. The room used has an isolated air supply.

C10.5.2.12.2. Covering the area with plastic sheeting or absorbent-lined plastic diapers (chucks) to contain loose contamination.

C10.5.2.12.3. Ensuring that personnel have the appropriate radiation detection instrumentation, i.e., alpha scintillation detectors, and they are versed in the use of this equipment.

C10.5.2.12.4. That personnel are wearing proper protective clothing. For this type of accident scenario, surgical gowns, gloves, shoe covers, and masks, should be appropriate for protection against alpha contamination.

C10.5.2.13. The DECON of the patients may then begin. These measures include:

C10.5.2.13.1. Carefully opening the sheet or plastic wrapping surrounding the patient avoiding spreading any contamination.

C10.5.2.13.2. Removing clothing by cutting away the sleeves and trouser legs and folding the contamination in on itself. This method parallels the standard methods of removing patient clothing in a nuclear, biological, or chemical (NBC) environment. These articles of clothing will then be bagged to contain the contamination. The removal of contaminated clothing may remove up to 90 percent of the contamination if the clothing is dry.

C10.5.2.13.3. Remaining contamination can be located with the use of monitoring equipment and then removed by washing with soap and water. Suspect areas include the hair, face and neck, and hands, as well as other exposed areas of the body due to injuries or torn clothing.

C10.5.2.13.4. The ambulance or evacuation vehicle will not be returned to normal service until it is monitored and decontaminated and such efforts have been confirmed by attending radiological monitors.

C10.5.3. Liaison with Civil Authorities. Emergency evacuation of contaminated casualties may have occurred prior to the arrival of response force personnel at an off-base accident. Additionally, some may have arrived from the contaminated area before appropriate controls were implemented; if so, follow-on responders must liaise with area medical facilities to ensure that proper procedures are taken to prevent the spread of contamination. It must be determined if local medical facilities have the ability to monitor and decontaminate their facilities or if assistance is required. The

following procedures may be used by medical facilities not prepared for radiological emergencies and to reduce the spread of contamination.

C10.5.3.1. Use rooms with an isolated air supply.

C10.5.3.2. Use scrub clothes, shoe covers, and rubber gloves, and bag them and any other clothing, sheets or materials that may have come in contact with the patient when leaving the room.

C10.5.3.3. Obtain radiation monitoring assistance for detecting plutonium or uranium.

C10.5.3.4. Use plastic sheeting on floors to facilitate decontamination and cleanup.

C10.5.3.5. Use isolation-control procedures.

C10.5.4. Processing of Fatalities. The remains of deceased accident victims should, in general, be treated with the same respect and procedures used in any accident; however, all fatalities must be monitored for contamination, and decontaminated if necessary, prior to release for burial. The determination of whether DECON is to be done before an autopsy should be made by the examining authorities. Any radiological support for autopsies should be arranged on a case-by-case basis. Service procedures for handling casualties are contained in AR 600-10, AFI 36-3002, and BUPERS Manual Article 4210100, references (p), (q), and (r). Civil authorities must be notified of any civilian casualties as quickly as possible, and if required, aid in identification of the deceased prior to DECON. Additional technical guidance concerning the handling of radioactively contaminated fatalities can be found in the National Council on Radiation Protection and Measurements (NCRP) Report, Number 37, and JCS Pub 4-06, references (s) and (t).

C10.5.5. Medical Clearing Facility. A medical clearing facility should be established near the CCS with supplies for medical treatment of response force injuries, and to assist in DECON of skin. Minimum response force medical staffing after the initial emergency response should include a medic, with a physician, and health physicist, on call. Should an injury occur within the RCA and injuries permit, the injured person should be brought to the CCS and clearing facility by personnel and vehicles already in the area. A separate first aid station may be needed to support the base camp.

C10.5.6. Collection of Bioassay Samples. Bioassay programs and techniques are

discussed in Chapter 7. Collection of required biosamples from response force personnel is normally a responsibility of medical personnel. Procedures for collecting and marking samples should be coordinated with the JHEC. The JHEC will also provide guidance on where samples should be sent for analysis. Depending on Service procedures, urine samples may be required of all personnel who enter the RCA, or of those suspected to have internalized radioactive material.

C10.5.7. Hot/Cold Weather Operational Conditions

C10.5.7.1. The reduction in natural cooling of the body caused by wearing full personal protective clothing with hoods and respirators increases the probability of heat injuries. Heat injuries (stroke, exhaustion, or cramps) can occur with the ambient air temperature as low as 70 °F when wearing full protective gear. Preventive measures to reduce heat injuries include acclimatization, proper intake of salt and water, avoidance of predisposing factors to heat illness, monitoring of temperatures, scheduling of adequate rest or cooling periods, and educating the work force on heat injury symptoms and remedial actions. Adequate water intake is the single most important factor in avoidance of heat injuries. Frequent drinks are more effective than the same quantity of water taken all at once. Although ambient temperature may be used, Wet Globe Temperature, or Botsball temperature, is a more effective method of monitoring heat conditions. Table C10.T1. is taken from Department of the Army (DA) Circular 40-82-3, "Prevention of Heat Injury," reference (u), and provides guidelines as a function of Botsball temperature. These guidelines assume fully acclimatized and fit personnel who are normally dressed and working at a heavy rate. The circular recommends subtracting 10 degrees from the measured Botsball temperature when protective clothing is worn, and using the adjusted Botsball temperature to determine preventive actions to be taken.

Table C10.T1. **Heat Injury Prevention Guidelines**

Botsball Temperature	Heat Condition	Water Intake (qts/hr)	Work/Rest Cycle (min)
80 to 83	Green	0.5 to l.0	50/10
83 to 86	Yellow	1.0 to 1.5	45/15
86 to 88	Red	1.5 to 2.0	20/30
Above 88	Black	2.0	20/40

C10.5.7.2. Specialized personnel cooling equipment (for example, cooling vest) should be used to allow additional stay-time for personnel in extreme heat conditions.

C10.5.7.3. The use of cold weather gear, personal protective clothing, and respiratory equipment presents severe demands on personnel. Personnel must be monitored closely to prevent frostbite and other cold weather effects.

C10.5.8. Public Affairs Considerations. All medical staff personnel should be aware of the sensitive nature of issues surrounding a nuclear weapon accident. All public release of information should be approved by the CRTF and coordinated with the JIC/CIB as discussed in Chapter 14. Medical personnel should ensure that public affairs personnel are informed of medical information provided to medical facilities receiving potentially contaminated patients and that queries for nonmedical information are referred to PA personnel.

C10.5.9. Base Camp Medical Support. Base camp support requirements include treatment of on-the job injuries and sickness, inspection of field billeting and messing facilities, evaluation of the adequacy of restroom facilities and sewage disposal, and water supply. Those personnel treated for cuts or open sores should be prohibited from entering the contaminated area until the wound is sufficiently bandaged to exclude possible contamination. Their supervisors should be notified of the restriction.

C10.6. ACCIDENT RESPONSE PLAN ANNEX

The medical annex should describe responsibilities and special procedures used by the medical staff. This annex should include procedures for:

C10.6.1. Differentiating between medical and radiological safety/health physics personnel.

C10.6.2. Receiving and treating contaminated patients.

C10.6.3. Establishing and operating a medical clearing facility at the accident scene, including controlling contaminated patients.

C10.6.4. Identifying and locating facilities for treating internal contamination.

C10.6.5. Evacuating contaminated casualties to major medical facilities.

C10.6.6. Decontaminating and processing the remains of deceased.

C10.6.7. Establishing the relationship of the response force medical staff and specialized medical teams responding to the accident.

C10.7. SPECIALIZED COURSES FOR MEDICAL RESPONSE PERSONNEL

C10.7.1. Radiological Hazards Training Course (RHTC). Several classes are scheduled each year at the Defense Nuclear Weapons School (DNWS), Kirtland AFB, NM. The course provides training in the organization and functions of IRF teams and in techniques in monitoring contaminated areas. This training includes the principles of nuclear devices, related hazards in a nuclear weapon accident or incident, hazards of explosive materials, and IRF operation.

C10.7.2. Medical Effects of Ionizing Radiation. Classes are scheduled each year by the AFRRI at various locations. Topics include biological effects of ionizing radiation, medical operations in a nuclear environment, and medical treatment of nuclear and nuclear-related injuries.
(http://www.afrri.usuhs.mil/www/outreach/meir/meirschd.htm refers.)

C10.7.3. Handling of Radiation Accidents by Emergency Personnel. A 3 1/2-day course scheduled several times each year at the REAC/TS, Oak Ridge, TN. This course emphasizes the practical aspects of handling a contaminated victim. Topics discussed in the course are the fundamentals of radiation, how to detect and measure it, how to prevent the spread of contamination, and other topics related to the care for contaminated accident victims.

C10.7.4. Health Physics in Radiation Accidents. A 4 1/2-day course for health physicists and radiation protection technologists who may be called upon to respond to accidents involving radioactive materials and injury to personnel. The major topics covered are radiological emergency procedures and the role of the health physicist in a medical environment. Classes are scheduled at the REAC/TS, Oak Ridge, TN.

C10.7.5. Medical Planning and Care in Radiation Accidents. This 4 1/2-day course presents an advanced level of information on the diagnosis and treatment of acute local and total body radiation exposure, internal and external contamination, combined injuries, and multi-casualty incidents involving ionizing radiation. Classes are scheduled at the REAC/TS, Oak Ridge, Tn.

C10.AP1. APPENDIX 1 OF CHAPTER 10

NON-RADIOLOGICAL TOXIC HAZARDS

C10.AP1.1. GENERAL

Several weapon-specific non-radiological hazards may be present as a result of a nuclear weapon accident. Some of those hazards are mentioned below. Additional information on them and other non-radiological hazards not mentioned can be obtained through DOE.

C10.AP1.2. PURPOSE

This appendix provides information useful in implementing training programs for medical personnel responding to nuclear weapon accidents.

C10.AP1.3. NON-RADIOLOGICAL TOXIC HAZARDS

C10.AP1.3.1. Beryllium

C10.AP1.3.1.1. Beryllium is a light, gray-white nonradioactive metal, hard and brittle, and resembles magnesium.

C10.AP1.3.1.2. Hazards and Health Considerations. In its solid state (normal state), beryllium is not a personnel hazard. However, in powder, oxide, or gaseous form, it is extremely dangerous. Inhalation is the most significant means of entry into the body. Because it oxidizes easily, any fire or explosion involving beryllium liberates toxic fumes and smoke. When beryllium enters the body through cuts, scratches, or abrasions on the skin, ulceration often occurs. One of the peculiarities of beryllium poisoning is that no specific symptoms are apparent. The most common symptom is an acute or delayed type of pulmonary edema or berylliosis. Other commonly occurring signs and symptoms are ulceration and irritation of the skin, shortness of breath, chronic cough, cyanosis, loss of weight, and extreme nervousness. Another hazard of beryllium is its interference with wound healing. A wound contaminated with traces of beryllium will not heal until the metal is removed. Beryllium or its compounds, when in finely divided form, should never be handled with the bare hands but always with rubber gloves. An M17, or equivalent protective mask/respirator, and personal protective clothing must be worn in an area known, or suspected, to be contaminated with beryllium dust. SCBA is necessary

when beryllium fumes or smoke are present. DECON of personnel, terrain, or facilities will be similar to radiological DECON. An effective method, when applicable, is vacuum cleaning, using a cleaner with a high efficiency particle air (HEPA) filter. Since beryllium is not radioactive, its detection requires chemical analysis in a properly equipped laboratory. Direct detection in the field is impossible.

C10.AP1.3.2. Lithium

C10.AP1.3.2.1. Lithium and its compounds, normally lithium hydride, may be present at a nuclear weapon accident. Due to its highly reactive nature, naturally occurring lithium is always found chemically with other elements. Upon exposure to water, a violent chemical reaction occurs, producing heat, hydrogen, oxygen, and lithium hydroxide. The heat causes the hydrogen to burn explosively, producing a great deal of damage.

C10.AP1.3.2.2. Hazards and Health Considerations. Lithium can react directly with the water contained in the body tissue causing severe chemical burns. Also, lithium hydroxide is a caustic agent that affects the body, especially the eyes, in the same manner as lye (sodium or potassium hydroxide). Respiratory protection and firefighter clothing are required to protect personnel exposed to fires involving lithium or lithium hydrides. An SCBA is necessary if fumes from burning lithium components are present. Protection for the eyes and skin is necessary for operations involving these materials.

C10.AP1.3.3. Lead. Pure lead and most of its compounds are toxic. Lead enters the body through inhalation, ingestion, or skin absorption. Inhalation of lead compounds presents a very serious hazard. Skin absorption is usually negligible, since the readily absorbed compounds are seldom encountered in sufficient concentration to cause damage. Upon entry into the body, lead will concentrate in the kidneys and bones. From the bone deposits, lead will be liberated slowly into the bloodstream causing anemia and resulting in a chronic toxic condition. Lead poisoning displays several specific characteristics and symptoms. The skin of an exposed individual will turn yellowish and dry. Digestion is impaired with severe colicky pains, and constipation results. With a high body burden, the exposed individual will have a sweet, metallic taste in his mouth and a dark blue coloring of the gums resulting from a deposition of black lead sulfide. Lead concentrations within the body have been reduced successfully by using chelating agents. An M17 or equivalent protective mask will protect personnel against inhalation of lead compounds.

C10.AP1.3.4. Plastics. When involved in a fire, all plastics present varying

degrees of toxic hazards due to the gases, fumes, and/or minute particles produced. The gaseous or particulate products may produce dizziness and prostration initially, mild and severe dermatitis, severe illness, or death if inhaled, ingested, placed in contact with the skin, or absorbed through the skin. Any fire involving plastics that are not known to be harmless should be approached on the assumption that toxic fumes and particles are present. This includes all nuclear weapon fires.

C10.AP1.3.5. High Explosives. Information on pressed, cast, and insensitive HE will be extracted from EOD Procedures Publication 60-1, reference (v), after a DOE classification review.

C10.AP1.3.6. Hydrazine. Hydrazine is used as a missile fuel or as a fuel in some aircraft emergency power units. Hydrazine is a colorless, oily fuming liquid with a slightly ammonia odor. It is a powerful explosive that when heated to decomposition emits highly toxic nitrogen compounds and may explode by heat or chemical reaction. Self-igniting when absorbed on earth, wood, or cloth, the fuel burns when a spark produces combustion; any contact with an oxidized substance such as rust can also cause combustion. When hydrazine is mixed with equal parts of water, it will not burn; however it is toxic when inhaled, absorbed through the skin, or taken internally. Causing skin sensitization as well as systemic poisoning, hydrazine may cause damage to the liver or destruction of red blood cells. The permissible exposure level is 0.1 parts per million and a lower concentration causes nasal irritation. After exposure to hydrazine vapors or liquids, remove clothing immediately and spray exposed area with water for 15 minutes. SCBA is required in vapor/liquid concentrations.

C10.AP1.3.7. Red Fuming Nitric Acid. Red nitric acid is an oxidizer for some missile propellant systems. It is a reddish brown, highly toxic corrosive liquid with a sharp, irritating, pungent odor. Dangerous when heated to decomposition, it emits highly toxic fumes of NOx and will react with water or steam to produce heat and toxic corrosive and flammable vapors. The permissible exposure level is two parts per million, although a lower concentration causes nasal irritation, severe irritation to the skin, eyes, and mucous membranes. Immediately after exposure, wash acid from skin with copious amounts of water. SCBA is required in vapor/liquid concentrations.

C10.AP1.3.8. Solid Fuel Rocket Motors. Rocket motors (composed of dymeryl diisocyanate (DDI), cured hydroxyl terminated polybutadine (HTPB) polymer, ammonium perchlorate, and aluminum powder or other cyanate, butadiene, perchlorate or nitrate-based compounds) present severe explosive hazards upon accidental ignition. If rocket motors ignite or catch fire, evacuate to a safe distance.

C10.AP1.3.9. Composite Fibers (CFs). CFs are carbon, boron, and graphite fibers that are milled into composite epoxy packages that are integral aircraft structural members. Upon fire or breakage of the epoxy outer layer, CF strands can be emitted into the environment and become a respiratory tract, eye, and skin irritation hazard. In the immediate accident area or location where a composite package has broken open, the fibers can cause severe arcing and shorting of electrical equipment.

C10.AP1.3.10. JP-10. JP-10 is used as a missile fuel. It is a clear liquid and has a kerosene-like odor. Recommended special firefighting procedures are to use a water spray to cool fire-exposed surfaces and to protect personnel. Wear self-contained breathing apparatus when firefighting in confined spaces. JP-10 is an aspiration hazard. It is slightly toxic by inhalation. Do not allow liquid or mist to enter lungs. Vapor contact causes very little to no eye irritation. High heat, sparks, open flame, or strong oxidizers may ignite JP-10 fuel.

C10.AP1.3.11. TH Dimer. Similar to JP-10, TH Dimer is also a missile fuel with the same color and odor characteristics. The hazards and firefighting precautions are also similar. TH Dimer can cause gastrointestinal irritation (vomiting and diarrhea) and nausea. For prolonged and/or repeated skin contact, appropriate impervious clothing is required (gloves, boots, pants, coat, face protection, etc.).

C10.AP1.3.12. Composite Materials. Composite materials are solids that are composed of two or more substances having different physical characteristics. Such materials could be at the site of a nuclear weapon accident and pose additional health and safety hazards if involved in a fire or explosion. Composite materials are broken down into three categories:

C10.AP1.3.12.1. Composite. A physical combination of two or more materials, i.e., fiberglass (glass fiber and epoxy).

C10.AP1.3.12.2. Advance Composite. A material composed of high strength/high stiffness fibers (reinforcement) with a resin (matrix). Examples include Graphite/Epoxy, Kevlar/Epoxy, and Spectra/Cyanate Ester.

C10.AP1.3.12.3. Advance Aerospace Material. A highly specialized material used to fulfill unique aerospace construction/environment/performance requirements. Examples include Beryllium, Depleted Uranium, and Radar Absorbent Materials (RAMs).

C11. CHAPTER 11

SECURITY

C11.1. GENERAL

The presence of nuclear weapons or components at an accident site requires implementation of an effective security program as soon as possible. When an accident occurs at a military installation, security assistance may need to be obtained from civil authorities/officials until sufficient military forces arrive. Additionally, off-installation accidents could require the establishment of an NDA to permit control of civilian land by military forces. Even after establishment of the NDA, close coordination with civil law enforcement agencies is essential to an effective security program. The equivalent DOE area for an incident/accident involving DOE equipment/materials is an NSA. Overseas, there is no equivalent to the NDA. The OSC will establish a disaster cordon or Security Area, to restrict entry and to provide for public safety.

C11.2. PURPOSE AND SCOPE

This chapter provides guidance for planning and conducting security operations at the scene of a nuclear weapon accident and discusses security requirements, many unique to a nuclear weapon accident. Also, the chapter outlines a concept of operations to satisfy these requirements.

C11.3. SPECIFIC REQUIREMENTS.

The security program at the accident scene should meet the following requirements:

C11.3.1. Provide effective control of the accident area.

C11.3.2. Protect nuclear weapons and components.

C11.3.3. Protect classified materials and information.

C11.3.4. Protect Government property.

C11.3.5. Provide effective coordination with civil law enforcement agencies/Host Nation law agencies.

C11.3.6. Provide unencumbered entry of medical and health physics personnel into the area when required.

C11.3.7. Provide necessary operational security (OPSEC).

C11.3.8. Counter potential terrorist and/or radical group activities or intelligence collection efforts.

C11.4. RESOURCES

C11.4.1. Initial Response Force. The IRF will have a security element for perimeter security, entry and exit control, and protection of classified information and property. Since sufficient personnel will not likely be included in the IRF security elements responding to a nuclear weapon accident, augmentation may be required. Security forces can expect to encounter large numbers of people attracted to the accident scene, and care should be exercised to ensure that only experienced security personnel are in supervisory positions. Installations with a nuclear weapon capability should maintain equipment to control an accident site. This requirement should include rope and stanchions for barricading the accident site, NDA and entry control point signs, and portable lights. The IRF should provide security personnel with anti-contamination clothing and protective masks in the event that security requires their presence within the RCA. Riot control gear should be available if crowd control is required. Normally, security personnel possess equipment such as weapons and ammunition, cold weather gear, protective masks, hand-held radios, canteens, and helmets.

C11.4.2. Response Task Force. The RTF security officer should assess manpower requirements and ensure that sufficient additional security personnel are included in the RTF. IRF security personnel may become part of the RTF security element. The security officer should be prepared to meet all security requirements on a 24-hour basis without degrading the alertness and capability of his or her personnel to respond.

C11.4.3. Civilian Response. Civilian law enforcement response depends on the location of the accident site. If the accident occurs off a military installation near a populated area, local police, fire, and rescue units will be notified and may be on scene when the IRF arrives. Civilian law enforcement personnel may augment military security personnel, if requested.

C11.5. CONCEPT OF OPERATIONS

C11.5.1. Accident Assessment. Upon arrival at the accident site, the security officer must assess the situation. This assessment includes an evaluation of ongoing emergency response operations and actions of local law enforcement agencies, and provides the foundation for the security program. While the assessment is made, security should be established at the accident site in cooperation with civil authorities. When overseas, the civilian authorities/officials will be requested to establish a Security Area (Disaster Cordon) to ensure public safety and appropriate security. This must be done in close coordination with the DOS COM. Fragmentation hazard distances and the possibility of contamination should be considered when posting initial security personnel around the scene. This initial security is not to be confused with the NDA, which may not yet be established and may be different in size. The Security officers should consider the following elements in their assessment:

C11.5.1.1. Threat (real and potential danger to the secure area).

C11.5.1.2. Location (on or off military installation).

C11.5.1.3. Demographics and accident environment (remote, rural, suburban, and urban).

C11.5.1.4. Terrain characteristics (critical or dominating features).

C11.5.1.5. Contamination (radiation intensity and extent and other HAZMAT).

C11.5.1.6. Accident hazards (HEs, rocket motors, or toxic chemicals).

C11.5.1.7. Local meteorological conditions (include speed and direction of prevailing winds).

C11.5.1.8. Transportation network in accident area (access routes, types, and quantities of vehicles).

C11.5.1.9. Structures in accident area (type and quantity).

C11.5.1.10. Safety of security personnel (fragmentation distances, contamination, and cold/hot weather).

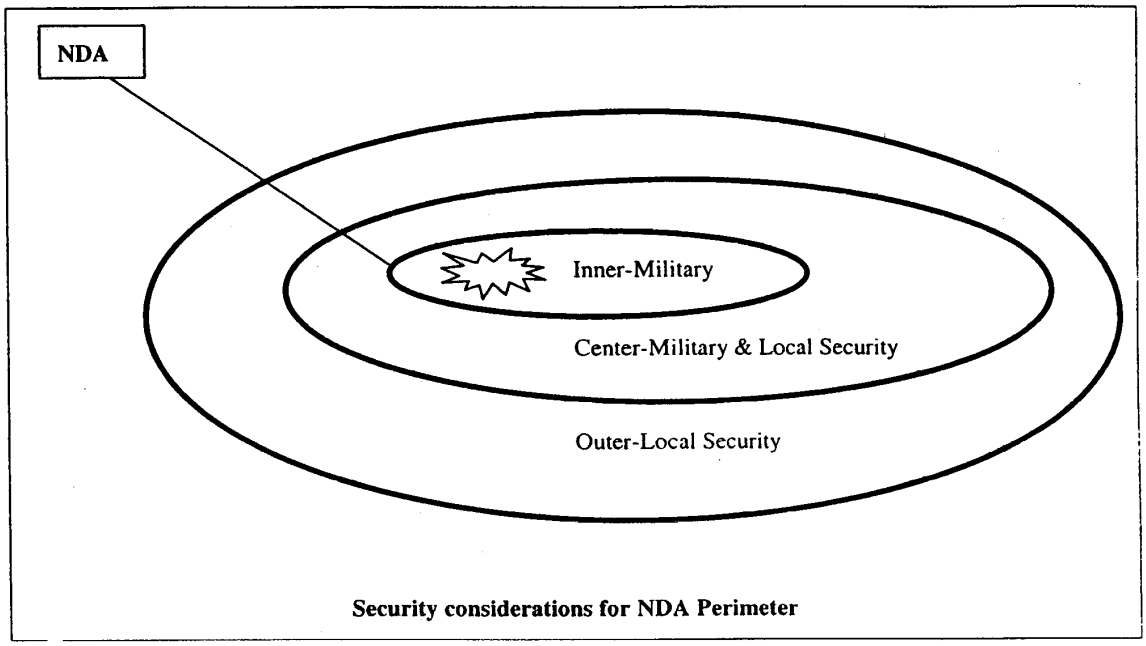
C11.5.2. National Defense Area

C11.5.2.1. An NDA may be required any time an accident involving nuclear weapons or components occurs on non-Federal property. The NDA may or may not encompass the entire RCA. Security of any portion of the RCA existing outside the NDA is a matter of public safety and should be provided by civilian authorities/officials; however, military assistance may be requested. (Note: To complement security for an NDA consider the following concept--Military only, control actual NDA perimeter. Extending out, another perimeter manned by military and civilian law enforcement. Out further, another perimeter manned by civilian law enforcement. This concept allows for two perimeters with law enforcement personnel to contain/control civilian population before gaining access to the actual security area. This concept is depicted in Figure C11.F1.)

C11.5.2.2. DoDD 5200.8, and Section 21 of the Internal Security Act of 1950, references (e) and (w), provide the basis for establishing an NDA only in the United States. This area is established specifically to enhance safeguarding Government property located on non-Federal land. The Senior DoD representatives are authorized to designate an NDA, and then only to safeguard Government resources, irrespective of other factors. The Commander should seek legal advice on any decisions regarding establishment, disestablishment, or modification of the NDA. Not applicable to overseas locations.

C11.5.2.3. The IRF and RTF Commander designating the NDA must ensure its boundaries are clearly defined and marked. Area boundaries are established to minimize interference with other lawful activities on and uses of the property. Initially, the dimensions of the NDA may be quite large, which is necessary until more specific information is available regarding the location of the Government material. The boundary is defined by some form of temporary barrier, for example, rope and wire. Warning signs as described in DoDD 5210.41-M, "Nuclear Weapon Security Manual," reference (x), should be posted at the entry control station and along the boundary and be visible from any direction of approach. In areas where languages other than English are spoken, bilingual signs should be considered.

Figure C11.F1. Security Concept



C11.5.2.4. Once the NDA has been established, the Commander must determine whether overflight restrictions are necessary to ensure the security and safety of the area. If so, a request should be made to the Air Traffic Control Center responsible for the geographic area in which the NDA is located. The physical dimensions of the restricted area must be reasonable while affording the security and safety the Commander seeks. The restrictions should be relaxed as conditions permit and eliminated as soon as practical.

C11.5.2.5. The Commander who establishes the NDA should advise civil authorities/officials of the authority and need for the NDA and the security controls in effect. If possible, the Commander should secure the landowners' consent and cooperation; however, obtaining such consent is not a prerequisite for establishing the NDA.

C11.5.2.6. In maintaining security of the NDA, military personnel should use the minimum degree of control and force necessary. Sentries should be briefed thoroughly and given specific instructions for dealing with civilians. All personnel should be aware of the sensitive nature of issues surrounding an accident. Moreover, controls should be implemented to ensure that public affairs policy is strictly adhered to, and that requests for interviews and queries concerning the accident are referred to public affairs personnel. Civilians should be treated courteously, and in a helpful, but

watchful manner. No one should be allowed to remove anything, nor touch any suspicious objects. Special provisions should be made to provide unencumbered access by medical and health physics personnel treating casualties, including deceased, within the security area.

C11.5.2.7. Local civil authorities/officials should be asked to assist military personnel in preventing unauthorized entry and in removing unauthorized personnel who enter the NDA. Apprehension or arrest of civilian personnel who violate any security requirements at the NDA should normally be done by civilian authorities. If local civil authorities are unavailable, or refuse to give assistance, on-scene military personnel should apprehend and detain violators or trespassers. Disposition should be completed quickly following coordination with the legal officer. The SFO should be notified of each apprehension and the actions taken. The security officer must ensure that actions of on-scene military personnel do not constitute a violation of the Posse Comitatus Act that prohibits use of DoD personnel to execute local, State, or Federal laws, unless authorized by the Constitution or an Act of Congress.

C11.5.2.8. When all Government resources have been located, the CRTF should consider reducing the size of the NDA. When all classified Government resources have been removed, the NDA will be disestablished. Early coordination with State and local officials permits an orderly transfer of responsibility to State and local agencies when reducing or disestablishing the NDA.

C11.5.3. Accidents Overseas. In the event of a nuclear incident/accident in a country outside the United States, the U.S. Government respects the sovereignty of the government of that country. Civil authorities there will be asked to establish a Security Area (Disaster Cordon) to restrict access and to provide for public safety. On- and off-site authority at a nuclear weapon accident/incident rests with such Government officials/representatives except that the United States shall maintain custody of the weapon(s) and/or classified components.

C11.5.4. Security Procedures

C11.5.4.1. Sentry posts around the NDA should be in locations that enable guards to maintain good visual contact. This action prevents unauthorized persons from entering the NDA undetected between posts and ensures that none of the guards violate the two-person concept. Lighting should be provided, night vision equipment supplied, or guard spacing adjusted, to ensure that visual contact can be maintained at night. Each guard should have a means of summoning assistance, preferably a radio, or be in contact with someone who does. Consideration should be given in obtaining

portable intrusion detection system sensors. This type of equipment will reduce security personnel requirements and the possibility of radiation exposure to them.

C11.5.4.2. During the initial emergency response, entry and exit of emergency units and other personnel may be largely uncontrolled. The security officer should recognize that during initial response, necessary lifesaving, fire suppression, and other emergency activities may temporarily take priority over security procedures; however, as response operations progress, standard security measures specified in DoDD 5210.41, "Security Policy for Protecting Nuclear Weapons," reference (y), must be enforced. As soon as possible, an entry control point should be established. When personnel from various Federal and/or civilian authorities/agencies arrive at the control point, leaders of the groups should be escorted to the operations center. An identification and badging system should be implemented, entry control logs established, and a record of all personnel entering or exiting the accident area made and retained.

C11.5.4.3. A security operations center or control point should be established as the focal point for security operations and be located close to the entry control point. Its location should be fixed so that personnel become familiar with the location. Representatives of all participating law enforcement agencies should be located at the security operations center and able to communicate with their personnel.

C11.5.4.4. A security alert force should be considered, although early in the accident response, sufficient personnel may be unavailable to form such a force.

C11.5.5. Security Considerations

C11.5.5.1. Some components in nuclear weapons may reveal classified information by their shape, form, or outline. Specified classified components must be protected from sight and overhead photographic surveillance.

C11.5.5.2. Individuals with varying degrees of knowledge and appreciation for security requirements will assist in response operations. A comprehensive and effective information security program is available as outlined in DoDD 5200.1-R, "Information Security Regulations," reference (z), and should be promulgated in coordination with the DOE Team Leader. The content of the information security program should be briefed to everyone in the weapon recovery effort.

C11.5.5.3. CNWDI access verification may have to be waived temporarily during the initial phases of accident response. When the urgency of the initial response is over and order has been established, compliance with DoDD 5210.2,

"Access to a Dissemination of Restricted Data," reference (aa), and Service-specific directives, regulations, and/or instructions should prevail.

C11.5.5.4. The two-person concept is addressed in DoD and Service directives. Security officers establish and enforce procedures to ensure only authorized personnel are granted access to the site areas that require two-person concept compliance.

C11.5.5.5. In the initial emergency response, Personnel Reliability Program (PRP) requirements may have to be waived due to a lack of PRP-certified personnel. When certified personnel are available, they should be used in security positions that require them. Security personnel assigned to directly guard nuclear weapons and components must be PRP certified. PRP personnel should be used on the perimeter, if available.

C11.5.5.6. An area should be available within the security perimeter where EOD and DOE personnel can discuss CNWDI-related to weapon(s) recovery operations. Also, areas will be established for storage of classified documents, recovered weapons, and weapon components. The security officer must ensure that adequate security is provided for these areas.

C11.5.5.7. If a base camp is established to support the response operation, traffic control signs should be posted, law enforcement procedures developed, and a base camp entry control point established. Verification of vehicle trip authorization, restriction of curiosity seekers, access to the camp, and maintaining order and discipline within the camp may be parts of base camp security functions.

C11.5.6. Military Intelligence. Intelligence personnel should be used to the fullest extent and incorporated actively in the overall security posture, including, but not limited to:

C11.5.6.1. Advice and assistance in counterintelligence to the CRTF and security staff.

C11.5.6.2. Liaison and coordination with Federal, State, and local agencies and civilian authorities/officials, on threats to response operations (for example, hostile intelligence collection efforts and terrorist activities).

C11.5.6.3. Coordination and advice to the CRTF and security staff regarding operations security.

C11.5.6.4. Investigating and reporting incidents of immediate security interest to the CRTF and the security staff (in cooperation with the local office of the FBI).

C11.5.6.5. Advise and assist the CRTF and security staff on matters of personnel and information security necessary to maintain high standards of security.

C11.5.6.6. Receiving requests for large-scale photographic coverage of the accident site.

C11.6. ACCIDENT RESPONSE PLAN ANNEX

The security annex should describe the responsibilities and procedures of the security forces. IRF and RTF forces may prepare an annex in advance that could be modified to fit the circumstances. The security annex should include:

C11.6.1. Security operating procedures including perimeter access/entry procedures, establishing and maintaining an NDA or Security Area, information security, Rules of Engagement (ROE), and use of deadly force.

C11.6.2. Descriptions of the interface with Federal, State, and civilian law enforcement officials. Specific points of contact and phone numbers may be contained in a separate appendix to be expanded in the event of an accident.

C11.6.3. Procedures for locating and operating the security operation center.

C11.6.4. Guidance for handling unprotected personnel encountered in contaminated areas.

C11.6.5. Procedures for coordinating with RADCON personnel to ensure that sentry posts outside the RADCON area are not affected by the resuspension of contaminants during wind shifts.

C11.6.6. Procedures for coordinating with medical and health physics personnel engaged in treatment of casualties and corpses within the security area.

C11.6.7. A description of the subversive/unfriendly threat, including an impact assessment on response operations; this and related information may be included in a separate intelligence annex.

C11.6.8. Administrative and logistic requirements, for example, maintenance of entry logs and badges, expected amounts of rope, stanchions, and signs to establish and maintain the NDA, Security Area, such as special communications and clothing requirements.

C12. CHAPTER 12

WEAPON RECOVERY OPERATIONS

C12.1. GENERAL

A mixture of weapons, weapon components, contaminants, and other hazardous debris may be at a nuclear weapon accident site. The number and type of weapons, the extent of damage, and the location of weapons, weapon components, and hazards are of primary concern. If the weapons appear to be intact, and radioactive contaminants have not been dispersed, the complexity of the problem is lessened considerably; however, even intact weapon(s) may pose significant recovery problems with potential explosive and contamination hazards. A continuing assessment of the situation is needed to determine the best method for conducting weapon recovery.

C12.2. PURPOSE AND SCOPE

This chapter provides information about weapon operations following a nuclear weapon accident. Also, requirements and planning are discussed to develop operational plans for recovery of nuclear weapons, weapon components, and other HAZMAT.

C12.3. SPECIFIC REQUIREMENTS

Service responsibilities for weapon recovery operations include all actions through transfer of weapon custody to a designated DOE representative. During weapon recovery operations, personnel:

C12.3.1. Determine the status and location of the weapon(s), including whether HE detonations occurred.

C12.3.2. Assess weapon(s) damage.

C12.3.3. Perform site stabilization, render safe, and continuation procedures on the weapon(s).

C12.3.4. Initiate a systematic search until the location for the weapon(s) and all weapon components is known.

C12.3.5. Establish an area and develop procedures for processing/packaging contaminated weapon(s) and components.

C12.3.6. Perform necessary actions for transport or shipping of the weapon(s) and components for interim storage and/or final disposition.

C12.4. RESOURCES

The CRTF can request many types of support during the accident response operation. The principal resources available to meet weapon recovery responsibilities are EOD Teams and the DOE ARG.

C12.4.1. Explosive Ordnance Disposal. Military EOD personnel are responsible for the actual performance, supervision, and control of hands-on weapon recovery operations. The following guidelines apply to the employment of EOD teams:

C12.4.1.1. The Combatant Commander having primary responsibility for C2 on site at the accident provides, or obtains from the owning service, EOD teams to perform required procedures on the weapon(s).

C12.4.1.2. Any Active Duty Service or Combatant Command EOD teams can provide emergency support until the designated EOD team arrives. Emergency support is limited to initial weapon assessment, emergency RSP, and site stabilization.

C12.4.1.3. USN EOD teams recover weapons located underwater because only USN EOD personnel are trained in these diving techniques.

C12.4.1.4. EOD personnel, officers and enlisted, are graduates of the Naval School, Explosive Ordnance Disposal (NAVSCOLEOD) at Eglin AFB, FL, formally Indian Head, MD. They are trained in access techniques and are the only personnel qualified to perform RSPs. Also, they are trained to identify, detect, contain and/or eliminate explosive, radiological and toxic hazards associated with nuclear weapons. Intensive training is conducted on RSPs.

C12.4.1.5. The EOD team provided, or obtained, by the Service having primary C2 responsibility will safe the weapon(s). If an extremely hazardous situation exists, the initial responding EOD team with the publications and capabilities to safe the weapon should do so.

C12.4.1.6. The organization of EOD teams varies among Services as does the

number and seniority of personnel assigned; however, all teams have the same basic capabilities and are trained in RADCON and monitoring techniques applicable to their operations. They have the necessary communications and personal safety equipment to operate in an accident environment. Moreover, teams have a background in weapon design information enhanced by coordination with DOE scientific advisors on arrival at the accident scene. While tasks assigned to EOD personnel are clearly in the realm of weapon safing and disposal, they must operate within the framework of the overall response group and conduct operations only as directed by the CRTF.

C12.4.1.7. The EOD teams actions, by priority are:

C12.4.1.7.1. Prevention of nuclear detonation.

C12.4.1.7.2. Prevention of a nuclear contribution or an HE detonation.

C12.4.1.7.3. Identification, detection, containment, and elimination of explosives and, if required, radiological hazards resulting from the accident or incident.

C12.4.1.7.4. Protection of personnel against hazards noted in C12.4.1.7.1. through C12.4.1.7.3., above.

C12.4.2. Department of Energy. The DOE ARG includes weapon design personnel and explosive experts familiar with weapons and associated hazards. The ARG provides technical advice and assistance in the collection, identification, decontamination, packaging, and disposition of weapon components, weapon debris, and resulting radioactive materials; and technical advice and assistance to EOD teams in RSP and recovery procedures. Each nuclear weapon has RSPs developed, evaluated, coordinated, and authenticated as binding jointly by DoD and DOE. Since weapons may have been subjected to extreme stress during an accident, consideration may be given to the DOE unique equipment to assess the applicability of these procedures.

C12.4.2.1. DOE radiographic capabilities are available for field diagnostics of damaged weapons in the event of an incident/accident. The Los Alamos National Laboratory (LANL) has fieldable radiographic units with accompanying film, film processing, and viewing equipment. The LLNL has an equivalent radiographic capability that serves as a backup to the LANL unit.

C12.4.2.2. DOE aerial radiological surveys by the AMS assist in locating weapons and weapon components. This capability is addressed in Appendix C4.AP4.

C12.4.2.3. Additional information concerning the ARG, DOE radiographic capabilities, the AMS, and other DOE capabilities may be obtained from the JNACC.

C12.5. CONCEPT OF OPERATIONS

Weapon recovery begins with the initial reconnaissance, proceeds through the conduct of RSPs, and ends with hazard removal and disposal of the weapons and components. These operations are discussed in this concept of operations. The two-person concept must be strictly enforced when working with nuclear weapons. In the early stages of accident response, personnel may find it difficult to follow all of the required security measures; however, the CRTF should implement necessary security procedures as soon as possible.

C12.5.1. Initial Entry. During the initial entry, weapons and the aircraft, vehicle, ship (submarine) or missile wreckage present several hazards. Nuclear weapons and some components contain conventional explosives and other HAZMAT. Nuclear material may have been dispersed on impact, during detonation of explosives, or by combustion in a fire. Weapons may need stabilizing to prevent further damage or explosions. Other explosive items that may be encountered include conventional munitions, aircraft fire extinguisher cartridges, engine starter cartridges, pyrotechnics, and egress or extraction devices. Leaking fluids, liquid oxygen, propellants, oxidizers, shredded or torn metals, and composite materials/fibers present additional hazards. The IRF marks these hazards, as well as marking a clear pathway/entryway. IRF EOD teams determine weapons condition, perform initial site stabilization, and perform emergency render safe procedures as required by the situation.

C12.5.2. Render Safe Procedures. The CRTF is responsible ultimately for the proper implementation of any render safe procedures. The EOD team evaluates and analyzes the accident situation and advises the CRTF of the safest and most reliable means for neutralizing weapon associated hazards. RSPs may begin, if required, as soon as the reconnaissance has been completed. Handling of nuclear weapons in an accident must be done according to written procedures. If the weapon is in a stable environment, no immediate actions should occur until a coordinated weapon recovery procedure has been developed by EOD personnel and DOE ARG representatives. These procedures must be approved by the CRTF after coordination with the DOE Team Leader and the senior member of the EOD Team. Consideration must be given to the following when determining a course of action:

C12.5.2.1. Explosive ordnance and accident debris are inherently dangerous,

but some minimum number of personnel may have to be exposed to hazards to complete the mission.

C12.5.2.2. Consequences should be evaluated before exposing personnel to hazards.

C12.5.2.3. When available, DOE radiographic equipment is used to assess internal damage and aid standard EOD procedures. ARG capabilities and knowledge, combined with EOD team procedures and experience in render safe procedures under hazardous conditions, provide the best method of determining a weapon's condition before it is moved.

C12.5.2.4. Staging, DECON, packaging, and the method, type, and final disposition of shipment should be an integral part of the RSP planning phase.

C12.5.2.5. The high priority given to weapon recovery operations does not inherently imply a need for rapid action. Personnel and public safety must never be sacrificed solely for speed.

C12.5.3. Nuclear Weapon Security. The two-person concept must be enforced strictly when working with nuclear weapons. The CRTF should ensure that all personnel are familiar with the concept and that it is strictly enforced. Physical security safeguards required to prevent unauthorized access to classified information and proper control and disposition of classified material must be strictly enforced during all operations involving the weapon(s) or weapon components. Because of the technical information requirements during nuclear weapon operations, some documents at the accident scene may contain CNWDI. The sensitive information contained in these documents requires that security measures be implemented consistent with the highest classification assigned. Personnel working in an area containing CNWDI should be properly cleared and authorized until recovery discussions are complete and the items have been covered or removed.

C12.5.4. Search Techniques. The location of all weapons and components must be determined. Depending upon the accident circumstances, weapons and weapon components may be scattered and/or buried over a large area. A systematic search may be required over a large area until accountability for all the weapons and weapon components is re-established. The search may become a time-consuming operation requiring numerous personnel. The search method used by the CRTF depends on many factors including the number of personnel available, topography, and environmental conditions. Metal detectors and RADIAC equipment may be needed to locate all weapons and components. As components are found, their location should

be marked, the position recorded on a map, and photographed. The items should be removed to a storage area after coordination with accident investigators, safety and security permitting. If all components are not found, the EOD team leader should coordinate with the ARG and make recommendations to the CRTF concerning additional search procedures that can be tried, and at what point the search for components will cease. Search techniques that may be employed are:

C12.5.4.1. Course Search. A search in loose crisscrossing patterns designed to locate weapon components rapidly. This technique is used by EOD and radiological monitoring personnel to search the accident area soon after the accident has occurred.

C12.5.4.2. Aerial Radiological and Photographic Survey. This technique is used to identify areas of significant radioactive intensity to assist in locating missing weapon components and provide high resolution photography.

C12.5.4.3. Instrument Search. Metal and radiation detectors monitor those areas where weapons or components were previously found. This method may supplement the visual search.

C12.5.4.4. Visual Search. A search normally conducted by a slow-moving line of personnel positioned abreast at various intervals dependent upon the object to be located.

C12.5.4.5. Scarifying Procedure. Components may have been buried during the accident or subsequently covered by wind action. A road grader equipped with scarifiers (large steel teeth) is used to plow a surface. Search teams should follow the graders and conduct a visual and/or instrument search for missing components. This system has proven successful in past search operations. Coordination must be made with the JHEC prior to implementing techniques to assess personnel protection requirements due to resuspension and the potential impact on site DECON and restoration.

C12.5.5. Hazard Removal. Another major step in weapon recovery begins with the removal of identified hazards. The CRTF establishes priorities for removing all hazards so that other response personnel may conduct operations. It is unsafe for anyone but task trained personnel under EOD supervision to clear an area of broken, scattered, or resolidified HEs.

C12.5.6. Disposal. After the weapons are evaluated by EOD and DOE as safe for movement and in coordination with accident investigators, weapons are moved to a designated weapon storage area.

C12.5.6.1. On-site disposal of HE depends on available space and hazards presented, including resuspension of contaminants. Storage area or disposal sites should be large enough to minimize hazards to personnel in the event of a detonation. The distances that storage areas are separated from other operations is determined by the type and amount of explosives stored. An isolated and segregated area should be set aside for the exclusive storage of exposed or damaged explosives.

C12.5.6.2. If open storage is used, protection from the elements and information sensors, including satellite surveillance, must be provided for weapons and weapon components.

C12.5.7. Storage of Explosives. If explosive items cannot be stored separately, a balance of safety and practical considerations requires assignment of each item to a storage group based on compatibility characteristics.

C12.5.8. Custody. Each Service has publications that address the storage, security, and safety aspects associated with nuclear weapons. These publications also address requirements for the custody of nuclear weapons and weapon components. Moreover, performance of EOD procedures does not, in itself, constitute transfer of custody to the EOD team. Final disposition of damaged weapon(s) and/or components involves return of these devices to DOE; therefore, close coordination between the CRTF and the DOE team leader is necessary throughout the weapon recovery phase. Custody of damaged weapon(s) and components is transferred to DOE at a point determined jointly by the CRTF and the DOE team leader.

C12.5.9. Packaging and Marking. Transportation specialist consultation is required for weapon(s), weapon components, and/or explosives damaged or subjected to extreme forces during accidents. Before weapon(s), weapon components, and/or explosives are shipped, they must be packaged to ensure that no contamination breaches the container and that the environment experienced during shipment will not cause further damage or explosions. To ensure this requirement, special packing, shipping, marking, and safety instructions must be obtained to comply with transportation regulations from the DoD, DOE, and Department of Transportation (DOT).

C12.5.10. Shipment. When the disposition decision has been made, DoD or

DOE may be assigned the primary responsibility for moving the weapons. Nuclear weapons will be moved by the safest means and over the safest routes. Movement should be kept to a minimum. Shipments of weapons/weapon components will be routed to a DOE facility for examination, analysis, and final disposition.

C12.6. ACCIDENT RESPONSE PLAN ANNEX

The weapon operations annex/recovery plan should establish the procedures used during weapon operations. This annex should include:

C12.6.1. Definition of the relationship between EOD personnel and DOE weapon experts and their respective responsibilities.

C12.6.2. Guidelines for establishing electromagnetic radiation hazard areas.

C12.6.3. Reference for explosive arcs to assist the RTF and IRF commanders.

C12.6.4. Procedures for locating and identifying weapon components and debris.

C12.6.5. Procedures for re-establishing accountability for weapons and weapon components.

C12.6.6. Procedures for establishing a secure staging/storage area.

C12.6.7. Procedures for moving weapons and components to the secure staging/storage area.

C12.6.8. Procedures for packaging weapon components.

C12.6.9. Procedures for shipping weapons and components.

C13. CHAPTER 13

COMMUNICATIONS

C13.1. GENERAL

C13.1.1. Fast, reliable, and accurate communications are essential for nuclear weapon accident response operations. Moreover, securing adequate internal communications to support activities at the accident scene is a time sensitive operation. Equally critical to effective C2 is the timely establishment of external communications to higher echelons, particularly in the Washington, DC, area. Therefore, the communications officers of the IRF and RTF must take immediate action to ensure that appropriate communications equipment is identified and requested early in response operations. Information must be made accessible. In general, the value of information increases with the number of users.

C13.1.2. Effective response to a nuclear weapon accident relies heavily on a communications officer's knowledge about secure and non-secure tactical, strategic, and commercial communications systems. He or she must be able to apply conventional and imaginative methods and ensure that required communications are available. He or she should be equally adept at establishing communications support in remote locations, or in areas near existing communications systems.

C13.1.3. In addition to military communications at the accident site, DOE, FEMA, State, and/or civilian officials establish their own internal communication systems. Careful attention must be afforded to ensure that these systems are interoperable.

C13.2. PURPOSE AND SCOPE

This chapter provides guidance for establishing communications systems and capabilities to support response operations. The communication requirements of both the IRF and RTF are discussed, including internal/external communications support for personnel at the accident scene. Also included are descriptions of communication systems hardware (e.g., telephone, radio, satellite, and visual signal) that are available to support these operations.

C13.3. SPECIFIC REQUIREMENTS

The CRTF requires internal communications with the operations center and forces in the field to control and keep abreast of response activities. External communications with higher echelons of command are necessary to keep key personnel informed. Many initial communications requirements can be met by unsecure voice communications; however, both secure voice and record communications are required early in the response period. Communication requirements:

C13.3.1. Establish internal communications.

C13.3.1.1. Telephone communications between fixed site locations, for example, the operations center and the JIC/CIB.

C13.3.1.2. Field phones for EOD operations (secure phones are desirable).

C13.3.1.3. UHF/VHF nets. Several UHF/VHF nets including Command (Secure Communications desirable), Weapons Recovery Operations (Secure), Radiological Operations (Secure Communications desirable), Security, and Public Affairs.

C13.3.1.4. Establish a local computer network or access to a local computer network. If possible, establish virtual command and control requiring password access.

C13.3.2. Establish external communications.

C13.3.2.1. Telephone communications with the Combatant Command's Operations Center, the Service Operations Center, the National Military Command Center (NMCC), and OASD(PA). Conferencing may suffice early in the response.

C13.3.2.2. Multiple telephone lines to support response force elements.

C13.3.2.3. Secure voice via satellite, telephone, or HF.

C13.3.2.4. Access to the DCS for record communications.

C13.3.2.5. Internet access.

C13.3.3. Coordinate frequency usage of all response organizations to prevent interference and radio operations in areas where electromagnetic emissions may create explosive hazards or affect electronic and field laboratory instruments.

C13.3.4. Obtain frequency clearances, as necessary.

C13.3.5. Prepare a Signal Operating Instruction (SOI) guide for use by all response organizations.

C13.4. RESOURCES

Communications capabilities and resources for nuclear weapon accident recovery operations vary widely. Resources are as familiar as the telephone or as sophisticated as satellite capable secure voice radio. Communications assets must be capable of deployment to, and operation in, remote locations. The following depicts a variety of communication resources for response organizations. Because the same equipment supports numerous contingencies, only those assets required for a specific nuclear weapon accident response effort should be requested. Resources are available from DoD, other Federal organizations, or commercial sources.

C13.4.1. Service Assets. The Military Services maintain communications assets organic to combat support units as well as for contingency assets. Information about specific assets as well as procedures for requesting and tasking Service assets can be obtained from the respective Service operations centers, or operational commanders. Telephone numbers are contained in Appendix C22.AP1.

C13.4.1.1. U.S. Army. U.S. Army Signal organizations are designed to support deployed forces from the theater Army level down to the smallest unit. Major communications support includes C2, C3, and automation systems. Essential elements of these areas include long-haul transmission systems (SHF and UHF satellite terminals), voice (Mobile Subscriber Equipment and TRI-TAC Voice Switches), record communications traffic (e.g., TRI-TAC Message Switches), FM and HF radio systems (e.g., SINCGARS), and data communications networks.

C13.4.1.2. U.S. Air Force. Tactical communications assets are available from both Combat Communication Groups (CCGs) and HAMMER ACE as described in paragraph C13.4.1.2.1., below.

C13.4.1.2.1. HAMMER ACE. HAMMER ACE is a rapidly deployable team with military and commercial off-the-shelf technology communications equipment. The mission of Hammer ACE is to provide initial secure C2 communications. The team deploys within 3 hours of notification and establishes communications within 30 minutes of arrival on site. HAMMER ACE personnel and

equipment can be transported on C-21, or equivalent-type aircraft, or commercial airliners. Hammer ACE communications capabilities allow for intra- and inter-site communications. Secure satellite communications provide voice, facsimile (fax), and data through International Marine Satellite (INMARSAT) (commercial satellite) terminals and military AN/PSC-5 EMUT, UHF satellite radios. The secure satellite link provides interface with STU-III, Defense Switched Network (DSN), and commercial telephone systems through the HAMMER ACE Ground Entry Point (GEP) located at Scott AFB, IL. Other capabilities include ground-to-air communications with frequency ranges to cover fixed- and rotary-wing aircraft from all Services and a securable Land Mobile Radio (LMR) network with a repeater and base station for local communications. The LMRs are capable of interfacing with the secure satellite system. Additional equipment available includes digital cameras, HI-8 video camcorders, Global Positioning System (GPS), RF scanner, document scanner, document printer, image printing system, and an imagery platform. HAMMER ACE equipment is capable of operating with commercial power, rechargeable batteries, vehicle batteries, solar panels, and portable generators. HAMMER ACE deploys enough power providing equipment to sustain 72-hour operations. Communications expertise provided by HAMMER ACE can assist the CRTF with evaluation of the situation and determine what, if any, additional capabilities are required.

C13.4.1.2.1.1. Requests for emergency HAMMER ACE support should be made directly to the Scott AFB, IL, Command Post or through the JNACC. Phone numbers are listed in Appendix C22.AP1. Any available communications media may be used to submit requests; however, verbal requests should be followed in writing within 24 hours. The requesting Agency must provide the following information with the request.

C13.4.1.2.1.1.1. Deployment location, including coordinates, if available.

C13.4.1.2.1.1.2. Situation, including type of emergency.

C13.4.1.2.1.1.3. POCs.

C13.4.1.2.1.1.4. Remarks concerning any unusual conditions for which the team should prepare.

C13.4.1.2.1.2. Requests for additional information should be directed to Headquarters (HQ), USAF Communications Agency (AFCA)/SYH, HAMMER ACE, Scott AFB, IL, or through the Internet by linking to www.afca.scott.af.mil/hammer-ace/ Web site. Phone numbers are listed in Appendix C22.AP1.

C13.4.1.3. U.S. Navy. The Joint Maritime Operations Command Center (JMOCC), Mobile Integrated Command Facility (MICFAC), and the Mobile Ashore Support Terminal (MAST) comprise the U.S. Navy's Joint Maritime Command Information System (JMCIS), the U.S. Navy's tactical ashore communications capability. These systems were fielded to replace the Ashore Mobile Contingency Communication System (AMCC). Although these capabilities primarily support the naval component commander of a CINC or Joint Task Force, their modular organization makes these systems ideally suited for use with liaison teams or in support of contingency requirements.

C13.4.1.3.1. Mobile Ashore Support Terminal (MAST). The smallest component of the JMOCC is the MAST. MAST is transported either as modules in fixed-wing aircraft or helicopters, or in a shelter on a HMMWV. It can be set up in less than 3 hours by two members of its four-person, full-time crew. Communications equipment for MAST includes the following:

C13.4.1.3.1.1. AN/VRC-93 UHF tactical satellite (TACSAT) radios.

C13.4.1.3.1.2. INMARSAT.

C13.4.1.3.1.3. STU IIIs.

C13.4.1.3.1.4. Two desktop computers.

C13.4.1.3.1.5. Facsimiles.

C13.4.1.3.1.6. One organic 5-kW gasoline generator.

C13.4.1.3.2. The MAST units are, at all times, under the operational control of the respective Fleet CINCs. All deployments of the MAST are approved by the Fleet CINC based on requests submitted by subordinate commands. Contingency requests should be forwarded to the Fleet CINC as expeditiously as possible. When the MAST is deployed, and until it returns to its host command, it is under the custody and operational control of the designated supported command.

C13.4.1.3.3. Mobile Integrated Command Facility (MICFAC). MICFAC includes all of MAST's functionality plus intelligence processing systems with inherent imagery and databases. The ability to process record message traffic through its larger connectivity links is an added feature to this suite of equipment. The transmission systems are significantly enhanced with the addition of SHF and military multiband radios. As the voice communications ability is improved through the addition of a telephone switch, more subscribers in the facility will also have telephone service. MICFAC can be air transported by the equivalent of two C-130s, or by mobilizer-equipped trailers, and set up in approximately 8 hours by four of its eight-person, full-time crew.

C13.4.1.4. U.S. Marine Corps (USMC). Present Marine Corps C4I systems mix some analog transmission equipment with digital transmission and switching equipment that is compatible with TRI-TAC. During contingency operations, and if approved by the support CINC, the Marine Air Ground Task Force Headquarters can extend Defense Information Infrastructure (DII) common users services (IP Router, DSN, Secure Voice Systems, DMS/AUTODIN) through a DII entry point by way of a GMF satellite link.

C13.4.2. Joint Chiefs of Staff-Controlled Assets. JCS contingency support communications resources are requested according to procedures contained in CJCSI 6110.01, "CJCS-Controlled Tactical Communications Assets," and in Allied Communications Publication 134, "Communications Assets," references (ab) and (ac). Additional information regarding these assets can be obtained from the JCS Contingency and Crisis Management Division.

C13.4.2.1. Joint Communications Support Element (JCSE). Details of the JCSE deployment/employment concepts capabilities and logistics requirements contained in U.S. Forces Command Manual 105-1, "Joint Communication Deployment and Employment," reference (ad), can be obtained by contacting the JCSE at McDill AFB, FL. The JCSE is a contingency support unit consisting of USA, USN, USAF, and USMC personnel and a variety of communications equipment including:

C13.4.2.1.1. Switchboards.

C13.4.2.1.2. HF radio.

C13.4.2.1.3. Microwave/troposcatter radios.

C13.4.2.1.4. UHF and VHF radios (secure and non-secure).

C13.4.2.1.5. Secure record communications terminals.

C13.4.2.1.6. Weather dissemination equipment.

C13.4.2.1.7. UHF and SHF satellite terminals.

C13.4.2.1.8. Secure TELEFAX (DACOM 412).

C13.4.2.1.9. KY-65, KY-70, and KY-75 secure voice devices.

C13.4.2.1.10. The AN/URC Joint Airborne Communications Center/Command Post (JACC/CP).

C13.4.2.1.10.1. The JACC/CP, commonly referred to as JACKPOT, consists of several pieces of equipment mounted in air transportable vans. The JACC/CP has four major components-operations center, communications control, generator, and an air-conditioner/accessory trailer.

C13.4.2.1.10.2. The JACC/CP can provide one HF, single sideband (SSB) voice or teletype communication channel over its 1-kw transceivers or HF, double independent sideband (ISB) with a total of four independent 3-kilohertz (3SPKHz) voice or teletype channels over its 10-kW system. The 10-kW system is limited to ground operations only. The JACC/CP also contains three radios, an AN/ARC-73 (VHF/alternating modulation [AM]), AN/ARC-54 (VHF/frequency modulation [FM]), and an AN/ARC-51 BX (VHF/AM), for ground-to-ground and ground-to-air communications.

C13.4.2.1.10.3. The voice radio system may be connected to a 10-line, 20-line, or 30-line, four-wire/two-wire telephone switchboard. The switchboard can connect any telephone subscriber to another telephone or a JACC/CP radio.

C13.4.2.1.10.4. The complete JACC/CP can be transported in a winch-equipped C-130 or larger aircraft. A wide lowboy trailer must be used to transport the vans any distance or over other than paved/gravel roads.

C13.4.2.1.10.5. The JACC/CP can be deployed within 24 hours from the time the JCS issues deployment approval messages.

C13.4.2.2. <u>JCS-Joint Controlled Tactical Communications Assets (JCTCA)</u>. Details on the JCTCA are in the USA plans for deployment of mobile/transportable

communications assets controlled by the JCS. During normal duty hours, additional information can be obtained from the USA Information Systems Command Contingency Branch, Fort Huachuca, AZ, or from their Emergency Operations Center (EOC). Phone numbers are in Appendix C22.AP1. The JCTCA consists of heavy mobile/transportable equipment that can be deployed separately or in packages by C-141/C-5 aircraft. Equipment includes:

C13.4.2.2.1. Switchboards

C13.4.2.2.2. HF radio

C13.4.2.2.3. Troposcatter radios

C13.4.2.2.4. Medium speed AUTODIN terminals

C13.4.2.2.5. Manual secure voice switch and terminals

C13.4.2.2.6. Super high frequency (SHF) satellite terminals

C13.4.2.3. Other JCS Controlled Assets. Most SHF satellite terminals are under JCS deployment control. These terminals include the Ground Mobile Forces (GMF) terminals assigned to the Military Services. The USA 235th Signal Company, Fort Monmouth, NJ, maintains UHF and SHF research and development satellite terminals that can be deployed for contingency operations and exercises. Also, the USAF has communication assets similar to those in the JCTSA. They are located at the 3rd CCG and the 281st CCG, Air National Guard, Tinker AFB, OK. Equipment in the van includes a Secure Cord Switchboard (SECORD), KY-3 secure voice terminals, and a narrow band (HY-2) trunk that will interface with the Automated Secure Voice Communication System (AUTOSEVOCOM). The van is outsized and requires C-5 aircraft transport.

C13.4.3. DOE Assets. The DOE maintains emergency response, air transportable communications services, and hardware. Systems include a multi-point telephone switch, fax, HF/VHF radio networks (with pagers), video teleconferencing, a terrestrial microwave system, and data communications including local area networks (LANs) and high speed transmission. A multi-channel satellite system is available to provide long-haul transmission capability. Single-channel INMARSAT terminals, with data interface, are included for advance party use and emergency backup. Secure communications include voice, fax, still and full-motion video, and data. Field communications are listed into the DOE Emergency Communications Network (ECN) via satellite.

C13.4.4. FEMA Assets. Deployable communication assets used by FEMA response groups are maintained at the FEMA regional office level. Although the specific equipment varies between FEMA regions, the FEMA response contingent usually arrives with the following capabilities:

C13.4.4.1. HF Radio (voice only) for external communication to their regional office, the State Disaster Response Headquarters, and the Emergency Information and Coordination Center (EICC) in Washington, DC.

C13.4.4.2. VHF radio to support on-scene DFO Federal Response Center (FRC) (internal) communications. Equipment includes hand-held radios, suitcase repeater, and suitcase base station with telephone interconnect. The quantities of these assets will vary depending on the size of the FEMA response contingent.

C13.4.5. Commercial Assets. In CONUS, acquisition of supporting communications systems from commercial carriers (for example, American Telephone and Telegraph [AT&T]) is possible. Commercial carriers can provide communications to a remote area via transportable microwave, carrier systems, or cable. Leased services, including telephone, data Teletypewriter Exchange (TWX), Telephone Exchange (TELEX), and Wide Area Telephone Service (WATS), are available in most locations.

C13.5. CONCEPT OF OPERATIONS

Nuclear weapon accidents present a variety of technical, logistical, and operational communications problems. Several factors, including the location of the accident, the response force involved, and the C2 arrangements of those forces, contribute to the complexity of the problems. This concept of operations focuses on the actions of the military response force(s) communications officer(s). The approach is to present items of concern sequentially without regard to whether the IRF or the RTF communications officer takes the action. Incumbent upon the RTF communications officer is the responsibility to ascertain what has been accomplished prior to arrival, and to carry on from that juncture.

C13.5.1. Initial Actions. The initial task of the response force communications officer is to determine the communications assets at, or close to, the accident site. The local telephone company, State/local officials, or civilian authorities can provide information on the communication infrastructure near the accident scene, and the capabilities for long-haul and local communications. Once existing capabilities are

determined, the communications officer should use these resources with deployed assets to establish an effective communications network.

C13.5.1.1. In remote or sparsely populated areas, the initial communication capability may consist of only hand-held, short range VHF/FM radios, portable HF radios, or wire (field phones). Conversely, if an accident occurs close to a populated area, a coin operated telephone, or even a business or private telephone may be available immediately for emergency use. In either case, additional leased communications such as WATS can be obtained to augment available communications. Naturally, more time is required to provide leased assets to remote areas; therefore, the requirements must be identified and requested at the earliest possible time. Follow-on deployment of mobile communications provides the response force with additional local telephone and radio, as well as long-haul secure voice and record capabilities.

C13.5.1.2. Another method of communications for external (long-haul) communications, particularly if assets are limited, is the telephone conferencing capability of Service operations centers and/or the NMCC. Further, if communication can be established from the site to the DoD JNACC, the DoD JNACC will assist by relaying information or coordinating with other forces/agencies. When requested by the Services, the DoD JNACC arranges for transportation of specialized communications resources.

C13.5.1.3. The CRTF may spend considerable time away from the CP. The response force communications officer must, therefore, plan communication methods to support the mobility of the CRTF. Radio nets provided for CRTF communications should have sufficient range and be capable of frequent use. If possible, the net should be secure and have a radio/wire integration capability into the local switchboard and long haul voice circuits. The staff directors for support and operations, and the special staff advisors should be included in this net.

C13.5.1.4. The communications officer must take prompt action to obtain frequency clearances. Radio frequencies are managed at the national level by the Military Communications-Electronics Board (Joint Frequency Management Office). Each Service has membership on the board. Moreover, each Military Department has a frequency management office, but in most cases these offices have delegated the authority to assign frequencies to area coordinators. Additional details may be obtained from USA FM 24-2, "Spectrum Management," or USAF Instruction 33-118, "Radio Spectrum Frequency Management," references (ae) and (af). DOE and FEMA communications personnel should coordinate frequency requirements through their

own channels and keep the military communications officer advised. Failure to obtain valid frequency authorizations could result in interference with other critical communications. The use of unauthorized frequencies could lead to embarrassment for the U.S. Government (USG).

C13.5.1.5. One of the more complex problems facing the response force communications officer is preparation of a SOI. The SOI should be an easy-to-use instruction containing the capabilities and limitations of equipment and detailed "how-to-use" procedures for all available systems. The instructions should be unclassified, if possible, and widely distributed. As a minimum, they should include system descriptions (charts and diagrams are helpful), an on-site telephone directory, dialing and telephone routing instructions, message addresses, message handling instructions and routing indicators, radio procedures and call signs, secure voice procedures, and communications security (COMSEC) operations security procedures, including Essential Elements of Friendly Information (EEFIs). An outline of a typical SOI is at Figure C13.F1.

C13.5.1.6. Although COMSEC instructions are a part of the SOI, COMSEC deserves additional emphasis. Enemy or dissident elements may be able to intercept and exploit C2 communications systems and traffic used for response to nuclear weapon accidents. Compilations of individually unclassified items concerning weapons communicated during recovery procedures may well be classified, and unfriendly elements may be able to compile these items; therefore, the communications officer must plan to defeat this threat by determining the EEFI for the operation, and then by acting to preclude interception or exploitation of this information. COMSEC actions to prevent exploitation of EEFIs may include using secure transmission facilities, communications discipline, codes and authenticators, and changing call signs.

Figure C13.F1. Signal Operating Instruction

Signal Operating Instruction
(Sample Contents)

SECTION 1 - Communications Security.....

SECTION 2 - Telephone Communications.....

Figure 2-1: Telephone Routing Diagram .....
Figure 2-2: Hot Line Routing Diagram .....

SECTION 3 - Message Communications Instruction.....

Figure 3-l: Message Example.....
Figure 3-2: Eyes Only Message Example .....

SECTION 4 - Radio Communications Instructions .....

ANNEX A - Response Force Traffic Diagram .....

ANNEX B - Telephone Numbers and Message Addresses.....

B-l - Tie Line Network Dialing Instructions .....
B-2 - On-Site Telephone Diagram.....
B-3 - Off-Site Contact Telephone Numbers and Message Addresses.....
B-4 - Intercom Systems .....

Intercom #1 .....
Intercom #2 .....
Intercom #3 .....
Intercom #4 .....

ANNEX C - Radio Call Signs .....

Net #1 Grader.....
Net #2 Looker .....
Net #3 Catcher.....
Net #4 Ivory .....
Net #5 Blue .....
Net #6 Angel .....
Net #7 Red .....

ANNEX D - Distribution.....

C13.5.2. Follow-On Actions. As additional response forces deploy to the accident scene and a support base camp is established, additional communication resources will be deployed or acquired concurrent with the buildup. As this buildup occurs, the response force communications officer should establish and maintain a list of communications assets and capabilities on scene. The list should include assets and frequencies belonging to non-DoD agencies identifying potential mutual interference, and should ensure that all possible assets are considered when meeting overall communication requirements. Coordination should be made with the appropriate representative from Federal and civilian authorities/officials agencies possessing on-scene communication systems.

C13.5.2.1. As emphasized throughout this chapter, increasing the quantity of communications assets and routing those assets into the appropriate users hands is of primary importance as the response organization grows. Additional communication assets, primarily in the form of telephones and VHF/FM radios, are needed for effective operation of the JIC/CIB, and to support radiological monitoring and SR operations.

C13.5.2.2. As the response operations peak, so will the communications support required. As the response transitions into site remediation, the primary communications should be routine situation reports, supply Military Standard Requisitioning and Issue Procedures (MILSTRIP) messages, and other administrative messages. After the weapon(s) and weapon components are removed from the site, little or no need will exist to communicate by secure voice; however, record communications support provided on site during the early response and weapon recovery should continue through SR.

C13.6. ACCIDENT RESPONSE PLAN ANNEX

Procedures and information appropriate for the communications annex to the accident response plan include:

C13.6.1. A description of actual or projected requirements and the location of assets to fill requirements.

C13.6.2. Procedures for establishing communications links with the NMCC and DCS from remote locations.

C13.6.3. Procedures for obtaining leased commercial communications.

C13.6.4. Procedures for obtaining Service- and JCS-deployable communications assets.

C13.6.5. Procedures for establishing local radio nets and assignment of call signs.

C13.6.6. Procedures for obtaining frequency clearances.

C13.6.7. Procedures for coordinating communications with non-DoD agencies.

C13.6.8. Procedures for using secure/clear fax resources.

C13.6.9. Preparation of an integrated communications plan.

C13.6.10. Procedures for using the Ethernet, Intranet, or Internet.

C14. CHAPTER 14

PUBLIC AFFAIRS

C14.1. GENERAL

C14.1.1. A nuclear weapon accident has immediate public impact. PA activities during the initial accident response are perhaps among the most critical aspects of the entire response and site remediation process. Within minutes of the accident, news media could be at the scene. Local citizens will seek information about how the accident affects them. A proactive, comprehensive public affairs program must be conducted to expedite the flow of information to the public and internal audiences. Timely, accurate information and frequent updates are essential to keep the public and news media informed, consistent with national and operations security.

C14.1.2. DoD response element commanders will face a wide range of complex PA issues as they respond to a nuclear weapons accident. The PA functions will include news media relations, internal or command information, and public outreach. Foremost among the CRTF responsibilities is notification to the public, through the news media, that a nuclear weapons accident has occurred, in accordance with DoD policy, provided in reference (g). The CRTF's PAO must establish and maintain coordination with Federal, State, and local response organization PA representatives/spokespersons to ensure unity of effort. Especially important is communication with the OASD(PA). The CRTF's PAO will establish a JIC (or ensure establishment of a CIB overseas) as a single point of interface between the military and news media representatives covering the response. Providing accurate, timely information is essential in establishing and maintaining credibility with the public, the news media, and response forces.

C14.2. PURPOSE AND SCOPE

This chapter provides general PA guidance for a nuclear weapon accident occurring in the United States, its territories, and possessions or overseas.

C14.3. POLICY

General DoD policy is to ensure that reporters are granted access to all unclassified activities. The DoD policy for U.S. nuclear weapons accidents and incidents, DoDD

5230.16, reference (g) is to provide effective PA activities near the scene of a nuclear weapon accident to expedite the flow of information to the public and the internal audience. While it is also DoD policy to neither confirm nor deny the presence or absence of nuclear weapons or nuclear components at any specific location, exceptions exist when a nuclear accident occurs. Joint Pub 3-61, "Doctrine of Public Affairs in Joint Operations," reference (ag) provides further guidance.

C14.3.1. In the United States, its territories, or possessions, DoD policy requires the CRTF to confirm the presence of nuclear weapons or radioactive nuclear components in the interest of public safety or to reduce or prevent widespread public alarm. Notification of public authorities is required if the public is, or may be, in danger of radiation exposure or other danger posed by the weapon or its components.

C14.3.2. Statements confirming the presence of nuclear weapons should contain information about the possibility of injury from HE weapon components and/or potential radiation exposure. If injury or radiation exposure is unlikely, that should also be stated. OASD(PA) should be notified in advance, or as soon as possible thereafter, if these exceptions are used.

C14.3.3. Overseas, unless bilateral agreements exist, the CRTF must have the concurrence of the host government, through the U.S. COM, prior to confirming the presence of nuclear weapons or radioactive nuclear components.

C14.3.4. Contingency statements for the above exceptions are provided in Appendix C14.AP1. Radiation information fact sheets for the general public and medical personnel are in Appendix C14.AP2.

C14.4. RESPONSIBILITIES

The CRTF's PA responsibilities are indicated below. The supported CINC may impose additional requirements contained in appropriate Service regulations. The CRTF PAO will:

C14.4.1. Protect classified information. The CRTF must practice "security at the source" to ensure no classified, sensitive, or privacy information is provided to the media or public. The CRTF is responsible for reviewing all information pertaining to nuclear weapons intended for public release. Information about nuclear weapon and component design and their storage is classified. In addition, unclassified, controlled nuclear information must be protected from public release. When JIC/CIB responsibility is transferred, care should be taken to ensure nuclear weapons

information proposed for public release is reviewed by appropriate U.S. DoD and DOE offices.

C14.4.2. Establish direct communications with OASD(PA) from the accident scene. The CRTF should ensure that the PAO at the scene expeditiously establishes direct communications with OASD(PA) by any means available. Communications are essential. The CRTF is the senior DoD representative at the scene and must have access to current policy guidance and statements issued at the national level. Direct communications also ensure that timely, accurate information can be provided at the national level. Contact telephone numbers are located in Appendix C22.AP1.

C14.4.3. Establish an Information Coordination Cell (ICC) in cooperation with State and local authorities in the United States, and with DOS, and Host Nation authorities outside the United States. The ICC should be collocated with the CRTF and his counterparts. In the United States, the ICC should be composed of one senior, co-equal PA representative from the CRTF, the local authorities, and the State emergency response organization. Overseas, the ICC should be composed of the senior U.S. military PAO, the Host Nation military public relations officer, and a local emergency response authority. The purpose of the ICC is to plan, manage, and coordinate the on-scene PA response. Appendix C14.AP3. addresses the PA response organization concept.

C14.4.4. Establish a JIC/CIB in cooperation with the State and local/DOS, Host Nation, and local authorities near the accident scene. The CRTF establishes a JIC/CIB in cooperation with FEMA, DOE, State and local agency officials/DOS, Host Nation, as appropriate, and in accordance with reference (g), (ag), DoDD 5400.13, "Joint Public Affairs Operations," reference (ah), and DoD Instruction 5400.14, "Procedures for Joint Public Affairs Operations," reference (ai). Located near the scene, the JIC/CIB serves as the focal point for information about the accident and the response. A JIC/CIB location in a permanent structure such as a hotel or office building is preferred due to support requirements. Local emergency management officials often have facilities available or designated that may be used during a nuclear weapons accident. The CRTF should provide dedicated administrative, communications, and logistic support for the JIC/CIB. A list of support equipment is located in Appendix C14.AP4.

C14.4.4.1. In the United States, its territories, and possessions, the CRTF has the primary responsibility to establish and direct the JIC until the response effort transitions to another agency for near- and long-term follow-up monitoring functions.

C14.4.4.2. Overseas, the CRTF responsibility may vary, depending on whether a bilateral agreement has been signed with the country. In the absence of an agreement specifying responsibilities, the CRTF will work with the U.S. COM to establish and codirect a CIB with the Host Nation.

C14.4.5. Identify and establish, in cooperation with State and local authorities/DOS, and Host Nation authorities, a media briefing area near the accident scene, but not in a location that interferes with response activities.

C14.4.6. Provide news media support at the accident scene. The CRTF is authorized to provide support to news media representatives covering a nuclear weapon accident. Support will be the same as that authorized on a military reservation; for example, transportation, logistic, and administrative. Support will depend upon the situation and available resources. The media should be briefed in the extent of support available.

C14.4.6.1. Military and local authorities should jointly establish a media center. Most local authorities already have locations designated for this. The important thing is that the media center should be located far enough away from the scene so as not to interfere with the recovery operation. Initial information provided to the media should be limited to basic, releasable facts. A media work area should be established as soon as practical. When possible, it should be collocated with the media briefing area.

C14.4.6.2. Photographers and film crews may arrive on scene before a cordon is established. The first PAO on scene should ensure that the initial emergency response force has covered classified or sensitive material. The PAOs should work with police/security personnel to identify suitable vantage points for photographers.

C14.4.6.3. Pre-approved handouts, video footage, and photos on background information should be made available, as appropriate.

C14.4.6.4. The media may be allowed access to the accident site after the area has been made safe and secure. Media will be escorted at all times.

C14.4.6.5. Briefings should be conducted as soon as possible and as often as practical (when there is new information to provide). Specialists should be available for briefings and interviews.

C14.4.6.6. The media should be provided regular photo and film opportunities with specialists and members of the response force, as appropriate.

C14.4.6.7. A media pool facility may be formed if all the media cannot be accommodated near the accident scene. The media will decide which organizations will be represented at the facility.

C14.4.6.8. Official photographs or video taken by response force personnel or audiovisual crews may be released to the media via the JIC/CIB after security review to ensure it does not contain classified information or military controlled technology.

C14.4.7. Provide internal information. The CRTF should ensure that all (military and civilian) response force personnel are briefed on the PA policy when they in-process and ensure that they are provided information on accident response through an internal information program.

C14.4.7.1. When press releases and statements are issued to the media, they should also be disseminated to the internal audience. Commanders and technical experts may speak to response force and base audiences in a "town meeting" format if circumstances warrant. A telephone number should be designated as a rumor control number. Information about logistics matters such as mess hours, laundry turn-in times, etc., should be distributed by the organizations responsible for providing the services. A newsletter on response activities and issues should be produced regularly and distributed to response personnel.

C14.4.8. Work with State and local or Host Nation authorities to identify and respond to public outreach needs. The CRTF should identify public concerns about the accident response and take appropriate action in cooperation with the SFO, State and local authorities, or the U.S. COM and Host Nation military personnel. As soon as DoD PA personnel arrive at the accident scene, they should ensure a mechanism is in place to plan a public outreach program and to analyze feedback from the public, the media, and local authorities to ensure the PA program meets the affected public's needs. Programs should be initiated, modified, or stopped based on data evaluation. Public concerns will probably include health and safety, response and recovery, impact on economy, impact on environment, and legal claims. Phone lines should be established with a published number for public inquires.

C14.4.9. Review and evaluate media reports about the accident response to ensure accurate information is provided to the public. The CRTF should ensure the

JIC/CIB monitors media reports to determine if key messages are understood and disseminated through the media to the public. JIC/CIB recommended key messages and non-releasable information are listed in Appendix C14.AP5. Information obtained should be provided to response organizations on scene as well as higher headquarters.

C14.4.10. Planning tips the CRTF can use in a response situation are located in Appendix C14.AP6.

C14.5. RESOURCES AND ROLES

The DoD IRF and RTF commander should have PAOs from the supporting installation and/or staff as members of the response force. At least one PAO should be part of the IRF. Other PA support is available from the organizations listed below, and interagency cooperation will be required to ensure accurate and consistent communication with the media and the public.

C14.5.1. Department of Defense. The OASD(PA), as the senior DoD PA organization, coordinates with the White House, DOS, DOE, FEMA, and other appropriate Federal Departments and Agencies. PAOs from the CINC's component commands may augment the CRTF's PA staff. A DTRA, CMAT PAO will provide advice and assistance in the JIC/CIB.

C14.5.2. Department of Energy. A DOE PAO will accompany the DOE Senior Official to the accident scene and be present in the JIC/CIB. Other DOE PA personnel from DOE field operation offices, national laboratories, and DOE contractors may also be requested to augment the JIC/CIB operations.

C14.5.3. Department of State. The U.S. COM will be the focal point for diplomatic and political decisions pertaining to the U.S. Government response. The COM will be assisted by a team from the Embassy's Emergency Action Committee (EAC), with augmentation as required.

C14.5.4. Federal Emergency Management Agency. When the accident occurs in the United States or its territories, a FEMA PA affairs representative will accompany the SFO to the scene and work in the JIC. Additional FEMA resources are available from FEMA HQ, regions, and FEMA's corps of reserve PAOs.

C14.5.5. Other Federal Organizations. PAOs from other Federal Agencies involved in the response effort may be present at the scene and should be integrated

into the JIC. Typically, there will be representatives from Agencies such as Health and Human Services, EPA, Department of Agriculture, and DOT.

C14.5.6. State and Local. PAOs from State and local response organizations, especially fire, police, and emergency management, are key to a successful response. They will probably arrive at the accident scene before Federal response forces. State and local representatives should be encouraged to become co-equal partners in PA operations. Shared Federal/State/local leadership of PA operations should ensure a timely, accurate, and coordinated response. If that is not possible, plans and information must be closely coordinated with State and local PA personnel and they should be encouraged to send representatives to help set up and participate in the JIC and media briefing area. State public affairs on-scene representatives may come from emergency response, agriculture, environmental, health, safety, and transportation agencies. Local PA on-scene representatives should be expected from fire, police, and emergency management organizations.

C14.5.7. Overseas. The theater PAOs will coordinate with the U.S. Embassy in the Host Nation, as well as OASD(PA), to respond to a U.S. nuclear weapon accident overseas. Host Nation PAOs should be expected to respond. They include representatives from military; national-level health, safety, agricultural, and environmental; and local response organizations. Local fire, police, and emergency management PAOs should be expected on scene and will probably arrive before U.S. forces. These officials are integral to a successful PA operation. In the absence of a bilateral agreement, they should be encouraged to form a combined, coordinated response modeled on the JIC concept. See Appendix C14.AP3.

C14.5.8. The Internet and the Worldwide Web offers an efficient means for response forces to communicate messages and information worldwide.

C14.5.8.1. Following confirmation of a U.S. nuclear weapons accident, "DefenseLINK" should have a Web site available for information about the accident. The JIC/CIB should ensure releasable information is forwarded to this site. As soon as practical, the JIC/CIB should determine whether a joint/combined response force Web site is more appropriately handled by a local or other organization.

C14.AP1. APPENDIX 1 OF CHAPTER 14

PUBLIC AFFAIRS GUIDANCE/CONTINGENCY RELEASE

C14.AP1.1. CONTINGENCY RELEASES

CONTINGENCY RELEASE NUMBER 1

"When Public Is Probably in Danger"
(Does confirm)

(Format of sample release to be used if public safety considerations require announcement that a nuclear weapon has been involved in an accident and contamination is likely because of fire or conventional high explosives detonation of the weapon. Make the following statement locally or from competent authority if no local authority is available.)

An/a (aircraft/railroad train/truck/other) accident occurred (state time and location). The accident involved a nuclear weapon that contains conventional high explosives and radioactive material.

There is no danger of a nuclear detonation.

The public is warned to stay out of the area (or indicate the area) (now under surveillance by guards) because the conventional high explosives in the weapon (have detonated, are burning, may detonate). Again, there is no danger of nuclear detonation, but there is a danger from the conventional high explosives in the weapon that (have detonated, are burning, may detonate).

An experienced Federal response team has been ordered to the scene of the accident.

The most immediate danger in an accident of this kind is the effect of the blast caused by detonation of the conventional high explosives in the weapon. Local scattering of nuclear material in the form of finely divided dust may have resulted near the accident site and downwind from the explosion (fire). This poses little risk to health unless taken into the body by breathing or swallowing, and it is considered unlikely that any person would inhale or swallow an amount that would cause illness. As a precaution and until further evaluations are made, anyone within a (to be filled in by CRTF or Deputy Director of Operations [DDO], NMCC) radius of the accident site, particularly downwind from this site (specify boundary where possible), is encouraged to remain indoors.

(NOTE: If applicable, the following shall be included in the release.)

The following precautionary measures are recommended to minimize any risk to the public.

The most appropriate initial action is to remain calm and inside homes or office buildings. Turn off fans, air-conditioners, and forced air heating units. Drink and eat only canned or packaged foods that have been inside. Trained monitoring teams will be moving through the area wearing special protective clothing and equipment to determine the extent of any possible contamination. The dress of these teams should not be interpreted as indicating any special risk to those indoors. If you are outside, proceed to the nearest permanent structure. If you must go outside for critical or lifesaving activities, cover your nose and mouth and avoid stirring up and breathing any dust. It is important to remember that your movement outside could cause yourself greater exposure and possibly spread contamination to those already supervised and protected.

(If plutonium is involved): One of the materials involved is plutonium. Plutonium is both a poison and a radiation hazard. The radiation given off consists of alpha particles that do not have sufficient energy to penetrate buildings, most clothing, or even the outer skin. Therefore, short-term exposure to contamination outside the body will pose negligible health risk.

(If uranium is involved): One of the materials involved is uranium. Contamination by uranium fragments or small particles dispersed by conventional (chemical) explosions or burning of a weapon is primarily a chemical health hazard (heavy metal poisoning similar to the lead poisoning associated with some paints), not a radiological hazard.

The public is asked to stay out of the area (under surveillance or closed off by guards) (and, if true) until a monitoring team, now en route to the site of the accident, can survey the ground and determine the exact area affected by the accident. As a result of the explosion (fire), any fragments found near the scene of the accident may be contaminated and should be left in place. If fragments have been picked up, avoid further handling and notify (authorities) for proper retrieval and disposition

Continuous announcements will be made as more information is known. It is expected that these immediate protective precautionary actions will be required for the next 4 to 6 hours.

A U.S. (Service) team from (name of installation) is en route to (has arrived at) the scene of the accident.

We have no details yet on civilian or military casualties (or give number only of civilian and military casualties) or property damage.

The (type of carrier) was en route from (name of facility) to (name of facility). The cause of the accident is under investigation.

CONTINGENCY RELEASE NUMBER 2

To notify the general public

"No Radiological Danger to the Public"

(Confirms to reduce public alarm)

(Format of sample release to be used initially when no danger to the public from contamination or blast exists, but when confirmation of the presence or absence of a nuclear weapon or nuclear components significantly prevents or reduces widespread public alarm that will result from unusual activity at the incident site.)

A U.S. (type) aircraft (other type of transportation) carrying hazardous material, classified cargo, or unarmed nuclear weapon(s) crashed (or other circumstances) at approximately (location and time).

The public is requested to stay out of the area (add, if true: under surveillance by guards) to prevent any remote possibility of hazard from the accident (or conventional high explosives detonation) and to avoid hampering removal operations. There is no need for evacuation. (There is no danger of nuclear detonation.)

The cause of the accident is under investigation. Further details will be provided as they become available.

CONTINGENCY RELEASE NUMBER 3

To notify the general public

"When Public Is Possibly in Danger"

(Confirms possibility of contamination in a nuclear weapon accident)

(Format of sample release to be used when nuclear weapons or nuclear components have been involved in an accident and the possibility exists for contamination due to fire or explosion, and details are unknown. The release to the general public should only be used after the area has been secured. Release can be modified as indicated below depending on audience.)

MINIMUM ANNOUNCEMENT

A U.S. (type) aircraft (other type of transportation) carrying unarmed nuclear weapons or nuclear components crashed (or other circumstances) at (location) at approximately (time).

The public is asked to stay out of the accident area in the interest of safety due to the possibility of hazard from the accident (or conventional high-explosives detonation) and to avoid hampering recovery operations. (There is no danger of nuclear detonation.)

Add the following for appropriate officials

Fire, rescue, and other emergency services personnel should approach the area with caution from upwind and be equipped with protective clothing and breathing apparatus. Any local official at the scene of the accident or who has left the site who can provide details on the situation should call this number (_____). Current information from the accident scene will assist response personnel in responding to the accident and providing additional public safety guidance. If contact with the accident scene is established, determine the following: condition of aircraft and/or vehicle (such as burning, evidence of explosion, or extent of damage); condition of accident site (such as fire or blast damage); or evidence of obvious cargo (such as shapes or containers). Avoid handling any debris at the crash site.

If the aircraft is transporting nuclear weapons containing insensitive high explosives or weapons overpacked with accident resistant containers, there is a much lower probability of a detonation, and the fire should be fought as long as there is a reasonable expectation of saving lives or containing the fire. The weapons, or containers, if exposed, should be cooled with water.

Law enforcement officials should prevent unauthorized personnel from entering the site and picking up fragments of the plane (vehicle) or its cargo. If any fragments have already been picked up, avoid further contact or handling. Notify (authorities) for retrieval and proper disposition.

A U.S. (Military Department) team from (name of installation) is en route to (has arrived at) the accident scene.

We have no details yet on civilian or military casualties or property damage.

The cause of the accident is under investigation. Further details will be provided as they become available.

CONTINGENCY RELEASE NUMBER 4-A

"To Notify Local and State Officials
When Public Is Possibly in Danger"
(Neither confirms nor denies)

Format of sample release to be used if public safety considerations require notifying local and State officials that hazardous cargo has been involved in an accident, the possibility exists for contamination due to fire or explosion and details are unknown.)

MINIMUM ANNOUNCEMENT

A U.S. (type) aircraft (other type of transportation) carrying HAZMAT crashed (or other circumstances) approximately (location) at (time).

Visitors are warned to stay out of the area of the accident in the interest of public safety. Fire, rescue, and other emergency services personnel should approach the area with caution from upwind and be equipped with protective clothing and breathing apparatus. Use of water directly on the aircraft should be avoided unless needed to save property or lives. Any local official at the scene of the accident who can provide details on the situation should make a telephone call to this number (local phone). Current information from the accident scene will assist in evaluating the accident and providing additional public safety guidance.[1]

EXPANDED ANNOUNCEMENT

If there is no immediate threat to life, and the fire cannot be extinguished immediately (5 minutes), the fire should be contained and allowed to burn out. Water as a firefighting agent should be used with caution due to possible adverse reaction with materials involved in the fire.

Law enforcement officials should prevent unauthorized personnel from entering the site and picking up fragments of the plane (vehicle) or its cargo. If any fragments have been picked up already, avoid further contact or handling. Notify (authorities) for retrieval and proper disposition.

Military personnel have been dispatched (will be dispatched) and will arrive (are scheduled to arrive) soon at the site.

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[1]If contact with the accident scene is established, determine the following:
- Condition of aircraft (burning, evidence of explosion, extent of damage, etc.)
- Condition of accident site (fire, blast, or damage)
- Evidence of obvious cargo (shapes or containers)

Determine the need for a public announcement of nuclear weapons involvement based on the responses to the above.

CONTINGENCY RELEASE NUMBER 4-B

To Notify the General Public
"When Public Is Possibly in Danger"
(Neither confirms nor denies)

(Format of sample release to be used if public safety considerations require making a PUBLIC RELEASE that hazardous cargo was involved in an accident, the possibility exists for contamination due to fire or explosion, and details are unknown.)

A U.S. (type) aircraft (other type of transportation) carrying HAZMAT crashed (or other circumstances) approximately (location) at (time). The public is warned to stay out of the area (under surveillance by guards) in the interest of safety and to aid operations at the accident scene.

A U.S. (Military Service) team from (name of installation) is en route to (has arrived at) the scene of the accident.

We have no details yet on civilian or military injuries or property damage.

Further announcements will be made as more information is known.

C14.AP1.2. IN RESPONSE TO QUERY ONLY

Question: "Are nuclear weapons stored at (name of facility) or (name of facility)?"

Reply: "It is Department of Defense policy neither to confirm nor deny the presence of nuclear weapons at any particular location."

C14.AP2. APPENDIX 2 OF CHAPTER 14

RADIATION FACT SHEETS

FACT SHEET 1

CHARACTERISTICS, HAZARDS AND HEALTH CONSIDERATIONS OF PLUTONIUM

(For release to the general public)

The accident at ___(to be filled in)___ has resulted in the release of the radioactive substance plutonium. Persons who are downwind from the accident may become exposed to this substance by coming into contact with contamination (radioactive material that has coated or fallen upon the surfaces of structures, the ground, or objects) from the mishap. Also, very small amounts of plutonium may have been spread by the winds to adjacent areas. Radiological survey teams are monitoring these suspected areas to determine the presence of plutonium and to measure the levels, if present. No immediate danger exists to anyone, and no medical intervention is necessary; however, some actions may help prevent further contamination or minimize its spread to clean areas.

Plutonium, which is abbreviated Pu, is a heavy metal that has a shiny appearance, similar to stainless steel when freshly machined. After exposure to the atmosphere for any period of time, it will oxidize to a dark brown or black appearance. When released from a weapons accident, plutonium may not be readily seen by the naked eye, but in areas close to the accident, its presence may be assumed in dust and dirt on the ground or on flat surfaces, and from ash resulting from the accident fire.

Plutonium is an alpha radiation emitter; that is, it radiologically decays by the emission of an alpha particle, a very heavy radioactive particle. Alpha particles do not substantially penetrate materials. Their range in air is only a few inches at most. This means that alpha radiation is not a hazard to people as long as it remains external to the body. The epidermis, or outer dead layer of the skin, is sufficient protection for exposure to this isotope from sources external to the body. No external hazard exists to people walking through an area contaminated with plutonium. Alpha radiation can, however, represent an internal radiation hazard when plutonium is taken into the body by inhalation of contaminated air, eating contaminated food, or getting contamination into a wound or cut. In actuality, contamination from ingestion is unlikely to be a problem, since plutonium is very poorly absorbed through the intestines. Less than .02 percent will be absorbed, or 2 of every 10,000 atoms eaten. Likewise, absorption from wounds is not a probable means of significant contamination either, since contamination of a cut or laceration will likely introduce only very small amounts of plutonium into the body. Because of its poor absorption, only inhaling plutonium particles is likely to result in any amount of internal radiation exposure.

Inhaled plutonium is retained in the lungs in much the same manner that people in a dust storm inhale dust. This "dust" settles in the lungs. Once in the lungs, a low percentage of plutonium may be translocated by the bloodstream to the liver and the bones. This deposition can be prevented by using "chelation" compounds, such as ethylenediamine tetraacetic acid (EDTA) or diethylenetriamine pentaacetic acid (DTPA), which hasten the excretion of plutonium from the body via the urine. The use of these chelating compounds is not without some medical hazard to the individual, since they are administered intravenously, and should be performed by a physician who has been in contact with appropriate agencies to coordinate the use of these drugs.

Plutonium in a weapon has a radiological half-life (the length of time it takes for the plutonium to lose one half of its radioactivity) of more than 24,000 years. This long half-life means that its radioactivity does not decrease substantially by nuclear decay or disintegration. Likewise, elimination of plutonium from the body is also a very slow process. Biological elimination of plutonium can be improved significantly by the use of the chelating agents mentioned above.

Therefore, until the limits of contamination are determined, the public is advised to follow a few simple guidelines to minimize the spread of contamination, and there will be little, if any, hazard. Remain inside and minimize opening doors and windows. Turn off fans, air-conditioners, and forced air heating units that bring in fresh air from the outside. Use them only to recirculate air already in the building. Children should not play outdoors. Fruits and vegetables grown in the area should not be eaten. Individuals who think they have inhaled some plutonium should not be unduly concerned. The inhalation of plutonium is not an immediate medical emergency. Very sensitive monitoring equipment is being brought into this area to survey the inhabitants of suspected contamination area(s) for inhaled radiation, and once established, this will be made available to those who need it.

FACT SHEET 2

MEDICAL DEPARTMENT FACT SHEET ON PLUTONIUM

(For Medical Personnel)

Plutonium is a highly reactive element that can exhibit five oxidation states, from three to seven. The principal routes into the body are via inhalation and contaminated wounds; ingestion and contaminated intact skin are unimportant.

Inhalation is probably the most significant route of contamination in a nuclear weapons accident. Retention in the lungs depends on particle size and the chemical form of plutonium involved. Generally, in a weapons accident, plutonium will be in the form of an oxide that has a pulmonary retention half-time of up to 1,000 days.

Absorption via wound contamination will result in a translocation of some of the material to the skeleton and liver. The majority will remain in the vicinity of the wound and may result in the formation of a fibrous nodule within months to years. The possible development of a sarcoma or carcinoma in such nodules is a matter of concern, although there have been no reports of such in the literature.

After entry into the body, some of the plutonium is solubilized by the body fluids, including blood, and is redistributed within the body. Ultimately, it will be distributed by the blood to the skeleton (45 percent), liver (45 percent), and the other tissues (10 percent). The retention half-times are estimated to be 200 years (whole body), 100 years (skeleton), and 40 years (liver).

All medical treatment for plutonium contamination or inhalation should be coordinated with the appropriate Service medical department or with REAC/TS because of the hazard of the substances involved. DTPA compounds are defined as investigational drugs that require the advice and concurrence of REAC/TS before administration. REAC/TS can be contacted at the following number: (423) 576-3131.

Treatment of plutonium-contaminated wounds should involve copious washing and irrigation to attempt to dislodge the contamination. If possible, washings should be saved for later counting to determine contamination levels. More extensive treatment by excision requires judgment in assessing the area involved, the difficulty of excision, and the total quantity in the wound. Greater than 4 mCi of Pu embedded in a wound would be considered a candidate for such treatment. It is not expected that the physician will need to make this determination, since a specialized team to perform such monitoring can be made available from the CRTF or his or her representative. Immediate chelation therapy with DTPA (consult REAC/TS for protocol) should be accomplished prior to surgical excision to prevent possible systemic absorption of Pu. In burn cases, flushing with sterile saline or water will remove a great deal of contamination. The remainder will likely be removed when the eschar sloughs off.

DTPA treatment given immediately following wound or burn treatment has been shown to remove up to 96 percent of the remaining plutonium. In the case of inhaled plutonium, the results have been relatively disappointing, since the oxide forms of Pu are transferred at a relatively slow rate from the lungs into the systemic circulation. Thus, little systemic burden of Pu is available for chelation in the early period after exposure and there is never a time when a sizable systemic burden is available in the extracellular spaces for effective chelation.

In spite of this, DTPA should be used as soon as possible after significant inhalation exposures, since the oxides may not be the only compound present. Attempts to stimulate phagocytosis and the mucociliary response, or to use expectorant drugs, have not been successful in animal studies; however, this may not be true in humans.

The only demonstrated useful procedure in enchasing the clearance of insoluble particles, such as plutonium oxides, from the lung is bronchopulmonary lavage. The risk of this procedure versus the risk of future health effects from the estimated lung burden must be very carefully weighed. The use of repeated lavages should remove 25 to 50 percent of the plutonium that would otherwise be retained in the lung. Again, advice should be sought from Service medical command and REAC/TS.

FACT SHEET 3

PLUTONIUM FACT SHEET

(For Operational Commanders)

As Operational Commander, you will be assaulted by many needs at once in determining the actions to be taken in coping with a nuclear weapons accident. You should have had the opportunity to review the preceding fact sheets for the general public and medical personnel. Several facts are important to keep in mind, as general guidance.

By the time you have arrived at the scene, the weapons will generally have suffered low order detonations if they are going to do so. This low order detonation produces a cloud of finely dispersed plutonium that falls out over the area downwind, depending on particle size, wind direction and speed, and amount of explosives in the detonation. A very worst case situation is shown on the ARAC plots that are made available to you. The initial ARAC plots show the detonation of all weapons involved, utilizing all the available explosives. The actual scenario should be less, perhaps 10 to 100 times less, based on the actual survey data from the site.

The cloud will deposit its radioactive material within minutes of the accident. Unless it happens on base, or you are at the scene, there is little you can do to prevent inhalation from the cloud passage. After initial cloud passage, the inhalation of material from the accident is by resuspending the plutonium by operations in the area of cloud passage, such as walking. DOE can calculate a dose equivalent for persons in the area of the initial cloud passage. Generally, these people will be in the area of hundreds of REM of exposure to the lungs. Note that this is only from the cloud passage; doses from resuspension will be on the order of 100 to 1,000 times less.

The important point is that the ARAC plot generally overestimates the total dispersion of plutonium, and the dose estimate is based only on cloud passage, not later resuspension of the plutonium; therefore, basing your sheltering plans on these numbers can easily result in a significant overestimation of the real problem.

Sheltering should be recommended for the downwind population, but you must be careful to avoid the impression of extreme hazard from the plutonium. Your sheltering advisory should indicate that there is a contamination hazard and a slight inhalation hazard. Care should be taken not to increase tension over the incident. You and your PAO should emphasize that people should remain indoors as much as possible, keep houses closed to prevent contamination, and other ideas as outlined in the public release.

Generally, the resuspension of plutonium in the original areas of contamination is not severe, except for the area very close to the accident site. To prevent the spread of material in this area, early thought should be given to spraying with some sort of fixative to prevent resuspension/spread of the plutonium. Something as simple as hand sprayers with vegetable oil may be used to bind the plutonium into the soil/surface around the site. A secondary advantage is that this method lowers the airborne hazard for the workers inside the control boundaries and may help in making the eventual cleanup process move faster. It will, however, mask the plutonium from some alpha detection RADIACs, such as the AN/PDR 56. Generally, these types of instruments are used only for monitoring people or material leaving the site, not site contamination surveys.

In dealing with a nuclear weapons accident, some of the concepts that are generally employed in handling injuries and/or fatalities on board ship do not hold true, or may be counterproductive. Such an example would be keeping the population under tight sheltering requirements or restricting traffic from the contamination area downwind. Any recommendation for the civilian populace will be just that, recommendations. The military has no authority in the contamination areas unless they are military areas, or are within the NDA. Utilize the local authorities, and have the FEMA representative assist in this function.

Some concept of the exact magnitude of the risk people experience from the incident can be compared with the risks outlined in the Nuclear Regulatory Guide 8.29, reference (aj). The Service/DOE health physicists should be consulted to give the best approximation of the public risk; this can be compared with the risks in the guide.

FACT SHEET 4

CHARACTERISTICS, HAZARDS, AND HEALTH CONSIDERATION OF URANIUM

(For Operational Commanders)

Some nuclear weapons may contain uranium. Uranium is a mild to moderately radioactive material that can be hazardous if inhaled in large quantities. In a nuclear weapons accident, it is possible that the uranium in the warhead of the weapon gets dispersed into the air by fire or explosion of the high explosives in the weapon. (NOTE: this is not a nuclear detonation.) The heat and smoke from the fire or explosion can carry small particles of uranium into the air. As the smoke plume travels downwind, the particles of uranium begin to settle to the ground, leaving a track of contamination on the ground surface and vegetation. Larger particles will settle out first, smaller particles may travel much further. The highest levels of uranium contamination will be in the immediate area of the accident. In general, the further away from the accident, the lower the levels of uranium contamination can be expected.

Uranium is a heavy metal, somewhat like lead. Uranium is a naturally occurring mineral that is mildly radioactive. As found in nature, uranium consists mostly of the isotope U-238, with small quantities of U-235 and extremely small quantities of U-234. This so-called "natural uranium" is only mildly radioactive, emitting alpha and beta radiation and low levels of gamma radiation. The half-life of U-238, the major constituent of natural uranium, is 4.5 billion years. It is likely that uranium released in the circumstances of a weapons accident is in the chemical form of uranium oxide.

Uranium can be "enriched" - that is, the concentration of U-235 can be increased, by a number of methods. Commercial nuclear reactors use uranium that has been enriched so that the U-235 makes about 5 percent of the total uranium mass (the rest is U-238.) Some nuclear weapons use highly enriched uranium (HEU) in which the U-235 makes up more than 90 percent of the total mass of uranium. The uranium left over from the enrichment process is called "depleted" uranium - because it has only about one-third as much U-235 as natural uranium. Nuclear weapons may contain several types of uranium, from depleted to highly enriched.

Uranium can be a mild to moderate radiation hazard if it is inhaled. Uranium is not particularly hazardous if it remains outside the body. If uranium is inhaled, the lungs and other organs of the body can receive doses of radiation; however, a person must inhale a very large quantity of uranium in order to get a significant dose of radiation. Even if the uranium was involved in a fire or explosion, it is unlikely that anyone would get a serious radiation dose from inhalation. It is much more likely that dispersal of uranium would create more of a "nuisance" contamination problem.

Compared to plutonium (the major hazardous material in many nuclear weapons), uranium is not very hazardous. In a nuclear weapons accident in which both plutonium and uranium have been dispersed, the hazard from plutonium will be far more serious than that from uranium. Although uranium emits alpha radiation (that can result in internal radiation doses if taken into the body) very much like plutonium, pound-for-pound, uranium is from 1,000 to 100,000 times less radioactive than plutonium. A person would have to inhale roughly 1,000 to 100,000 times as much uranium mass to get the same dose as they would from plutonium. In addition, uranium does not remain in the body as long as plutonium; therefore, the radiation dose received by the organs is somewhat lower.

Depleted and natural uranium is at least 100 times less radioactive than HEU. It is unlikely that accidents involving dispersal of depleted or natural uranium will result in any significant radiation doses. HEU contamination presents more of a problem than depleted or natural uranium, but is still far less of a problem than plutonium contamination.

If a person is directly exposed to a smoke plume from a fire or explosion involving uranium, they may have been exposed to significant levels of airborne uranium. If they are in areas where the ground was contaminated, they may have been exposed to a much lower level of uranium that was re-suspended into the air. If a person thinks they may have been exposed to uranium (as described above) they should contact the appropriate State or Federal authorities and let them know. The authorities will arrange for appropriate radiation detection tests to be made. These tests may include the collection of urine samples, and/or scheduling for a "lung count" examination. Depending upon the chemical form of the uranium that has been inhaled, some portion of the uranium in the body is excreted in the urine. Urine samples can be analyzed for the presence of uranium. (NOTE: All people have a low concentration of uranium in their urine from the trace quantities of uranium in the normal diet.) Lung count is a procedure performed by placing very sensitive radiation detectors near a person's chest to look for low energy x-rays emitted by the uranium mixture. Typically, the person reclines on a table or in a chair while the detectors are placed very near the chest wall. A lung count is not like an x-ray exam. A lung count is a completely passive exam - the detectors do not emit any radiation, and the person does not receive any radiation dose from the exam. A "quick" screening lung scan can be performed in about 10 or 15 minutes. A more sensitive exam performed at a special "whole body counting" facility typically takes about 45 to 50 minutes.

In general, uranium is more hazardous to children than adults, due to the smaller size and different metabolism of children. In order to assure that children are adequately protected, protective action guidelines established by EPA take this increased sensitivity into account.

If uranium remains outside of the body, it is not particularly hazardous. The beta and gamma radiation emitted by uranium is relatively weak, and uranium emits only low levels of this radiation. The intensity of these gamma rays is so low that the measurable radiation field from uranium only extends a few feet away from solid uranium metal. Even high levels of uranium contamination on the ground will not produce any significant external radiation hazards.

FACT SHEET 5

CHARACTERISTICS, HAZARDS, AND HEALTH CONSIDERATIONS OF TRITIUM

(For Operational Commanders)

Some nuclear weapons have small metal bottles that contain tritium, a radioactive gas. In an accident involving nuclear weapons, it is possible that these gas bottle systems may be damaged, and some or all of the tritium gas released into the air. Tritium gas that is released into the air will be quickly diluted and dispersed, and is not likely to be a significant hazard, unless there was a fire or explosion at the accident, and then it would only be a hazard to people in the immediate area of the accident.

Tritium is a radioactive form of the element hydrogen. From a chemical standpoint, tritium atoms behave just like hydrogen atoms. Tritium is often stored and used in the form of a gas. Like hydrogen, tritium combines readily with many other elements. For example, a tritium atom can take the place of a hydrogen atom in a water molecule, to form what is called "tritiated water," sometimes called "HTO."

Some tritium is produced naturally, by the interaction of cosmic rays in the earth's atmosphere. These cosmic ray interactions produce about 4 million curies of tritium every year worldwide. This tritium is incorporated into rainwater, resulting in a low, but measurable "background," level of tritium in almost all water. The concentration of tritium in surface water is typically on the order of 10 to 50 picocuries per liter.

Tritium is also produced in nuclear reactors. This manufactured tritium can be separated and purified for a variety of uses. There is no difference between manufactured tritium and tritium that is produced naturally. Tritium is used in nuclear weapons, fusion research, luminous signs and watches, and in biomedical research.

Tritium gas is relatively harmless, since very little of it is absorbed into the body, even if inhaled; however, if there were a fire or explosion at the same time as the tritium was released, some or all of the tritium gas would probably be converted into tritium-oxide, (HTO). When people are exposed to HTO in the air, some of it is inhaled, and some of it can be absorbed through the skin.

The radiation doses that might be received from exposure to the smoke plume decrease rapidly with distance away from the accident. People who were directly exposed to the smoke plume, very close to the accident site (within a few hundred yards) might receive radiation doses greater than the occupational limit of 5 rem. Beyond a few hundred yards, doses would be well below a few rem. Beyond about 1/2 mile, the dose to a person who was directly in the smoke plume is likely to be less than the dose a person receives every year from natural background radiation.

Tritium is relatively easy to detect with appropriate instruments. Tritium on surfaces can be detected by rubbing a small piece of filter paper over the surface, and then "counting" the radioactivity on the paper (which is placed in a small vial) in an instrument called a "liquid scintillation counter." Tritium in water or other liquid can be counted by placing a sample of the liquid in a small vial and then counting the vial in the liquid scintillation counter. Tritium in the air can be measured by sampling the air with a "flow-through ionization chamber" instrument, which gives a real time reading of the concentration of tritium in air.

The form of tritium that is most likely to get inside the body is HTO in the form of water vapor (in the air.) Airborne tritium (as tritiated water vapor) can be inhaled, and can also be absorbed through the skin. When people are exposed to tritiated water vapor, about 2/3 of the total intake comes from inhalation of the tritium, and about 1/3 comes from absorption of the tritium through the skin. Tritium can also be incorporated into crops, which then can be ingested.

Once tritium is inside the body, it behaves just like water - and is distributed rapidly and uniformly throughout the entire volume of body water, where it can deliver a radiation dose to the soft tissues of the entire body. Tritium is eliminated from the body at the same rate and via the same pathway as water is eliminated from the body - excretion of urine and feces, sweat, and loss through exhalation.

The amount of time required for half of the tritium remaining in the body to be removed from the body is called the "biological half life." Since tritium in the body behaves just like water, and since the body's water is continually eliminated and replaced, the biological half life of tritium is very short - about 10 days.

C14.AP3. APPENDIX 3 OF CHAPTER 14

PUBLIC AFFAIRS RESPONSE ORGANIZATION CONCEPT

C14.AP3.1. INFORMATION COORDINATION CELL

An ICC of PA decision makers should be established to develop a PA strategic plan that incorporates key messages and ensures frequent coordination with higher headquarters and organizations not represented in the JIC/CIB. The ICC should consist of a senior U.S. military, State emergency response (or foreign national government/military), and local (police and emergency response) PA officer. The ICC should be located with the CRTF and other senior response leadership.

C14.AP3.1.1. The ICC should:

C14.AP3.1.1.1. Authorize JIC/CIB release of information.

C14.AP3.1.1.2. Ensure response personnel are prepared for press briefings and interviews.

C14.AP3.1.1.3. Ensure adequate staffing, equipping, and support of the JIC/CIB and any sub-JICs/CIBs.

C14.AP3.2. JIC/CIB

The JIC/CIB is established for media relations; however, internal information and public outreach programs may be collocated in separate areas of the JIC/CIB, as appropriate.

C14.AP3.2.1. The JIC/CIB should include representatives from all participating organizations that have PA personnel. Computer and administrative support is required.

C14.AP3.2.2. PA personnel must be assigned to the accident scene to handle media at that site and to gather information to provide to the JIC/CIB and ICC.

C14.AP3.2.3. JIC/CIB personnel research, prepare, and coordinate responses for media queries; notify media of briefings; arrange interviews; coordinate photo, film, and video opportunities; and monitor media reports and provide feedback to the ICC.

C14.AP3.2.4. The JIB/CIB personnel support the ICC by setting up press briefings, providing recordings and transcripts of briefings and key interviews, arranging and briefing media escorts, and ensuring frequent contact with the media/media center.

C14.AP3.2.5. The U.S. military ICC director should establish an internal information program for U.S. military personnel.

C14.AP3.2.6. The U.S. military ICC director should ensure a public outreach program is established and ensure participation by response force PA and other members, as appropriate.

C14.AP3.2.7. JIC/CIB layout should include:

C14.AP3.2.7.1. Private JIC/CIB director work area with telephones for the co-directors.

C14.AP3.2.7.2. Media response area with telephones.

C14.AP3.2.7.3. Multi-agency work area with telephones.

C14.AP3.2.7.4. Administrative support area.

C14.AP3.2.7.5. Conference area for JIC/CIB meetings.

C14.AP3.2.7.6. A multimedia area to collect, monitor, and review media coverage.

C14.AP3.3. MEDIA CENTER

The media center is the media work area. This should be collocated with the media briefing area, when possible.

C14.AP3.4. MEDIA BRIEFING AREA

The CRTF PAO, working with local authorities (police, emergency response, and county), should select a large area with adequate seating, acoustics, power, and lighting for media briefings. This should be collocated with the media center, when possible.

C14.AP3.5. SUB-JIC/CIB

PA representatives should be assigned to the accident site to gather information, escort media, and distribute internal information products to on-site personnel. The CRTF should provide these personnel with adequate communications, logistic, and transportation support.

C14.AP4. APPENDIX 4 OF CHAPTER 14

JIC/CIB ADMINSTRATIVE, COMMUNICATION AND LOGISTIC SUPPORT/EQUIPMENT

Administrative, communications and logistic support/equipment needed to support an established JIC/CIB:

- Personal computers, to include laptop systems with CD-ROM capabilities (access to a response force intranet and Internet desired)
- Portable television satellite antennas
- Printers and ink cartridges
- Software and blank disks
- Photocopier machine(s) and access to offset printing
- Copy paper
- Furniture to support multiple work areas
- Visual information, audiovisual and sound reinforcement equipment
- Graphics capability/support
- Professional quality multi-system still and video cameras, video recorders, and playback systems (film, developing equipment, digital electronic imaging equipment)
- 35mm slide and overhead projectors
- Appropriate directional and/or information signs
- Tape recorders and battery chargers
- AM-FM radios
- Blank audio and videotapes

- Office supplies

- News sources to include: Televisions and radio receivers (portable, battery operated); wire services; newspapers; magazines; and electronic bulletin boards, news banks, and databases

- Position locators and/or navigational equipment

- Power converters (110 and 220 volt)

- Extension cords, plug adapters and power strips

- Various types of batteries

- Mobile radios

- Cellular phones

- Answering machines

- Facsimile machines

- Support vehicles (for public affairs staff and media pools/escort)

- Satellite communications

C14.AP5. APPENDIX 5 OF CHAPTER 14

JIC/CIB RECOMMENDED KEY MESSAGES AND NON-RELEASABLE INFORMATION

C14.AP5.1. JIC/CIB RECOMMENDED KEY MESSAGES

The responsibility for public safety rests with local emergency response officials. CRTF release of information to those officials must not be confused with release of information to the general public. It is crucial to publicly confirm a nuclear weapons accident and confirm radioactive contamination (if true) as soon as this information is received and confirmed. Delay will lead to public speculation (response forces will show up in personal protective suits), possible panic, and loss of credibility. Delay may also cause members of the public to be unnecessarily exposed to low levels of radiation that may be released during the accident.

INITIAL PHASE

Safety

- Public safety is our first priority.
- Trained military and civilian personnel are responding.
- There is no risk of a nuclear detonation.
- Please stay away from the cordon so that we can work without interference.
- Preventing any further injuries or loss of life is paramount.
- Please continue to listen to local TV and radio for further advice.

Sympathy

- We deeply regret this accident has occurred.
- Our thoughts and condolences go out to families and friends of those involved.
- We are working closely with all involved military and civilian organizations.

- We are working together as a team.
- Hundreds (thousands) of trained military and civilian personnel are responding.
- We are bringing our best people and the most advanced equipment to deal with this emergency.

Disclosure

- We are here to coordinate the initial response.
- We will give you information as soon as it becomes available.
- We want to answer your questions.
- We do not have all the answers.

Compensation

- There will be an investigation.
- Procedures will be established to handle requests for compensation.

C14.AP5.2. JIC/CIB NON-RELEASABLE INFORMATION

The JIC/CIB must ensure the media and public understand early on that there will be some information that is not expected to be released by the CRTF or the JIC/CIB.

Political

- U.S. host national diplomatic efforts
- Foreign relations
- North Atlantic Treaty Organization (NATO)
- Russia, China, etc.

Policy

- Future nuclear program/posture
- Deterrence
- Legality of nuclear weapons and their use
- Nuclear disarmament
- Weapons safety record
- U.S. nuclear weapons overseas
- Accident investigation arrangements
- Details of government-to-government agreements/arrangements

Operational

- Nuclear weapon command and control arrangements
- Location of nuclear weapons (excluding those involved in the accident)
- Transportation of nuclear weapons (frequency of flights and routes)
- Specific weapon design/characteristics/modifications
- Weapon recovery plans (routes, packaging, and containerization)
- Cost of cleanup/remediation

C14.AP6. APPENDIX 6 OF CHAPTER 14

CHECK LIST

- Recommend CRTF confirms (nuclear weapons accident occurred and radiation contamination).

- Communication with the OASD(PA) and appropriate local and State PA personnel. Overseas, ensure communication with the theater PAO, U.S. Embassy and, as appropriate, foreign military, and local and national PA personnel.

- Ensure security review of, coordinate (legal, weapons, medical, radiological, and SR), and authorize release of information about U.S. nuclear weapon accident response.

- With local authorities, and where appropriate foreign military, establish an ICC, JIC, or CIB, a media center and briefing area.

- Develop a PA plan with key messages.

- Monitor media reports and provide feedback to response organizations and higher headquarters.

- Establish an internal information program.

- Establish and participate in a public outreach program to provide information to the public.

- Ensure adequate communications, transportation, logistic, computer/information system, and administrative support for PA response staff.

- Ensure adequate transportation, communication, and logistic support for media, as appropriate.

C15. CHAPTER 15

LEGAL

C15.1. GENERAL

The occurrence of a nuclear weapon accident will present a myriad of complex legal problems for the Commander of the IRF and the CRTF. The CRTF represents the USG to the general public, State and local officials, the Executive Departments, and other Federal Agencies. Legal issues range from complex questions regarding jurisdiction and authority to exclude the general public from specific areas, to payment of simple personal property claims. The response force organization should include a legal element to advise and assist the CRTF in resolving these issues. The Senior military member of the legal element responding with the staff of the CRTF is the DoD PLA to the CRTF.

C15.2. PURPOSE AND SCOPE

This Chapter identifies specific requirements, resources, and actions to resolve legal issues. Also, it provides a reference list of statutory authorities, regulations, and instructions.

C15.3. SPECIFIC REQUIREMENTS

The PLA will:

C15.3.1. Advise the CRTF and functional staff elements on any matters related to the accident.

C15.3.2. Organize and supervise the legal functional element at the site of the accident, including establishing and operating a claims processing facility.

C15.3.3. Coordinate technical legal matters with a higher authority, when required.

C15.3.4. Coordinate legal issues with the principal legal advisors of other participating Departments or Agencies, as required.

C15.3.5. Provide legal advice and assistance to other Federal officials, upon request.

C15.3.6. Review operational plans to identify potential legal problems and ensure that they are legally sufficient, with emphasis on security, radiological safety, and documentation of evidence for use in resolving claims or in litigation.

C15.3.7. Legal personnel work closely with PAO to ensure no hidden legal implication will impact on response efforts.

C15.4. RESOURCES

C15.4.1. The provision of timely and sound legal advice and assistance is dependent upon adequate personnel and communication among functional elements. The designated legal element of the RTF should include, at a minimum, two attorneys and one legal clerk. The legal element of the IRF response force should remain at the site as an additional resource. Depending upon the nature of, and circumstances surrounding an accident, additional personnel may be required. Predesignated response forces should ensure that the assigned legal element is aware and capable of addressing the complex and politically sensitive national defense issues that evolve from a nuclear weapons accident as well as managing and administering a claims processing facility.

C15.4.2. Other Federal Departments and Agencies may include a legal advisor as an element of their response force. To assure consistency, all legal advice and assistance should be coordinated jointly through the DoD PLA.

C15.4.3. The General Counsel, DTRA, is a member of the CMAT, and will deploy to the accident site to provide expert advice and assistance to the PLA.

C15.5. CONCEPT OF OPERATIONS

This concept establishes guidelines for the operation of the PLA and his or her staff. Circumstances surrounding an accident are the driving force of the sequential order.

C15.5.1. Planning. The PLA must be knowledgeable concerning the authority and responsibility of the DoD as well as that of the various other Federal Departments and Agencies in a nuclear weapon accident. Inherent in this event are the relationships between local, State, national, and international authorities, as well as

jurisdictional principles, security requirements, environmental requirements, and claims administration. Inasmuch as requests for legal advice require immediate response, and adequate research facilities are unlikely to be available on site, designated legal elements should prepare a handbook of references, including those listed at Appendix C15.AP1. These references provide the authority and some background for subject areas, such as establishment of the NDA, law enforcement, use of force, evacuation of civilians, and damage to public or private property. The handbook should be tailored to the respective Service or Agency.

C15.5.2. Initial Actions

C15.5.2.1. The CRTF and staff must have immediate access to the PLA; accordingly, the legal element should be located in or near the JOC/CP.

C15.5.2.2. The provision of timely and legally sound advice and assistance is based primarily upon communication; therefore, liaison must be established with all of the major functional elements of the CRTF's staff to make all elements aware of the need for coordination of planned actions.

C15.5.2.3. The claims processing facility should be established at a location easily accessible to the public and mutually agreeable to local officials. Dependent upon circumstances, more than one claims facility may be required. When possible, the claims processing facility should be collocated with the civil emergency relief and assistance office. As soon as the claims processing facility is established, information regarding the location should be provided to the JIC/CIB for inclusion in a news release.

C15.5.2.4. Claims processing personnel should be aware of the sensitive nature surrounding the accident. The PLA ensures that any information provided to claimants is according to established policies, and that queries for any information other than claims procedures are referred to the PAO.

C15.5.2.5. Response efforts may necessarily result in the disturbance and/or destruction of physical evidence that may later prove to be significant in resolution of claims or litigation. Accordingly, the PLA should take immediate action to ensure preservation of factual and evidentiary information for both safety investigations and claims resolution. This includes photographs and/or videos, interviews with witnesses, documentation of radiological hazards and safety procedures, identification of responding forces and civilians at or near the accident scene, and appropriate recording and receipting of property.

C15.5.2.6. The PLA must identify and establish liaison immediately with local law enforcement officials, legal authorities, and local and State emergency response organizations.

C15.5.2.7. To ensure that legal advice is timely, responsive, and consistent, the PLA should establish liaison with legal advisors representing other Federal Agencies at the accident site.

C15.5.3. Follow-On Actions. The PLA, or a representative, remains at the scene until the response operation is complete. The PLA advises the CRTF when the claims processing facility should cease operation.

C15.5.4. Public Affairs. Adverse publicity is inherent to a nuclear weapon accident simply by its occurrence. Mishandling of PA may impact on claims and litigation, result in a loss of confidence by the public in the actions of the USG in the cleanup process, or have long-term political and financial implications that could undermine support for the Nation's nuclear deterrent capability. It is therefore essential that:

C15.5.4.1. Legal personnel work closely with the PAO to ensure that no hidden legal implications will impact on response efforts.

C15.5.4.2. All personnel involved in the response effort are required to refer all media and public queries for information to the PAO.

C15.6. ACCIDENT RESPONSE PLAN ANNEX

Accident response plans should include a Legal Annex that:

C15.6.1. Identifies the resources to be deployed with the legal element.

C15.6.2. Provides a checklist or synopsis of the actions to be taken by the PLA immediately upon arrival at the site.

C15.6.3. Establishes a policy requiring all functional elements to coordinate actions with the PLA.

C15.6.4. Provides guidelines for documentation of physical evidence that may be significant in the resolution of claims or litigation.

C15.6.5. Describes procedures for establishing and operating a claims processing facility.

C15.6.6. Identifies technical channels of communication.

C15.6.7. Identifies applicable environmental laws, regulations, directives, and instructions.

C15.AP1. APPENDIX 1 OF CHAPTER 15

PERTINENT STATUTES AND INSTRUCTIONS

C15.AP1.1. AUTHORITY FOR RESPONSE TO ACCIDENT

C15.AP1.1.1. Executive Order (E.O.) 12656, "Assignment of Emergency Preparedness Responsibilities," 53 FR 47491, November 18, 1988.

C15.AP1.1.2. White House Memorandum, 19 January 1988, Subject "National System for Emergency Coordination."

C15.AP1.1.3. 42 U.S. Code Annotated (USCA) Sec. 5121 et seq. (Public Law 93-288, amended by Public Law 100-107), "The Robert T. Stafford Disaster Relief and Emergency Assistance Act."

C15.AP1.1.4. E.O. 12148, "Federal Emergency Management," 44 FR 43239, July 20, 1979.

C15.AP1.1.5. E.O. 12241, "National Contingency Plan," 45 FR 64879, September 29, 1980.

C15.AP1.1.6. "Federal Radiological Emergency Response Plan (FRERP)," May 1, 1996.

C15.AP1.1.7. DoDD 3150.8, "DoD Response to Radiological Accidents," June 13, 1996.

C15.AP1.1.8. DoDD 3025.1, "Military Support to Civil Authorities," January 15, 1993.

C15.AP1.1.9. DoDD 3025.15, "Military Assistance to Civil Authorities," February 18, 1997.

C15.AP1.1.10. DoDD 3150.5, "DoD Response to Improvised Nuclear Device (IND) Incidents," March 24, 1987.

C15.AP1.1.11. DoDD 5230.16, "Nuclear Accident and Incident Public Affairs (PA) Guidance," December 20, 1993.

C15.AP1.1.12. DoDD 5410.14, "Cooperation with U.S. News Media

Representatives at the Scene of Military Accidents Occurring Outside Military Installations," October 25, 1963.

C15.AP1.1.13. 44 CFR Part 206, "Federal Disaster Assistance for Disasters On or After November 23, 1988."

C15.AP1.1.14. "Federal Response Plan," April 1999.

C15.AP1.2. AUTHORITY TO ESTABLISH RESTRICTED AREA TO PROTECT CLASSIFIED INFORMATION

C15.AP1.2.1. 50 USCA § 797, "Security Regulations."

C15.AP1.2.2. 42 USCA § 2271, "General Provisions."

C15.AP1.2.3. DoDD 5200.8, "Security of Military Installations and Resources," April 25, 1991.

C15.AP1.2.4. DoDD 5210.2, "Access to and Dissemination of Restricted Data."

C15.AP1.2.5. DoDD 5210.41, "Security Policy for Protecting Nuclear Weapons," September 23, 1988.

C15.AP1.2.6. DoDD 5210.56, "Use of Deadly Force and the Carrying of Firearms by DoD Personnel Engaged in Law Enforcement and Security Duties," February 25, 1992.

C15.AP1.3. CRIMINAL STATUTES

C15.AP1.3.1. 18 USCA § 111, "Assaulting, Resisting, or Impeding Certain Officers or Employees."

C15.AP1.3.2. 18 USCA § 231, "Civil Disorders."

C15.AP1.3.3. 18 USCA § 241, "Conspiracy Against Rights."

C15.AP1.3.4. 18 USCA § 245, "Federally Protected Activities."

C15.AP1.3.5. 18 USCA § 372, "Conspiracy to Impede or Injure Officer."

C15.AP1.3.6. 18 USCA § 641, "Public Money, Property, or Records."

C15.AP1.3.7. 18 USCA § 793, "Gathering, Transmitting, or Losing Defense Information."

C15.AP1.3.8. 18 USCA § 795, "Photographing and Sketching Defense Installations."

C15.AP1.3.9. 18 USCA § 796, "Use of Aircraft for Photographing Defense Installations."

C15.AP1.3.10. 18 USCA § 797, "Publication and Sale of Photographs of Defense Installations."

C15.AP1.3.11. 18 USCA § 1361, "Government Property or Contracts."

C15.AP1.3.12. 18 USCA § 1362, "Communication Lines, Stations, or Systems."

C15.AP1.3.13. 18 USCA § 1382, "Entering Military, Naval, or Coast Guard Property."

C15.AP1.3.14. 18 USCA § 2101, "Riots."

C15.AP1.3.15. 18 USCA § 2231, "Assault or Resistance."

C15.AP1.3.16. 18 USCA § 2381, "Treason."

C15.AP1.3.17. 18 USCA § 2384, "Seditious Conspiracy."

C15.AP1.4. AUTHORITY OF FEDERAL BUREAU OF INVESTIGATION

C15.AP1.4.1. 18 USCA § 3052, "Powers of Federal Bureau of Investigation."

C15.AP1.4.2. 42 USCA § 2271(b), "General Provisions."

C15.AP1.5. AUTHORITY FOR MILITARY ACQUISITION OF LAND AND JUST COMPENSATION FOR PROPERTY

C15.AP1.5.1. 10 USCA § 2672a, "Acquisition: Interests in Land When Need Is Urgent."

C15.AP1.5.1.1. Amendment V. U.S. Constitution.

C15.AP1.6. AUTHORITY FOR PAYMENT OF CLAIMS

C15.AP1.6.1. 10 USCA §§ 2731-2738, "Military Claims."

C15.AP1.6.2. 28 USCA § 2672, "Administrative Adjustment of Claims."

C15.AP1.7. ENVIRONMENTAL AUTHORITIES

C15.AP1.7.1. 42 USCA § 4321, et seq., "National Environmental Policy Act."

C15.AP1.7.2. 42 USCA §§ 9601-9675, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980."

C15.AP1.7.3. E.O. 11514, as amended by E.O. 11991, 42 FR 26967, May 24, 1978, "Protection and Enhancement of Environmental Policy." 35 FR 4247, March 7, 1970.

C15.AP1.7.4. 33 USCA §§ 1251-1386, "Federal Water Pollution Control Act."

C15.AP1.7.5. 16 USCA §§ 1531-1544, "Endangered Species Act."

C15.AP1.7.6. 33 USCA §§ 2701-2761, "Oil Pollution Act."

C15.AP1.7.7. 42 USCA §§ 7401-76719, "Clean Air Act."

C15.AP1.7.8. 42 USCA §§ 6901-6992K, "Resource Conservation and Recovery Act."

C15.AP1.7.9. CFR Part 300, "National Oil and Hazardous Substance Pollution Contingency Plan."

C15.AP1.7.10. E.O. 12580, "Superfund Implementation," 52 FR 5923, January 23, 1987, as amended by E.O. 13016, August 28, 1996.

C15.AP1.7.12. DoDD 6050.7, "Environmental Effects Abroad of Major DoD Actions," March 31, 1979.

C15.AP1.7.13. E.O. 12114, "Environmental Effects Abroad of Major Federal Actions," 44 FR 1957, January 4, 1979.

C15.AP1.7.14. 40 CFR, Part 300, "The National Oil and Hazardous Substance Pollution Contingency Plan."

C15.AP1.7.15. DoDD 5030.41, "Oil and Hazardous Substances Pollution Prevention and Contingency Program," June 1, 1977.

C15.AP1.7.16. DoD Overseas Environmental Baseline Guidance Document.

C15.AP1.7.17. DoD Instruction 4715.5, "Management of Environmental Compliance at Overseas Installations," April 22, 1996.

C15.AP1.8. MISCELLANEOUS

C15.AP1.8.1. 5 USCA § 552. as amended, "Freedom of Information Act."

C15.AP1.8.2. 5 USCA § 552a, as amended, "Privacy Act."

C15.AP1.8.3. 5 USCA § 552b, "Government in Sunshine Act."

C15.AP1.8.4. DoDD 5030.14, "Disclosure of Atomic Information to Foreign Governments and Regional Defense Organizations," July 24, 1981.

C15.AP1.8.5. DoD Directive 2000.12, "DoD Antiterrorism/Force Protection (AT/FP) Program," April 13, 1999.

C15.AP1.8.6. DoD Instruction 2000.16, "Combating Terrorism Program Standards."

C15.AP1.8.7. DoD Directive 3020.36, "Assignment of National Security Emergency Preparedness (NSEP) Responsibilities to DoD Components," November 2, 1988.

C15.AP1.8.8. DoD Directive 5100.46, "Foreign Disaster Relief," December 4, 1975.

C15.AP1.8.9. DoD 5200.8-R, "Physical Security Program."

C15.AP1.8.10. DoD Directive 5525.5, "DoD Cooperation with Civilian Law Enforcement Officials," January 15, 1986.

C15.AP1.8.11. 28 USCA §§ 2671-2679, "Federal Torts Claims Act."

C15.AP1.9. POSSE COMITATUS ACT, EXCEPTIONS TO THE POSSE COMITATUS ACT, AND RELATED STATUTES

C15.AP1.9.1. 18 USCA § 1385, "Use of Army and Air Force as Posse Comitatus."

C15.AP1.9.2. 10 USCA § 331, "Federal Aid for State Governments."

C15.AP1.9.3. 10 USCA § 332, "Use of Militia and Armed Forces to Enforce Federal Authority."

C15.AP1.9.4. 10 USCA § 333, "Interference with State and Federal Law."

C15.AP1.9.5. 10 USCA § 371, "Use of Information Collected During Military Operations."

C15.AP1.9.6. 10 USCA § 372, "Use of Military Equipment and Facilities."

C15.AP1.9.7. 10 USCA § 373, "Training and Advising Civilian Law Enforcement Officials."

C15.AP1.9.8. 10 USCA § 374, "Maintenance and Operation of Equipment."

C15.AP1.9.9. 10 USCA § 375, "Restriction of Direct Participation by Military Personnel."

C15.AP1.9.10. 10 USCA § 376, "Support Not to Affect Adversely Military Operations."

C15.AP1.9.11. 10 USCA § 377, "Reimbursement."

C15.AP1.9.12. 10 USCA § 382, "Emergency Situations Involving Chemical or Biological Weapons of Mass Destruction."

C15.AP1.9.13. 18 USCA § 175, "Prohibitions with Respect to Biological Weapons."

C15.AP1.9.14. 18 USCA § 831, "Prohibited Transactions Involving Nuclear Materials."

C15.AP1.9.15. 18 USCA § 2332c, "Use of Chemical Weapons."

C15.AP1.9.16. 18 USCA § 2332e, "Requests for Military Assistance to Enforce Prohibition in Certain Emergencies."

C15.AP1.10. TREATIES

C15.AP1.10.1. Convention on Early Notification of a Nuclear Accident.

C15.AP1.10.2. Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

C15.AP1.10.3. Rio Declaration on Environment and Development (Rio Declaration).

C15.AP1.10.4. Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Busel Convention).

C15.AP1.10.5. Convention on Environmental Impact Assessment in a Transboundary Context.

C15.AP1.10.6. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Materials (1972 London Convention).

C15.AP1.10.7. Applicable Status of Forces Agreement.

C16. CHAPTER 16

LOGISTICS SUPPORT

C16.1. GENERAL

The Military Service or Agency providing assistance or responding to a nuclear weapon accident will fund costs initially incurred within existing funds. The Military Service or Agency having possession of the nuclear weapon or nuclear weapon components at the time of the accident is responsible for reimbursing, upon request, the Military Service or Agency providing assistance or response. These costs are in addition to normal operating expenses, and that are directly chargeable to, and caused by, the incident/accident. DoDD 4000.25.1-M, "Military Standards Requisitioning and Issue Procedure (MILSTRIP)," reference (ak) is used, as feasible, and supplemented by local service contracts. The amount of logistics support depends upon the location of the accident and the extent of contamination, if any. If an accident results in extensive contamination, Crisis Management and Consequence Management actions, including Site Remediation (SR) and recovery operations may involve up to 2,500 people, extending to 6 months or longer to complete. Specific accident needs may increase or decrease these requirements. As a minimum, billeting, messing, and sanitation services will be provided.

C16.2. PURPOSE AND SCOPE

This chapter provides guidance on logistics support matters peculiar to a nuclear weapon accident. Included are discussions for establishing a project code, base camp support, transportation, and some radiological support.

C16.3. SPECIFIC REQUIREMENTS

Commanders and logistics officers of forces responding to a nuclear weapon accident should determine the availability of assets and facilities at, or near, the scene of the accident and initiate actions to obtain support to satisfy the following requirements:

C16.3.1. Medical evacuation of acute casualties.

C16.3.2. Rapid transport (air or ground) from the airhead or the nearest military installation during early stages of accident response.

C16.3.3. Airhead cargo support for air delivery of supplies to remote sites.

C16.3.4. Transportation.

C16.3.5. Messing and billeting facilities for response force personnel.

C16.3.6. Sufficient water, potable and/or non-potable, to support response force personnel, equipment and personnel DECON stations, temporary fixation of contamination by sprinkling, and leaching operations.

C16.3.7. Maintenance support.

C16.3.8. Sanitation facilities for response force personnel and news media.

C16.3.9. Heavy equipment for base camp construction and recovery/remediation operations.

C16.3.10. POL.

C16.3.11. Packaging and shipping materials for weapons, components, and contaminated waste.

C16.3.12. Electrical power.

C16.3.13. Personal protective and other specialized clothing (climate dependent).

C16.3.14. Laundry facilities for contaminated and uncontaminated clothing.

C16.3.15. Logistical support unique to the JIC/CIB (see Chapter 14, "Public Affairs").

C16.3.16. Documentation of accident-related costs.

C16.4. RESOURCES

Response to a nuclear weapon accident is a high priority operation, and all required resources from DoD, DOE, and other Federal Agencies with a radiological or disaster response capability are normally available to the accident response forces. Use of local facilities and equipment near the accident scene, such as National Guard armories and vehicles, gymnasiums, and hotels, may be viable solutions to some of the logistic

problems. Military installations near the accident site may provide a supply point, messing, and billeting for response force personnel.

C16.4.1. Base Camp Support. If accident location dictates the establishment of a base camp for response personnel, HARVEST EAGLE/HARVEST FALCON, a mobile messing and billeting package maintained by the USAF, may be used. Details on HARVEST EAGLE/HARVEST FALCON capabilities and request procedures are in Appendix C16.AP1.

C16.4.2. Personnel Protective Clothing. Sources of personal protective clothing are in Appendix C16.AP1.

C16.4.3. Contaminated Clothing Laundering Facilities. Commercial contaminated clothing laundry facilities are available and can be identified with the assistance of the DoD JNACC.

C16.4.4. General Services Administration Support. A GSA representative may accompany FEMA personnel and can assist in obtaining telephone service, office and other building spaces, and other administrative and support services.

C16.5. CONCEPT OF OPERATIONS

The importance of the logistics staff officer's involvement in the development of the accident response plan from its conception cannot be overemphasized. It is a basic responsibility to ensure that decontamination and remediation operations are supportable. Base camp logistics support represents a rather routine situation and is almost totally dependent on the number of personnel involved and the duration of the operation.

C16.5.1. Planning. Planning is initiated to identify the location and availability of items not organic to the response organization and that might be a limiting factor to the response effort. Such items may include mylar for radiation instrument probe faces, protective masks, mask filters, and anti-contamination clothing. The logistics staff at the accident site should be tailored to support requirements, but as a minimum should consist of the following:

C16.5.1.1. A materiel control officer.

C16.5.1.2. Three or four administrative supply personnel to maintain the document register and submit requisitions.

C16.5.2. Project Code Generation. Immediately upon notification of a nuclear weapon accident, the RTF logistics staff officer should request assignment of a JCS project code from the Joint Materiel Priorities and Allocations Board, an Agency of the Joint Chiefs of Staff, through the CRTF, Joint Staff (JS), Military Service Headquarters, or unified or specified command headquarters, as appropriate. Once approved, all response-related requisitions should contain the JCS project code. For processing purposes, requisitions with a JCS project code will be ranked above all other requisitions with the same priority designator. Upon assignment of a JCS project code, the Defense Logistics Agency will disseminate implementing instructions to all concerned. The JCS project code request includes the following information:

C16.5.2.1. The type of project code required (always 9 Alpha Alpha).

C16.5.2.2. Project name.

C16.5.2.3. Service monitor or coordinator.

C16.5.2.4. Proposed effective date.

C16.5.2.5. Proposed termination.

C16.5.2.6. Force/activity designator.

C16.5.2.7. Brief narrative background on the nature of the requirement.

C16.5.2.8. Where available, units and forces using the project code should be included.

C16.5.3. Installation Support. The logistics staff officer identifies military installations nearest the accident site and establishes liaison to determine their support capabilities. The installations should be alerted of potential support requirements. If the nearest installation is not within 2 to 3 hours of driving distance, consideration should be given to requesting helicopter support to assist in meeting urgent logistic requirements during the early days of the accident response. Procedures for submitting requisitions and picking up supplies from nearby military installations should be established.

C16.5.4. Base Camp Establishment. The accident location determines if a base camp is needed for feeding and billeting response force personnel, or if local facilities can be used. Any military base within acceptable driving distance and available local

facilities should be considered before establishing a base camp. If required, HARVEST EAGLE and HARVEST FALCON kits may be requested from the USAF. When establishing a base camp, water supply and sanitation facilities must be considered. If a power generating facility is required, it should be positioned so that it can provide power for both the base camp and operations center areas.

C16.5.5. Vehicular Support. A wide variety of vehicles, both in tonnage and purpose, are required to support response operations. If operations continue more than 30 days, equipment maintenance may become a major consideration. To keep the number of maintenance personnel on site to a minimum, frequent rotation of vehicles with the providing organization is recommended. As an alternative, consideration may be given to replacing unit vehicles with rented or leased vans with six- to nine-passenger and cargo carrying capacity when an off-road capability or vehicle mounted radio is not a specific requirement. A sufficient supply of GSA or Defense Energy Support Code (DESC) general use credit cards should be held or readily available for refueling vehicles used in areas where Government fueling facilities may not be available. Vehicles in contaminated areas should not be removed for maintenance or returned to the owning organization until after they have been decontaminated. Minor on-site maintenance of contaminated vehicles may, therefore, be necessary. Base camp construction and/or SR may also require heavy equipment. If resources are obtained through a contract, and work will be done in the contaminated area, decontamination criteria and hazardous working conditions will be addressed in the contract.

C16.5.6. Support for the Department of Energy. The DoD is responsible for providing logistics support to DOE elements, upon request. DOE's logistics requirements, including those of DOE's advance party, will be identified and coordinated by the DOE Support Team Coordinator. The CRTF should be prepared to provide logistics support in coordination with the SEO and the DOE Support Team Coordinator.

C16.5.7. Local Service Contracts. Use of local service contracts to facilitate logistics support is recommended for the following services:

C16.5.7.1. POL.

C16.5.7.2. Water.

C16.5.7.3. Sanitation.

C16.5.7.4. Maintenance.

C16.5.7.5. Laundry of noncontaminated clothes.

C16.5.7.6. Radiological waste.

C16.5.8. Contaminated Clothing Laundry Support. Decontaminating and cleaning personal protective clothing is a critical requirement supporting accident response operations. Additionally, it may be necessary for the response force to assist in decontamination of area residents' clothing. The identification of commercial laundry facilities that provide this service can be made through the DoD JNACC.

C16.5.9. Dissemination of Procedures. Provisions should be made to ensure that all personnel or units responding to the accident are provided written information describing procedures to follow in requesting logistical or administrative support. This information should indicate clearly to whom requests should be submitted, and the approval authority. The status of all requests should be monitored and any problems encountered reported to the requesting person or organization.

C16.5.10. News Media and JIC/CIB Support. Advance planning should take into account the possible billeting, messing, and transportation support for news media as authorized by DoD and Service directives. The number of media personnel could vary from a small number to hundreds depending upon the severity of the accident. Close coordination is required with the PAO to determine specific requirements. The JIC/CIB should be provided full logistical support including transportation, expendable and non-expendable equipment, and supplies. Specific requirements will be determined by the PAO.

C16.6. ACCIDENT RESPONSE PLAN ANNEX

The Logistic Support annex should provide procedures for establishing and maintaining support for response force operations. This annex should include:

C16.6.1. Procedures for obtaining appropriate JCS and/or Service project codes.

C16.6.2. Procedures for establishing and supporting a base camp in remote areas.

C16.6.3. Procedures for establishing maintenance support or equipment rotation during extended operations.

C16.6.4. Procedures for laundering contaminated clothing, including shipping, if required.

C16.6.5. Sources of personal protective clothing.

C16.6.6. Procedures for delivery of requisitioned material to the accident site.

C16.AP1. APPENDIX 1 OF CHAPTER 16

LOGISTICS RESOURCES

C16.AP1.1. HARVEST EAGLE/HARVEST FALCON KITS

C16.AP1.1.1. HARVEST EAGLE and HARVEST FALCON kits are air transportable operations support sets for supporting units that operate in remote locations where pre-positioning is not politically or economically feasible. The kits include tents, field kitchens, cots, and similar housekeeping items. Additional equipment includes generators, NF2 "Lightalls," shower and laundry facilities, water storage bladders, and water purification equipment. The kits do not include vehicles, personal equipment items (such as parkas, bedding, or sleeping bags), or expendables (such as food, fuel, or medical supplies). HARVEST EAGLE and HARVEST FALCON kits are designated war reserve materiels and maintained in a ready-to-deploy status in CONUS by the 4400 Mobility Support Flight, Robbins AFB, GA. These kits are under the operational control of HQ Air Combat Command/Logistics Plans (ACC/LGX).

C16.AP1.1.2. Each HARVEST EAGLE kit can support 550 people, whereas the HARVEST FALCON kit can support 1,100 people. Each total kit can be transported on 14 C-141B aircraft. Kits are configured in four separately deployable packages, each designed to support 275 people. If HARVEST EAGLE or HARVEST FALCON kits are required at an accident scene, the on-scene staff must make arrangements for personnel to unpack and assemble the equipment, and to manage billeting space and operate the field kitchens. Special teams, such as USAF Prime BEEF and RIB units can be requested to provide additional support.

C16.AP1.1.3. HARVEST EAGLE and HARVEST FALCON kits are designated war reserve material and are maintained by ACC, U.S. Air Forces in Europe (USAFE), and Pacific Air Forces (PACAF). Number of kits per command varies.

C16.AP1.2. PERSONNEL PROTECTIVE CLOTHING SOURCES

C16.AP1.2.1. Either permanent or disposable personal protective clothing is used for nuclear accident response.

C16.AP1.2.2. Disposable Personal Protective Clothing. Sources for disposable personal protective clothing are:

C16.AP1.2.2.1. DA Services, Inc., Defense Apparel
247 Addison Road
Windsor, CT 06095
Phone: 1-800-243-3847
Fax: (860) 688-5787
www.daway.com

C16.AP1.2.2.2. Lancs Industries, Inc.
12704 NE 124th Street
Kirkland, WA 98034
Phone: (425) 823-6634
Fax: (425) 820-6784

C16.AP1.2.2.3. Norvell
164 Edgewood Street
Alexandria, TN 37012
Phone: (615) 529-2855
Fax: (615) 529-2853

C16.AP1.2.2.4. RSO, Inc.
P.O. Box 1526
Laurel, MD 20725-1526
Phone: (301) 953-2482
Fax: (301) 498-3017
www.rsonic.com

C16.AP1.2.2.5. Vallen Safety Supplies
5551 Midway Parkplace, NE
Albuquerque, NM 87109
Phone: (505) 344-6631
Fax: (505) 344-0301
www.vallen.com

C16.AP1.2.2.6. FRHAM Safety Products, Inc.
P.O. Box 3491
Rock Hill, SC 29732
Phone: (803) 366-5131
Fax: (803) 366-2005
www.frhamsafety.com
AND

P.O. Box 101177
Nashville, TN 37224
Phone: (615) 254-0841
Fax: (615) 726-2514

C16.AP1.2.27. Durafab Disposables, Inc.
P.O. Box 658
Cleburne, TX 76031
Phone: (800) 255-6401
www.k-caway.com

C16.AP1.2.3. Permanent Personnel Protective Clothing. NSN for permanent personnel protective clothing are:

ITEM	SIZE	NSN
Coveralls, Radioactive	Small/medium	8415-00-782-2815
Coveralls, Radioactive	Large, extra large	8415-00-782-2816
Hood, Radioactive Contaminant		8415-00-782-2808
Hood, M6A2		4240-00-999-0420
Gloves, Cloth		8415-00-634-5026
Glove Shells, Radioactive Contaminant	8 through 10	8415-00-782-281 through 8415-00-782-2814
Shoe Covers	Small through extra large	8430-01-712-2872 through 8430-01-721-2876
Overshoes, Combat	Small	8430-01-048-6305

C16.AP1.3. CONTAMINATED CLOTHING LAUNDERING FACILITIES

Commercial contaminated clothing laundry facilities may be used at various locations throughout the United States. The DoD JNACC assists in identifying any commercial facilities near an accident site.

C17. CHAPTER 17

TRAINING

C17.1. GENERAL

The Services have the responsibility to ensure that accident response personnel are efficiently trained. The management of nuclear weapon accident response depends on the availability of well trained and skilled personnel. To achieve and maintain a posture capable of responding well to a nuclear weapon accident, commanders of designated response forces should ensure that their personnel have the knowledge and training necessary to fulfill their responsibilities; therefore, designated CRTF and other key personnel should attend appropriate courses offered by the DNWS and the respective Services at the earliest opportunity.

C17.2. PURPOSE AND SCOPE

This chapter informs senior staff planners and potential CRTFs about training courses available in nuclear weapon accident response.

C17.3. ORGANIZATIONAL TRAINING

When organizational nuclear weapon accident response training exercises are conducted, consideration should be given to inviting external organizations with which the exercising unit would expect to interface in an actual accident, to observe or participate in the exercise. These exercises can provide the basis for developing draft recovery plans/portions of plans that are not accident specific. The JNACC is willing to participate in organizational training, operational commitments permitting.

C17.4. TRAINING COURSES

C17.4.1. Defense Nuclear Weapons School. The DNWS at Kirtland AFB, NM, offers a variety of courses designed to develop and maintain a nuclear weapon emergency response capability. These courses are available to all Service personnel and employees of the Federal Government whose positions require special skills and knowledge in nuclear weapon emergency situations. A list of available courses at the DNWS is in Table C17.T1.

C17.4.2. Service Schools. Specific course information for Service schools is found in the following:

C17.4.2.1. DA Pamphlet 351-4, "USA Formal Schools Catalog."

C17.4.2.2. Catalog of Naval Training Courses (CANTRAC), Vol. SP11, "Naval Education and Training (NAVEDTRA) 10500."

C17.4.2.3. AF Catalog 36-2223, "USAF Formal Schools Catalog."

C17.4.2.4. DoDD 5010.16, "Defense Management Education and Training Program," July 28, 1972.

C17.4.3. The FEMA, National Emergency Training Center, Emmittsburg, MD, offers the FRERP Workshop (Course E358).

C17.4.4. Specialized courses for medical response personnel.

C17.4.4.1. Handling of Radiation Accidents by Emergency Personnel. A 3 1/2-day course scheduled several times each year at the REAC/TS, Oak Ridge, TN. This course emphasizes the practical aspects of handling a contaminated victim.

C17.4.4.2. Health Physics in Radiation Accidents. A 4 1/2-day course for health physicists and radiation protection technologists who may be called upon to respond to accidents involving radioactive materials and injury to personnel. Classes are scheduled at the REAC/TS, Oak Ridge, TN.

C17.4.4.3. Medical Planning and Care in Radiation Accidents. This 4 1/2-day course presents an advanced level of information on the diagnosis and treatment of acute local and total body radiation exposure, internal and external contamination, combined injuries, and multi-casualty incidents involving ionizing radiation. Classes are scheduled at the REAC/TS, Oak Ridge, TN.

Table C17.T1. **Nuclear Weapon Accident Response Training Courses**

COURSE	CONTENT	DURATION
Radiological Accident Command, Control, and Coordination (RAC3) Course	Provides training in responsibilities; problem resolution involved in a radiological weapons accident	4-1/2 days
Nuclear Weapons Technical Inspection Course (NWTIC)	Provides an overview of the nuclear weapons technical inspection process	1 day
Radiological Hazards Training Course (RHTC)	Provides medical personnel training to be members of an emergency response team and set up a CCS	4 days
Radiological Emergency Team Operations (RETOPS) Course	Covers the scope of actions required to respond to a radiological accident as a radiological emergency team member, basic physics, accident/ incident history, and Federal response plans and capabilities	10 days
Joint Nuclear Explosive Ordnance Disposal Course (JNEODC)	Provides detailed sustainment training for officers and enlisted in nuclear EOD operations	5 days
Joint DoD/DOE Nuclear Surety Executive Course (JNSEC)	Provides an overview of safety, security, and control features incorporated into stockpiled nuclear weapon systems	1-1/2 days
Nuclear Weapons Effects Course (NWEC)	Basic familiarization in effects of nuclear weapons and information found in numerous DoD publications	1 day
Commander and Staff Radiological Accident Response (CASRAR) Workshop	Provides worldwide deployable mobile training to promote a fundamental understanding of complex radiological accident response issues and to involve/ integrate the Commander's staff	3 days
Radiological Emergency Team Orientation (RETOR) Course	To provide worldwide deployable mobile training tailored to specific organization/installation radiological emergency response needs	3 to 5 days
Medical Effects of Ionizing Radiation (MEIR) Course	Provides medical personnel with background material relating to human injury and combat effectiveness in a nuclear weapons detonation or accident scenario	4 days

PART III

SITE REMEDIATION GUIDANCE

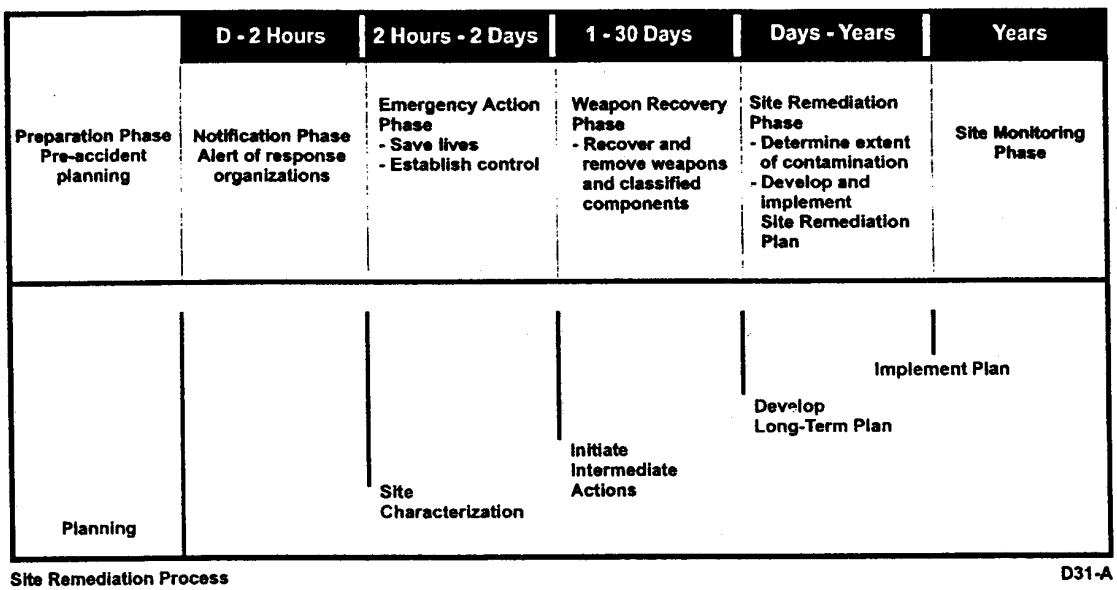
C18. CHAPTER 18

OVERVIEW OF THE SITE REMEDIATION PROCESS

C18.1. INTRODUCTION

SR is that phase of the radiological accident response that primarily deals with remediation of the affected area. SR is closely integrated with other phases of accident response (Figure C18.F1.). Many of the response teams that arrive early on to support the emergency response and recovery phases will remain at the accident site in some capacity to support SR. Remediation actions at the site may begin as early as the initial response phase and last for years after the radiological material is recovered. Ideally, the work of SR begins when response organizations develop plans to integrate their forces with other Federal, State, and local response organizations at an accident site.

Figure C18.F1. Nuclear Accident Response Phases



C18.2. THE SITE REMEDIATION PROCESS

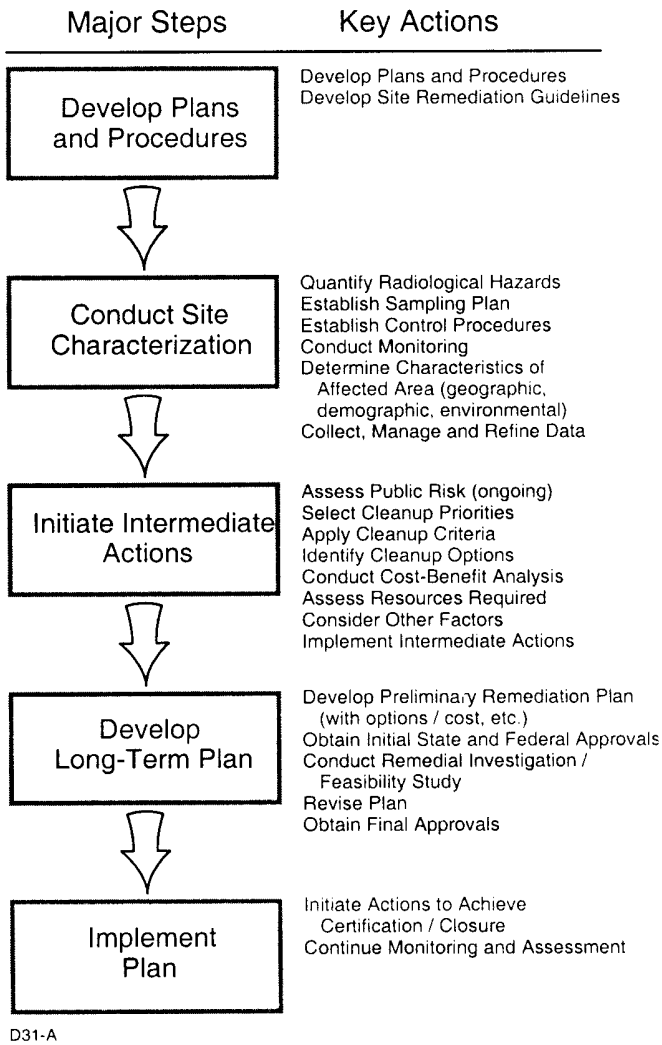
SR can be viewed in five steps: planning, site characterization, conducting intermediate actions, developing a long-term plan, and implementing the plan. Figure C18.F2. illustrates these steps and their key actions. In actuality, the SR process is

ongoing. Many actions overlap from one step to the next as response forces address the difficult problem of remediating contaminated land, buildings, and property to agreed upon safe levels. By understanding the key actions required in each step, primary response organizations can refine their plans and organizational structures to meet the demanding tasks of SR.

C18.2.1. Develop Plans and Procedures. The overall purpose of Part III is to assist the CRTF and supporting organizations in developing and refining SR plans and procedures. The five-step process described below was developed by SR experts in an attempt to identify key actions that must be accomplished during the SR effort.

C18.2.2. Conduct Site Characterization. The key actions identified in this step are highly technical in nature, but a comprehensive and complete characterization of the problem is necessary to an effective SR effort. Current Service and DOE guidance addresses this step in detail.

Figure C18.F2. The Site Remediation Process



C18.2.3. Initiate Intermediate Actions. Intermediate actions are discussed in detail in Chapter 20. Planners must recognize that some SR actions will begin very soon after the accident, before the full SR effort has begun. Events in this step may take days or weeks to complete and have a significant impact on the final SR plan. During this step, the SRWG is formally established.

C18.2.4. Develop Long-Term Plan. Once the radiological material and classified components have been removed from the accident site, developing the SR plan becomes the primary goal of the CRTF and other supporting organizations responding to the accident. This step will involve extensive coordination and approval at all levels before a final plan evolves. While a budget should be developed, the cost of

remediation should not be the driving factor in developing a plan. Realize that it may take months, or perhaps years, to complete.

C18.2.5. Implement Plan. Once all plans have been approved, various elements will implement the plan, monitored by an LFA representative and the State and local government. Members of the SRWG continue to provide advice and assistance to the LFA and State during this period.

C18.3. ROLE OF THE CRTF

C18.3.1. Upon arrival at the accident scene, the CRTF faces the challenge of integrating forces from diverse Federal and Service accident response organizations to recover the radiological material, ensure the safety of all personnel in the area, and remove the material and all classified components as quickly and safely as possible. At the same time, the CRTF must work closely with Federal, State, and local officials to ensure public health and safety issues are adequately addressed. At times, these priorities may appear to be in conflict, but public health and safety concerns are always paramount. Recognizing the role of State and local authorities and the importance of public involvement throughout the SR process is vital to a successful SR effort.

C18.3.2. The State or local governments have the primary responsibility for planning the recovery of the affected area. Recovery planning will be initiated at the request of the States. The Federal Government will, on request, assist the State and local government in developing off-site recovery plans prior to the deactivation of the Federal response.

C18.3.3. Regardless of where the accident occurs, the CRTF plays a key role in ensuring that DoD fulfills its responsibilities in accident site recovery and cleanup. This role varies somewhat depending on the location of the accident. The CRTF always maintains primary responsibility for recovery and removal of material and classified components. Once accomplished, the focus is on the SRWG in the development of an SR plan. If the accident occurs on a military installation or on Federal property, the CRTF takes the lead in SR activities and cleanup with a major responsibility for coordination with other Federal, State, and local authorities. If the accident occurs off an installation or Federal property with DoD in possession, then DoD assumes the role of the LFA. In this case, the CRTF retains a major role in development of the SR plan by the SRWG and in supporting State and local authorities who will direct the SR effort.

C18.3.4. Coordination with all supporting organizations is critical. Support from

other Federal Agencies responding to the accident is coordinated through the DFO, chaired by FEMA. In addition, the State will probably deploy a forward element of its emergency management division to the accident site. This organization, which normally works directly for the Governor, will take the lead in remediation of affected State property. Coordination with local jurisdictions that may be affected is essential throughout the process.

C18.3.5. The CRTF's role in directing and coordinating SR activities changes as the activities at the accident scene progress from initial recovery operations to intermediate and long-term activities. Chapter 19 discusses more fully the role of the CRTF, responding organizations represented in the SRWG and the overall SR process.

C19. CHAPTER 19

ACCIDENT SCENE RESPONSE

C19.1. INTRODUCTION

C19.1.1. In the area of SR, the challenge for the CRTF is to form a cohesive and effective organization at the accident scene that can address the wide variety of SR issues in support of State and local governments. The expertise to accomplish this task comes from separate and distinct organizations that respond to the accident. The CRTF must integrate Federal, State, and local resources in order to achieve the goal of remediation to a level that is technically and fiscally achievable within socially and politically acceptable guidelines. The primary organization for coordinating Federal resources, when DoD is the LFA, is the SRWG.

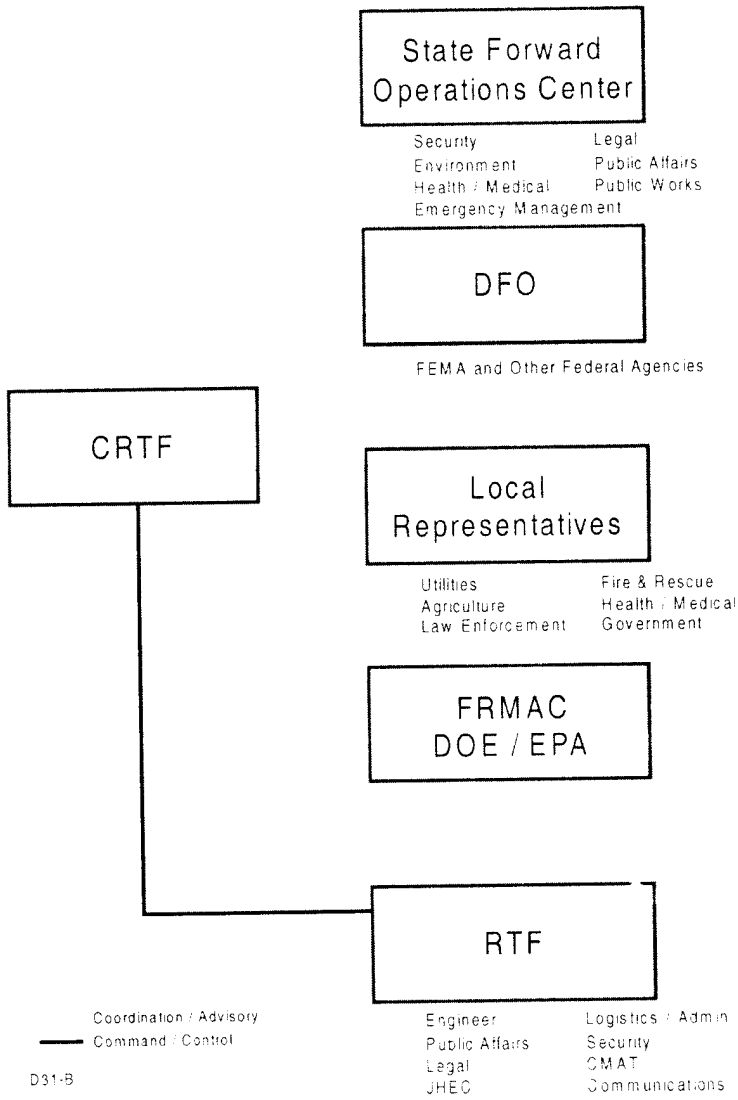
C19.1.2. The SRWG is an organization formed at the accident scene whose sole purpose is to focus on SR issues. The SRWG draws upon the expertise of the various elements who respond to the accident to form a coordinated SR team. Membership in the SRWG will vary, depending on the extent of contamination at the accident scene. SRWG members should have the requisite qualifications and level of authority to plan and coordinate SR activities on behalf of their organizations.

C19.1.3. The timing for forming the SRWG is unique to the specific conditions of the accident. Most of the agencies, organizations, and groups that eventually have representation on the SRWG are present from the early stages of accident response. An informal SRWG could form even as weapon recovery operations are ongoing; however, the expectation is that the SRWG, as a formal, authoritative and responsible organization, will be convened after weapons are removed, classified components and documents are recovered, but prior to the deactivation of the Federal response. The SRWG will remain active after deactivation, if continued support to State and local governments is requested.

C19.2. EARLY SITE REMEDIATION EFFORTS

C19.2.1. Early efforts addressing SR are likely to be less formal as the CRTF concentrates on the successful recovery and removal of the nuclear weapons. At this stage, small numbers of people are working separately on issues related to SR. Elements of the SRWG exist in an informal relationship that is coordinated by the CRTF. Figure C19.F1. illustrates this relationship. During this stage, the CRTF is responsible for coordination and communication among key SR elements.

Figure C19.F1. Site Remediation: Early Stages



C19.2.2. These separate elements will begin the process of SR. Some preliminary planning within the JHEC is possible as contamination and damage information becomes available. The JHEC is the CRTF's single control point for all on-site hazard/radiological data and has access to off-site information through coordination with the FRMAC.

C19.2.3. The FRMAC, employing DOE assets other than those supporting the RTF, conducts off-site response to a radiological accident as directed by DOE during the emergency phase, with subsequent transfer to the appropriate lead agent for intermediate and long-term actions. It provides information and support to the State and the CRTF as well as the JHEC in the development of the SR plan. The Director of the FRMAC will assign a representative to the SRWG.

C19.2.4. FEMA, in accordance with the FRERP, forms the DFO to coordinate Federal, State, and local agencies' assistance to the CRTF for off-site accident response functions other than radiological monitoring and assessment. It will continue operations into the remediation phase. The SFO, Director of the DFO, has a major coordinating function as the CRTF's official liaison with State, local, and public representatives at the site.

C19.2.5. The State will establish a forward operations center at the accident scene to maintain close coordination with the CRTF and Governor's office. State and local representatives will also participate in the DFO and FRMAC. State and local representatives must be included in early stages of SR planning and throughout development and implementation of the long-term plan.

C19.3. REMEDIATION PHASE: THE SRWG

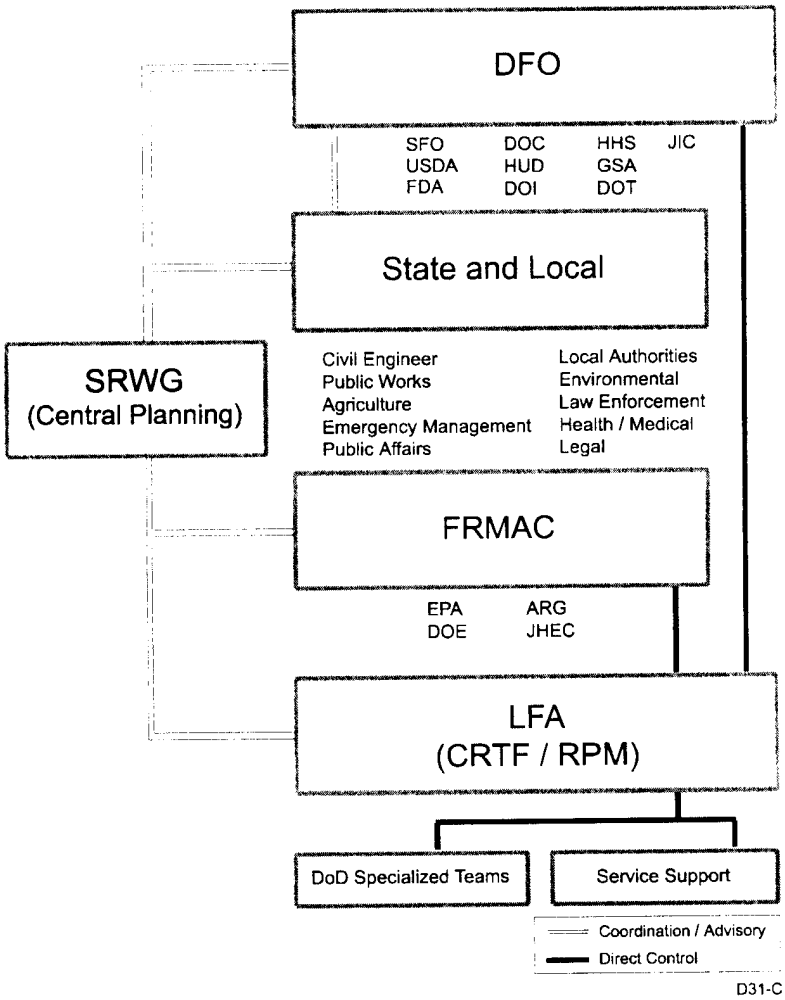
C19.3.1. As weapon recovery operations wind down, the focus of activity shifts to SR. Using guidance from Federal, State, and local authorities, the SRWG becomes the central planning agent for SR and begins the SR activities described in detail in the following chapters. In accomplishing this, the SRWG will be constantly reaching out to organizations at the accident site (Figure C19.F2.) as well as to those in a position of authority to gather information, make decisions, and affect SR activities.

C19.3.2. The SRWG is expected to be a dynamic organization with a varied composition. Leadership will depend on many factors, such as time elapsed since the accident, scope of the remediation problem, location of remediation activity, and the desires of the State. The SRWG may be directed by the LFA or the State. Figure

C19.F2. illustrates how the SRWG interacts with other elements in the SR process. While the SRWG includes important representation by State and local interests, assistance and advice from several Federal Agencies, coordinated through the DFO and FRMAC, may be needed to solve specialized problems, for example:

U.S. Department of Agriculture (USDA)	- crop damage
Department of the Interior (DOI)	- Federal lands
Department of Commerce (DOC)	- industrial damage
Department of Transportation (DOT)	- highway, railway closures
Housing and Urban Development (HUD)	- housing assistance
Health and Human Services (HHS)	- medical services
- Food and Drug Administration (FDA)	- food contamination
- Centers for Disease Control and Prevention (CDC)	- public health concerns
General Services Administration (GSA)	- contracting assistance
Corps of Engineers (CE)	- water supply
Environmental Protection Agency (EPA)	- non-radiological impact
Armed Forces Radiobiology Research Institute (AFRRI)	- cleanup cost estimates

Figure C19.F2. Remediation Phase Relationships

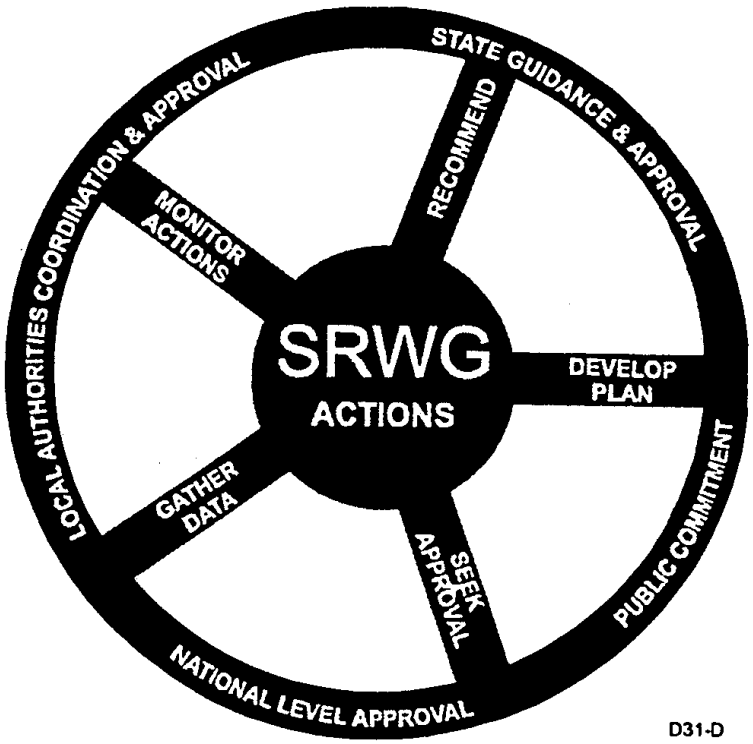


C19.3.3. The SRWG should apply a similar coordination process to take full advantage of State and local assets, as well as additional DoD and DOE resources, that may be available.

C19.3.4. Using this coordinated approach, the SRWG's role is to make recommendations, monitor implementation of approved intermediate actions and their impact on long-term recovery and begin long-term SR planning. During the SR phase of accident response, the SRWG will coordinate with a variety of sources both at the accident site and at other locations. Members have the responsibility to coordinate long-term remediation plans at higher levels but should have the expertise necessary to advise accident site authorities on immediate remediation actions. Figure C19.F3. illustrates the complicated process of drafting, approving, and implementing an SR

plan using the SRWG as the central planning organization. Representing interests of the Federal, State, and local governments and the public, SRWG members must have the authority to make some independent decisions when time does not permit coordination and approval at higher levels. This is especially true where intermediate actions are concerned.

Figure C19.F3. SRWG Approval and Coordination Process



C19.4. EVOLUTION OF THE SRWG

The SRWG will expand and contract with changing conditions at the accident scene. As recovery operations are completed, the SRWG may absorb some cells from other response organizations, or the SRWG Director may decide to keep those elements separate and use the SRWG as a final coordination and approval group. Membership, size, and location of the SRWG are flexible and dynamic. Coordination and approval of the long-term plan may take an extended period of time and concentrated effort, requiring a substantial SRWG membership. Once the plan is agreed upon, the SRWG's role should become that of monitor and advisor. Members will likely return to their normal responsibilities, meeting on an ad hoc basis to address issues that arise in implementing the plan.

C20. CHAPTER 20

INTERMEDIATE ACTIONS

C20.1. INTERMEDIATE ACTIONS

C20.1.1. Step 3 in the SR Process is to initiate intermediate actions. Intermediate actions are those steps taken to achieve three principal goals: protect public health and environment, restore essential services, and develop the basis for a long-term plan. Some intermediate actions will occur very early in the accident response, before the formation of the SRWG. The CRTF should consider these factors:

C20.1.1.1. Intermediate actions will have an impact on future SR decisions.

C20.1.1.2. There is a need for visible and immediate SR actions that will require rapid State and Federal approval.

C20.1.1.3. Remediation decisions at this early stage will be influenced by political and social factors as well as technical goals and limitations.

C20.1.1.4. While authority for remediation decisions could rest with the State/local representatives, responsibility for remediation costs and damages is expected to remain with DoD.

C20.1.1.5. Priorities of Federal, State, and local authorities and special interest groups may differ.

C20.1.1.6. Intermediate actions will vary depending on the circumstances surrounding the accident.

C20.1.2. The CRTF must weigh each of these factors, in coordination with other Federal, State, and local authorities, in deciding which intermediate actions to take.

C20.2. IMPORTANCE OF INTERMEDIATE ACTIONS

C20.2.1. Perhaps the most important objective of intermediate actions is to demonstrate to the community and public officials that steps are being taken to restore their pre-accident quality of life as soon as possible; however, this should only be done within the parameters of public health and safety.

C20.2.2. Initially, SR planners should develop a process or structure which, to the extent possible, permits the eventual return to normalcy for the affected area. Including public participation in the development of this process allows the people to have their questions answered and gains public confidence in the SR plan that will emerge.

C20.2.3. Intermediate actions should concentrate on those problems that are most important or can be accomplished quickly and easily. For example:

C20.2.3.1. Reopen transportation arteries that may have been closed (i.e., highways, bridges, railways, and airports).

C20.2.3.2. Minimize health and safety threats. Attempt to certify as safe from contamination any affected water and food sources; otherwise, ensure the rapid and plentiful supply of food and water from alternate sources.

C20.2.3.3. Identify remediation means and materials that are already present among Federal, State, local, and private/commercial resources. Knowledge of what is available may reduce response time and cost.

C20.2.3.4. Address the short-term economic impact on the area and people. Confer with FEMA as to relief alternatives available such as disaster declaration or Federal assistance from other sources that can provide immediate assistance.

C20.2.4. Effective intermediate actions such as these, properly coordinated and communicated to the public, can be instrumental in building public trust and confidence in the remediation effort.

C20.3. INTERMEDIATE ACTION PLANNING

C20.3.1. The typical intermediate actions identified in this section are not meant to be exhaustive. These were identified as areas of emphasis all planners should consider in developing organizational site remediation plans.

C20.3.2. Protecting public health and safety is the most important consideration when site remediation becomes the focus of attention. Earlier steps taken by accident response forces should be reviewed for adequacy and applicability for the present and future, including:

C20.3.2.1. Public service announcements (PSAs) on television and radio

explaining what is happening, how to find shelter/protection, and/or what type of materials to use.

C20.3.2.2. Control of transportation arteries in the affected area.

C20.3.2.3. Application of appropriate fixatives.

C20.3.2.4. Testing water sources.

C20.3.2.5. Testing air and soil for contamination.

C20.3.2.6. Controlled evacuation of affected population.

C20.3.2.7. Controlled access to contaminated areas.

C20.3.2.8. Certification of contamination-free areas and resources.

C20.3.3. As long as contamination exists, there is a possibility that people may receive an uptake of radioactive material or an external radiation exposure. It is likely that as SR is initiated, limited DECON will have been accomplished. As a result, protective action should be taken to minimize radioactive material uptake via ingestive pathway methods. Some that should be considered are:

C20.3.3.1. Develop PSAs on proper handling of food, both fresh and packaged.

C20.3.3.2. Monitor food and water sources.

C20.3.3.3. Embargo foods from contaminated lands and water sources.

C20.3.3.4. Seek alternate food sources.

C20.3.3.5. Establish examining stations for followup monitoring.

C20.3.3.6. Establish a bioassay program.

C20.3.3.7. Implement inspection program for restaurants along with food production and handling businesses.

C20.3.4. There is little doubt that feared or actual radiation damage to the environment will dominate public, political, and media discussions, second only to concerns for public health and safety. SR managers must be prepared to demonstrate

that the actions being taken are necessary and environmentally sound. Plans should consider:

C20.3.4.1. Test soil for contamination.

C20.3.4.2. Apply fixatives, as appropriate.

C20.3.4.3. Conduct air sampling.

C20.3.4.4. Analyze contamination level of rivers, lakes, and streams.

C20.3.4.5. Minimize threat to fish and wildlife by removing contamination from their respective habitats.

C20.3.4.6. Identify temporary and safe storage areas for waste.

C20.3.5. Among the earliest questions will be those concerning a return to normalcy. Remediation of services should be a priority for SR planners. The plan should consider actions necessary to restore:

C20.3.5.1. Water supply.

C20.3.5.2. Electricity.

C20.3.5.3. Highways.

C20.3.5.4. Heating fuels.

C20.3.5.5. Gasoline.

C20.3.5.6. Refuse pickup.

C20.3.5.7. Mail delivery.

C20.3.5.8. Sewage treatment.

C20.3.5.9. Sanitation.

C20.3.5.10. Health care.

C20.3.5.11. Transportation systems.

C20.3.6. The largest and most complicated challenge, after weapon recovery, is

the containment of contamination. There are many avenues by which contamination can be spread. Consideration should be given to the following:

C20.3.6.1. Limit access, ground and air.

C20.3.6.2. PSA to stay inside when/if threat exists.

C20.3.6.3. Apply fixatives.

C20.3.6.4. Restrict water distribution.

C20.3.6.5. Movement of birds and animals.

C20.3.7. Re-entry to contaminated areas by residents to care for pets, obtain essential items, or secure property may be possible on a limited basis. Careful consideration should be given to the potential difficulties that may arise. Security personnel should:

C20.3.7.1. Determine circumstances under which residents can return temporarily.

C20.3.7.2. Verify that contamination levels are not hazardous.

C20.3.7.3. Evaluate the impact of not allowing access to residents.

C20.3.7.4. Maintain adequate security.

C20.3.7.5. Limit exposure time.

C20.3.7.6. Have adequate decontamination facilities.

C20.3.7.7. Provide proper protective clothing for limited entry, when required.

C20.3.7.8. Allow only a manageable number of people into the area.

C20.3.7.9. Caution residents against disturbing the area.

C20.3.8. Consider the public impact of early SR actions. This may be the beginning of a protracted period of inconveniences that will be imposed upon the population. Carefully evaluate planned actions and:

C20.3.8.1. Keep the public informed: dispel rumors and inaccuracies immediately.

C20.3.8.2. Involve public officials and residents in planning.

C20.3.8.3. Explain hazards and how to avoid them.

C20.3.8.4. Provide health and medical services for affected individuals.

C20.3.8.5. Control the number of visible response personnel, if operationally possible.

C20.3.9. Realize that, in a highly visible operation like SR, political oversight is to be expected. Do not fail to include political considerations in decision making. Strongly recommend:

C20.3.9.1. The establishment of a political liaison office.

C20.3.9.2. Inviting participation or observation by representatives of Federal, State, and local political officials, when operationally possible.

C20.3.9.3. Seeking input from public interest and environmental groups.

C20.3.10. Cost benefit considerations should be a factor, albeit perhaps minor, in any operation as expensive as SR is expected to be. While return of the affected area to its original state may be the desire of residents, the cost of that last marginal improvement could be prohibitive. Recognize that:

C20.3.10.1. Costs may be difficult to assess in the short and intermediate terms.

C20.3.10.2. "Level of risk" rather than "cleanup level" is the preferred benchmark/goal.

C20.3.11. Unless the accident site is in an isolated location, it is likely there will be at least a short-term economic impact on residents. Depending on location, the CRTF may have to address such issues as:

C20.3.11.1. Agricultural losses.

C20.3.11.2. Pressing for disaster area designation for Federal relief.

C20.3.11.3. Loss of work by residents.

C20.3.11.4. An impact on tourism.

C20.3.12. The pre-accident usage of the affected area will dictate (to some extent) the site remediation priorities to be set and methods to be used. Residential, commercial, industrial, agricultural, forested - each requires a unique remediation plan.

C20.3.12.1. Contamination of two or more types of areas complicates SR.

C20.3.12.2. Prioritize for best use of remediation efforts and resources.

C20.3.12.3. The proposed remediation action may necessitate a long-term change from prior usage.

C20.3.12.4. Timeframe for returning the area to near normal usage varies by affected area.

C20.3.13. Any Intermediate Action plan should also examine the impact on long-term SR. Questions to be addressed include:

C20.3.13.1. Will this step have to be reversed? At what cost, financially or in good will?

C20.3.13.2. Can the action increase size of contaminated area?

C20.3.13.3. What are the potential long-term political and social considerations?

C20.3.14. Remember the goals of intermediate actions: protect public health and environment, restore essential services, and develop the basis for a long-term plan. Intermediate actions are the start of an effective SR effort. They should be considered by the CRTF from the onset.

C21. CHAPTER 21

LONG-TERM ACTIONS

C21.1. LONG-TERM ACTIONS

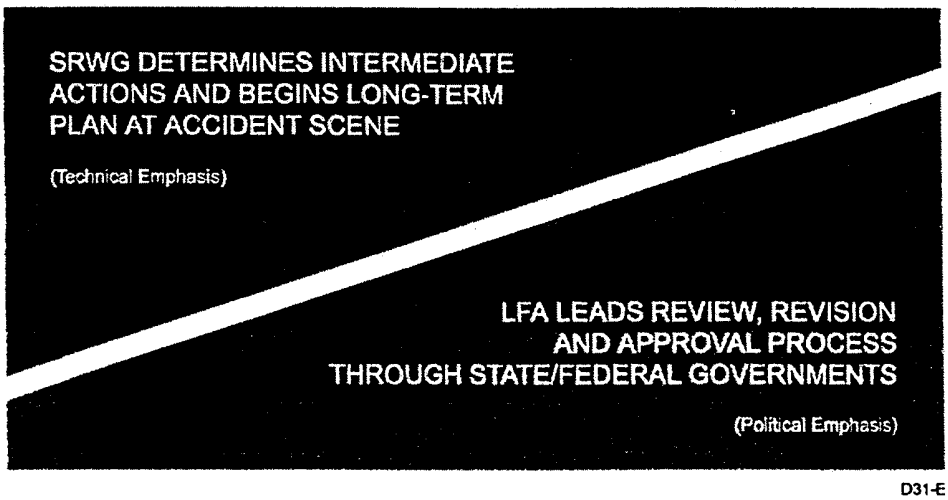
C21.1.1. Long-term actions are those steps taken to achieve ultimate remediation of the affected area to an agreed acceptable level as determined by all concerned. The major goals of this step are to:

C21.1.1.1. Protect the public health and environment (long term).

C21.1.1.2. Restore the affected area to a level that is technically and fiscally achievable within socially and politically acceptable guidelines.

C21.1.2. The method of achieving these goals will be detailed in the final SR plan developed by the SRWG. During this step of the process, there is a gradual shift away from accident scene-oriented activities and intermediate actions to long-term planning. During this step, the SRWG membership tackles the difficult process of completing a plan of action that will gain Government and public approval. Figure C21.F1. denotes the shift in responsibility from the accident scene to higher level Federal and State organizations during this step.

Figure C21.F1. Notional Site Remediation Plan and Approval Process



C21.2. CHANGING ROLES AND RELATIONSHIPS

C21.2.1. The SRWG continues to play a major role in developing the SR plan; however, as the focus of activity shifts to long-term planning, the roles and relationships of organizations supporting the SRWG will change. While circumstances will dictate the precise changes, planners should anticipate the following:

C21.2.1.1. The CRTF's role will diminish as a leader in the SR effort. DoD will likely retain the role of LFA, but the CRTF will become more of a coordinator. His deputy or designated representative may assume the lead role for DoD in the SRWG. As the preliminary plan is submitted and the lengthy process of approval begins, expect DoD to assign a Remedial Project Manager (RPM) to replace the CRTF in this role.

C21.2.1.2. State and local officials will assume more authority for coordinating the SRWG and developing the final remediation plans. Federal response organizations will continue their supporting roles.

C21.2.1.3. Proposed SR actions will get greater public scrutiny. There will be increased public and political influence on the decision-making process.

C21.2.1.4. Initiating actions will be more complicated, requiring approval at more levels of Government before any SR activity begins.

C21.2.1.5. The Federal Radiological Preparedness Coordinating Committee (FRPCC) will likely assume the role of coordinating national-level approval of the long-term plan.

C21.2.2. Regardless of the changing roles and relationships, the SRWG remains as the central planning organization for SR. During this phase, the SRWG will consider many of the typical long-term actions identified below.

C21.3. PLANNING FOR LONG-TERM ACTIONS

C21.3.1. Long-term SR actions are similar in many respects to those carried out in the intermediate action phase. A high level of public involvement can be expected as SR transitions to a long-term program. The CRTF/RPM and staff should be prepared to respond accordingly and consider the following areas when addressing long-term actions:

C21.3.1.1. Environmental groups will be closely monitoring the actions proposed and taken.

C21.3.1.2. Citizens committees may form to influence plan development and ensure compliance.

C21.3.1.3. Congressional interest will be extensive throughout the process.

C21.3.1.4. Legal officers should be prepared to respond to expected lawsuits.

C21.3.1.5. Business representatives may be pushing for expeditious resolution of complications affecting commercial enterprises.

C21.3.1.6. Public presentations/press releases/press briefings/press interviews or newsletters should be considered as a means to keep the public informed.

C21.3.2. Establishing cleanup criteria may be a long process as various interests propose their own preferred standards. SR planners emphasize that preliminary plans should be based on a health risk assessment analysis rather than cleanup levels. Achieving consensus among those directly involved may be the greatest task facing the remediation authorities. Ultimately, the standard must be developed in consultation with officials at Federal, State, and local levels. It is suggested that:

C21.3.2.1. It first be determined what has to be cleaned up.

C21.3.2.2. Decontamination steps to reach the agreed levels be determined.

C21.3.2.3. The standard, the bases of the standard, and how to reach it be clearly stated and explained during the approval process.

C21.3.3. Waste disposal may be a monumental challenge due to the variables of a nuclear weapon accident. Planners must:

C21.3.3.1. Determine the type of material to be removed (i.e., water, soil, sand, stone, rock, and trees).

C21.3.3.2. Determine the level of contamination in the waste material.

C21.3.3.3. Determine the quantity of contaminated materials and waste to be removed.

C21.3.3.4. Determine where radioactive waste will go for processing and/or disposal.

C21.3.3.5. Consider on-site disposal.

C21.3.3.6. Locate appropriate shipping containers - determine size and composition.

C21.3.3.7. Select the type or types of transportation: air, rail, highway, or water.

C21.3.3.8. Identify the best route, depending on means of transportation.

C21.3.3.9. Maintain coordination between CRTF/RPM, SFO, and civilian authorities.

C21.3.3.10. Obtain needed approvals.

C21.3.4. Potentially, health risks exist until the last container of waste is removed, so health concerns must remain a major part of the remediation program. Basically, it is a continuation of the program established as an intermediate action and includes, but is not limited to:

C21.3.4.1. An effective contamination monitoring program.

C21.3.4.2. Maintenance of security around the contaminated area.

C21.3.4.3. Continued bioassay programs.

C21.3.4.4. Monitoring of food sources, packaging, and handling.

C21.3.5. Medical tracking of people actually or potentially contaminated is a responsibility of DoD. Planners should address:

C21.3.5.1. Monitoring of bioassay program results for remediation workers and the public.

C21.3.5.2. Extended followup monitoring of exposed individuals.

C21.3.5.3. Source of medical personnel.

C21.3.5.4. Determining how long to track.

C21.3.5.5. Computerization of program for ease of monitoring.

C21.3.6. The economic impact of remediation activities needs to be considered to the maximum extent possible. For example:

C21.3.6.1. Legal ramifications, i.e., lawsuits, challenges to authority to perform tasks.

C21.3.6.2. Federal disaster assistance: amount, source, and disbursement.

C21.3.6.3. Will the restrictions within the contaminated area result in a loss of jobs, temporarily or permanently?

C21.3.6.4. Apprehensive citizenry: will they move away, lowering the economic viability of the area?

C21.3.6.5. If a tourist attraction, what actions are needed to dispel negative public perceptions?

C21.3.7. It is not enough simply to design a long-term remediation program of actions that will return the affected area to agreed conditions; a long-term monitoring plan to ensure goals are being reached must be included. Suggested steps:

C21.3.7.1. Develop and gain approval of the monitoring plan along with the overall program.

C21.3.7.2. Make regular reports to public; keeping them informed precludes many problems.

C21.3.7.3. Computerize the process.

C21.3.8. Environmental consequences of any action, planned or accidental, have to be at or near the top of the long-term remediation program.

C21.3.8.1. Consider the impact of a Remedial Investigation/Feasibility Study (RI/FS).

C21.3.8.2. Bring environmental interest groups into the planning process early.

C21.3.8.3. Expect to receive legal challenges over any or all actions affecting the environment.

C21.3.9. Remediation of the area is a highly visible undertaking that will be praised and criticized. Avoid being affected by either extreme and maintain focus on the goal by keeping in mind that:

C21.3.9.1. Supporting State and local decisions, if possible, makes the job easier.

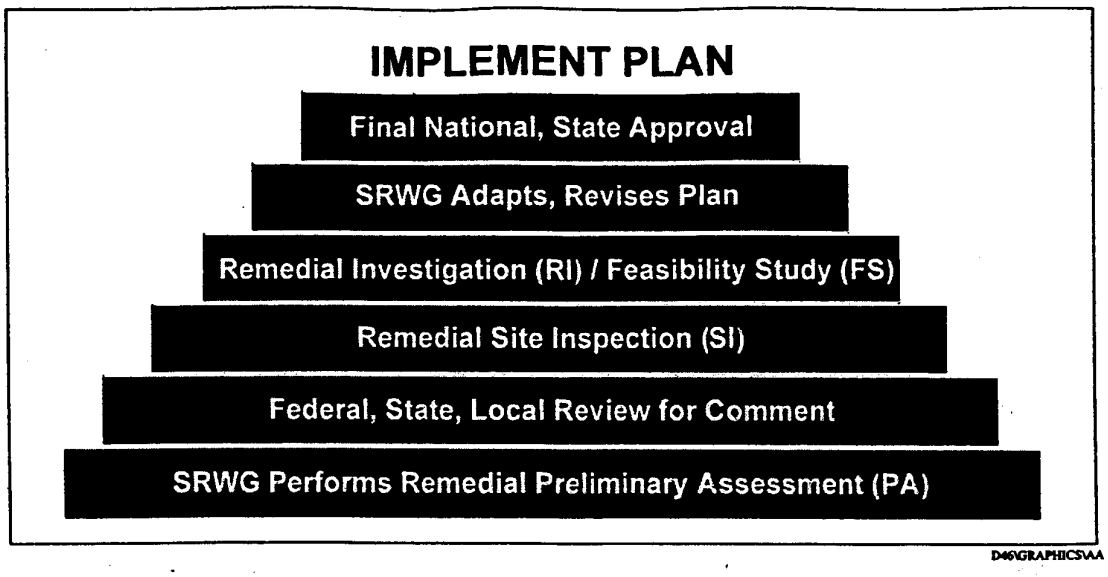
C21.3.9.2. Reaching consensus on what is technically achievable while being socially and politically acceptable will be a considerable challenge.

C21.3.9.3. While a budget should be developed, the cost of remediation actions should not be the driving factor in developing a remediation plan. It should be understood though, that ignorance, fear, and exaggeration of the risks can drive the cleanup costs to enormous extremes. Therefore, the agreed upon cleanup goals and their bases must be realistic, clear, concise, and well published.

C21.4. THE APPROVAL PROCESS

C21.4.1. This guidance has emphasized the concept of coordination and communication among all SR participants throughout the planning and remediation process. Final approval of the SR plan may be a lengthy and complicated process requiring coordination with multiple levels of government and extensive public involvement. Figure C21.F2. summarizes this process.

Figure C21.F2. Steps in the Approval Process



C21.4.2. Under the direction of the lead agency, the SRWG performs a remedial PA. State, Federal, and local authorities will provide an initial review that paves the way for a remedial SI, which builds upon the information collected in the remedial PA. This environmental study solicits formal public comment on the remediation plan; however, site remediation planners emphasize that any plan that overlooks public comment throughout the process is flawed. After the SI, the RI/FS is conducted. The purpose of the RI is to collect data necessary to adequately characterize the site for the purpose of developing and evaluating effective remedial alternatives. The FS is to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the remedial action options can be presented to a decision maker and an appropriate remedy selected. Final remediation goals will then be determined. Planners should not wait until the RI/FS to incorporate public views and concerns. The SRWG will consider all comments on the plan, revise accordingly, and submit a final plan for approval. The site remediation plan will ultimately be approved by the Governor of the State involved and by the Federal Government. The mechanism for accomplishing this approval on the Federal side is not completely clear; however, the FRPCC is expected to coordinate Federal approval of the plan at the national level.

PART IV

SPECIALIZED ASSETS AND POINTS OF CONTACT

C22. CHAPTER 22

SUMMARY OF SPECIALIZED CAPABILITIES

C22.1. GENERAL

Numerous units and organizations with specialized capabilities are discussed throughout this manual. This chapter summarizes these units and organizations and the capability or service they offer. The CRTF has at hand, for weapon recovery, removal, and contamination containment, the assets of numerous DoD and DOE accident response organizations. From these, the CRTF identifies personnel and equipment that will contribute to the planning and execution of a successful response through SR.

C22.2. PURPOSE AND SCOPE

This chapter provides a ready reference to units and organizations that maintain specialized capabilities. Each unit or organization is organized by title, specialized capability, or service.

C22.3. UTILIZATION

A summary of the capabilities of organizations and specialized units is provided. Appendix C22.AP1. provides telephone numbers for requesting services, or additional information on organizational or specialized unit capabilities discussed in this document.

C22.4. DEPARTMENT OF DEFENSE

DoD will be named the LFA if the emergency involves one of its facilities or any nuclear weapon in which it has responsibility/custody. Required resources will vary to some extent depending on the contamination problem (e.g., urban/rural, land/water, and agricultural/industrial) and DECON method(s) selected. Federal, State, and local government agencies, along with commercial enterprises, can be expected to provide either the specific resources or the funding by which the necessary assets can be acquired. A JHEC will be established to oversee the on-site radiological data

collection and assessment efforts and exchange data with the FRMAC. Within the JHEC is a high level of knowledge of the contamination problem both on and off site and how best to employ the technical resources available.

C22.4.1. Joint Chiefs of Staff-Controlled Assets

C22.4.1.1. Joint Communications Contingency Station Assets (JCCSA). JCCSA is a communications asset consisting of heavy mobile/transportable equipment deployable by C-141/C-5 aircraft.

C22.4.1.2. Joint Communications Support Element. The JCSE is a contingency support unit consisting of USA, USAF, and USMC personnel and a variety of communications equipment. A part of this equipment, the AN/URC JACC/CP, consists of several pieces of equipment mounted in air transportable vans.

C22.4.1.3. Defense Threat Reduction Agency. DTRA runs the DoD portion of the JNACC at its Alexandria, VA, Telegraph Road facility. HPAC development support is located here as well as the CMAT (formally, the DNAT). The CMAT is an established and trained specialized team of senior advisors deployed to assist the CRTF and his staff in the management of recovery operations through the SR phase following a nuclear weapon accident. A part of the CMAT capability is the AFRRI's MRAT. This team can assist medical personnel and commanders by providing state-of-the-art medical radiobiology advice by telephone or at the accident scene. DTRA's HPAC is a forward deployable modeling capability to accurately predict the effects of HAZMAT releases into the atmosphere and its impact on populations. Also available throughout the response phase will be one or more of the Service-sponsored radiological and health physics units: AFRAT, RAMT, and the RADCON Team. Release of these teams during SR, particularly those not of the Service that owns the weapon(s), is likely, provided their radiological expertise is replaced by civilian health organizations with similar capabilities. Regular monitoring of remediation personnel and area residents for exposure to contaminated materials must continue.

C22.4.1.4. Other Joint Chiefs of Staff-Controlled Communication Assets. SHF satellite terminals, GMF terminals, and other communications assets can also be deployed on request.

C22.4.2. U.S. Air Force

C22.4.2.1. HARVEST EAGLE and HARVEST FALCON Kits. HARVEST EAGLE and HARVEST FALCON kits consist of air transportable operations support sets with tents, field kitchens, collapsible cots, and other housekeeping items. Each

HARVEST EAGLE kit can support 550 people and each HARVEST FALCON kit can support 1,100 people. Each can be transported on 14 C-141B aircraft. If kits are required at an accident scene, the on-scene staff must make arrangements for personnel to unpack and assemble the equipment, and to manage billeting space and operate the field kitchens. Special teams, such as USAF PRIME BEEF and PRIME RIB units can be requested to provide additional support.

C22.4.2.2. Institute of Environmental, Safety, and Occupational Health Risk Analysis. This organization has a deployable team of health physicists, health physics technicians, and equipment, collectively called the AFRAT. AFRAT provides assistance in radiological health matters.

C22.4.2.3. HAMMER ACE. HAMMER ACE is a rapidly deployable team equipped with commercial off-the-shelf technology communications equipment. See Chapter 13 for further discussion.

C22.4.3. U.S. Army

C22.4.3.1. Radiological Advisory Medical Team. This team will provide radiological health hazard guidance to the CRTF, other officials, and local medical authorities.

C22.4.3.2. Radiological Control Team. This team was established to provide technical assistance and advice to the CRTF in all kinds of radiological emergencies. Assets include an air transportable mobile radiological laboratory and various types of air and field monitoring equipment.

C22.5. DEPARTMENT OF ENERGY

DOE responds to a nuclear weapon accident with multiple capabilities that are available to the CRTF. Coordination of these resources will be through existing DoD and DOE channels. Like the DoD assets, a number of DOE's response resources certainly will remain for SR.

C22.5.1. Department of Energy Accident Response Teams. Requests for these services should be coordinated with the SEO.

C22.5.1.1. Accident Response Group. The ARG is DOE's primary technical response element for a nuclear weapons accident. ARG is comprised of technical and scientific experts, with specialized equipment, composed of a cadre of senior scientific

advisors, weapons engineers and technicians, experts in nuclear safety and HE safety, health physicists, radiation control technicians, industrial hygienists, physical scientists, packaging and transportation specialists, and other specialists from the DOE weapons complex. The ARG maintains a technically capable staff knowledgeable of all the nuclear weapons in the U.S. inventory. Team members are responsible for assessing the condition of weapons involved in an accident and providing technical advice to the DoD EOD teams in developing joint plans for recovery of damaged weapons. ARG maintains readiness to provide DOE technical assistance to peacetime accidents and incidents involving nuclear materials anywhere in the world.

C22.5.1.2. Aerial Measuring System. A system that can provide aerial radiological surveys and aerial photography. This capability should be of value in the early stages of remediation. Additional information on AMS is in Chapter 4.

C22.5.1.3. Contaminated Laundering Facilities. Commercial facilities may be contracted by DOE near the accident site.

C22.5.1.4. Atmospheric Release Advisory Capability. This unit can quickly provide computer-generated estimates of the distribution of radioactive contaminants released into the atmosphere. This capability will be of great value in the earliest stages of an accident until a full survey is completed. Additional information on ARAC is in Chapter 4.

C22.5.1.5. Mobile Accident Response DOE Mobile Counting Laboratory (Hotspot). Two air transportable trucks and trailers with equipment to analyze, identify, and document radioactive contamination. This is another important asset to the CRTF in evaluating the radiological threat that remains after weapon(s) removal.

C22.5.1.6. Non-Destructive Evaluation (NDE) Response Capability. Two units capable of taking and developing radiographs of weapons using cobalt or x-ray sources.

C22.5.1.7. The Radiation Emergency Assistance Center Training Site. A WHO Collaborating Center that provides 24-hour direct or consulting assistance to medical and health physics practitioners dealing with radiation-related health problems or injuries from local, national, or international radiation incidents. REAC/TS provides on-scene medical support to DOE's ARG and FRMAC when they are deployed. Also, REAC/TS provides advice and assistance to the LFA responding to nuclear events. Additional information on REAC/TS is provided in Chapters 2 and 10.

C22.5.1.8. RANGER. The Ranger is a mobile, real-time mapping system

that efficiently monitors large areas of land for radioactive contamination. It can use either a commercially available line-of-site microwave ranging system or a GPS for determining its geographic position and location of the data taken. The Ranger can be operational in 2 hours.

C22.5.1.9. Transportable Decontamination Station. Equipment to perform field personnel DECON. An obvious necessity until levels of contamination are reached that are no longer a threat.

C22.5.1.10. Radiological Air Sampling Counting and Analysis Lab. RASCAL is a mobile, self-sufficient analytical laboratory capable of supporting a large number of field-deployed air-sampling stations. RASCAL rapidly analyzes air sample filters and feeds this information to the JHEC. It is capable of processing one gamma air sample every 100 seconds and three alpha-spectroscopy samples each hour. Setup time is approximately 3 hours.

C22.5.1.11. 6 meV PORTAC. This system radiographs a damaged or suspect weapon to provide information on its internal condition. The system can image a large variety of materials, from lower-density foams and HEs to high-density, special nuclear materials. The portable LINAC can be used with film and/or the Real-Time Radiography (RTR) system.

C22.5.1.12. Portable Liquid Abrasive Cutter (LAC). The LAC uses an extremely high-pressure jet of water (30,000 pounds per square inch) into which abrasive particles are fed to cut through any material accurately and rapidly, with no heat or sparks, while minimizing the frictional forces being imparted to the material being cut. For local operations, the LAC can be set up and ready to operate in about 30 minutes. For remote operation, setup time is about 2 hours.

C22.5.1.13. Radiological Assistance Program Team. RAP teams are regionally-based, fully trained health physics personnel who are equipped to respond to all types of radiological incidents and can normally be on scene in 2 to 6 hours after notification. The responding RAP team(s), who are normally the first responders at the emergency or incident scene, will characterize the radiation environment at the scene, advise on the hazards and risks of the radiation and/or radioactive materials involved, and assist in controlling and mitigating immediate radiation exposures to workers and the public and the spread of radioactive contamination to the environment. Additional information on RAP is in Chapter 2.

C22.5.1.14. Federal Radiological Monitoring and Assessment Center (FRMAC). The FRMAC coordinates and manages all Federal radiological monitoring

and assessment activities during major radiological emergencies when the United States in support of State, local, and tribal governments through the Local Federal Agency (LFA).

C22.6. FEDERAL EMERGENCY MANAGEMENT AGENCY

FEMA is responsible for coordinating the overall Federal response in support of State and local authorities. FEMA will dispatch an SFO (or designate a FEMA Region Official to act as the Deputy SFO) and an ERT to establish at a location identified in conjunction with the State, the DFO, which serves as a focal point for Federal interactions with State and local authorities.

C22.7. OTHER FEDERAL AGENCIES

C22.7.1. Department of Agriculture. The USDA has the responsibility and the ability to determine the safety of meat and poultry products for human consumption.

C22.7.2. Department of Health and Human Services. The HHS has the capability to analyze food and environmental samples for radioactivity content and provide radiological advice.

C22.7.3. Department of Transportation. DOT can arrange special transportation activities and assistance in contacting consignors and consignees of shipments.

C22.7.4. Environmental Protection Agency. EPA has monitoring teams to measure and evaluate contamination and to advise of actions to be taken for the protection of the public health and safety.

C22.7.5. Federal Bureau of Investigation. The FBI is the LFA for improvised nuclear devices, incidences, and terrorist nuclear-related activities in the United States, territories, and possessions.

C22.7.6. Nuclear Regulatory Commission (NRC). The NRC's responsibility includes regulation of commercial nuclear power reactors; non-power research, test, and training reactors; fuel cycle facilities; medical, academic, and industrial uses of nuclear materials; and the transport, storage, and disposal of nuclear materials and waste.

C22.8. STATE AND LOCAL AUTHORITIES

The capabilities of State and local agencies to assist in the resolution of the initial radiation emergency could be limited by lack of equipment and training. However, State and local agencies have considerable resources that will be critical to the successful development and implementation of the intermediate and long-term plans to remediate the affected area. Mentioned throughout this manual, these are health and medical technicians, emergency management officials, environmental experts, civil engineers, law enforcement and security personnel, transportation, logistics, legal representatives, and PA.

C22.AP1. APPENDIX 1 OF CHAPTER 22

POINTS OF CONTACT

C22.AP1.1. MILITARY COMMAND CENTERS

National Military Command Center	DSN 227-6340 Commercial 703-697-6340
JFCOM	DSN 262-6000 Commercial 757-836-6000
EUCOM	DSN 314-432-3000 Commercial 049-711-680-3000
PACOM	DSN 315-477-5186 Commercial 808-477-5186
SOUTHCOM	DSN 567-4900 Commercial 305-437-4900
ACC RTF	DSN 574-4816 Commercial 757-764-4816
Navy RTF	DSN Commercial
U.S. Air Force Operations Center	DSN 227-6103 Commercial 703-697-6103
U.S. Navy Operations Center	DSN 225-0231 Commercial 703-695-0231
U.S. Army Operations Center	DSN 227-0218 Commercial 703-697-0218
U.S. Marine Corps Operations Center	DSN 225-7399 Commercial 703-695-7366
Director of Military Support (DOMS)	DSN 227-3203 Commercial 703-697-3203

C22.AP1.2. COORDINATION CENTERS

Office of the Secretary of Defense Executive Services Center	DSN 364-9320/22 Commercial 703-769-9320/22
Office of the Assistant Secretary of Defense (Public Affairs) (OASD(PA))	DSN 227-5131 Commercial 703-697-5131 Fax 703-697-3501
Joint Nuclear Accident Coordinating Center (JNACC)	DSN 221-2102 Commercial 703-325-2102
Department of Defense (DoD)	DSN 221-2102/3/4 Commercial 703-325-2102/3/4
DOE Operations Center	Commercial 202-586-8100
DOE Accident Response Group	Commercial 505-845-4667
FBI Operations Center	Commercial 202-324-6700
DOS Operations Center	Commercial 202-647-1512
FEMA Rapid Response Information System (RRIS)	Handled through DOE Ops Center Commercial 202-586-8100
Nuclear Regulatory Commission (NRC) Operations Center	Commercial 301-816-5100
U.S. Coast Guard National Response Center	Commercial 1-800-424-8802

C22.AP1.3. INFORMATION ON DoD SPECIALIZED CAPABILITIES

DoD	
Defense Threat Reduction Agency Consequence Management Advisory Team (CMAT) (formally DNAT)	DSN 221-2102/3/4 Commercial (703) 325-2102/3/4
JCS Contingency and Crisis Management Division (JCS-controlled contingency communications)	DSN 227-0007 Commercial
Joint Communication Support Element (JCSE)	DSN 968-4141 Commercial
JCS Controlled Tactical Communications Assets	DSN 879-6591/6925 Commercial
AFRRI Medical Radiobiological Advisory Team (MRAT)	DSN 295-0530 Commercial 301-295-0530

U.S. Air Force Assets	
HQ Air Combat Command/LGSCE (HARVEST EAGLE)	DSN 867-2166/7 Commercial 505-475-2166/7
HQ Air Combat Command/LGSCF (HARVEST FALCON)	DSN 867-7412 Commercial 505-475-7412
Scott AFB, IL Command Post (HAMMER ACE)	DSN 576-5891 Commercial 618-256-5891 DSN 576-3431 Commercial 618-256-3431 Email AFCA-SYH@scott.af.mil
U.S. Air Force Radiation Assessment Team (AFRAT)	Central Time Zone duty hours DSN 240-3486 Commercial 210-536-3486 After duty hours, Brooks AFB Command Post DSN 240-3278 Commercial 210-536-3278 Pager 210-553-0848
U.S. Air Force Institute for Environment, Safety and Occupational Health Risk Analysis (IERA)	Central Time Zone duty hours DSN 240-3486 Commercial 210-536-3486 After duty hours, Brooks AFB Command Post DSN 240-3278 Commercial 210-536-3278

U.S. Army Assets	
Soldier Biological and Chemical Command (SBCCOM) Operations Center (U.S. Army)	DSN 584-2933 Commercial 410-436-2933
U.S. Army Radiological Control (RADCON) Team	DSN 992-9723 Commercial 732-532-9723 FAX 732-542-7161 After duty hours, DSN 992-3266 Commercial 732-532-3266
U.S. Army Radiological Advisory Medical Team (RAMT)	DSN 642-0058 Commercial 202-356-0058 FAX 202-356-0086

U.S. Marine Corps Assets	
CBIRF	DSN 751-9067 Commercial 910-451-9067

C22.AP1.4. OTHER AGENCIES

Department of Health and Human Services (HHS)	Commercial 202-857-8400
Centers for Disease Control and Prevention (CDC)	Commercial 404-639-3235
Environmental Protection Agency (EPA)	Commercial 202-475-8383
NRC	Commercial 301-816-5100 Backup 301-415-0550

C22.AP1.5. DOE ASSETS

The DOE assets listed below may be contacted directly for assistance or requests for assistance may be directed to the DOE HQ EOC.

Request for assistance for any other DOE asset should be directed to the DOE HQ EOC.

	24-Hour Commercial
DO HQ Emergency Operations Center	202-586-8100
RAP-1 (DOE Brookhaven Area Office)	516-344-2200
RAP-2 (DOE Oak Ridge Operations Office)	423-576-1005
RAP-3 (DOE Savannah River Ops Office)	803-725-3333
RAP-4 (DOE Albuquerque Ops Office)	505-845-4667
RAP-5 (DOE Chicago Operations Office)	630-252-4800
RAP-6 (Idaho Operations Office)	208-526-1515
RAP-7 (DOE Oakland Ops Office)	925-637-1794
RAP-8 (DOE Richland Ops Office)	509-373-3800
Radiation Emergency Accident Center/Training Site (REAC/TS)	423-576-3131
REAC/TS (alternate number) Methodist Medical Center Disaster Network	423-481-1000
Atmospheric Release Advisory Capability (ARAC)	925-422-9100

C22.AP1.6. INFORMATION ON DOE SPECIALIZED CAPABILITIES

DOE Defense Program Office of Emergency Response (DP-23)	Commercial 301-903-3558

C23. CHAPTER 23

BIBLIOGRAPHY

Section 5121, et seq. of title 42 U.S. Code Annotated (U.S.C.A.) (Public Law 93-288, amended by Public Law 100-707), "The Robert T. Stafford Disaster Relief and Emergency Assistance Act."

Section 4321, et seq. of title 42 U.S.C.A., "National Environmental Policy Act."

Section 9601, et seq. of title 42 U.S.C.A., "Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA)."

AFI 31-401, "Managing the Information Security Program," July 1994.

AFI 32-4001, "Disaster Preparedness Planning and Operations," May 1, 1998.

AR 380-150, "Access to and Dissemination of Restricted Data," September 1978.

AR 40-13, "Medical Support-Nuclear/Chemical Accidents and Incidents," February 1, 1985.

DoD Directive 5210.42, "Nuclear Weapon Personnel Reliability Program (PRP)," May 25, 1993.

DTRA-AR-40H, "Weapons of Mass Destruction Terms Handbook," July 1, 1999.

EPA-520/1-88-020, September 1988.

Executive Order (E.O.) 12241, "National Contingency Plan."

Federal Response Plan (FRP) for Public Law 93-288, as amended.

ICRP Publication 26, "Recommendations of the International Commission on Radiological Protection," Pergamon Press, NY, NY, 1977.

ICRP Publication 30 Part 1, "Limits for Intakes of Radionuclides by Workers," Pergamon Press, NY, NY, 1979.

ICRP Publication 48, "The Metabolism of Plutonium and Related Elements," Pergamon Press, NY, NY, 1986.

Lessard, E.T., et al, "Interpretation of Bioassay Measurements," NUREG/CR-4884, BNL-NUREG-52063, Brookhaven National Laboratory/U.S. NRC, June 1987.

NCRP Report No. 65, "Management of Persons Accidentally Contaminated with Radionuclides," National Council on Radiation Protection and Measurements, April 1980.

OPNAVINST 3440.15A, "Minimum Criteria and Standards for Navy and Marine Corps Nuclear Weapons Accident and Incident Response," May 30, 1997.

SECNAVINST 5510.36, "Department of the Navy (DON) Information Security Program (ISP) Regulation," March 17, 1999.

SECNAVINST 5510-30A, "Department of Navy Personnel Security Program," March 10, 1999.

Section 142d, Atomic Energy Act (AEA) of 1954, as amended.

U.S. EPA, Federal Guidance Report No. 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion."