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NUCLEAR WEAPON ACCIDENT RESPONSE PROCEDURES (NARP)

MANUAL

ASSISTANT TO THE SECRETARY OF DEFENSE (ATOMIC ENERGY)

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ASSISTANT TO THE SECRETARY OF DEFENSE
WASHINGTON, DC 20301-3050

DoD 5100.52-M

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FOREWORD

This Manual has been developed by the Defense Nuclear Agency (DNA) under the authority of DoD Directive 5100.52, "DoD Response to an Accident or Significant Incident Involving Radioactive Materials," December 21, 1989, and supersedes DNA 5100.1, "Nuclear Weapon Accident Response Procedures (NARP) Manual," January 1984.

This Manual applies to the Office of the Secretary of Defense (OSD); the Military Departments; the Chairman, Joint Chiefs of Staff and Joint Staff; the Unified and Specified Commands; and the Defense Agencies and DoD Field Activities that support response to a nuclear weapon accident (hereafter referred to collectively as "DoD Components"). This Manual is effective immediately.

The purpose of this Manual is to provide the On-Scene Commander and his or her planning staff with a single, comprehensive document that summarizes procedural guidance, technical information, and DoD responsibilities for responding to an accident involving nuclear weapons. The NARP also describes the substantial resources in other Federal Agencies that can be made available to assist in the response effort.

This Manual should be widely disseminated and made available to all commanders and staff who may be called upon to respond to a nuclear weapon accident. It should serve as a guide for more detailed planning for nuclear weapon accident response, and can be used to improve training and exercise programs.

Suggestions to update or improve this Manual are solicited. Send proposed changes through appropriate channels to:

Headquarters, Defense Nuclear Agency
Attn: NOEA
6801 Telegraph Road
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.

Robert B. Barker

Robert B. Barker

NUCLEAR WEAPONS ACCIDENT RESPONSE PROCEDURES

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AAC	Ambient Air Concentration
AF	Air Force
AFB	Air Force Base
AFOC	Air Force Operations Center
AFRAT	Air Force Radiation Assessment Team
AFRRI	Armed Forces Radiobiology Research Institute
AMS	Aerial Measurement System
AOC	Army Operations Center
ARAC	Atmospheric Release Advisory Capability
ARG	Accident Response Group
ASD(PA)	Assistant Secretary of Defense (Public Affairs)
ATRAP	Air Transportable RADIAC Package
ATSD(AE)	Assistant to the Secretary of Defense (Atomic Energy)
AUTODIN	Automatic Digital Network
AUTOSEVOCOM	Automatic Secure Voice Communications Network
AUTOVON	Automatic Voice Network
Bq	Becquerel
CAT	Crisis Action Team
CCA	Contamination Control Area
CCC	Crisis Coordination Center
CCG	Combat Communications Group
CCS	Contamination Control Station
CDCE	Contamination Disposal Coordinating Element
CDRH	Center for Devices and Radiological Health
CEAT	Community Emergency Action Team
CEOI	Communications Electronic Operating Instruction
CF	Composite Fiber
CINC	Commander-in-Chief
CNWDI	Critical Nuclear Weapon Design Information
COM	Chief of Mission
COMSEC	Communications Security
CP	Command Post
CPM	Counts Per Minute
CPX	Command Post Exercise
DCE	Disaster Control Element
DCO	Disaster Control Officer
DCS	Defense Communications System
DHHS	Department of Health and Human Services
DNA	Defense Nuclear Agency
DNAAT	Defense Nuclear Agency Advisory Team
DoC	Department of Commerce
DoD	Department of Defense
DoE	Department of Energy
DoE/AL	Department of Energy/Albuquerque Operations
DoE/NV	Department of Energy/Nevada Operations
DoI	Department of the Interior
DOMS	Director of Military Support
DoS	Department of State

ACRONYMS (CONTINUED)

DoT	Department of Transportation
DPM/m3	Disintegrations Per Minute Per Cubic Meter
DRF	Disaster Response Force
DSFO	Deputy Senior FEMA Official
EAC	Emergency Action Committee
ECS	Exercise Control Staff
EEFI	Essential Elements of Friendly Information
EICC	Emergency Information and Coordination Center (FEMA)
EMR	Electro-Magnetic Radiation
EMT	Emergency Medical Team
EOC	Emergency Operations Center
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
EPZ	Emergency Planning Zone
ERT	Emergency Response Team
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FCDNA	Field Command, Defense Nuclear Agency
FCO	Federal Coordinating Officer
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
FONAC	Flag Officers' Nuclear Accident Course
FRC	Federal Response Center
FRERP	Federal Radiological Emergency Response Plan
FRMAC	Federal Radiological Monitoring and Assessment Center
FRMAP	Federal Radiological Monitoring and Assessment Plan
FTS	Federal Telecommunications System
FTX	Field Training Exercise
GMF	Ground Mobile Force
GSA	General Services Administration
HE	High Explosive
HEPA	High Efficiency Particle Air
HF	High Frequency
HHS	Department of Health and Human Services
HDNA	Headquarters, Defense Nuclear Agency
HOT SPOT	Department of Energy Mobile Counting Laboratory
HUD	Department of Housing and Urban Development
IC	Inhaled Concentration
ICC	Interstate Commerce Commission
IND	Improvised Nuclear Device
INWS	Interservice Nuclear Weapons School
IRF	Initial Response Force
JA	Judge Advocate
JACC/CP	Joint Airborne Communications Center/Command Post
JCS	Joint Chiefs of Staff
JCSE	Joint Communications Support Element
JHEC	Joint Hazard Evaluation Center
JIC	Joint Information Center
JNACC	Joint Nuclear Accident Coordinating Center

ACRONYMS (CONTINUED)

JS	Joint Staff
JSCP	Joint Strategic Capability Plan
keV	Thousand Electron Volts
LOS	Limit of Sensitivity
MAC	Military Airlift Command
MARD	Mobile Accident Response Development
MeV	Million Electron Volts
MILSTRIP	Military Standard Requisitioning and Issue Procedures
MPC	Maximum Permissible Concentration
MRAT	Medical Radiobiology Advisory Team
MRT	Medical Radiology Team
NAIR	Nuclear Accident Incident Response
NARCL	Nuclear Accident Response Capability Listing
NARP	Nuclear Weapon Accident Response Procedures Manual
NASA	National Aeronautics and Space Administration
NAVMED	Navy Bureau of Medicine and Surgery
NCA	National Command Authority
NCAIC	Nuclear Chemical Accident/Incident Control
NCC	National Coordinating Center
NCC	Navy Command Center
NCS	National Communications System
NDA	National Defense Area
NESDIS	National Environmental Satellite Data and Information Service
NEST	Nuclear Emergency Search Team
NMCC	National Military Command Center
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRC	Nuclear Regulatory Commission
NSA	National Security Area
NSC	National Security Council
NSN	National Stock Number
NTS	Nevada Test Site
NTSB	National Transportation Safety Board
NUWAX	Nuclear Weapon Accident Exercise
NWS	National Weather Service
OAR	Office of Oceanic and Atmospheric Research
OASD(PA)	Office of the Assistant Secretary of Defense (Public Affairs)
OEHL	Occupational and Environmental Health Laboratory
OEMT	Operational Emergency Management Team
OSC	On-Scene Commander
PAG	Protective Action Guide
PAO	Public Affairs Officer
PAR	Protective Action Recommendation
PLA	Principal Legal Advisor
PRP	Personnel Reliability Program
QD	Quantity Distance
R	Roentgen
RADCON	Radiological Control
RAMT	Radiological Advisory Medical Team

ACRONYMS (CONTINUED)

RAP	Radiological Assistance Program (DoE)
RCA	Radiological Control Area
RCL	Radiological Control Line
REAC/TS	Radiation Emergency Assistance Center/Training Site
RER	Re-entry Recommendations
RRF	Regional Response Force
RSP	Render Safe Procedures
SAAM	Special Assignments Airlift Mission
SCBA	Self Contained Breathing Apparatus
SECORD	Secure Cord Switchboard
SENAC	Senior Executive Nuclear Accident Course
SFO	Senior FEMA Official
SONAC	Senior Officers' Nuclear Accident Course
SRF	Service Response Force
SRP	Site Restoration Plan
SSN or SSAN	Social Security Number
TELEX	Telephone Exchange
TWX	Teletypewriter Exchange
uCi/m^3	Microcuries per cubic meter
UHF	Ultra High Frequency
US	United States
USCINC	U.S. Commander-in-Chief
USDA	U.S. Department of Agriculture
USFORSCOM	U.S. Army Forces Command
USMC	U.S. Marine Corps
VHF	Very High Frequency
WATS	Wide Area Telephone Service

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(c) Federal Radiological Emergency Response Plan (FRERP), Federal Register, 50 Fed. Reg. 46542, 8 Nov 85.

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(f) DoD Directive 4000.19, Interservice, Interdepartmental, and Interagency Support, 14 Oct 80.

(g) Public Law 93-288, 22 May 74, amended by Public Law 100-107, 23 Nov 88.

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(aa) AFR 100-31, Frequency Management and Electromagnetic Compatability, Sep 85.

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(ao) Explosive Ordnance Disposal Training Publications 60-1.

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(ap) Nuclear Regulatory Guide 8.29, January 1984.

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DEFINITIONS

Access Procedures. See Explosive Ordnance Disposal Procedures.

Accident Response Group (ARG). The Department of Energy (DoE) Accident Response Group consists of qualified scientific, medical, and technical personnel and specialized equipment designated to execute DoE's response operations upon notification of a nuclear weapon accident/incident.

Aerial Measurement 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 integrated into the system.

Airborne Radioactivity. Any radioactive material suspended in the atmosphere.

Air Force Radiation Assessment Team (AFRAT). A field qualified team of health physicists and health physics technicians established at the USAF Occupational and Environmental Health Laboratory (USAF OEHL). The team is capable of responding worldwide with air transportable equipment to radiation accidents/incidents, providing on-site health physics consultation and instrumentation for the detection, identification, and quantification of any possible radiation hazard.

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

Air Transportable RADIAC Package (ATRAP). A collection of RADIAC equipment, spare parts, and trained instrument repair technicians maintained in an alert status by the Air Force Logistics Command for airlift to the scene of a nuclear weapon accident/incident to supplement the local RADIAC equipment and repair capability.

Alpha Team. An Army team possessing an alpha radiation monitoring capability. The team is identified usually as part of a Nuclear Accident and Incident Control (NAIC) Team.

Anti-Contamination Clothing (Anti-C's). Clothing consisting of coveralls, shoe covers, gloves, and hood or hair cap. Anti-contamination clothing provides protection for the user from alpha radiation, and is also a control device to prevent the spread of contamination. A respirator can be worn with the anti-contamination clothing which provides protection against the inhalation of contaminants.

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

Atmospheric Release Advisory Capability (ARAC). A DoE asset capable of providing a computer generated model of the most probable path of the radioactive contamination released at an accident site.

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

Background Radiation. Radiation arising from radioactive material other than the one under consideration. Background radiation due to cosmic rays and natural radioactivity is always present.

Becquerel. The unit of activity of a radionuclide, equal to the activity of a quantity of a radionuclide having one spontaneous nuclear transition per second. Symbolized Bq.

BENT SPEAR. A term used in the DoD to identify and report a nuclear incident involving a nuclear weapon/warhead or nuclear component. In the Army and Air Force, this term includes a "significant incident" as defined in DoD Directive 5100.52. See nuclear weapon incident.

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

BROKEN ARROW. A DoD term to identify and report an accident involving a nuclear weapon/warhead or nuclear component. In the Navy this includes a "significant incident" as defined in DoD Directive 5100.52. See nuclear weapon(s) accident.

Cognizant Agency Authority or Official. The foreign government agency, official or the senior representative of the involved country's government at an accident/ incident site.

Community Emergency Action Team (CEAT). A team of response and local experts that operates out of the JIC and is available to assist the local community.

Cognizant Federal Agency (CFA). The Cognizant Federal Agency is that Federal agency having custody of the weapon at the time of the accident. The CFA is responsible to:

a. Conduct and manage Federal on-site actions.

b. Develop or evaluate recommendations for public protective action measures off site.

c. Present recommendations for off-site protective action measures, in coordination with FEMA, to the appropriate State and/or local officials or Foreign government.

d. Coordinate initially the release of information to the public, Congress, and the White House until transferred to FEMA by mutual agreement.

Contamination. The deposit and/or absorption of radioactive material, biological, or chemical agents or hazardous materials on, and by, structures, areas, personnel, or objects.

Contamination Control. Procedures to avoid, reduce, remove, or render harmless, temporarily or permanently, nuclear, biological, chemical agent and hazardous materials contamination.

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 is operational, this line is the outer boundary that separates the reduced hazard area from the clean area.

Contamination Control Station (CCS). An area (tent or facility) specifically designated for controlling ingress and egress of personnel and equipment to/from the radiation control area. The outer boundary of the Contamination Control Station is the contamination control line, and the inner boundary is the line segment labeled the hot line. An illustration of the Contamination Control Station is at Chapter 5.

Critical Nuclear Weapon 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, fussionable, and high explosive materials by type. Among excluded items are the components which Service personnel set, maintain, operate, test, or replace.

Contamination Reduction Area (CRA). The area concept is employed at the Contamination Control Station 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 Contamination Control Station.

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

Custody. Responsibility for the control of, transfer and movement of, and access to, weapons and components. Also custody includes the maintenance of weapons and components.

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

Decontamination. The process of making any person, object, or area safe by absorbing, destroying, neutralizing, making harmless, or removing hazardous materials clinging to or around it.

Decontamination Station. A building or location equipped and organized to cleanse personnel and material of chemical, biological, or radiological contaminants.

Department of Defense Executive Agent. One who acts on behalf of the Secretary of Defense with his authority over the military services and DoD agencies. For military assistance to disaster relief operations, the Secretary of the Army is the DoD Executive Agent.

Department of Energy Team Leader. The coordinator of all Department of Energy matters, both off and on-site, including Department of Energy Accident Response Group operations.

Directorate of Military Support (DOMS). Action agency for the Secretary of the Army when acting in the capacity of DoD Executive Agent. Directs a task-organized joint staff formed to support the planning, coordination, and execution of military support to domestic disaster relief operations.

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

Disaster Control Officer (DCO). The DCO is the DoD point of contact with FEMA at the disaster scene for providing DoD support to disaster recovery operations.

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

Disaster Preparedness. That series of actions to control and manage nuclear incidents or accidents 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 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 include: survey of the incident/accident area to establish isodose lines and all types of monitoring; personnel and area decontamination; disposition of nuclear, high explosive, and contaminated items.

Disaster Response Force (DRF). The USAF base level organization which responds to disasters/accidents for establishing command and control, and to support disaster operations.

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.

Dosimetry. The measurement of radiation doses as it applies to both the devices used (dosimeters) and to the techniques.

Exclusion Area. Any designated area containing one or more nuclear weapons or components.

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; 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.

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

Explosive Ordnance Disposal Incident. The suspected or detected presence of unexploded ordnance, or damaged explosive ordnance, which 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.

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 hazardous material associated with an explosive ordnance disposal incident.

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

b. Recovery Procedures. Those actions to recover unexploded ordnance.

c. 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 ordnance to prevent an unacceptable detonation.

d. Final Disposal Procedures. The final disposal of explosive ordnance by explosive ordnance disposal personnel, which may include demolition or burning in place, removal to a disposal area, or other appropriate means.

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.

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.

Exposure. The exposure at a given point is a measurement of radiation in relation to its ability to produce ionization.

Federal Coordinating Officer (FCO). The Federal official appointed by the President upon declaration of a major disaster or emergency under Public Law 93-288 to coordinate the overall Federal response.

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 nuclear weapon accident is one of coordinating Federal, state, local, and volunteer response actions.

a. Emergency Information and Coordination Center (EICC) - The EICC is located in FEMA Headquarters in Washington, DC and provides overall direction, control and coordination of Federal and state emergency services response/recovery to a radiological accident or emergency.

b. Emergency Response Team (ERT) - The FEMA team deployed to a radiological emergency scene by the FEMA Director to make an initial assessment of the situation and then provide FEMA's primary response capability.

c. 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.

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 U.S., its possessions and territories.

Federal Radiological Monitoring and Assessment Center (FRMAC). A center established near the scene of a radiological emergency responsible for off-site radiological response from which the FRMAC Director conducts the FRMAP response. This center need not be located near the on-site or Federal-State operations centers as long as its operations can be coordinated with them. Staffed by DoE NV.

Federal Radiological Monitoring and Assessment Plan (FRMAP). A plan to provide coordinated radiological monitoring and assessment assistance to the State and local governments in response to radiological emergencies. This plan, authorized by 44 CFR Part 351, supercedes the Interagency Radiological Assistance Plan.

Federal Response Center (FRC). The on-site focal point established by the Senior FEMA Official (SFO), as required, for coordinating the Federal response to a nuclear weapon accident or significant incident. Representatives of other Federal, state, local, and volunteer agencies will be located in the center.

FIDLER (Field Instrument for the Detection of Low Energy Radiation). A probe, used with the PRM-5 and other supporting instrument packages, capable of detecting low energy gamma and X-rays.

Film Badge. A photographic film packet or badge carried by personnel, for measuring and recording gamma ray dosage permanently.

Final Disposal Procedures. See Explosive Ordnance Disposal Procedures.

Formerly Restricted Data (FRD). Information removed from the Restricted Data category upon determination jointly by the Department of Energy and Department of Defense that such information relates primarily to the military utilization of atomic weapons and that such information can be safeguarded adequately as national security information (Section 142d, Atomic Energy Act of 1954, as amended).

Hazardous Materials. 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 human life or property.

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.

Initial Response Force (IRF). An element, whose capabilities are listed in the Nuclear Accident Response Capabilities Listing (NARCL), belonging to DoD or DoE installations, facilities, or activities, which would take emergency response actions necessary to maintain command and control on-site pending arrival of the Service or agency response force. Functions which the initial response force is tasked to perform (within its capabilities), are:

a. Rescue operations.

b. Accident site security.

c. Firefighting.

d. Initiation of appropriate EOD procedures.

e. Radiation monitoring.

f. Establishment of command, control, and communications.

g. Public affairs activities.

Improvised Nuclear Device (IND) Incident. Is an event resulting from a deliberate act, involving nuclear weapons or nuclear materials which include the sabotage, seizure, theft, or loss of a nuclear weapon or radiological nuclear weapon component or the fabrication and employment of an IND or a credible threat of either.

Ingestion Pathway. The means by which a person is exposed to radiation through the food chain.

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

Hot Line. The Hot Line is 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.

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. "HOT SPOT" also refers to the DoE Accident Mobile Counting Laboratory and Mobile Support Equipment.

Joint Communications Support Element (JCSE). A communications element that provides high frequency, very high frequency, secure and super high frequency satellite terminals and other equipment.

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.

Joint Information Center (JIC). A facility at the scene of a nuclear weapon accident or significant incident to coordinate all public affairs. The JIC includes representation from DoE, DoD, FEMA, DoS, and other Federal agencies, as well as state, local, and/or foreign governments.

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

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.**

Licensed Material. Source material, special nuclear material, or by product material received, possessed, used, or transferred under a general or specific license issued by the Nuclear Regulatory Commission or a state.

Maximum Permissible Dose. That radiation dose which 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.

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

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.

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 a National Defense Area temporarily places such non-Federal lands under the effective control of the DoD and results only from an emergency event. The senior DoD representative at the scene will define the boundary, mark it with a physical barrier, and post warning signs. The landowner's consent and cooperation will be obtained whenever possible; however, military necessity will dictate the final decision regarding location, shape, and size of the NDA.

National Security Area (NSA). An area established on non-Federal lands located within the United States, its possessions, or territories, for 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 control of the DoE and results only from an emergency event. The senior DoE representative having custody of the material at the scene will define the boundary, mark it with a physical barrier, and post warning signs. The landowner's consent and cooperation will be obtained whenever possible; however, operational necessity will dictate the final decision regarding location, shape, and size.

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

Nuclear Accident and Incident Control Team (NAIC). An Army team organized to minimize and prevent the loss of life, personal injury, hazardous effects, and destruction of property, to secure classified material, and to enhance and maintain the public's confidence in the Army's ability to respond effectively to a nuclear accident or incident.

Nuclear Contribution. Explosive energy released by nuclear fission or fusion reactions, as part of the total energy released by the accidental explosion of a nuclear weapon. Any nuclear contribution equivalent to four or more pounds of TNT is considered significant, and would add beta and gamma radiation hazards to other radiological and toxic hazards present at a nuclear weapon accident site.

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

Nuclear Radiation. Particulate and electromagnetic radiation emitted from atomic nuclei in various nuclear processes. The important nuclear radiations, from the weapons standpoint, are alpha and beta particles, gamma rays, and neutrons. All nuclear radiations are ionizing radiations, but the converse is not true.

Nuclear Emergency Search Team (NEST). The NEST is a DoE asset with specialized equipment for conducting radiation survey and detection, field communications, EOD support, bomb/weapon diagnostics, hazard prediction, damage mitigation, and decontamination.

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

Nuclear Weapon. A device in which the explosion results from the energy released by reaction involving atomic nuclei, either fission or fusion, or both.

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

a. Accidental or unauthorized launching, firing, or use by U.S. forces or U.S. supported allied forces of a nuclear capable weapons system.

b. An accidental, unauthorized, or unexplained nuclear detonation.

c. Non-nuclear detonation or burning of a nuclear weapon or nuclear component.

d. Radioactive contamination.

e. Jettisoning of a nuclear weapon or nuclear component.

f. Public hazard, actual or perceived.

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:

a. An increase in the possibility of explosion or radioactive contamination.

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

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

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

a. Results in evident damage to a nuclear weapon or radiological nuclear weapon component to the extent that major rework, complete replacement, or examination or recertification by the DoE is required.

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

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

d. Could lead to a nuclear weapon accident and warrants that senior national officials or agencies be informed or take action.

Nuclear Yield. The energy released in the detonation of a nuclear weapon, measured in terms of the kilotons or megatons of trinitrotoluene (TNT) required to produce an equivalent energy release.

Occupational and Environmental Health Laboratory (OEHL). 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 OEHL is called the AFRAT.

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.

One-Point Detonation. A detonation of HE (High Explosives) initiated at a single point.

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 four pounds of TNT (equivalent energy release) when the high explosive is initiated and detonated at any single point.

On-Scene Commander (OSC). The Flag or General Officer designated to command the DoD response efforts at the accident site.

On-Site. That area around the scene of a nuclear weapon accident or significant incident under the operational control of the installation commander, facility manager, DoD OSC, or DoE team leader. The on-site area includes any area which has been established as a NDA or NSA.

Operational Emergency Management Team (OEMT). The DoE senior management team at headquarters that coordinates the initial FRMAP response to radiological emergencies.

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

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

Personnel Reliability Program (PRP). A DoD 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.

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.

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

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

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

Quantity/Distance (QD) 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.

RAD. Old unit of absorbed dose radiation. One rad represents the absorption of 0.01 joule of nuclear (or ionizing) radiation energy per kilogram of the absorbing material or tissue.

RADIAC. A term designating various types of radiological measuring instruments or equipment. (This term is derived from the words "radioactivity detection, indication and computation," and is normally an adjective.

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

Radiation Emergency Assistance Center Training Site (REAC/TS). A treatment and consultative team for radiation emergencies, which provides training courses, at Oak Ridge, Tennessee.

Radiological Advisory Medical Team (RAMT). A special team established at Walter Reed Army Medical Center under the Commander, U.S. Army Health Services Command, available to the OSC, Nuclear Accident and Incident Control Officer, or Commander of a military hospital. Team personnel will advise on radiological health hazards and exposure level criteria.

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

a. Evaluate the radiological hazard.

b. Accomplish emergency rescue and first aid.

c. Minimize safety hazards to the public.

d. Minimize exposure of personnel to radiation or radioactive material.

e. Minimize the spread of radioactive contamination.

f. Minimize damaging effects on property.

g. Disseminate technical information and medical advice to appropriate authorities.

Radiological Assistance Program Team (RAP Team). DoE teams available through DoE regional offices to assist in radiological emergencies.

Radiological Control Area (RCA). The control area encompassing all known, or suspected, radiological contamination at a nuclear weapon accident.

Radiological Control (RADCON) Team. Special radiological teams of the U.S. Army and U.S. Navy organized to provide technical assistance and advice in radiological emergencies.

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

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.

Recovery Procedures. See Explosive Ordnance Disposal Procedures.

Render Safe Procedures. See Explosive Ordnance Disposal Procedures.

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

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

a. Design, manufacture, or utilization of nuclear weapons.

b. Production of special nuclear material.

c. Special nuclear material in the production of energy but shall not include data declassified or removed from the restricted data category pursuant to Section 142 of the Atomic Energy Act (Section 11W, Atomic Energy Act of 1954, as amended).

Roentgen. A obsolete unit of exposure of gamma (or X-ray) radiation in field dosimetry. One roentgen is essentially equal to one rad.

Roentgen Equivalent Man/Mammal (rem). 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 one (1) roentgen of X-ray or gamma radiation. The SI unit replaced the rem.

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

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 countries consent should be obtained prior through host nation agreements.

Senior FEMA Official (SFO). A person appointed by the Director of FEMA to coordinate the Federal response to a civil emergency.

Service Response Force (SRF). A DoD response force appropriately manned, equipped, and able to perform and coordinate all actions necessary to control and recover from an accident or significant incident. The specific purpose of a Service/agency response force is to provide nuclear weapon accident/significant incident assistance. Service/agency response forces are organized and maintained by those Services or agencies which have custody of nuclear weapons or radioactive nuclear weapon components.

Transuranic. Having an atomic number greater than that of uranium (The known elements belonging to the actinide series).

Tritium. Tritium is a radioactive isotope of hydrogen having one proton and two neutrons in the nucleus. Tritium is a beta emitter.

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. See uranium.

Two-Person Policy. 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-man concept or policy.

Uranium. 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.

Warhead. That part of a missile, projectile, torpedo, rocket, or other munition which contains either the nuclear or thermonuclear system, high explosive system, chemical or biological agents, or inert materials intended to inflict damage.

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

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.

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

CHAPTER 1

INTRODUCTION

1-1 GENERAL

DoD Directive 5100.52, reference (a), provides response guidance and the following definitions:

a. A Nuclear Weapon Accident is:

"An unexpected event involving nuclear weapons or nuclear components that results in any of the following:

(1) Accidental or unauthorized launching, firing, or use by U.S. forces or U.S. supported allied forces of a nuclear capable weapons system."

(2) An accidental, unauthorized, or unexplained nuclear detonation.

(3) Non-nuclear detonation or burning of a nuclear weapon or nuclear component.

(4) Radioactive contamination.

(5) Jettisoning of a nuclear weapon or nuclear component.

(6) Public hazard, actual or perceived.

b. A Nuclear Weapon Significant Incident is:

"An unexpected event involving nuclear weapons, nuclear weapon components, or a nuclear weapon transport or launch vehicle when a nuclear weapon is mated, or loaded on board that does not fall in the nuclear weapon accident category but:

(1) Results in evident damage to a nuclear weapon or radiological nuclear weapon component to the extent that major rework, complete replacement, or examination or recertification by the DoE is required.

(2) Requires immediate action in the interest of safety or nuclear weapons security.

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

(4) Could lead to a nuclear weapon accident and warrants that senior national officials or agencies be informed or take action."

This directive also directs the Defense Nuclear Agency (DNA) to develop a technical document for nuclear weapon accident response. The Nuclear Weapon Accident Response Procedures (NARP) manual has been developed for this requirement. This manual summarizes DoD responsibilities and provides procedural guidance for a joint response to accidents involving nuclear weapons or components thereof in the United States and its territories or possessions. General guidance for overseas areas is included.

1-2 PURPOSE AND SCOPE OF THE NARP

This manual consolidates procedural guidance and technical information to assist DoD forces in preparing for nuclear weapon accident response and in responding to a DoD nuclear weapon accident. The document is designed to standardize where appropriate and integrate DoD methods with Department of State (DoS) procedures, the Federal Radiological Emergency Response Plan (FRERP), and DoE Accident Response Group (ARG) responsibilities/procedures. Portions of the document may be useful to DoD elements responding to non-DoD radiological accidents or incidents under current interagency support agreements.

Procedures will not be addressed for response to accidental or unauthorized launching, firing, or use of a nuclear capable weapon system, or for response and recovery of seized or stolen weapons. This manual is designed to furnish a general approach to nuclear weapon accident response. The procedures must be used in conjunction with DoD directives, Federal instructions, State/local plans, international/bilateral agreements and theater policy to be effective.

1-3 ORGANIZATION AND USE OF THE NARP

This chapter introduces the NARP and provides checklists for On-Scene Commanders (OSCs) and their staffs. Chapters 2 and 3 describe responsibilities of the DoD and other Federal agencies and provide general information on foreign governments' responsibilities/capabilities in nuclear weapon accident response/recovery. Chapter 4 discusses the concept of operations for response and recovery procedures, while Chapters

5 through 14 address radiological/hazardous material safety aspects, communications, security, medical assistance, weapons recovery, public affairs, logistics support, legal implications, and site restoration. Chapter 20 lists specialized units and organizations discussed throughout the document. Chapter 21 addresses training.

Potential OSCs and their staffs will enhance their ability to respond to a nuclear weapon accident by gaining familiarity with this manual.

1-4 NUCLEAR WEAPON ACCIDENT RESPONSE OVERVIEW

In a nuclear weapon accident, health and safety, public affairs, classified information security, and weapons recovery are the critical concerns facing the response force. Other aspects, such as medical assistance, security, logistics, legal implications, site restoration, communications and response force integration are areas that must also be addressed.

a. Health and Safety. A nuclear weapon accident can result in an immediate, but temporary, nonradiological threat to public safety from toxic or explosive hazards associated with the accident. Also, contamination may be released that could create long term public health concerns. Rapid initial safing actions on the nuclear weapons involved in the accident are the highest priority so that subsequent detonations and site contamination will not occur. Should conventional explosives in the weapon detonate, radiological contamination may exist. If the weapon is breached by external forces (for example, impact, fuel fire/explosion) there may be radiological contamination. Rapid determination of the presence or absence of radiological contamination is a critical element of initial accident response. Air sampling for radiation downwind of the accident may not be feasible because once the explosion and/or fire is over, the resultant contamination may settle or disperse in a few hours. Initial ground radiation surveys will probably be the means of determining the presence/absence of contamination. If a radiological problem exists, or is caused during weapon recovery operations, specialized Federal, state, and local radiological response teams will be required to define extent of contamination, protect the public, and return the area to normal use.

(1) Radiological Safety. The primary hazards associated with a nuclear weapon accident, unless the accident involves a nuclear yield, are materials which emit alpha radiation. Therefore, measures should be implemented to prevent alpha radiation from entering the body. Radiation hazards and basic radiation protection principles are described in Appendix 1-F. If radioactive contamination occurs as a result of the accident, the first radiological response should be to identify the initially affected area and personnel, minimize any continuing radiological hazard to residents, and characterize the site contamination. Action to accomplish these tasks should be included in response force accident procedures/plans. In general, the extent of contamination is over-estimated initially to provide the greatest margin of safety for the public and then refined as actual measurement of contamination is obtained. The response force must obtain factual information to define the actual details of the contamination problem. The procedures/plans will identify limitations on the response organization's capability to perform such actions and will state additional resource requirements, their availability, and how additional resources will be employed. Specific actions to resolve the radiological problem include:

(a) Estimate the boundaries of radiological contamination using the Atmospheric Release Advisory Capability (ARAC), if available.

(b) Disseminate precautionary/protective measures to be taken by residents in potentially contaminated areas, for example, notification, sheltering, or evacuation.

(c) Identify, monitor, and decontaminate, if necessary, personnel at the accident scene and first responders who may have already departed the accident scene.

(d) Establish a radiological controls program to limit radiation exposures to personnel.

(e) Determine the various levels of contamination present within the contaminated area.

(f) Establish a bioassay program to quantify radiation doses, if required.

(g) Fix highly contaminated areas as appropriate to minimize resuspension.

(2) Hazardous Materials Response. An accident involving a weapon system can release non-nuclear hazardous materials, for example, high explosives, heavy metals, propellants, oxidizers, and plastics. Response procedures must include evacuation or sheltering recommendations to local officials and identifying, marking and containing of hazardous/toxic materials.

(3) Site Decontamination/Restoration. Restoring a contaminated area may include removing, diluting, or fixing contamination at levels which are not detrimental

to health over a lifetime of exposure, and which will be technically achievable and financially acceptable. This process will be the most time consuming portion of nuclear weapon accident response and will be a coordinated Federal, State, local and/or involved country government effort. It will involve preparation of protective measures, reentry recommendations and development of restoration procedures. One of the most difficult steps will be selection of criteria to determine when site restoration is complete. Many of the legal claims against the government will be related to the site restoration process; consequently, actions must be accurately documented.

b. Public Affairs. Public Affairs encompasses much more than the release of information to the public. The relationships of the OSC, his staff, and his public affairs officials with the news media and the general public is an important element in a comprehensive public affairs program designed to gain public understanding of accident response efforts.

(1) Public concerns which can be expected following an accident with a nuclear weapon include:

(a) Danger to those involved in or responding to the accident;

(b) Treatment of casualties;

(c) Credibility of information provided concerning the accident and its long term effects;

(d) Precautions to be taken by those in contaminated areas with regard food, water, livestock safety;

(e) Adequacy of contamination diagnoses and effects on the health of any persons exposed to contamination;

(f) Availability of shelter, food, water, and clothing if the accident situation results in people being evacuated from their homes, and security of their possessions;

(g) Safety of U.S. nuclear weapons;

(h) Decontamination of contaminated areas;

(i) Reparations for damages caused by the accident.

(2) DoD Directive 5230.16, reference (b), states that, in general, it is DoD policy neither to confirm nor deny the presence or absence of nuclear weapons at a specific location. The OSC is authorized to invoke two exceptions:

(a) First, confirmation of the presence of a nuclear weapon is appropriate when public safety is endangered.

(b) Second, the OSC may confirm or deny the presence of the weapon, as necessary, to allay public alarm.

(c) No other variations from DoD policy are authorized. If the exceptions are invoked, confirmation of the presence of the weapon should be made as soon as possible to preclude undue public concern and to establish response force credibility. The Assistant Secretary of Defense (Public Affairs) (ASD(PA)) and local government officials should be notified in advance or advised as soon as possible that an exception has been invoked.

(d) In locations outside the United States, its territories, and possessions, unless bilateral agreements exist, the OSC must have the concurrence of the appropriate theater Commander-in-Chief (CINC) and the approval of the host government through the U.S. Chief of Mission (COM), prior to exercising the exceptions above.

c. Weapon(s) Recovery. All nuclear weapon accidents will, by definition, have some form of weapon problem. Security and weapon safety concerns should not preclude or interfere with the performance of basic medical and humanitarian response to accident victims. Public affairs and health issues must be addressed concurrently with the weapon recovery effort. The weapon presents both a technical problem to be addressed by Explosive Ordnance Disposal (EOD) personnel and the DoE ARG and a need for appropriate security for the weapon and its components. Safety and security procedures for nuclear weapons are documented in EOD and security publications. Weapons involved in an accident may have been subjected to severe stress; consequently, as much time as necessary should be taken to permit a thorough assessment of possible damage by qualified EOD and DoE response personnel. (Through documented planning and close coordination between EOD and DoE ARG, the OSC can ensure safe removal, packaging, and shipment of weapon(s) and/or weapon components to their final destination.) If the high explosives detonate during the accident, or detonate during recovery operations, searching for classified and hazardous components may be necessary. Coordination between EOD, weapon recovery, and radiological response personnel is essential to minimize risk to personnel.

d. Response Forces Integration and Coordination and Associated Areas of Concern. From the initial report of the accident until the final actions of site restoration, several organizations, both within and without the DoD, will be involved in the response effort. The extent of involvement and degree of responsibility are situation dependent, but all forces must be integrated totally to ensure effective use of their capabilities. Following initial identification of arriving response teams, an exchange of briefings should occur to apprise the arriving team of the current situation, actions in progress, and to inform the OSC about the capabilities of the newly arrived response teams. To ensure a coordinated effort, liaison officers may be exchanged, or select members of one team may be integrated into the lead team's staff. The following concerns and actions must be considered: initial identification and security clearance level of response team members with follow-on actions to ensure rapid recurring access to the accident site: medical, communications, security, legal, restoration and logistical support (for example, lodging, clothing, and equipment) needed or provided; and extensive administrative support to ensure complete documentation of events, decisions, and costs.

1-5 THE PHASES OF RESPONSE TO A NUCLEAR WEAPON ACCIDENT

The response procedures addressed throughout this document consider two force levels. The first level is that of Initial Response Force (IRF). The IRF may be a small force on-scene if an accident occurs near an installation with only a humanitarian emergency response capability. The second level is that of the Service Response Force (SRF). The response effort of these forces can be divided into two phases:

a. Initial Phase. The initial phase includes accident notification and immediate emergency measures taken by the nearest DoD/DoE installation to provide a Federal presence and humanitarian support. Initiation of nuclear weapon accident response actions by the National Military Command Center (NMCC), Service operations centers, and others assisting in the response, results automatically from accident notification. Therefore, accidents must be reported immediately using the most expeditious means available (secure if possible). Upon receipt of accident notification, the appropriate response forces are identified and tasked by the Unified Commands, or Service and specialized teams are alerted and prepared for deployment by the Service operations center. A simplified notification chain resulting from the initial accident report to NMCC and/or Service operation centers is shown in Figure 1-1. Also, the initial phase requires defining and stabilizing the situation by the IRF. These actions include fire suppression, rescue and treatment of casualties, assessment of control, reconnaissance, and assessment of the hazards to public health and safety. Other actions of immediate concern include establishing communications with the accident site, the supporting military installation and command centers, public affairs, and providing security for classified material. Figure 1-2, although not all-inclusive, illustrates the inter-relationship of initial actions.

b. Follow-on Phase. The follow-on phase includes the conduct of all operations required to recover the weapon(s) and restore the environment to a technically achievable/financially acceptable condition using the combined assets of the various agencies and organizations in the response and recovery.

1-6 NUCLEAR WEAPON ACCIDENT RESPONSE CHECKLISTS

Checklists derived from the primary nuclear weapon accident response requirements identified in this document are contained in Chapter 1, Appendices 1-A through 1-F as a guide for the OSC in monitoring the progress of an accident response. The checklists' paragraphs are not all inclusive or arranged in priority order; the accident situation will dictate the priority and order of response force actions. Figure 1-3 (centerfold), Nuclear Weapon Accident Response Recovery Operations Flow Diagram, depicts the various response actions and the approximate time of their occurrence. Also, Figure 1-3 may be of assistance in accident response planning.

1-7 CHANGE PROCEDURES

Users are encouraged to submit recommended changes and comments which may enhance this manual's usefulness. Comments should be keyed to a specific page and paragraph of the text. Sufficient detail and justification should be provided to ensure understanding and provide for evaluation of the recommended change. Comments should be forwarded through command and Service channels to Director, Headquarters, Defense Nuclear Agency, ATTN: NOEA, 6801 Telegraph Road, Alexandria, VA 22310-3398.

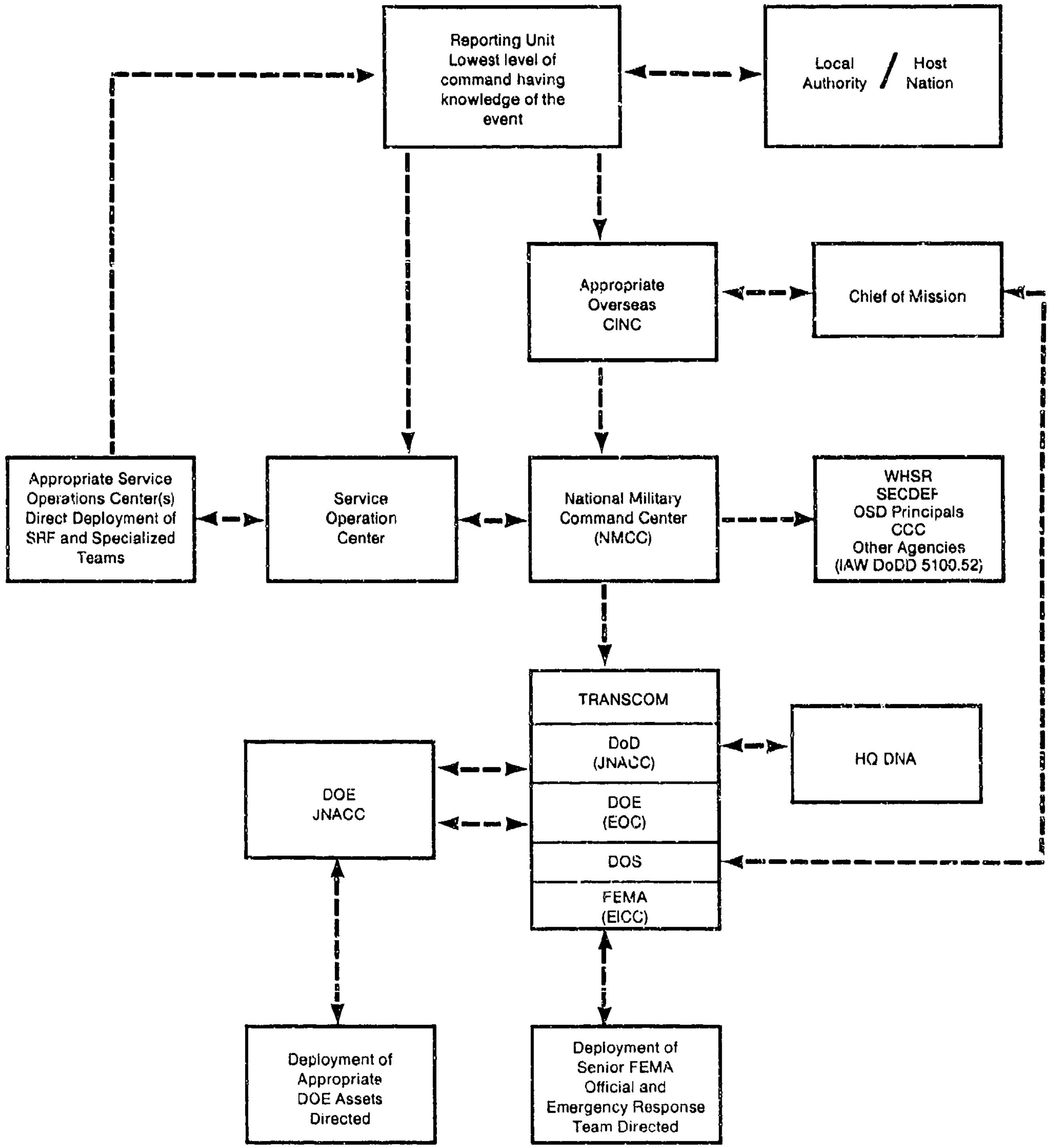


Figure 1-1. Nuclear Weapon Accident Notification Flow (Simplified).

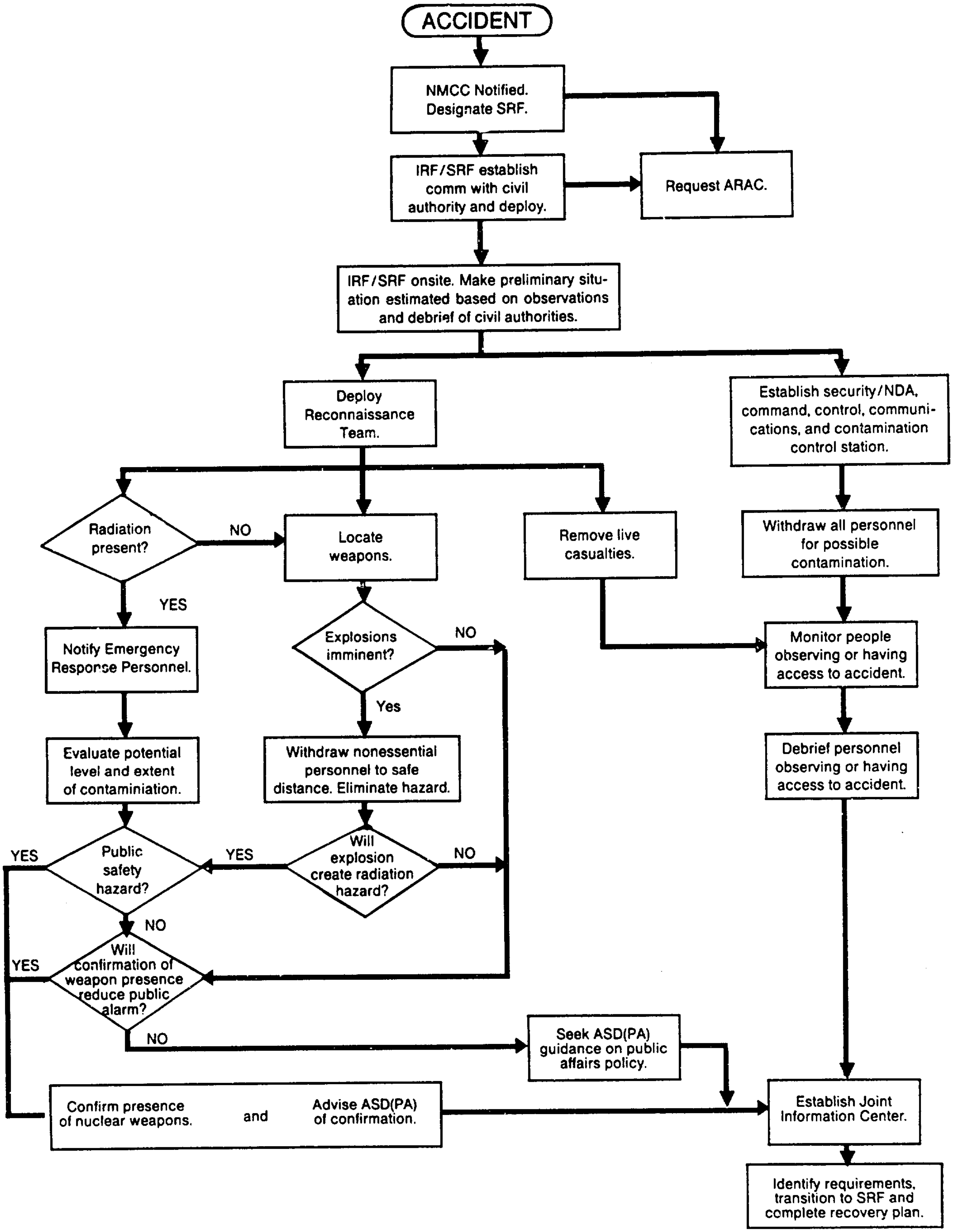
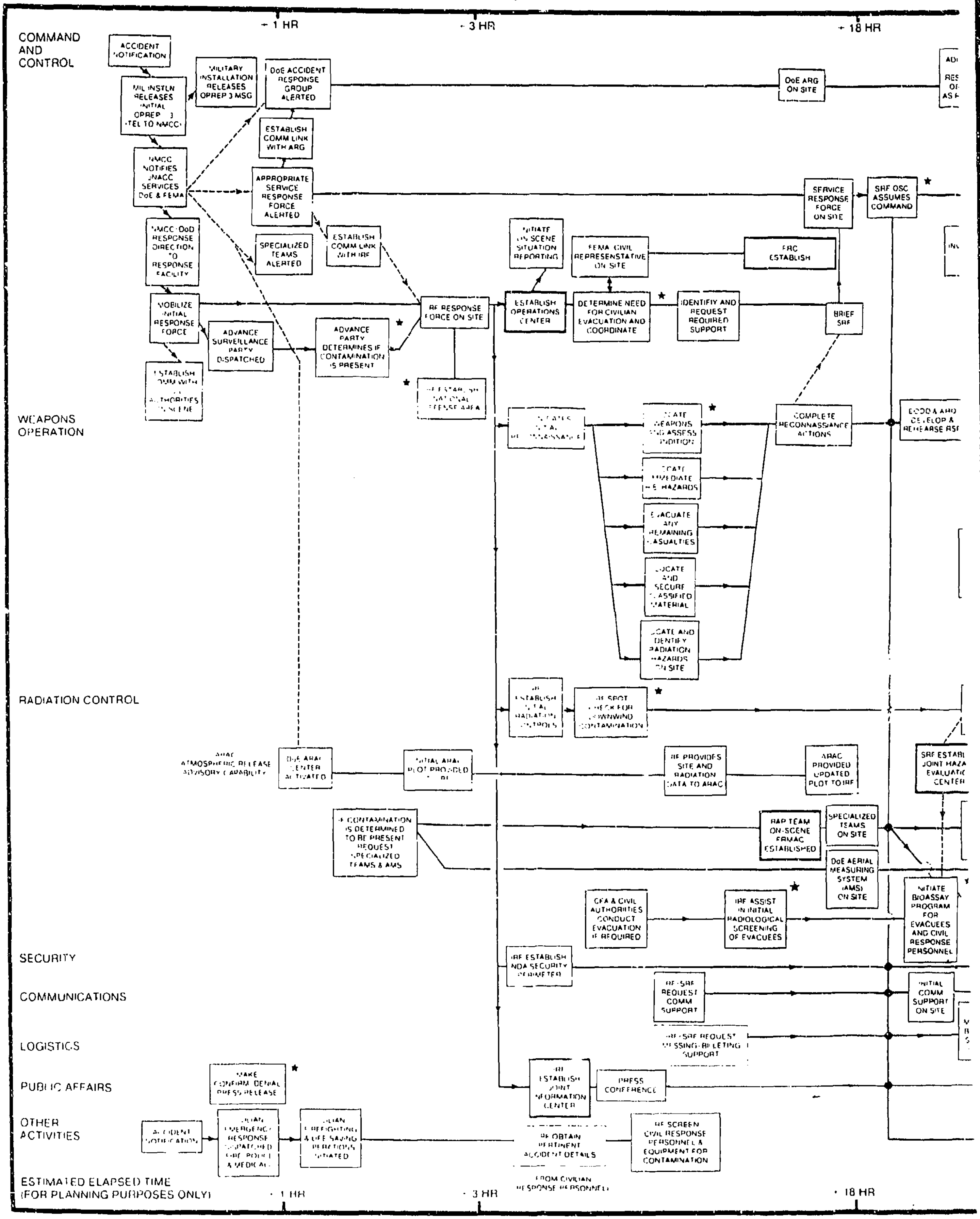


Figure 1-2. Relationship of Initial Actions During a Nuclear Weapon Accident Response.



+1 HR
+3 HR
+18 HR
COMMAND AND CONTROL
ACCIDENT NOTIFICATION
MILITARY INSTALLATION RELEASES OPREP 3 MSG
DoE ACCIDENT RESPONSE GROUP ALERTED
DoE ARG ON SITE
ESTABLISH COMM LINK WITH ARG
NMCC NOTIFIES JNACC SERVICES DoE & FEMA
APPROPRIATE SERVICE RESPONSE FORCE ALERTED
SERVICE RESPONSE FORCE ON SITE
SRF OSC ASSUMES COMMAND
SPECIALIZED TEAMS ALERTED
FEMA CIVIL REPRESENSTATIVE ON SITE
FRC ESTABLISH
MOBILIZE INITIAL RESPONSE FORCE
IRF RESPONSE FORCE ON SITE
ESTABLISH OPERATIONS CENTER
DETERMINE NEED FOR CIVILIAN EVACUATION AND COORDINATE
IDENTIFY AND REQUEST REQUIRED SUPPORT
BRIEF SRF
ADVANCE SURVEILLANCE PARTY DISPATCHED
ADVANCE PARTY DETERMINES IF CONTAMINATION IS PRESENT
WEAPONS OPERATION
COMPLETE RECONNASSIANCE ACTIONS
RADIATION CONTROL
ARAC ATMOSPHERIC RELEASE ADVISORY CAPABILITY
ARAC PROVIDED UPDATED PLOT TO IRF
RAP TEAM ON-SCENE FRMAC ESTABLISHED
SPECIALIZED TEAMS ON SITE
DoE AERIAL MEASURING SYSTEM (AMS) ON SITE
CFA & CIVIL AUTHORITIES CONDUCT EVACUATION IF REQUIRED
IRF ASSIST IN INITIAL RADIOLOGICAL SCREENING OF EVACUEES
INITIATE BIOASSAY PROGRAM FOR EVACUEES AND CIVIL RESPONSE PERSONNEL
SECURITY
IRF ESTABLISH NDA SECURITY PERIMETER
COMMUNICATIONS
INITIAL COMM SUPPORT ON SITE
LOGISTICS
PUBLIC AFFAIRS
PRESS CONFERENCE
OTHER ACTIVITIES
IRF SCREEN CIVIL RESPONSE PERSONNEL & EQUIPMENT FOR CONTAMINATION
ESTIMATED ELAPSED TIME (FOR PLANNING PURPOSES ONLY)

2

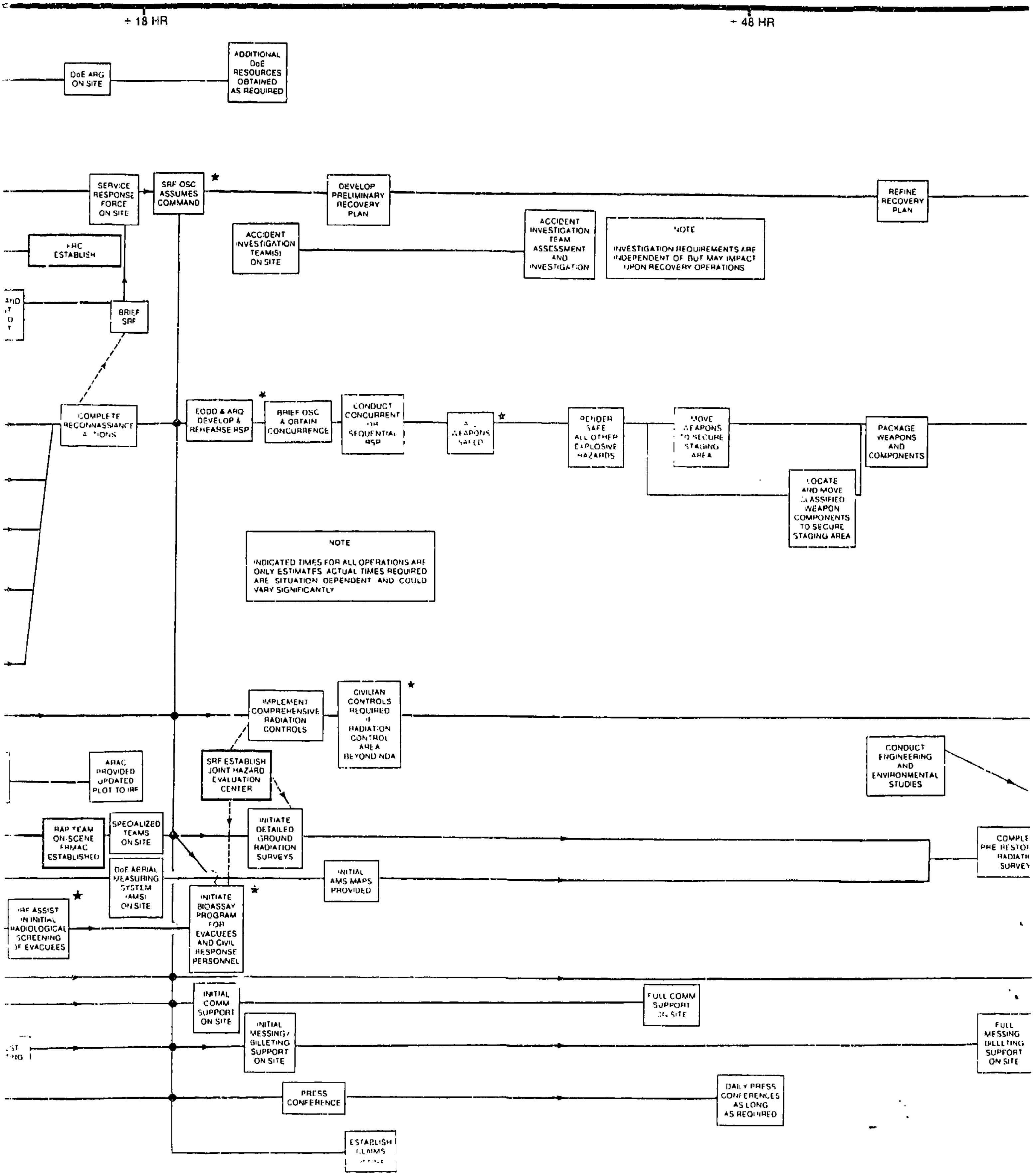


Figure 1-3. Nuclear Weapon Accident Response Recovery Operatio

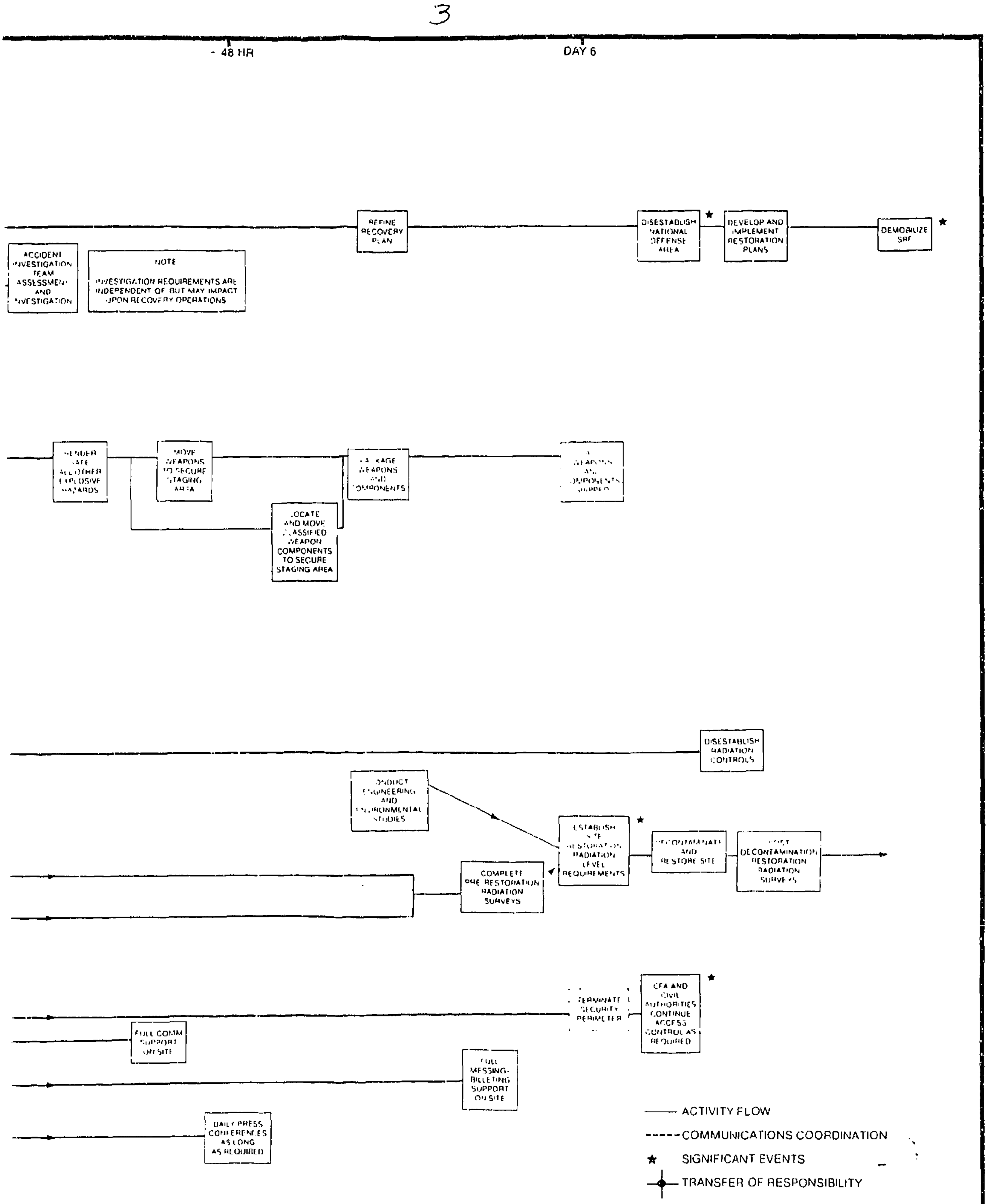


Figure 1-3. Nuclear Weapon Accident Response Recovery Operations Flow Diagram.

- 48 HR
DAY 6

APPENDIX 1-A

RESPONSE FORCE PLANNING CHECKLIST

1. Review accident response plans to ensure:

a. Response force personnel roster is current.

b. Actions required upon arrival on-scene are identified.

c. Procedures exist for establishing communications from on-base, off-base, or remote sites.

d. Procedures/authority are addressed for public release of information.

e. Recommended guidance for involving civil officials/authorities.

f. Potential assistance is identified from civil officials/authorities and other federal agencies.

g. Personnel/equipment deployment plans are current and functional.

h. Proposed response force equipment is appropriate and adequate for the mission.

i. Notification procedures and telephone numbers are correct.

j. Reception plans for support teams are adequate.

2. Inspect response force equipment to ensure it is:

a. Fully serviceable/operable.

b. Ready for short notice deployment.

3. Verify readiness through periodic response force field and command post exercises.

4. Trained personnel are assigned to key positions. Replacements are appointed and trained promptly upon departure of incumbent.

APPENDIX 1-B

INITIAL RESPONSE FORCE

PRE-DEPARTURE CHECKLIST

1. Recall response force personnel and assemble equipment.

2. Contact authorities on-scene, if possible, for additional information.

3. Assess situation.

4. Review accident notification message (OPREP-3), as appropriate.

5. Provide advice on possible hazards to on-scene officials.

6. Dispatch advance party, if appropriate.

7. Obtain weather data at time of accident and weather forecast for accident site.

8. Coordinate communications procedures with home base/station.

9. Request ARAC plot, if available for the accident.

10. Augment response force, if necessary.

11. Ensure arrangements are being made for required logistics support.

12. Ensure proper travel route is established and obtain security escort.

13. Ensure other agencies are aware of response force and OSC's status.

APPENDIX 1-C

RESPONSE FORCE IMMEDIATE ACTIONS CHECKLIST

1. Establish a command post:

a. Identify civil and military forces present and their capabilities.

b. Determine actions to treat, identify, and evacuate casualties.

c. Reduce any immediate hazards (such as fires).

d. Place air samplers up and downwind of the accident.

e. Determine if contamination has been released. (Notify NMCC immediately).

f. Determine actual weather conditions at the accident site.

2. Establish control of the accident site to:

a. Protect personnel from explosive, radiological, toxic, or other hazards.

b. Safeguard classified material.

c. Establish internal and external communications, using secure means when possible, with DoD Joint Nuclear Accident Coordinating Center or NMCC in addition to the Service operation center.

3. Prepare appropriate press releases with Service and DoD Directives.

4. Establish direct communications with the Office of the Assistant Secretary of Defense (Public Affairs), if possible.

5. If contamination is present:

a. Advise medical treatment facilities receiving casualties the type of actual or possible contamination.

b. Through NMCC recommend deployment to the scene of the specialized teams from the appropriate Service operations center, if necessary.

(1) Army Radiological Control Team
(2) Navy Radiological Control Team
(3) Army Radiological Advisory Medical Team
(4) Air Force Radiation Assessment Team
(5) Air Force Air Transportable Radiac Assistance Package
(6) Defense Nuclear Agency Advisory Team
(7) Department of Energy Accident Response Group

c. Advise the NMCC of the TELEFAX phone number for ARAC plot delivery.

d. Identify and record names, addresses, and locations of persons possibly contaminated.

7. Determine the status and location of all weapons, if possible.

8. Seek the assistance of civilian authorities/officials and advise them of any possible hazards and precautions.

9. Keep the Service operations centers and/or National Military Command Center informed of conditions at the accident scene.

10. Establish a continuous and secure communications link with the military communications system.

11. Request HAMMER ACE, Joint Communications Support Element, Joint Communications Contingency Station Assets or other appropriate communication systems.

12. Establish a Joint Information Center (JIC) with toll free number for information request.

13. Identify a forward operating or staging base and reception center for follow-on forces.

14. Secure airspace (that is, prohibited area over accident site) with assistance of the Federal Aviation Authority or host country.

15. Establish liaison with Host Nation through Chief of Mission.

16. Perform emergency render safe procedures on weapons if necessary.

APPENDIX 1-D

RESPONSE FORCE CHECKLIST OF ACTIONS TO BE TAKEN ON-SCENE AS SOON AS AVAILABLE RESOURCES AND PERSONNEL PERMIT

1. Initiate surveys and determine extent of contamination.

2. Direct activities of a JIC to interface with DoS, Federal, state, or local and/or affected country government public affairs.

3. Establish a National Defense Area, or "Security Area" in coordination with affected country officials, if required. (Dissolve the designated area and return control to civil authorities/officials after all classified materials have been removed).

4. Establish a Joint Hazard Evaluation Center to coordinate explosive, toxic, or other hazard safety measures and radiological monitoring and health physics matters in supporting on-site operations.

5. Establish liaison with the FRC, FRMAC, and civil authorities/officials, legal, and law enforcement agencies.

6. Establish the approximate perimeter of the contamination area.

7. Control exposure of public/response force personnel to contamination. Coordinate actions with local/host nation police and public health officials.

8. Identify individuals who may have been exposed to contamination.

9. Provide advice to civil authorities or affected country government specialists, if requested, by establishing a radiological health program for any civilian personnel who may have internal contamination. Establish a similar program for response forces and people stationed at the accident site.

10. Conduct weapon(s) damage assessment.

11. Perform render safe procedures on weapon(s), as required.

12. Initiate systematic search to re-establish accountability for all the weapon(s) and weapon(s) components.

13. Develop and implement a weapons recovery plan, in conjunction and coordination with DoE ARG, to include the appropriate packaging requirements consistent with final disposition/disposal requirements of the weapon(s).

14. Transport/ship weapon(s) and components to appropriate disposal areas.

15. Establish an environmental exposure injury prevention program.

16. Establish a claims processing facility. For overseas accidents, this facility will be in coordination with the Embassy and involved host government.

17. Determine availability of assets and facilities at or near the scene of the accident. Initiate actions to use supporting response force requirements.

18. Inform the Senior FEMA official or foreign government officials, upon arrival, of all on-site activities which could impact off-site and establish continuing liaison.

19. Document actions taken and ensure that evidence is retained for an accident investigation board.

20. Establish a standardized access control system.

21. Consider applying fixatives to highly contaminated areas to reduce resuspension.

22. Establish the Community Emergency Action Team (CEAT).

APPENDIX 1-E

SERVICE RESPONSE FORCE CHECKLIST OF ACTIONS TO SUPPORT SUSTAINED SITE RESTORATION

1. Provide required medical, administrative, and logistic support (including that needed by DoE response organizations).

2. Assess levels of public understanding and identify/respond to concerns about nuclear issues.

3. Establish coordination with Service and National Transportation Safety Board accident investigation teams.

4. Coordinate communications assets and frequency requirements of all response organizations. Be prepared to coordinate such actions with a representative of the National Communications System, who is responsible for coordinating and managing telecommunications support for Federal agencies during a radiological emergency.

5. Publish a Communications-Electronics Operating Instruction for use by all response organizations.

6. Request frequency clearances, if required.

7. Obtain additional communications assets, as required.

8. Establish channels for coordination of technical legal matters with higher headquarters and principal legal advisors of other participating Federal departments and agencies and/or involved country officials.

9. Coordinate site restoration planning/action with FRMAC, FEMA, responsible state civil authorities, and military organizations and/or involved host government officials.

10. Ensure actions are taken to begin preparations of a draft site restoration strategy.

11. Conduct environmental impact assessments.

12. Conduct decontamination operations.

13. Restore contaminated area to a condition that is technically achievable and financially acceptable.

14. Coordinate environment protection plans for post-restoration radiation monitoring and assessment with site restoration plans. This monitoring will be defined by restoration agreements.

15. Ensure protection of U.S. Government property.

16. Provide necessary operational security.

17. Counter potential terrorist and/or radical group activities or intelligence collection efforts.

18. Establish personnel replacement/rotation program to support long term operations and, as appropriate, to minimize radiation exposure to radiation workers.

19. Debrief personnel with access to classified information.

20. Discuss with the Senior FEMA Official (SFO) the possible transfer of responsibility for the Joint Information Center to the SFO.

21. Request a Service Project Code for fund cites.

22. Consider transition of Federal responsibility for the disestablishment of the NDA and site restoration. Coordinate with State and local officials through FEMA.

APPENDIX 1-F

RADIATION HAZARDS AND BASIC RADIATION PROTECTION PRINCIPLES

1-F-1 RADIATION HAZARDS

a. With no nuclear detonation, radiation levels will be too low to cause immediate (acute) biological effects. Do not delay or omit life or limb-saving measures because of radiation or contamination to keep low the probability that delayed effects, such as cancer, will occur years later.

b. The primary pathway for introduction of alpha-emitting radiological contamination is inhalation. The greatest hazard from inhalation occurs immediately after an accident when contamination is released. If a weapon's high explosives detonate, the explosion can create a cloud of contamination which gradually dissipates and settles from the air as it moves downwind. If a weapon burns, contamination may be carried into the air by the smoke and thermal currents from the fire and again be dispersed by the wind. In either case, once the explosion and/or fire is over and the resulting contamination has settled or dispersed (approximately two/three hours), the remaining inhalation hazard from resuspension of radioactive particles is significantly reduced.

c. Radioactive contamination can be introduced into the body through wounds. The greatest potential for contamination of wounds involves personnel, involved in the accident or at the accident site initially; responding EOD personnel and associated workers may suffer injuries within the contaminated area. When responding to an accident involving injury, those responding always should be aware that administration of first aid for serious injuries is of primary importance.

d. Ingestion of radioactive fissile material (for example, plutonium or uranium) is a minimal problem, since these materials are not absorbed appreciably across the lining of the gastrointestinal tract.

1-F-2 RADIATION PROTECTION PRINCIPLES

Four basic radiation protection principles involve concentration and isotope, time, distance, and shielding. These four factors are interrelated.

a. Concentration and Isotope. The exposure rate from a radioactive material is related directly to the amount or quantity of the material present. For the types of radioactive materials present at nuclear weapons accidents, the total quantity present normally does not present a significant external radiation hazard. The primary radiation threat in a weapon accident is from inhalation. Quantity of radioactive material will be expressed in units depending upon the medium the radioactive material is in, for example, for the measure of radioactive material in air, the units are microcuries per cubic meter ($\mu Ci/m^3$) or becquerels per cubic meter (Bq/m^3); for ground measurement, the units are microcuries per square meter ($\mu Ci/m^2$) or becquerels per square meter (Bq/m^2). Field measurements of quantity are normally expressed in instrument-dependent units of counts per minute (CPM) or counts per second (CPS) and must be converted to definitive units such as $\mu Ci/m^2$ or Bq/m^2 for meaningful comparison.

b. Time. Any radioactive material will emit a known amount of radiation per unit time. For the type and quantities of radiation present at a nuclear weapon accident, exposure to the material for months or years would normally be required for external radiation to be a hazard. Exposure time to the radioactive materials present at a nuclear weapon accident is related to a health hazard primarily through the amount of material deposited in the lungs through inhalation over a period of time. The rate at which contamination may be inhaled is highest during the initial period following the accident when a substantial quantity of contamination is airborne. If no airborne contamination exists, or if respiratory protection is being worn, exposure time is not a critical factor in nuclear weapon accident response when no beta/gamma emitters are present.

c. Distance. The protective principle of distance, where radiation intensity varies inversely with the square of the distance (if the distance doubles the intensity is reduced by a factor of four), applies primarily to gamma radiation (not normally a significant part of the radiological problem in a nuclear weapon accident). Alpha particles, the primary radiological problem, will travel about two to three centimeters in air from its source; hence, distance will not be a significant radiation protection factor. Note: The source material could travel long distances.

d. Shielding. Shielding results from the ability of a material to attenuate or stop radiation. The alpha particles, emissions of primary concern in a nuclear weapon accident, can be stopped by paper, or cotton clothing. The emissions will not penetrate the outer layer of skin. Beta emissions can be stopped by a sheet of aluminum, while gamma emissions may require several inches of lead to be stopped. Alpha emitters are the primary type of radiation dispersed following a nuclear weapon accident. Assuming there is no nuclear yield, any light clothing or gloves used to prevent contamination of underlying clothing or the body will provide protection automatically from this type of external radiation.

APPENDIX 1-G

QUICK REFERENCE EMERGENCY PHONE NUMBERS

DEPARTMENT OF DEFENSE (DoD)

National Military Command Center (NMCC)	AUTOVON Commercial	227-6340 703-697-6340
Crisis Coordination Center	AUTOVON Commercial	364-9320 202-769-9320
Joint Nuclear Accident Coordinating Center (DoD-JNACC)	AUTOVON Commercial	221-2102 703-325-2102
U.S. Army Operations Center (AOC)	AUTOVON Commercial	227-0218 703-697-0218
U.S. Navy Command Center	AUTOVON Commercial	225-0231 703-695-0231
U.S. Air Force Operations Center (AFOC)	AUTOVON Commercial	227-6103 703-697-6103
U.S. Marine Corps Operations Center	AUTOVON Commercial	225-7366 703-695-7366
Assistant Secretary of Defense (Public Affairs)	AUTOVON Commercial	227-5131 703-697-5131

DEPARTMENT OF ENERGY (DoE)

HQ DoE Emergency Operation Center	Commercial	202-586-8100
Joint Nuclear Accident Coordinating Center (DoE-JNACC)	AUTOVON Commercial	245-4667 505-845-4667
Radiation Emergency Assistance Center/ Training Site (REAC/TS)	Commercial	703-557-2380

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

Emergency Information and Coordination Center (EICC)	AUTOVON Commercial	544-7721/7720 202-646-2400
National Emergency Coordinating Center (NECC)	AUTOVON Commercial	380-6100 202-898-6100

DEPARTMENT OF STATE (DoS)

Operations Center	Commercial	202-647-1512

CHAPTER 2

RESPONSIBILITIES OF THE DEPARTMENT OF DEFENSE

2-1 GENERAL

The Department of Defense (DoD) is charged with the security, safe handling, storage, maintenance, assembly, and transportation of nuclear weapons and nuclear weapon components in DoD custody. Inherent in this responsibility is the requirement to protect personnel and property from any health or safety hazards which could ensue from an accident or significant incident involving nuclear weapons. To fulfill these responsibilities, the DoD has issued policy guidance and plans requiring the development of well-trained and equipped nuclear weapon accident response organizations. The DoD response policy recognizes the response roles of nuclear weapon owners or custodians, the statutory responsibilities of various Federal agencies, of State and local governments, and the sovereignty of foreign governments concerning accidents on their territory.

2-2 PURPOSE AND SCOPE

This chapter describes the responsibilities of various DoD organizations, including the management responsibilities of the Secretary of Defense and the military Services, the command and control responsibilities of On-Scene Commanders (OSC)s, and the responsibilities of the Joint Nuclear Accident Coordinating Center (JNACC) and interface requirements as stated in the Federal Radiological Emergency Response Plan (FRERP), reference (c).

2-3 RESPONSIBILITIES

DoD Directive 5100.52, reference (a), outlines responsibilities for on-site command and control at the scene of a nuclear accident or significant incident, as follows:

(1) The Under Secretary of Defense (Policy) (USD(P)) shall activate the Crisis Coordination Center (CCC), if required, and provide required support to the Assistant to the Secretary of Defense (Atomic Energy) (ATSD(AE)) in the acquisition and dissemination of information about the accident.

(2) The Assistant to the Secretary of Defense (Atomic Energy) (ASTD(AE)) shall:

(a) Establish policy and exercise staff coordination for DoD radiological response and assistance matters in furtherance of the responsibilities assigned by DoD Directive 5148.2, reference (d).

(b) In the event of a nuclear accident, serve as technical advisor to the Secretary of Defense and OSD Principals regarding weapons composition, characteristics, and safety features; interdepartmental responsibilities and the Federal radiological emergency response system; and technical capabilities of the various Federal response elements.

(3) The Secretaries of the Military Departments and Commanders of Unified Commands shall have primary responsibility for responding to an accident involving radioactive materials, including nuclear weapons, as follows:

(a) When the accident occurs on a DoD installation, including ships at sea, responsibility shall rest with the Secretary of the Department or Theater Commander in Chief concerned in accordance with DoD Directive 5200.8, reference (e).

(b) When the accident occurs beyond the boundaries of DoD installations, responsibility shall rest with the Secretary of the Department or Theater Commander in Chief having custody of the radioactive materials at the time of the occurrence.

(4) The Secretary of the Military Department or Commander of Unified Commands having primary responsibility for DoD response to an accident shall:

(a) Establish, maintain, fund, and exercise a flag rank On-Scene Commander and Service Response Force(s) to manage all actions required to recover from the effects of a radiological accident. Service response forces and On-Scene Commanders will be exercised, as a minimum, every other year.

(b) Provide available administrative, medical, and logistical support (including communications and military transportation) and other available radiological response resources to the DoE and other Federal response organizations supporting a non-DoD radiological accident, in accordance with enclosure 3 to DoD Directive 4000.19, reference (f).

(c) Coordinate all military support requirements to civilian authorities with FEMA for domestic accidents or through the Department of State for accidents occurring outside the United States, its territories, or possessions. If PL 93-288, as amended, reference (g), is involved, coordination shall be handled in accordance with DoD Directive 3025.1, reference (h).

(5) The Secretary of the Army, upon Presidential declaration of a major disaster or emergency under reference (l), shall become the DoD Executive Agent for military support to civilian authorities through FEMA in accordance with reference (h).

(6) The Secretary of the Navy shall provide a representative to the Federal Radiological Coordinating Committees and joint working groups to address naval reactor considerations and develop planning guidance in coordination with the other Military Departments for dealing with accidents involving DoD mobile reactors.

(7) The Secretary of the Air Force, through the Military Airlift Command (MAC), shall plan for and provide Special Assignment Airlift Mission (SAAM) support for deployment of DoD and interdepartmental response organizations.

(8) The Chairman, Joint Chiefs of Staff (CJCS), shall:

(a) In coordination with the Theater Commands and appropriate Defense Agencies, be responsible for implementing the DoD response to radiological accidents.

(b) Make notification of radiological accidents and significant incidents as stated in DoD Directive 5100.52, reference (a).

(c) Through the NMCC, keep the OSD CCC staff informed of the radiological accident response.

(d) Through the overseas theater commander, provide the command and control for response to radiological accidents within the respective theater.

(e) Assemble a Joint Nuclear Accident Response Team (JNAIRT) as appropriate to accomplish tasks listed above.

(9) The Director, Defense Nuclear Agency, shall:

(a) Operate a Joint Nuclear Accident Coordinating Center (JNACC) in coordination with the DoE.

(b) Develop and maintain a deployable (technical) advisory team than can assist the DoD On-Scene Commander in dealing with technical aspects of a nuclear accident or incident.

(c) Serve as an advisor to the ATSD(AE) and Joint Chiefs of Staff (JCS) on procedures for response to accidents involving nuclear weapons.

(d) Provide liaison to the JNAIRT and CCC.

(10) The Heads of DoD Components shall:

(a) Ensure that accidents and significant incidents involving radioactive materials are reported in accordance with reference (i).

(b) Ensure that all public information concerning accidents involving radioactive materials and DoD personnel, equipment, property, or other resources is released in accordance with DoD Directive 5230.16, which authorizes the OSC to confirm the presence of nuclear weapons, and the FRERP, references (b) and (c).

(c) Ensure that the JNACC is advised of all accidents involving radioactive materials and requests for radiological assistance. Provide the JNACC with information necessary to maintain current records reflecting the location and capability of specialized units and teams that can be used for response to accidents involving radioactive materials.

(d) Provide radiological assistance within existing capabilities to DoE or FEMA, as set forth in reference (c), in the event of an accident involving radioactive materials not in DoD custody without creating additional personnel, facilities, or funding requirements.

(e) Upon request, reimburse other DoD Components for incurred costs for requested radiological assistance that are not included in their normal operating expenses and that are directly chargeable to, and caused by, the assistance provided.

CHAPTER 3

RESPONSIBILITIES OF OTHER AGENCIES

3-1 GENERAL

Several agencies/organizations outside the Department of Defense (DoD) have roles in a nuclear weapon accident response. Each agency's/organization's responsibilities are situation dependent. Their involvement may be as a direct result of their responsibilities, interagency agreements, the Federal Radiological Emergency Response Plan (FRERP), reference (c), bilateral agreements, theater policy, or in response to a request for assistance.

3-2 PURPOSE AND SCOPE

This chapter provides an overview of Federal, State, and local government agency responsibilities, and capabilities. The DoE and FEMA have numerous nuclear weapon accident responsibilities. Conversely, some agencies have no specific response roles, but do have capabilities useful to response organizations.

3-3 DEPARTMENT OF ENERGY

a. The DoE is responsible for dispatching appropriate DoE response elements, on request, to the scene of a DoD or DoE nuclear weapon accident or incident. The specific elements and equipment will be tailored by DoE to best meet the accident or incident situation, and will be coordinated with the DoE Joint Nuclear Accident Coordinating Center (JNACC).

b. The DoE has established an Accident Response Group (ARG) as its primary accident response element. The ARG is managed by the Manager, Albuquerque Operations Office and is comprised of scientists, technical specialists, crisis managers, and equipment ready for short notice dispatch to the scene of a nuclear accident. The ARG will advise and assist the DoD On-Scene Commander (OSC) through the DoE Team Leader in weapon recovery operations and in evaluating, collecting, handling, and mitigating radioactive and other weapons associated hazards. Other DoE assets, for example, the Aerial Measurement System (AMS), will be a part of the ARG, when required.

c. While at a DoD accident, the ARG provides technical support to the DoD and will support all needs and policies of the DoD OSC for on-site activities. A definition of on-site is found in the GLOSSARY.

d. The ARG provides technical advice and assistance to the OSC in:

(1) Supporting Explosive Ordinance Disposal (EOD) teams in weapon render safe and recovery procedures.
(2) Determining the extent of any on-site hazards.
(3) Minimizing hazards to on-site workers and the public.
(4) Collecting, identifying, packaging, and disposing of weapon components, weapon debris, and the resulting radioactive material.
(5) Identifying and protecting nuclear weapon design information and other restricted data.
(6) Discussing with State, local, or foreign country government officials matters of special DoE competence.
(7) Explaining public affairs matters, particularly in weapons and radiological hazards.

e. The ARG will be headed by the DoE Team Leader who will:

(1) Coordinate the activities of all DoE response elements.
(2) Advise the DoD OSC of DoE response capabilities available at the scene or which may be obtained.

f. The ARG includes a Senior Scientific Advisor who will provide technical advice and assistance regarding weapons and radiological health and safety matters.

g. The ARG provides liaison to the Joint Information Center (JIC).

h. The ARG provides one or more experienced individual to help manage the Joint Hazard Evaluation Center (JHEC) for the OSC.

i. The DoE Radiological Assistance Program (RAP) Regional Coordinating Offices responding to a nuclear weapon accident or significant incident in the United States shall:

(1) Support the DoE ARG through the DoE Team Leader, as directed by the Director, Headquarters DoE Operational Emergency Management Team (OEMT).

(2) Provide technical advice and assistance to the State, local, and county government emergency response forces through the DoE Team Leader, if requested.

(3) Represent the DoE, if first on the scene, until the DoE Team Leader arrives.

(4) Initiate monitoring off-site as outlined in the FRERP, reference (c).

j. Nuclear Emergency Search Team (NEST). The NEST is a DoE team of scientists, engineers, and technicians trained and organized to provide rapid technical assistance in locating nuclear weapons or special nuclear material. The NEST has special equipment for conducting radiation searches and detection, field communications, EOD support, bomb/weapon diagnostics, hazard prediction, damage mitigation, and decontamination. The NEST is managed by the Manager, Nevada Operations Office, Las Vegas, Nevada. NEST assets may be included as a part of the DoE ARG.

3-4 DEPARTMENT OF STATE (DoS)

a. Under the direction of the Secretary of State, the DoS exercises diplomatic and political control of the U.S. response to a nuclear weapon(s) accident outside the U.S., its territories and possessions. In the host country, responsibilities rest specifically with the U.S. Chief of Mission (COM) who will be the focal point for diplomatic and political decisions of the U.S. government. The COM:

(1) Will be the senior U.S. government official in communication with officials of the government involved with whom he will coordinate U.S. response/recovery actions.

(2) Has the overall responsibility for U.S. government diplomatic actions responding to a nuclear weapon accident/incident and will direct the activities of the U.S. embassy and its constituent posts.

(3) Shares with the Unified Commander the responsibility for resolution of the situation. In fulfilling those responsibilities, the COM will be assisted by a team from the embassy's Emergency Action Committee (EAC) with augmentation required by the situation. Liaison officers from the embassy will be provided to assist the OSC and the JIC, at a minimum.

b. From the onset of the accident/incident, the COM and USCINC will consult regarding military operations in view of their potential impact on U.S. political interests. Any differences not resolved in theater will be relayed immediately to Washington for resolution in joint messages which will include as action addressees the White House, Secretary of State, Secretary of Defense, and Chairman, Joint Chiefs of Staff, with information copies to other concerned parties.

c. The DoS activates an accident/incident task force in the Operations Center and provides liaison officers to agencies as agreed in existing plans or at the time of the accident.

3-5 FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

When the FRERP is implemented, FEMA is responsible for coordinating response actions among Federal agencies and assistance requests from State and local governments during a nuclear weapon accident in the U.S., its territories, or possessions, and/or causing an effect into Canada or Mexico. Activities at the scene of the accident include coordinating requests from State and local governments for assistance from Federal agencies. Also, FEMA ensures that off-site actions and response activities of Federal, State, and local officials are mutually supportive and coordinated with the on-site actions of DoD and DoE. This FEMA role is implemented by a Senior FEMA Official (SFO).

a. FEMA will dispatch the SFO and an Emergency Response Team (ERT) to the scene of a nuclear weapon accident or incident when the accident has an effect outside of DoD or DoE facility boundaries. In addition to the SFO, the ERT consists of a deputy SFO (DSFO), an administrative officer, a communications officer, a public information officer, and others as required by the situation.

b. The SFO will establish a Federal Response Center (FRC) at a location either pre-selected with the State(s) and DoD or established at the time of the emergency at a location identified in conjunction with the State. The FRC will be located near the accident scene, but outside the NDA, to avoid restrictions on access by representatives from other Federal agencies, State, and local authorities. Each Federal agency at the scene is represented in the FRC. The FRC may also have representation from State emergency services organizations and volunteer agencies. The Service Response

Force (SRF) should assign a liaison officer to the FRC and/or coordinate information exchange.

c. The SFO or DSFO will provide a liaison representative to the OSC.

d. The SFO or DSFO will assist the OSC, as requested, in developing and evaluating protective action recommendations.

e. The SFO will supply coordinated information on the Federal response to the State and/or local government officials.

3-6 DEPARTMENT OF AGRICULTURE (USDA)

The functions and capabilities of the USDA to provide radiological assistance in the event of a nuclear weapon accident include the following areas:

a. Provide assistance through regular USDA programs if legally adaptable to radiological emergencies.

b. Provide emergency food coupon assistance in officially designated disaster areas when a threshold of need is determined by State and Federal officials and the commercial food system is sufficient to accommodate food coupons.

c. Provide listings of locations of alternate sources of livestock feed.

d. Provide advise to State and local officials regarding the disposition of livestock and poultry contaminated by radioactive material.

e. Ensure the wholesomeness of meat and meat products, poultry and poultry products, and egg products identified for interstate commerce.

f. Provide for the procurement of food.

g. Assist State and local officials, in coordination with HHS and EPA, in the recommendation and implementation of protective measures to minimize exposure by contaminated food ingestion.

h. Assist in coordinating with HHS and EPA, in the emergency production, processing, storage, and distribution of food through the wholesale level during a radiological emergency.

i. Assess damage to agricultural resources.

j. Provide advice to State and local officials on minimizing losses to agricultural resources from radiation effects.

k. Provide information and assistance to farmers, food processors and distributors to aid in returning to normal after a radiological emergency.

l. Assist in reallocation of USDA donated food supplies from warehouses, local schools, and other outlets to emergency food centers. These are foods donated to various outlets through USDA food programs administered by the Food and Nutrition Service.

m. Provide a liaison to State agricultural agencies to keep State and local officials informed of Federal efforts.

n. Assist DoE at the FRMAC in collecting agricultural samples within the 50-mile Ingestion Pathway Emergency Planning Zone (EPZ).

o. Assist in providing available temporary housing for evacuees.

3-7 DEPARTMENT OF HEALTH AND HUMAN SERVICES (HHS)

a. The HHS can provide:

(1) Guidance to State and local governments on the use of radio-protective substances, including dosage, and projected radiation doses which warrant usage of such drugs.

(2) Advice to medical care personnel regarding proper medical treatment of people exposed to, or contaminated by, radioactive material.

(3) Advice and guidance to State and local officials in assessing the consequences of radiological accidents on the health of persons in the affected area.

(4) Resources, in conjunction with the USDA, ensuring that food and animal feeds are safe for consumption.

(5) Assistance, in coordination with USDA, in developing technical recommendations for State and local officials regarding protective measures for food and animal feeds.

b. The Center for Devices and Radiological Health (CDRH) is responsible for radiological health activities conducted in the Food and Drug Administration (FDA) and provides the major source of radiation expertise within the Public Health Service. The FDA prescribes contamination levels for canned and/or packaged foods/materials.

3-8 DEPARTMENT OF COMMERCE (DoC)

a. DoC response functions for accidents involving nuclear weapons are:

(1) Estimate the damage to industrial resources and recommend measures to deal with problems of the industrial sector.

(2) Provide current and forecast meteorological information about wind direction and speed, boundary layer mixing, precipitation, and any other meteorological and hydrological parameters affecting radiological contamination.

(3) Provide a representative to both the on-site and off-site radiological monitoring agencies to coordinate meteorological and hydrological information and to arrange for supplemental meteorological measurements.

b. The National Oceanic and Atmospheric Administration (NOAA) is the primary agent within DoC responsible for providing radiological emergency assistance to Federal, State, and local organizations. The National Weather Service (NWS) is the focal point for radiological emergency coordination. The NWS maintains coordination with the National Ocean Service (NOS) and Coastal Zone Management, the National Environmental Satellite Data and Information Service (NESDIS), the National Marine Fisheries Service (NMFS), and the Office of Oceanic and Atmospheric Research (OAR). In an actual emergency, these offices take collective action to focus DoC resources and expertise to assist Federal, State, and local government offices in controlling and resolving a radiological emergency. NOAA's main responsibilities include:

(1) Acquiring weather data and providing weather forecasts in connection with the emergency.

(2) Disseminating weather and emergency information via NOAA Weather Radio.

(3) Assisting the FDA in assessing the safety of marine fishery products from radiological contamination.

(4) Providing current and forecast meteorological information about wind speed and direction, low-level stability, precipitation, and other meteorological and hydrological factors affecting the transport or dispersion of radiological materials.

3-9 DEPARTMENT OF THE INTERIOR (DoI)

a. DoI manages over 500 million acres of Federal lands and thousands of Federal natural resource facilities. DoI is responsible for these lands and facilities when threatened by a radiological emergency. In addition, DoI coordinates emergency plans for DoI-managed park and recreation areas with State and local authorities and operates DoI water resource projects to protect municipal and agricultural water supplies in cases of radiological emergencies.

b. DoI provides advice and assistance concerning hydrologic and natural resources, including fish and wildlife, to Federal, State, and local governments upon request. It is DoI policy to:

(1) Respond to incidents that affect or may affect its jurisdiction or resources.

(2) Respond to requests for assistance from the Cognizant Federal Agency, SFO, and State and local officials to the extent its mission and resources allow.

(3) Cooperate with relevant Federal, State, and local radiological response authorities and coordinate regional and field-level contingency plans.

3-10 DEPARTMENT OF TRANSPORTATION (DoT)

a. DoT participation during a nuclear weapon accident will be limited primarily to arranging special transportation activities and assistance in contacting consignors and consignees of shipments to or from the accident.

b. Federal Aviation Administration (FAA). The Associate Administrator for Air Traffic and Airway Facilities coordinates all FAA crisis management functions. The FAA's principal nuclear accident function is to direct, upon request, air traffic in and around the affected area.

3-11 ENVIRONMENTAL PROTECTION AGENCY (EPA)

a. The Office of Radiation Programs of the EPA has responsibility for coordinating EPA response to requests for radiological assistance. The radiological assistance available consists of monitoring teams to measure environmental radiation, evaluate the extent of the contamination, and advise on the actions required for protection of the public health and safety. Each team can collect samples for subsequent processing and analysis at its laboratory. The EPA has the responsibility for coordinating the intermediate and long term radiological monitoring function at a mutually agreed upon time with DoE.

b. The Director of Criteria and Standards of EPA is responsible for establishing radiation levels to protect the general public and to provide guidance for Federal agencies. EPA has prescribed guidelines for monitoring radioactive contamination of drinking water and exposures to the general population from nuclear activities.

c. The EPA has radiological assistance teams located in Montgomery, Alabama and Las Vegas, Nevada.

3-12 NATIONAL TRANSPORTATION SAFETY BOARD (NTSB)

The NTSB is responsible for transportation safety and may conduct or assist in an investigation of the accident and issue a report. In any case, a military accident investigation will be conducted in accordance with Service directives. The OSC should make provisions to assist and support the accident investigation to the maximum extent that public safety and weapon(s) recovery permits.

3-13 INTERSTATE COMMERCE COMMISSION (ICC)

The ICC assists in arranging for or expediting emergency transportation of people or property moving interstate or of foreign commerce to or from distressed areas. Specifically, the ICC establishes priorities and expedites emergency surface transportation of people and property to or from areas impacted by the accident. Under the coordinating authority of the Secretary of Transportation, the ICC establishes the priorities for all surface transportation of people and property.

3-14 DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD provides information on available housing/shelter for disaster victims or displaced persons and assists in planning for and placing homeless victims by providing emergency housing and technical support staff within available resources.

3-15 GENERAL SERVICES ADMINISTRATION (GSA)

GSA provides service, administrative supplies, facilities, and equipment within available resources.

3-16 NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA coordinates the response and recovery operations for downed NASA spacecraft which may carry nuclear materials.

3-17 NUCLEAR REGULATORY COMMISSION (NRC)

The NRC provides personnel who can quickly assess the nature and extent of the radiological emergency and its potential on and off-site effects on public health and safety. The NRC provides this information to the appropriate State and local agencies. Also, the NRC has radiological monitoring equipment and mobile radiological laboratories to assist in the analysis of environmental contamination and has public information personnel and technical experts who can be used to assist in public information efforts.

3-18 STATE/LOCAL GOVERNMENT/ HOST NATION

Off-site authority and responsibility at a nuclear weapon accident rests with State and local officials. It is important to recognize that land placed temporarily under Federal control by the establishment of NDA or NSA to protect U.S. Government material or classified property and materials, will revert to State control upon disestablishment of the NDA or NSA. The State governor is responsible for the health, safety, and welfare of individuals within the territorial limits of the State during periods of emergency or crisis. The OSC will assist the State in ensuring that the public is protected. The Host Nation retains Sovereignty over its soil and the responsibility for the health, safety, and welfare of its citizens.

CHAPTER 4

MANAGEMENT OF ACCIDENT RESPONSE

4-1 GENERAL

a. Command and control on-site at the scene of a nuclear weapon accident rests with the agency in charge of the facility or geographic area where the accident occurs. If the accident occurs outside these boundaries, the Service or agency having custody of the weapon at the time of the accident has command and control. If the accident occurs outside the 48 contiguous states, responsibility for directing the US response shall rest with the Unified Commander in Chief in whose area of responsibility the accident occurred. If the accident occurs outside the US or its territories, the Unified Commander will coordinate with the State Department, as appropriate. "On-site" is that area around a nuclear weapon accident under the operational control of the installation commander, facility manager, Department of Defense, On-Scene Commander (OSC), or Department of Energy Team Leader (at a DoE accident), or host government official. For accidents/incidents in the U.S., its territories or possessions, on-site includes any area established as a National Defense Area (NDA) or National Security Area (NSA). When overseas, this on-site secure area should be defined in the host nation agreement and will be referred in this document as a Security Area. This area, although not equivalent to the NDA or NSA, uses local authorities to restrict people from the immediate area of the accident for their protection and the safeguarding of weapon systems. "Off-site" is defined as that area beyond the boundaries of a DoD/military installation or DoE facility, including the area beyond the boundary of a NDA, NSA or a Security Area, affected by a nuclear weapon accident/incident.

b. Civil authorities/officials have primary responsibility for command and control off-site and will request Federal assistance and assets through the Federal Emergency Management Agency (FEMA). The Senior FEMA official (SFO) coordinates requests for Federal assistance to ensure that assistance is provided. If an accident/incident involving nuclear weapons results in a Presidential declaration of a major disaster or emergency, Public Law 93-288, reference (g), states the President will appoint a Federal Coordinating Office (FCO) to coordinate the overall Federal response. The Secretary of the Army will become the DoD Executive Agent for providing additional military support (off-site) to the FCO as required, subject to the military missions and priorities of DoD.

c. The responsibility for security and command and control at accidents/incidents in a country outside the U.S. rests with the host country government.

d. Command and control for the Initial Response Force (IRF) and Service Response Force (SRF) at a nuclear weapon accident involves directing DoD resources and coordinating DoD actions with civilian authorities/officials providing response to any domestic emergency.

4-2 PURPOSE AND SCOPE

This chapter provides guidance on interagency relationships at the accident site suggested response force organization and actions required during an accident response. The discussions in this chapter are applicable to the IRF and the SRF On-Scene Commanders (OSC) and their staffs.

4-3 SPECIFIC REQUIREMENTS

The basic requirements for command and control of a nuclear weapon accident response are similar for the IRF and SRF OSC's though they vary in scope and magnitude. Specific actions taken by the respective response forces will vary because of differences in manning, resources, capabilities, and training between the IRF and SRF. As a minimum, the IRF and SRF OSC's are required to:

a. Provide life saving/humanitarian assistance at the accident site.

b. Establish command and control.

c. Safeguard classified material.

d. Protect the public and mitigate public health and safety hazards.

e. Seek the assistance and cooperation of civilian authorities/officials and advise them of possible hazards.

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

g. Establish a NDA. When overseas, request that local authorities establish a Security Area to provide a cordon for security of classified material, and protection of the public.

h. Establish an operations area, a base camp, and a contamination control area.

4-4 RESPONSE ORGANIZATIONS

Military and civilian response organizations which may be present at the scene of a nuclear weapon accident are:

a. Initial Response Force (IRF). A response force belonging to the nearest DoD activity/unit, which will take emergency response actions to establish command and control on-site pending arrival of the SRF.

(1) The IRF OSC will generally be an 0-5 or 0-6, as established by Service policy. An illustration of a typical response force is at Figure 4-1. He will usually remain the OSC until relieved by the SRF OSC.

(2) The IRF performs the following functions: rescue operations; fire fighting; accident site security; public affairs activities; establish command, control, and communications. The IRF initiates EOD procedures; determines if hazardous materials and/or radioactive contamination are present, and if so, minimizes its spread; and establishes procedures to control the exposure of personnel to contamination.

b. Service Response Force (SRF). The SRF consists of a military and DoD civilian staff. The response force may be augmented by DoE scientific and technical advisors, and by specialized teams from other Services, FEMA personnel and/or host country government officials/representatives as required. An example of the SRF functional organization and interagency relationships is at Figure 4-2.

(1) OSC. The SRF OSC will be a flag/general rank officer appointed by the responsible Service/Unified Command. A Deputy OSC should be in grade of 0-6 and shall manage the information flow between the site, headquarter's operation centers, and DoS. The OSC is responsible for all SRF actions at the accident site including:

(a) Safeguarding national security materials and information. Establishing a NDA or NSA. Overseas, requesting that local authorities establish a Security Area to provide a disaster cordon and security for classified material.

(b) Establishing command and control. Ensuring that special teams arriving at the accident scene are integrated into the response force with a clear chain of command and that their capabilities are known by all cleared personnel on the SRF. Communications must be established with the NMCC and other levels of authority, and frequency assignments allocated to all response teams.

(c) Establishing priorities for response/recovery efforts.

(d) Assessing hazards involving public health and safety.

(e) Seeking the assistance and cooperation of civilian authorities/officials and advising them of the possible hazards.

(f) Notifying civilian authorities/officials of the precautions and other measures required for the protection of public health and safety and potential impact off-site.

(g) Establishing a public affairs program for coordinating, reviewing, and approving public information and news releases. Establishing direct communications with the (OASD(PA)) or American Embassy/USCINC as appropriate.

(h) Integrating civilian authorities/officials/representatives into the response force. As a minimum, coordination must be completed between civilian authorities/officials. A liaison officer will be provided by the SFO to the OSC. Overseas, a liaison officer will be provided by the U.S. Embassy to the OSC.

(i) Assessing protective action measures and re-entry recommendations developed by the State.

(j) Coordinating with the SFO and civilian officials to develop a site restoration plan.

(k) Coordinating with the accident investigation board or team.

(l) Obtaining assets required to support response/recovery operations.

(m) Establishing the Joint Hazard Evaluation Center (JHEC) and initiating an on-site hazard and radiation health, weapons recovery, safety and environmental monitoring

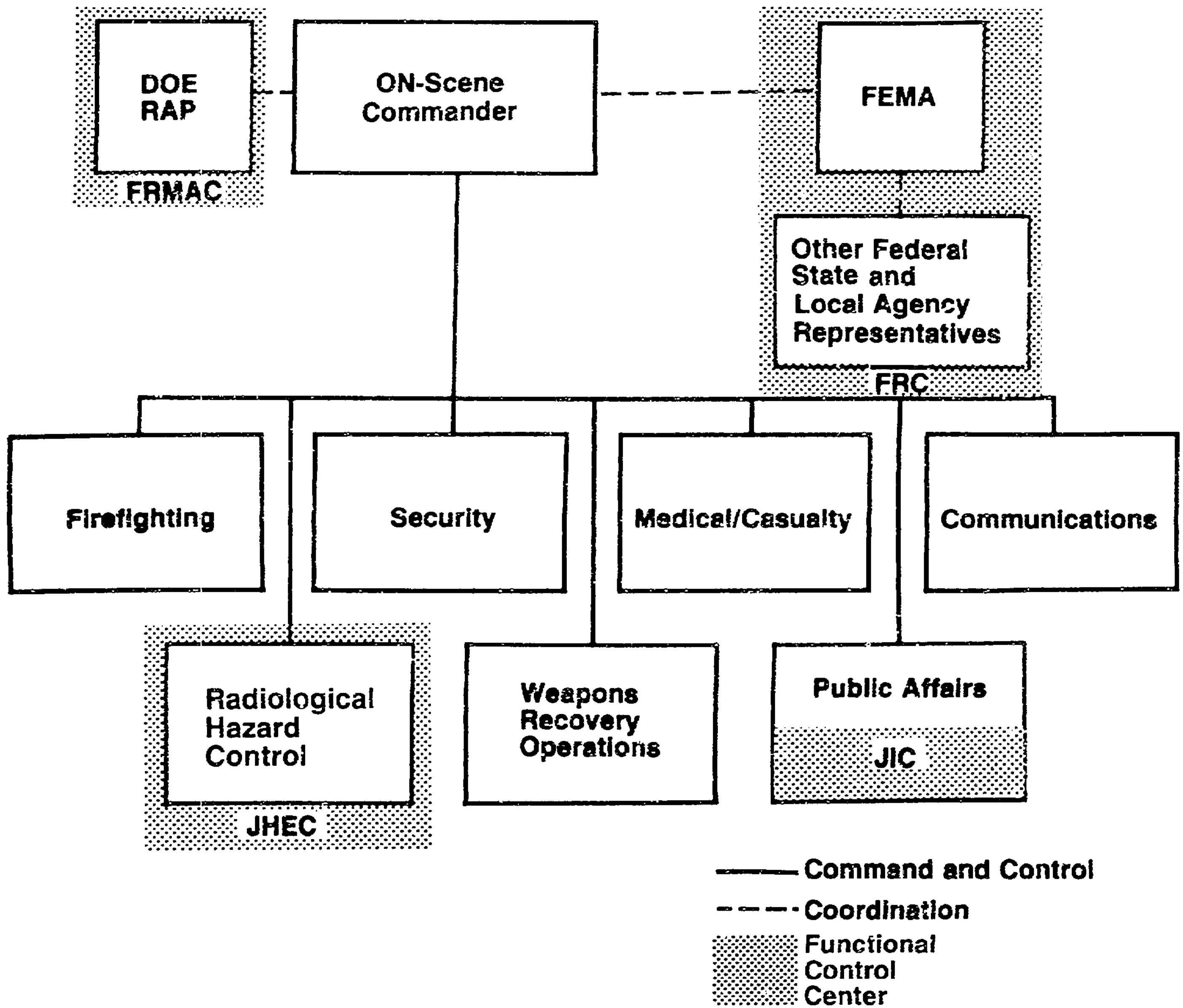


Figure 4-1. Initial Response Force (Example).

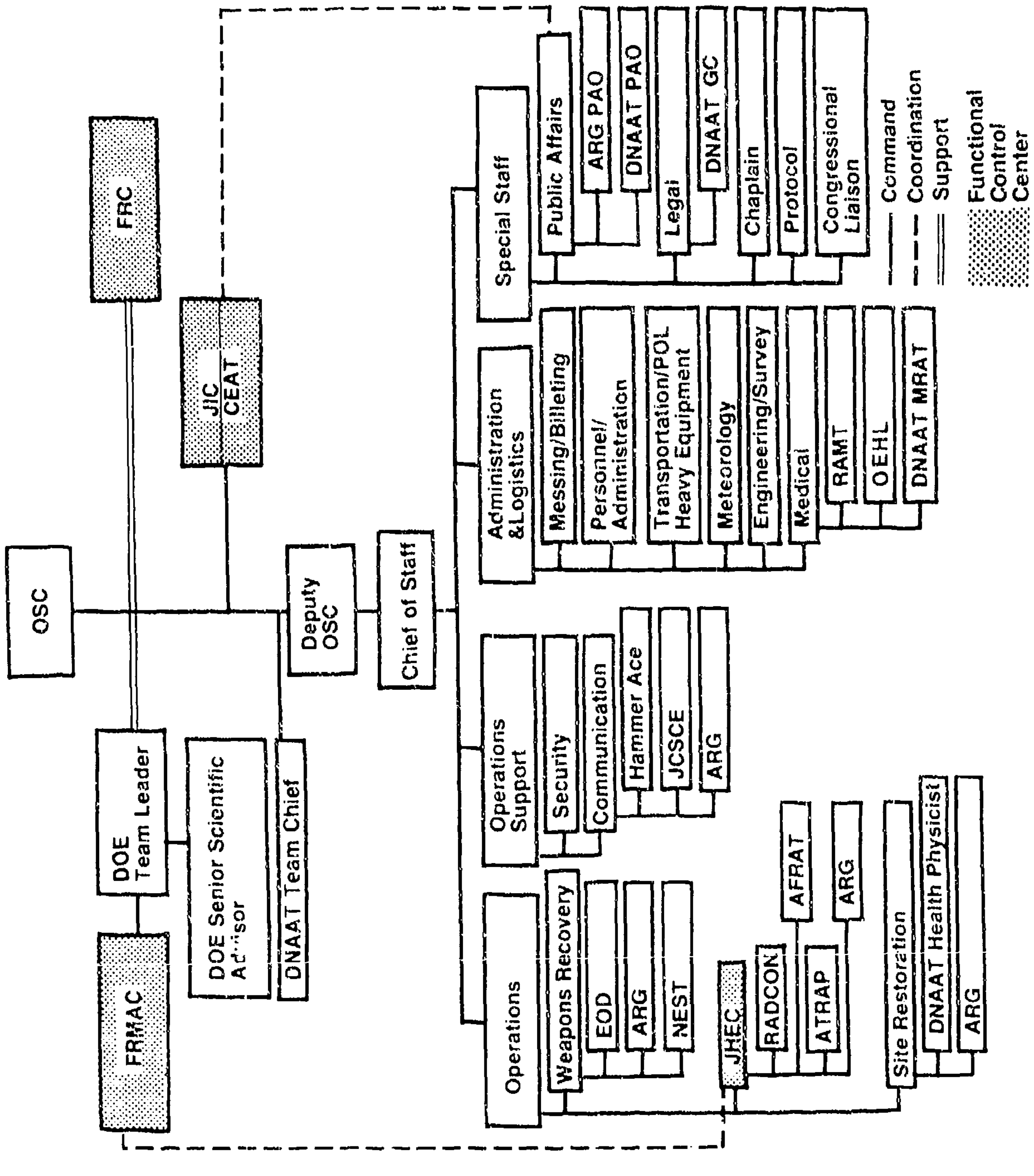


Figure 4-2. Service Response Force Functions and Interagency.

program. Off-site coordination will be with the Federal Radiological Monitoring and Assessment Center (FRMAC) and civilian authority response elements, as appropriate.

(n) Assisting the involved country government official/representative in ensuring the health and safety of individuals within the country. Response force officials and the Embassy representative will assist in implementing measures that satisfy host government requirements.

(o) Providing required medical, logistics, and administrative support, including that needed by DoE response organizations.

(2) SRF Staff Members. Members are responsible to the OSC and include expertise in hazardous materials and radiological safety, security, medical, EOD, public affairs, and legal areas. Representatives from DoE, JHEC, and the site restoration planning group should serve as staff members to improve response force effectiveness. More than one person may be required to keep the OSC apprised of all on-going hazardous materials and radiological related activities. Protocol officers should facilitate visits to the accident scene by senior civil and military officials.

c. DoE Accident Response Group (ARG). The composition of the ARG, including specialized equipment, will be selected to meet the requirements of the accident or incident. Initially, the ARG will deploy a Team Leader, Senior Scientific Advisor, and specialists to assess the situation and determine what additional DoE assets are required.

(1) Deployment of additional equipment and personnel will be coordinated through the DoD Joint Nuclear Accident Coordinating Center (JNACC) and the DoD OSC.

(2) The ARG is responsible to the OSC for on-site activities at a DoD nuclear weapon accident. In the event of an accident or significant incident affecting off-site areas, the DoE Team Leader has specific responsibilities and activities implemented through the Federal Radiological Emergency Response Plan (FRERP), reference (c).

d. Federal Emergency Management Agency (FEMA). FEMA will establish a Federal Response Center (FRC) at a location selected in cooperation with State and local authorities. The FRC located near the accident scene will initially be manned by an Emergency Response Team (ERT) deployed by FEMA. The FRC and the DoD on-scene command post have similar functions and representatives should be exchanged. The FRC will be concerned primarily with nonradiological off-site support to the state and local agencies. At FEMA's request, the ERT will include a General Services Administration (GSA) representative to assi ' the response force in obtaining local services and suppnes.

e. Defense Nuclear Agency Accident Advisory Team (DNAAT).

(1) The DNAAT assists an OSC and his or her staff in the response operations following an accident. The advisory team is composed of personnel knowledgeable in nuclear accident response requirements, health physics, radiation medicine, public affairs, legal implications and site restoration. This team is available upon request and can deploy as soon as transportation becomes available. When deployed, the team is responsible to the OSC.

(2) Request for services or additional information about the DNAAT should be directed to the DoD JNACC.

f. Other Organizations

(1) Accident Investigation Boards. A Service accident investigation board, and, if appropriate, the National Transportation Safety Board (NTSB) will dispatch investigation teams to the accident site. Commensurate with personnel and public safety, the OSC should support the activities and administration/documentation requirements of these teams.

(2) The Services and the DoE maintain various teams with specialized training applicable to nuclear weapon accident response. When a team is deployed, it is responsible to the OSC, either directly, or through the DoE Team Leader. These teams are discussed in Chapter 20.

(3) State and Local Response. In an off-installation accident, State and local police, firefighters, and medical treatment personnel may be the first to respond. The IRF should coordinate directly with personnel from State and local agencies. State and local authorities establish control over any portion of the hazardous and radiological control area which extends beyond the NDA or NSA. Upon dissolution of the NDA or NSA, State and local authorities will become the controlling authority for any portion of the accident site not under Federal control (e.g., military installations). The SRF OSC should provide essential information to state and local authorities.

(4) For accidents/incidents outside the U.S., its territories, and possessions:

(a) On and off-site authority for a nuclear weapon/components accident/incident rests with the host Government officials/representatives. The American Embassy provides the diplomatic and political focal point to the host government.

(b) The host government officials/representatives will ensure the health and safety of individuals within the country and will be assisted by the response force staff or the Embassy to implement measures to satisfy host government requirements.

4-5 CONCEPT OF OPERATIONS

The concept of operations presents actions of the IRF and SRF and assumes a "worst case" accident; that is, a nuclear weapon accident off a military installation with the spread of contamination. Also the concept presents difficult weapon recovery problems, public involvement, extensive logistic support requirements, the need for extensive deployed communications support, and complex site restoration problems.

a. Response Phases. Response can be divided into two phases.

(1) Initial Phase. Included in this phase are those immediate measures taken by the nearest DoE or DoD installation to provide a U.S. government presence, humanitarian support and assistance, and designation and deployment of a response force. Accidents will be expeditiously reported directly to the National Military Command Center (NMCC) and/or the Service operations center in accordance with JCS Pub 1-03.6. Upon receipt of accident notification, the appropriate IRF and SRF will be identified and tasked, and specialized teams alerted and prepared for immediate deployment. A simplified notification plan is illustrated in Chapter 1, Figure 1-1.

(2) Follow-on Phase. The SRF, during the follow-on phase, continues those actions initiated by the IRF, and commences long term actions to return the environment to an acceptable condition. Weapon(s) recovery and site restoration are the primary objectives of this phase

b. Response Considerations. As the OSC assesses the accident, the following differences between a nuclear weapon accident and other accidents should be considered:

(1) Classified Material. In accidents involving nuclear weapons/components, classified materials must be located, recovered and protected.

(2) Contamination.

(a) Non-radiological hazardous materials may be released due to weapon system damage. The problem may consist of various hazardous materials, for example, solid or liquid missile propellants, oxidizers, or high explosives. A high explosive detonation could disperse hazardous materials several hundred meters around an accident site. Aerosolized hazardous materials could be released and dispersed downwind. The materials would remain in the area unless diffused by aeration, neutralization, or removal. The toxic materials may present a serious hazard to the general public and require immediate and effective reaction by public affairs personnel to allay public apprehension.

(b) The radiological hazards released by the burning or high explosive detonation of a nuclear weapon or weapon components may consist of isotopes of plutonium, uranium, and possibly tritium. Wind velocity and other meteorological conditions, the height of the cloud or plume containing the radioactive material, and terrain, all influence the extent to which contamination may be spread. After the contaminant has fallen to the ground, it may be resuspended by wind or mechanical action. The long term carcinogenic effects of inhaled plutonium represents the greatest hazard to the general public; actions to assess specific risk must be promptly initiated. Public perception of the radiological hazard may be disproportionately larger than the actual hazard.

(3) Public Affairs. An immediate, but temporary, threat to the safety of the nearby public may exist from toxic or explosive hazards associated with the accident. However, the less immediate radiological hazard has historically been of greatest concern to civil authorities and the general public. Although DoD policy is to neither confirm nor deny the presence of nuclear weapons or components at a specific location, such confirmation shall be made either when required to protect public safety or to reduce or prevent widespread public alarm. In locations outside the United States, its territories and possessions, the OSC must have the approval of the appropriate Commander-in-Chief (CINC) and host government, through the American Embassy, prior to exercising the exceptions (reference: DoD Directive 5230.16, Nuclear Accident and Incident Public Affairs Guidance). Early notification of actual accident associated hazards, and of what can and is being done to reduce the risk, is a key issue in allaying public concern. Media interest and public scrutiny will be intense; the OSC and his staff must prepare to address those public concerns related to nuclear accidents as they assess the accident situation.

c. Response Force Actions. The initial actions of the response force upon arrival at the accident scene will be directed toward stabilizing the situation and defining the problem. The following paragraphs describe some of the actions required:

(1) Command Post (CP). The IRF should establish a CP to accommodate the arriving personnel and equipment of the SRF. This facility should serve as the focal point of command and control as the accident response expands. All accident response elements must report to the CP which will facilitate continuity of command and control during the transition from IRF to SRF.

(a) The CP may be located within the NDA or NSA. Access routes and prevailing winds will determine the direction and distance of the CP from the accident scene and contaminated area. The CP should be located so that normal wind shifts will not interfere with operations and require relocating the CP. Figure 4-3 provides a sample accident site organizational diagram. Consideration should be given to establishing the CP, the DoE ARG operations center, and the communications center in a restricted area to simplify the protection of classified information. The FRC and CP will exchange liaison representatives to coordinate off-site actions and concerns.

(b) Communications. Among the various agencies, frequency management is important. Communications at the accident site may be limited initially. When establishing initial communication from an off-base accident site, consideration should be given to using radio or telephone through the nearest military installation. Also, relay via local police communications channels may provide a viable initial communications channel. Until record communications are established, specific relay instructions should be included in telephonic communications, and consideration should be given to conference calls to keep all concerned commands informed. Situation reporting according to Service/agency directives should be initiated as soon as possible. Effective communication within the response force, with higher authorities, and with Federal, State and local and/or involved country agencies responding to the accident is essential to command and control. The CP should be established by the IRF with adequate communications to maintain command and control between the accident site, SRF, and NMCC.

(2) Fire Suppression. Weapons and other materials involved in the accident pose a danger to firefighters. If for any reason, the response force does not arrive on-scene soon after the accident, civilian firefighters should be advised of the possible presence of hazardous materials, including high explosives. All safety precautions should be taken including electromagnetic radiation (EMR) restrictions. Specific firefighting guidance is contained in Technical Publication TP 20-11, TM 39-20-11, Navy SWOP 20-11, Air Force TO 11N-20-11, references (k), (l), (m), and (n).

(3) Casualty Identification and Treatment. The rescue and treatment of casualties should receive high priority. Until proven otherwise, casualties should be considered as having been contaminated by radioactive material. For this reason, officials at hospitals and clinics to which casualties are evacuated should be notified of the possibility of radioactive contamination so that proper measures can be taken. Ensure of compliance with DoD notification procedures. As soon as the presence or absence of radioactive contamination is confirmed, these officials should be advised. Casualty handling procedures are described in Chapter 14.

(4) Assessment. The OSC determines the accident situation, status, and implications of the accident. Determination and reporting of whether contamination was released is of highest priority. The OSC assesses the extent of the hazard(s), accident response elements must report to the CP which will facilitate continuity of command and control during the transition from IRF to SRF.

(5) Air Sampling. Air sampling provides an effective means of determining airborne and downwind contamination at the accident scene. Within approximately 1 hour after the high explosive detonation or fire extinguishment, the OSC should have air sampler(s) placed downwind from the accident. Monitoring and decontamination, as appropriate, will be provided for personnel positioning air samplers.

(6) Identification of Public Health Hazards. Once an evaluation has been made, the effect of any hazards and the potential impact of the hazards to public health must be determined. If required, coordination should be made with civilian officials to inform the public of protective action measures to minimize undesirable effects on the public. This action is time sensitive and must be completed rapidly. Radiological hazards and possible actions to minimize hazards are discussed in Chapter 5. Hazardous materials which may be present are discussed in Chapter 9.

(7) Public Affairs. The OSC must establish or ensure direct communication with OASD/PA. A Joint Information Center (JIC) must be established and public affairs measures implemented to ensure that timely, accurate and consistent information is available at the

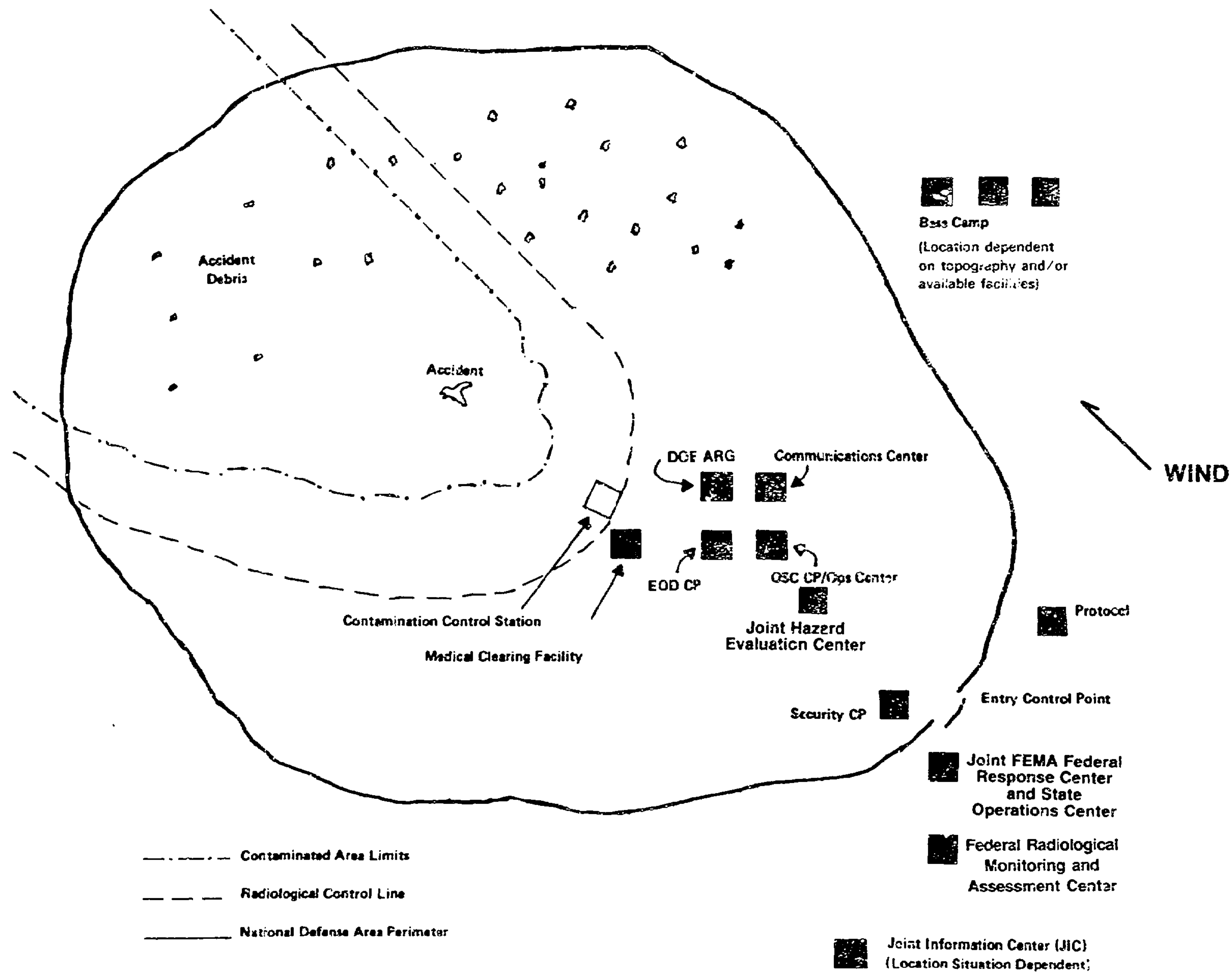


Figure 4-3. Sample Accident Site Organization.

accident scene. Since a great deal of information will be generated at the accident site and more than one organization will be collecting and analyzing data, all information must be coordinated within the JIC before release to the media or general public. Additionally, the public affairs officer must be informed of all information provided to civil authorities/foreign government officials by the OSC or his designated representative. Public affairs actions are discussed in more detail in Chapter 16.

(8) Reconnaissance Operations.

(a) Confirmation of weapon location and status may not be possible until fires are extinguished, the wait time is observed, and the wreckage can be examined. Reconnaissance and Render Safe Procedures by EOD personnel should commence as soon as possible. Radiological considerations, protective measures requirements, and/or re-entry recommendations on the initial entry are discussed in Chapter 5, and EOD entry procedures in Chapter 15. If contamination is present, actions to determine the extent of contamination should be initiated immediately. The initial reconnaissance should provide enough information to determine subsequent actions and priorities. The initial reconnaissance should provide or confirm the following:

1. Casualties (injured and deceased) not previously found, their number, location, and extent of injuries. Injured people will be moved to a safe area.
2. Weapons and components condition, location, and chance of explosions.
3. Existence of radioactive contamination and levels of it.
4. Explosive hazards present.

(b) Other specialists or emergency personnel may be part of the initial reconnaissance team if the OSC considers them essential. The OSC will approve all entries into the exclusion area prior to the weapons being declared safe. As a safety precaution, the senior EOD person entering the accident site should be the initial reconnaissance team chief. The team chief should ensure that team members are briefed on emergency, safety, and other procedures before entering the accident site. If possible, still photography should be used to depict the accident site and area, document findings, and assist in developing the weapon recovery procedures. Positive measures should be taken to prevent electromagnetic (RF) energy from initiating explosive devices. Also, unsecure radio transmission and the use of classified information and data which may cause undue alarm to outside listeners, should be avoided. Vehicles and equipment used in a contaminated area during reconnaissance may be left for future use, but must be checked for contamination before leaving the accident site. The radiological control area need not be established prior to reconnaissance team entry. However, the following should be considered by the OSC: establish an initial or cursory contamination control line at least 100 meters upwind of the initial contaminant or hazard, so that exiting initial reconnaissance team members can be monitored and decontaminated, if required. If contamination is present, determine the actual area which is contaminated so that appropriate actions can be taken, and civil authorities can be advised of the extent of the problem. Procedures for completing the initial perimeter survey of the contaminated area are discussed in Chapter 5. Atmospheric Release Advisory Capability (ARAC) projections discussed in Appendix 5C will provide a worst case estimate of the contaminated area to assist in planning the survey.

(9) Hazard Assessment.

(a) Radiation Monitoring/Control. The first priority is to determine if contamination has been released. Upon making this determination, heavy demands will be placed upon available radiation detection instruments and personnel. A contamination control station should be established as soon as equipment and personnel are on-scene unless it has been determined that all weapons are intact and that there was no spread of contamination. The reconnaissance team need not wait for the contamination control station to be established before entering the area; however, the reconnaissance team and any civilian personnel in the contaminated, or potentially contaminated area, should be processed through the initial contamination control line or the contamination control station upon exit from the area. When contamination is present, immediate actions should be initiated to obtain information on the extent of contamination, establish radiological control lines, and notify medical treatment facilities which may have contaminated casualties or emergency response equipment. If resources are available, assistance in monitoring and decontaminating response forces should be offered. The amount of radiation monitoring equipment available to the response force may preclude simultaneous accomplishment of all actions, and the OSC must establish priorities based on the hazard to the general public and responding forces.

1. Prior to departing for the accident site, the response force, if not on the notification system, should

provide its Service operations center with an appropriate TELEFAX phone number for delivery of ARAC projections of downwind radiation doses and contamination depositions. If a TELEFAX device is deployed to the accident site, the on-site phone number should be provided for direct data receipt. Specific accident data provided in Appendix 5C should be provided to ARAC directly, or through the Service operations center or JNACC.

2. Equipment and personnel limitations may preclude the response force from conducting detailed radiation surveys of the accident site. If contamination is present, available radiation monitoring equipment will be needed to:

a. Monitor and decontaminate response personnel/ vehicles, bystanders, nearby residents, and affected medical treatment facilities.

b. Perform an initial perimeter survey to determine the extent of contamination and position for establishing a contamination control area.

c. Operate the contamination control station.

d. Determine which, if any, security posts are in the contaminated area.

(b) Hazard Evaluation. Include an evaluation of all the hazardous materials present.

(10) Weapon Recovery Operations. Weapon recovery operations commence with reconnaissance and continue until the weapons and/or components have been removed from the accident site. Locating and determining the status of the weapons and weapon components should receive a high priority. Until the location and status of the weapons can be determined, fragmentation distances should be considered when establishing the CP, NDA, NSA or Security Area and positioning security guards and other personnel. Render safe procedures (RSP) shall be conducted by EOD personnel. Until this action is taken by certified technicians, no personnel should be allowed into the area without the OSC's approval. Specific EOD books (series 6) cover RSP operations and must be followed unless situations or conditions dictate a need for procedural deviations. Only emergency RSP actions should be performed to achieve site stabilization. If site stabilization has been achieved, continuation of RSP beyond emergency procedures should be suspended until the SRF and DoE ARG can arrive. Necessary weapon recovery procedures should then be developed jointly by EOD and ARG personnel and modified to assure maximum safety. Plans for packaging and shipping the damaged weapon(s) or their components will be an integral part of these procedures and must be approved by the OSC prior to implementation.

(11) Security (Physical and Classified Material).

(a) A security perimeter should be established as soon as possible. Civilian response personnel will establish some form of control to keep nonessential personnel from interfering with the civilian response actions. Coordination with civilian law enforcement agencies should be conducted to ensure that adequate security is provided for the weapons until the response force arrives. Upon arrival of the response force, establishment of a NDA or NSA as discussed in Chapter 13, should be considered. In overseas areas, cooperation with local authorities allows establishment of a disaster cordon or a Security Area. This area, although not equivalent to the NDA or NSA, utilizes local authorities to restrict personnel from the accident site for their protection and safeguarding weapon systems.

(b) Debriefings. The OSC is required to debrief all personnel with access to classified information. A comprehensive debriefing procedure should be established to gain all possible information from response force personnel who observed the accident and its aftermath, or who were in the accident area. Information gained from these debriefings may also assist in subsequent accident investigations and aid in planning for initial response actions.

(12) Protective Measures, Re-Entry Recommendations and Recovery Plan. The protective measures recommendations include procedures to protect personnel and resources in the hazard area. These actions include notification, protective measures, and controlled evacuation. The re-entry recommendations include procedures to remove or decontaminate materials and to return contaminated land/resources to an acceptable condition. The recommendations will be incorporated into the recovery plan. Details on protective measures and recovery are contained in Chapter 5.

(13) SRF Organization and Operation of the Accident Scene.

(a) The Operations Area. The operations area provides facilities for the OSC, command and control, response, recovery and restoration functions. This area will be located far enough from the accident site to ensure that the operations area is free of airborne contamination and, in the event of a wind change, the area is out of the contamination area. Figure 4-3 provides a sample accident site organizational diagram.

1. Space (an area approximately 100 meters x 150 meters) is furnished for the following functions

with the DoE, FEMA, and civilian authorities counterparts or equivalents as appropriate:

a. OSC or DoE Team Leader.
b. On-Scene CP.
c. On-Scene Control Group (DoE ARG, and/or the EOD team).
d. JHEC

2. Other facilities which should be provided include:

a. Communications area.
b. Control group briefing area.
c. Personnel and dosimeter control point.
d. Radiation equipment repair area.
e. Vehicle park.
f. Medical control point.
g. VIP/visitor reception/briefing area.
h. Messing.
i. Rest area.
j. Latrines.

(b) The base camp.

1. The base camp includes those logistical, administrative, billeting, and recreation functions to support recovery and restoration requirements. The nearest military installation should be used as the base camp if practicable. (The distance from the installation or terrain may require setup in the field.) The IRF unit commander or the nearest Installation Commander will set up and operate the base camp.

2. The base camp will be located farther from the accident than the operations area is located from the accident. Base camp facilities will include as a minimum:

a. Personnel control point.
b. JIC.
c. Helipad
d. Material receiving point.
e. Clean clothing and bulk issue area.
f. Mess/ration breakdown point.
g. Billeting area.
h. Shower and latrines.
i. Administrative vehicle park area.
j. Water and POL point.

(c) The Contamination Control Area. The Contamination Control Area (CCA) includes facilities for monitoring and decontaminating personnel, resources and vehicles. The CCA incorporates the contamination control line (hot line), the contamination control station, personnel and equipment processing lines, and material/casualty transfer point. Consideration should be given for using building(s) or tent(s) for setup of the contamination control station and contamination control line. Multiple processing lines will be used to facilitate personnel processing. Contaminated materials and run-off will be contained and maintained for DoD disposition.

d. Service Response Force. Upon arrival at the accident site, the SRF continues actions initiated by the IRF, and initiates additional actions as required. Specific operations and actions of concern to the SRF are addressed below.

(1) Command, Control and Communications.

(a) Upon designation of the SRF, the commander establishes communications with the response force or the response force's base command center to obtain all possible information and coordinate SRF arrival and expected requirements. The DoE ARG composition, travel plans, and support requirements are obtained through the Service operations center or JNACC.

(b) Upon arrival at the accident site, the SRF commander should be briefed by the IRF OSC and meet with senior State and local emergency response authorities or host-country officials. The briefing should cover the status, functions, capabilities, and support requirements of all organizations, agencies, and specialized teams on-scene. An overflight of the accident site is recommended. Upon completion of turnover briefings, the SRF commander should assume the duties of OSC. All members of the response force should remain on-scene until the OSC determines that they are no longer required.

(c) As soon as all radiological data is known, preparation of a site recovery and restoration plan should be directed. FEMA, state, and local authorities and host government officials must be included in the planning and management of site restoration operations.

(d) Initial communications capabilities on-scene may be inadequate and should be improved as soon as possible.

(e) Congressional relations support must be provided as required.

(2) Public Affairs. The OSC should form a Community Emergency Action Team (CEAT) at some point after weapons recovery. The CEAT, coordinated

with FEMA or affected country representatives, would provide a direct interface with the public through a variety of means that could include town meetings.

(3) Hazard Evaluation.

(a) Radiation Monitoring/Hazard Control. Radiological surveys are required to define the contamination area and identify any personnel exposed to contamination. The SRF is responsible for all on-site operations. DoE is responsible for coordinating off-site radiological monitoring and assessment activities of Federal agencies through the FRMAC in accordance with reference (c). Also, civil authorities may conduct monitoring and survey operations, and are responsible for control of off-site contaminated areas. To obtain a consolidated and consistent presentation of the best data available, on-site radiological monitoring and surveying must be coordinated by the JHEC, as described in Chapter 5. The radiological hazard to response personnel and the general public are a major concern of Federal, State, and local authorities and involve country government officials. All personnel must be kept informed. An effective health safety program should be initiated as soon as possible. State, DoE and host country government personnel are responsible for monitoring and treating the general public; however, military assistance can be offered and may be required until sufficient civilian equipment and personnel are available.

1. The DoE has an Aerial Measurement Survey (AMS) capability that can determine the extent and severity of contamination. This capability should be coordinated with the DoE team leader.

2. Ground surveys are required to confirm and refine the results of aerial surveys. Military assistance may be requested for ground surveys conducted outside the NDA, NSA or Security Area. If possible, initial ground surveys should be performed within 5 days of the accident because the contamination may migrate into surfaces and become more difficult to measure and remove. The USAF Air Transportable Radiac Package (ATRAP) team can field, calibrate, and repair all instruments to provide standardization.

(b) Hazard Assessment. The JHEC assesses the radiological and non-radiological hazards at a nuclear weapons accident/incident. Also, for assessment and ultimate clean-up of radiological and non-radiological materials, a respiratory protection program should be established to ensure the health and safety of each person entering the controlled area.

(4) Weapon Recovery Operations. Accident conditions, the time required to locate the weapon(s), and the availability of qualified EOD personnel determine to what extent RSP have been accomplished prior to the SRF's arrival. If the weapon(s) were in a stable environment and time permitted, RSP may have been held in abeyance until the SRF and DoE ARG arrive. The condition of the weapons should be assessed carefully prior to movement, even if RSP were performed by the response force. If all weapons and components have not been located when the SRF arrives, an extensive search may be required to find them.

(a) Weapons involved in an accident may have suffered substantial internal structural damage. When time permits, joint EOD and DoE inspection and assessment of weapon damage is desirable. The high priority given to weapon recovery operations does not inherently imply a need for rapid action. Safety is of utmost importance.

(b) A staging area should be established outside the contaminated area, but within the NDA, or host government Security Area, where weapons, components, and hazardous material can be packaged for shipment and stored until shipment may be made.

(c) A large number of personnel may be required to conduct searches for weapons, weapon components, and explosive hazards. EOD personnel will supervise searches by available personnel on-site after providing appropriate briefings on search and safety procedures. Search procedures are discussed in Chapter 15.

(5) Security. Site security is established by the response force and/or civil authorities. Additional security is required for temporary weapon storage areas, the communications center, and other areas where classified material is kept or discussed. A badging and identification system should be implemented to facilitate passage of civilian and military response personnel and teams. When DoD resources, such as nuclear weapons, components, and other classified materials are removed from the accident site, justification for an NDA, or NSA with military control no longer exists, although a radiological hazard may still exist. Therefore, transition from military control should be coordinated with civil authorities.

(6) Claims. A nuclear weapon accident which results in contamination will generate a large number of claims by civilians. A claims processing facility should be established where people can gain access easily and is mutually agreeable to local officials. This location must be publicized.

(7) Site Restoration. A comprehensive and detailed plot of the contaminated area is essential for developing an accurate site restoration plan. Determination of clean-up levels will be a major issue and require the concurrence/agreement of Federal and State authorities and host country government officials. Most of the site restoration work occurs after weapon or components removal. The SRF and the appropriate response force elements will assist civil authorities/officials in performing site restoration work. Federal assistance to the state is coordinated by the SFO.

e. Logistic Support.

(1) Arrangements must be made for feeding, billeting, and for sanitation facilities at or near the accident site. The extent and specific requirements for these facilities depend primarily on location, environmental conditions, the number of personnel involved, and the expected duration of response operations. Until messing and billeting arrangements are established, all personnel should arrive with sufficient personal items to meet their needs for a period of 2 to 3 days without significant external support. In remote areas, extremely austere conditions should be anticipated with only limited support for 7 to 10 days.

(2) Weapon recovery operations, radiological and site restoration operations, and base camp requirements determine the type and amount of logistic support required. Historical data supports initial planning for 1000 people for up to 6 months.

f. Reporting and Documentation.

(1) Reports are prepared according to applicable Service directives. In addition to the reports of the OSC, the DoE has reporting requirements that should be considered when establishing response force communication capabilities. Parent organizations of specialized units and teams on-scene should be information addressees on situation reports. The OSC staff must recognize the need to provide information up the chain-of-command to keep the Washington policy organization informed. If adequate information is not provided, direct communication to the site will be established to obtain status. Information expected or requested by various agencies and officials may include:

(a) On-scene response forces by Service or Agency.

(b) Status of weapon recovery operations.

(c) Status and results of radiological surveys.

(d) Status and results of personnel monitoring, including number of people contaminated, and the radiation doses received.

(e) Names, SSN, and service/agency of all participants and visitors.

(2) Documentation of the accident response effort is essential. In addition to the documentation requirements of the accident investigation teams, all aspects of the accident response itself should be documented to permit improvement of response procedures. Even in accidents with little or no spread of contamination, complete documentation of radiological surveys is necessary because questions concerning the accident may arise many years later. Early in the accident response, a responsible official should be tasked with the primary responsibility for documenting events and recording data for historical records.

4-6 ACCIDENT RESPONSE PLAN DEVELOPMENT

Development of the accident response plan should begin during planning and training, and those portions of the plan which may be accident specific completed as soon as practicable. The plan should establish priorities for expected actions, provide procedures to be followed, and identify what coordination may be required with other accident response organizations. The accident response plan outlined in Appendix 4-A should not be confused with the site restoration plan developed in conjunction with civil authorities. The operations annex to the accident response plan should include:

a. A description of all expected operations and their interrelationships.

b. Identification of those activities responsible for expected operations and methods for coordinating elements.

c. Identification of required equipment and personnel for the operations center.

d. A description of the operations center organization, responsibilities, and procedures for the response operations.

e. Procedures for liaison with other agencies' operations centers (for example, FEMA and State).

APPENDIX 4-A

ACCIDENT RESPONSE PLAN

4-A-1 GENERAL

Every nuclear weapon accident has its own unique requirements, priorities, and problems. Also, the specific forces responding to each accident will vary, as will the type and amount of support required. Although numerous unpredictable variables are involved in a nuclear accident, the key to a successful response is planning. Many actions and procedures required in response to an accident are known and can be planned in advance. However, some planned actions and procedures may not be required, or may require modification to meet specific circumstances encountered. All response forces should draft as much of an accident response plan and its associated annexes as possible to be prepared when, and if, called upon.

4-A-2 PURPOSE AND SCOPE

This appendix provides basic guidelines and information which should be contained in an accident response plan. The response plan is intended to identify actions and procedures to be used at the accident scene commencing with the arrival of the response force and continuing through site restoration and the return home of the response forces. Possible site restoration procedures should be included as an annex to the SRF accident response plans to assist in preparation of site restoration plans in conjunction with civil authorities.

4-A-3 BASIC ACCIDENT RESPONSE PLAN

The basic accident response plan should state the situation, the mission, the method of execution, logistics arrangements, command relationships, and communications links.

a. Situation. The situation section should provide facts surrounding the accident and accident location, the status of response efforts at the time the plan was prepared, and other key planning factors which may have an impact on mission accomplishment. Information which might be contained in this section, if known, includes:

(1) The number, type, condition, and location of weapons and weapons components involved.

(2) The number of military and civilian personnel injured or killed and the disposition of all casualties.

(3) Radiological, explosive, and other hazards expected to be encountered.

(4) A summary of initial response actions and problems encountered, including chronology of significant events.

(5) The area of contamination, either projected or surveyed.

(6) Habitation and terrain features which may impact on operations or be affected significantly by the accident (for example, watersheds, nearby residences or population centers, major roads or thoroughfares, animal feed lots, or other farming enterprises).

(7) Public awareness of the presence of nuclear weapons, either by official announcement or observation/assumption.

(8) Status of arrangements with civilian authorities including establishment of National Defense Area (NDA), or Security Area if required.

(9) Civil and military response organizations or teams on scene, or requested, and their specific functions or capabilities.

b. Mission. This section contains a statement of the tasks and objectives to be accomplished by the accident response force. Normally there will be two major objectives: weapon(s) recovery and site restoration. Scattering of weapon parts by high explosive detonations, an unlocated weapon, and specific site restoration objectives are factors to be considered when stating the mission.

c. Execution. In the first subparagraph, give a summary of the tentative plan. In subsequent subparagraphs, assign specific tasks to each element of the response force based upon the element's functional capabilities. All organizations and teams, whether civilian or military, working in the NDA or Security Area or reporting to the OSC should be considered a part of the response force. The plan must delineate the reporting structure and responsibilities of the various response force elements. Moreover, guidance on the interface with civilian authorities should be provided, and the plan should identify the response force role in joint activities, such as public safety, the JHEC, and the JIC. If desired, instructions applicable to two or more elements of the response force may be placed in a final subparagraph headed "Coordinating Instructions."

d. Logistics and Administration. This section contains a statement of the administrative and logistic arrangements applicable to the operation. Billeting, transportation, and airheads or other key supply points/routes to support the operation should be identified. Some requirements may not be known until engineers have determined what equipment is required to restore the site. If lengthy, or not ready for inclusion when the rest of the plan is completed, this section may be issued separately.

e. Command and Communications. Command relationships for the entire operation should be stated with expected changes of command indicated, and time or event at which such changes will occur. These changes may be in overall command, such as would occur when the SRF commander relieves the IRF commander. Additionally, changes should be stated within areas, such as civilian security forces relieving the military security forces following removal of weapons, weapon components, and other classified information from the accident site. Plans should ensure communications links between all organizations participating in the response force, with participants' parent organizations, and with organizations supporting the response force. Many organizations will arrive with some degree of organic communications which should be coordinated by this plan. COMSEC and OPSEC requirements should be identified.

4-A-4 ACCIDENT RESPONSE PLAN ANNEXES

Annexes to the accident response plan should provide in-depth guidance for operations in functional areas which are applicable to the response effort. They should include all actions which must be performed, including supplementary information indicating which actions require coordination with other elements to insure safety and/or optimum use of assets. Areas in which annexes may be desired are:

a. Task Organization (if not included in basic plan). Integrating the actions of the multitude of units and organizations, both civilian and military, responding to a nuclear weapon accident is essential to an efficient response operation. Organizational relationships will vary as the response operation progresses, most notably when the NDA or Security Area is dissolved. The Task Organization annex should identify all units and organizations responding to a nuclear weapon accident, their capabilities, and their relationships. At a minimum the following units and organizations should be considered:

(1) Initial Response Force.

(2) Service Response Force.

(3) Department of Energy Accident Response Group.

(4) Specialized Service Teams.

(5) Federal Emergency Management Agency, including the Senior FEMA Official, i.e., FRC.

(6) Defense Nuclear Agency Nuclear Weapon Accident Advisory Team.

(7) Other Federal agencies responding to the accident.

(8) Civilian/Host country agencies responding to the accident.

b. Operations. This annex should identify those actions which will, or may be required, assign responsibilities for execution of identified actions, and establish procedures for coordinating and controlling all actions at the accident site, i.e., FRC liaison officer.

c. Hazard/Radiological Safety/Health Physics. This annex should define the responsibilities of all agencies and elements with a hazard/radiological capability and establish a comprehensive hazard/radiation control program.

d. Communications. This annex should establish communications requirements and communications operating procedures.

e. Security. This annex should describe the responsibilities and procedures of the security forces.

f. Medical. This annex should describe responsibilities and special procedures used by the medical staff.

g. Weapons Operations. The Weapons Operations Annex should establish the procedures used for weapons recovery operations.

h. Public Affairs. The Public Affairs Annex should provide procedures for the coordination and release of public affairs information. This annex should include:

(1) Procedures to ensure that all press releases are coordinated properly with the OSC and other key staff members prior to release.

(2) Guidance on selecting the location for, representation to, and operation of the Joint Information Center.

(3) Pre-coordinated contingency releases for confirming the presence of nuclear weapons, and checklists prescribed by DoD Directive 5230.16, reference (b).

i. Logistic Support. The logistic Support Annex should provide procedures for establishing and maintaining support for response force operations. Chapter 17 provides guidance and recommended procedures for the development of this annex.

j. Legal. This annex should provide procedures for establishment of a claims center. Chapter 16 contains a discussion of legal problems which may be encountered following a nuclear weapon accident.

k. Site Restoration. The Site Restoration Annex should identify possible methods to restore an accident site and contaminated area. A separate Site Restoration Plan will be developed in coordination with Federal, State, and local authorities and will probably require that an environmental assessment and engineering study be made. The Site Restoration Annex should provide information to guide the response force and be of use in drafting a site restoration strategy. Chapter 19 discusses site restoration issues which may assist in preparation of the Site Restoration Annex.

CHAPTER 5

RADIOLOGICAL HAZARD AND SAFETY

ENVIRONMENTAL MONITORING

5-1 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 On-Scene Commander (OSC) must therefore, quickly establish a vigorous and comprehensive health physics program to manage the health safety aspects of a nuclear weapons accident. A good health physics program provides for civil authority/official involvement in the cooperative development of response efforts and a site restoration plan.

5-2 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 OSC in the operations under his control. The Joint Hazard Evaluation Center (JHEC) is the OSC'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 non-radioactive toxic materials, such as beryllium, lithium, lead, propellants, high explosives, oxidizers and plastics. These hazards are discussed in Chapter 9. The JHEC coordinates closely with the FRMAC. The FRMAC supports the OSC with off-site monitoring and assessment.

5-3 SPECIFIC REQUIREMENTS

Department of Defense (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, the DoD establishes a JHEC with the following objectives:

a. Determine if radioactive contamination has been released.

b. Advise the OSC of precautionary measures for residents and other persons in potentially contaminated areas.

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

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

e. Establish dosimetry and documentation procedures during personnel decontamination and restoration operations.

f. Recommend methods and procedures to prevent spread of radioactive contamination.

g. Assist the Federal Radiological Monitoring and Assessment Center (FRMAC) in coordinating and planning the site restoration plan.

5-4 RESOURCES

a. 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 radiation detection equipment (RADIACs) available to initial response forces will not meet initial operational needs after a large release of contamination. Though response forces are equipped and trained to conduct radiation surveys for low levels of radioactive contamination, it is difficult to do over rough surfaces like rocks, plants, and wet surfaces. Specialized DoD and Department of Energy (DoE) teams are better equipped to conduct low level contamination monitoring, and monitoring should wait until the teams arrive. Appendix 5-A 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 of the method of converting from one unit to another. A conversion table for various measurements is provided in Chapter 11.

b. Specialized Teams. Several specialized teams are available within the 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 Service Response Force (SRF), 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 SRF. Integration of specialized team operations is accomplished best through establishment of a JHEC as discussed in paragraph 5-5. When not required on-site, DoD specialized teams should assist in the off-site radiological response efforts. Specialized teams are:

(1) The U.S. Army Radiological Advisory Medical Team (RAMT) is discussed in Chapter 14.

(2) The following specialized teams or resources are discussed in detail in Chapter 20:

(a) U.S. Army Radiological Control (RADCON) Team.

(b) U.S. Navy Radiological Control (RADCON) Team.

(c) U.S. Air Force Radiation Assessment Team (AFRAT).

(d) U.S. Air Force Air Transportable RADIAC Package (ATRAP).

(e) Department of Energy Aerial Measurement System (AMS).

(f) Department of Energy Atmospheric Release Advisory Capability (ARAC).

(g) Department of Energy Mobile Accident Response Group Unit (HOT SPOT).

(h) Department of Energy RANGER Environmental Monitoring Capability.

(i) Department of Energy Radiological Air Sampling Counting and Analysis Lab (RASCAL).

(j) Department of Energy Mobile Decontamination Station.

(k) Defense Nuclear Agency Advisory Team.

(l) DoD EOD Teams.

5-5 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 initial response force.

a. Initial Response Force (IRF) Actions. Within the constraints of available resources, IRF action 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. If responding by air, radiation detection instrumentation should be carried to ensure that personnel and aircraft are not contaminated. Efforts should be made, during the flight, to avoid contamination; appropriate ground support should be provided upon landing if personnel and aircraft become contaminated.

(1) Pre-Deployment Actions.

(a) Prior to departing for the accident site, delivery arrangements should be made for an Atmospheric Release Advisory Capability (ARAC) plot, if available, to assist in determining possible areas of contamination. ARAC 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 contamination deposition on the ground. A detailed discussion of ARAC is in

Appendix 5-C. As it becomes known, specific accident data described in the appendices should be provided to the ARAC facility at Lawrence Livermore National Laboratory.

(b) 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 earlier that confirmation of released contamination is established, the easier it will be to develop a plan of action and communicate with involved civil authorities.

(2) Initial Actions.

(a) If the OSC, 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 effected 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.

(b) After arrival at the site, a reconnaissance team should enter the accident site to inspect the area for hazards; determine the type(s) of contamination present; measure levels of contamination; and assess weapon status. The approach to the scene should be from an upwind direction if at all possible. The accident situation indicates whether anti-contamination or respiratory protection is required for the initial entry team. Every consideration should be given to protecting the initial entry team, and to 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 610 meters (2000 feet); however, the contamination may extend beyond this distance. Additional explosive safety distances may be found in classified EOD publications. 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 OSC. Anti-contamination clothing and respiratory protection should always be donned before entering a suspect area.

(c) If radiation detection instruments are not yet on-scene, observations from firefighters and witnesses and the condition of the wreckage or debris may indicate contamination. Anticipated questions that may be asked to evaluate the release of contamination are:

1. Was there a high explosives detonation?

2. Has a weapon undergone sustained burning?

3. How many intact weapons or containers have been observed?

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

(d) If no contamination was released by the accident, the remaining radiological response becomes preparations for response in the event of a release during weapon recovery operations.

(3) Actions to be taken if contamination is detected. Authorities should be notified and the assistance of specialized radiological teams and the DoE Aerial Measurement System requested. The highest priority should be actions to initiate general public hazard abatement. Do not delay or omit any life-saving measures because of radiation 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 which should be initiated include:

(a) Dispatch monitor teams, with radios if possible, to conduct an initial survey of the security area.

(b) Prepare appropriate news release.

(c) 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. Also assist in ensuring that contamination has not spread in the facility. Procedures a medical treatment facility may use to minimize the spread of contamination are described in Chapter 14.

(d) Initiate air sampling.

(e) Identify, in conjunction with civil authorities/officials, witnesses, bystanders, and others present at the accident scene.

(f) Establish a contamination control station and a personnel monitoring program. If available, civil authorities/officials should have monitoring assistance provided at established personnel processing points.

(g) Implement procedures to protect response personnel. Protective coveralls (anti-contamination clothing), hoods, gloves, and boots are necessary to protect response personnel from contamination and to 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 self-contained breathing apparatus. 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.

(h) 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 Contamination Control Station (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 National Defense Area (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.

(i) Establishing the location and initial operation of the Command Post, Operations Area, JHEC, and Base Camp is discussed in Chapter 4.

b. Service Response Force (SRF) Actions. Upon arrival on-scene, the SRF personnel review the initial response force actions. Actions include: the status of identification and care of potentially contaminated people, casualties, and fatalities; the results of radiation surveys and air sampling; radiological response assets on-scene or expected; logs and records; and the location for the JHEC. Representatives from the DoE, Federal Emergency Management Agency (FEMA) and Environmental Protection Agency (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 SRF should continue to provide assistance and radiation monitoring support, as necessary. During those periods early in the response when Explosive Ordnance Disposal (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 Department of Energy Accident Response Group (DoE ARG) are integral parts of the SRF. The OSC should integrate DoE ARG radiological assets into the JHEC organization.

(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 at Figure 5-1.

(a) On-site collected data is processed through and further distributed by the JHEC to the FRMAC.

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

1. Collect radiological and hazard data required by the OSC on-site. Refer all unofficial requests for contamination information to the Joint Information Center (JIC).

2. Analyze and correlate all contamination data collected to identify inconsistencies which require further investigation.

3. Provide contamination plots and other required data to the OSC.

4. Review and correlate records from contamination control stations and other personnel processing points to ensure bioassays or other appropriate follow-up actions are taken.

5. Implement OSC's health and safety standards and monitor the safety procedures of all participating in weapon recovery operations.

6. Brief and train people not designated previously as radiation workers who will be working in the contaminated area on personal protective equipment, hazards, and safety measures.

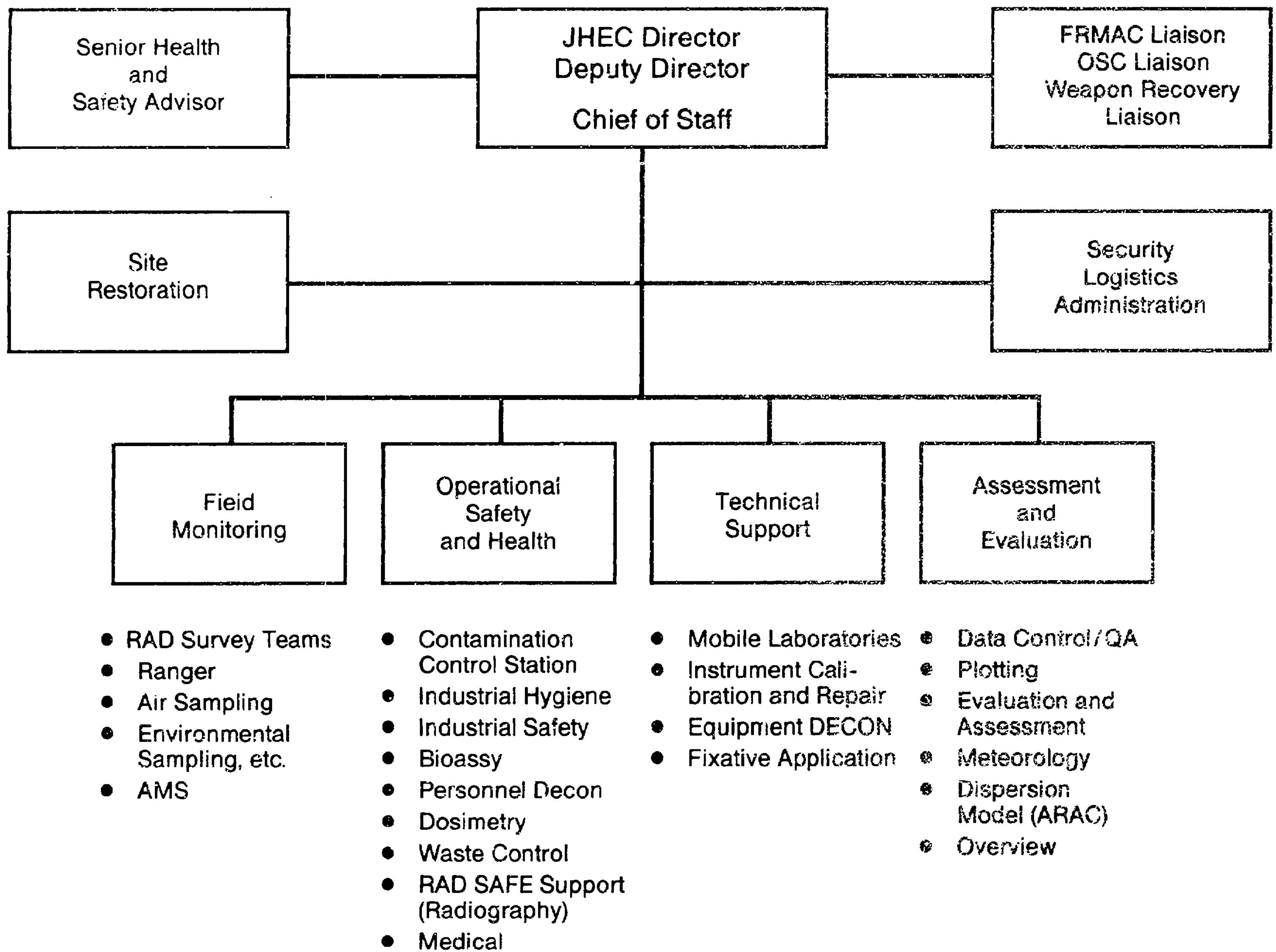


Figure 5-1. Joint Harard Evaluation Center (JHEC) Functional Organization.

(c) Consolidate all radiological assessment information for on-site recovery operations and provide it to the OSC.

(d) When the National Defense Area (NDA) is dissolved, JHEC personnel and resources may be integrated into FRMAC operations.

(2) Materials Sampling.

(a) Environmental Sampling.

1. Air sampling is conducted to determine if airborne contamination is present. Also it provides a basis for estimating the radiation dose/exposure which people without respiratory protection may have received. The reaction time to an accident combined with the time required to initiate air sampling will result in little or no data being obtained during the initial release of contamination. It is at this period that the highest levels of contamination are expected. Later placement of a sampler downwind the accident, per Appendix 5-B, will result in a sample of airborne contamination. Air sampling will verify the resuspension hazard during response and recovery operations. To achieve this, samplers should be placed downwind of the accident, dependent on wind velocity approximately 500 meters upwind, and at the contamination control station.

2. Soil, water, vegetation and swipe sampling of surfaces are required. Sampling should be initiated in the contaminated area soon after the accident. Samples must be taken also 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 decontamination/recovery completion. The JHEC will determine on-site sampling parameters, for example, sample location(s), method, frequency, volume of sample, and size.

(b) Bioassay Program.

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

2. A bioassay program for all individuals is recommended to determine if any internal dose was received, and to assure those who did not receive a dose that their health was not impaired. 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 8.

(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 dosage calculation methods and previous dosages as long as their procedures do not jeopardize health and safety, or unduly impair operations. The JHEC is responsible for implementing the OSC's health and safety standards and monitoring closely the safety procedures of all participating organizations. Personnel entering the contaminated areas, if not trained to work in a radiation environment, should be given specific guidance.

(4) Radiological Surveys. Radiological surveys and other radiological data are required by the OSC and civil authorities/officials to identify actions to minimize hazards to the response force and the public. Site characterization and decontamination, and restoration 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 results are complicated by sensitivity/fragility of equipment, background readings, and the age of the fissile materials. The survey process can require days to weeks to complete. Survey procedures are located in Appendix 5-D and forms are at Appendix 5-E.

(5) Radiological Advisory to the JIC. All public release of information will be processed by DoD Directive 5230.16, reference (b), and made through the JIC. Public interest in the actual or perceived radiological hazard resulting from a nuclear weapon accident will produce intense media concern and public scrutiny of response operations. The JIC requires assistance from the JHEC and FRMAC in preparing press releases to minimize and allay these concerns. Any portion of the public which 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 and the Community Emergency Action Team (CEAT) explaining all real hazards, in terms which

recognize the populace's knowledge level and understanding of radiation and its effects.

(6) Fixing of Contaminants. Fixatives may 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 run-off from highly contaminated areas. The use of fixatives in areas of low level contamination is usually inappropriate. Fixatives may enhance or hinder decontamination and restoration operations, and affect radiation survey procedures. 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.

(7) Recovery/Restoration.

(a) Recovery. This activity includes the initial reconnaissance, the render safe procedures, hazard removal, and disposition of the weapons and components. The two-person rule 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 OSC 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, search may be required to find the weapon(s). The OSC directs the initiation of the render safe procedures. The EOD team advises the OSC of the safest and most reliable mean· for neutralizing weapon hazards.

(b) Site Restoration. Procedures/methods to return the accident scene to a technically achievable and financially acceptable condition begins early in the response effort. Site restoration becomes a major issue after classified information, weapons, weapon debris, and other hazards are removed. Several factors have significant influence on site restoration decisions and procedures, such as size of the contaminated area, topographical, geological, hydrological, meteorological and demographic information. Other important aspects are utilization of the area and civil authorities/officials prerogatives for the area. Restoration will include those measures to remove or neutralize the contamination.

(8) Disposal of Contaminated Waste. Contamination control station operations and JHEC field laboratory operations creates 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 site restoration in Chapter 19.

(9) Logistics Support for Recovery/Radiological Operations. Radiological response assets arrive with sufficient supplies to last a few days. High use items which soon require resupply include hundreds of sets of anti-contamination clothing each day, two-inch masking or duct tape, varied sizes of polyethylene bags, marking tape for contaminated materials, and respirator filters. Anti-contamination clothing may be laundered in special laundry facilities (discussed in Appendix 17-A) 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 SRF supply officer.

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

(1) Radiological Hazard Assessment. From the outset, concern exists about the potential health hazard to the general public, particularly by 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 which 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. Atmospheric Release Advisory Capability (ARAC), described in Appendix 5-C, provides a theoretical projection 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 ARAC plot. Exposure to resuspended contaminants normally results in doses which are a small fraction of that dose which 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.

(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 made based on health and safety considerations.

(a) The initial response force 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 service response force personnel may not arrive for some time.

(b) Protective measures include:

1. Establishing a contamination control area. This operation requires identifying people in the area at the time of the accident/incident or and restricting access to the area. Any vehicles or people exiting the area should be identified and directed to go to a monitoring point immediately.

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.

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.

4. Fixing Areas of High Contamination. Areas of high contamination must be controlled to prevent spread by resuspension, water run-off, or movement of personnel. Although fixing of contamination is part of the site restoration process, some fixing procedures may be necessary long before site restoration plans are implemented.

d. 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 Appendix 5-D for additional guidance.

e. Radiation Surveys. Extensive radiation surveys will be required to identify and characterize the area so that decontamination and restoration 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 5-E.

f. Site Restoration. Site restoration involves negotiating cleanup levels and fixing or removing contamination. The removal is most 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.

g. Verification. The decontamination effectiveness will be verified by remonitoring, resurveying the accident scene to determine that the cleanup levels are achieved.

h. Protective Action Recommendations (PARs) and re-entry recommendations (RERs) provide appropriate protective action and re-entry recommendations to the public. 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 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 hazardous materials 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 found on the next page.

5-6 ACCIDENT RESPONSE PLAN ANNEX

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

Protective Action Recommendation

for

Major Accident ______________________________ at (location)

Issued by:

Problem: An accident involving ____________________ missile system re-entry vehicle occurred at (Time, date and location). Maintenance technicians have experienced complications in removing the missile second stage from the missile launch facility.

Discussion: It is possible, though highly improbable, that the second stage could explode. In the unlikely event of an explosion, debris could be thrown __________ yards/meters. As a result, an evacuation of (outline the specific area) has been ordered by Civilian Authority Office.

Action: With the possibility of the explosion of the missile second stage during removal operations, the following area will be evacuated. (Indicate the specific area to be vacated and a schedule indicating evacuation start, completion, verification of evacuation, maintenance 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/SRF personnel verify that all personnel are out of the area prior to maintenance start. A holding area, for example, YMCA, gymnasium, or school may be a temporary holding area for evacuees. Also, the evacuees could be released for shopping or other activities outside the area. Upon successful completion of maintenance, the personnel would return to their houses/businesses.

Note: Release of this "Protective Action Recommendation" cannot precede confirmation of the presence of a nuclear weapon by the OSC and should be coordinated with local officials and PAO prior to release.

a. A description of the JHEC organization and responsibilities.

b. Procedures for operation of the JHEC.

c. Procedures for establishing and maintaining the contamination control line.

d. Procedures for ensuring that all indigenous personnel possibly exposed to contamination are identified, screened, and treated. This function will become DoE and/or civilian responsibility as time progresses.

e. Guidelines for determining radiation survey and decontamination priorities.

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

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

h. Procedures for recording, correlating, and plotting the results of radiological surveys and data collection instrumentation (for example, air samplers).

i. Procedures for JHEC and FRMAC interfacing.

j. Procedures for JHEC incorporation into the FRMAC.

APPENDIX 5-A

RADIOLOGICAL MONITORING EQUIPMENT

DOSIMETERS

Instrument	Capability/Limitations
Self Reading Ionization Chamber Dosimeter	Reusable device for measuring exposure to X- and/or gamma radiation. Limitations: False positive readings due to charge leakage and sensitivity to mechanical shock.
Non-Self Reading Ionization Chamber Dosimeter	Same capabilities, limitations, and use as Self-Reading Ionization Chamber Dosimeter. Additional Limitations: Requires reading device.
Film Badge	Provides measurement and permanent record of beta and gamma radiation doses over wide dosage range. Special neutron films are available. Ten (10) percent dose accuracy depending on quality control during development. Limitations: Sensitive to light, humidity, aging, and exposure to x-radiation. Delay between exposure and dose reading due to processing time.
Thermoluminescent Dosimeter (TLD)	The TLD (thermoluminescent dosimeter) provides measurement of gamma radiation dose equivalents up to 10000 rem. Accurate to within a factor of two when the energy of the neutrons is unknown. Limitations: after long periods of exposure (± mrem), damaged or bent cards delay processing, static electric discharge causes spurious readings, and temperatures >115° degrees F reduce sensitivity. Delay between exposure and dose reading due to central processing of TLDs.

TRITIUM DETECTION INSTRUMENTS

Instrument	Capability	Scale	Indicator
T-446	Tritium	0 to 10	μCi/m^3

Portable, tritium detector; automatic scale switching; and trickle charger for nickel cadmium F cells. With adapter kit, has urinalysis capability for tritium with 5-minute response. Weighs 22 pounds. Has particulate filter with filters down to 0.3 microns (eliminates sensitivity to smoke and paint fumes).

Instrument	Capability	Scale	Indicator
T-290A	Tritium	0 to 1,000 3 ranges	μCi/m3 Concentration of gas in chamber

Portable, air sampler; and detects presence of radioactive gas. Weighs 17 pounds. Must be rezeroed after 15 minutes of operation and once an hour thereafter. Sensitive to smoke and paint fumes. External battery pack is available for cold weather operations.

TRITIUM DETECTION INSTRUMENTS (CONTINUED)

Instrument	Capability	Scale	Indicator
IC-T2/PAB(M)	Tritium	0 to 100,000 3 ranges	$\mu Ci/m^3$

Portable air monitor designed to detect gaseous radioactivity in ambient air. Alarm sounds at preset meter readings.

Instrument	Capability	Scale	Indicator
AN/PDR-74	Tritium	0 to 100K 3 ranges	$\mu Ci/m^3$

The portable RADIAC set contains an IM-246 light weight tritium air monitor to detect airborne radioactive gases. Also, the instrument is calibrated directly in terms of tritium activity but may also be used to detect other radiogases or to monitor gamma radiation if appropriate calibration factors are applied to the meter reading. The instrument is battery operated (D cells) and has an audible alarm when radioactivity exceeds a preset level.

ALPHA SURVEY INSTRUMENTS

Instrument	Capability	Type	Scale	Indicator
AN/PDR-56	Alpha	Scintillation	0 to 1,000K 4 ranges	CPM/17 cm^2

A small auxiliary probe provided for monitoring irregular objects. Mylar probe face is extremely fragile and a puncture disables the instrument until repaired. Accompanying x-ray probe is calibrated for 17 KeV with associated meter scale from 0-10 mg/m^2 in four ranges.

Instrument	Capability	Type	Scale	Indicator
AN/PDR-60 (PAC-ISAGA)	Alpha Gamma	Scintillation G-M tube	0 to 2,000K 4 ranges	CPM/60 cm^2 R/hr

Capable of measuring gamma utilizing the 2R range. Intermediate and high-range alpha survey; intermediate gamma range; weighs eight pounds. May use plutonium gamma detector (PG-1) for inclement weather. Mylar probe face is delicate and puncture disables alpha monitor capability until repaired; gamma detector will continue to function. AN/PDR-60 or PAC-1S has identical alpha capabilities but does not have the gamma detection capability.

Instrument	Capability	Type	Scale	Indicator
PRM-5	Alpha	Scintillation	0 to 500K 4 ranges	CPM

Portable, high and low-range instrument, for detecting alpha contamination through measurement of the associated X-rays and low energy gamma radiation. This exercise is done with probes with separate ranges. PG-2 probe, 10 to 100 KeV and FIDLER probe 0 to 100 Kev. Weighs 5.4 pounds. The FIDLER probe has significantly greater sensitivity than other probes. Very few units other than specialized Service and DoE teams possess the FIDLER. PRM-5 probes are effective in inclement weather and are much less subject to damage during field use than other alpha meter probes.

ALPHA SURVEY INSTRUMENTS (CONTINUED)

Instrument	Capability	Type	Scale	Indicator
Ludlum Model 3	Alpha/Beta/Gamma	Scintillation G-M Tube	0 to 400K 0 to 200mR/h	cpm mR/h

Portable, high and low range analyzer for detecting alpha, beta and gamma emissions. The Model 3 is an electronic package similar in operation and function to the PDR-60 analyzer. Probe 43-5 detects alpha via scintillation, the probe surface area is 50 cm^2. Probe 44-6 (Hot Dog) uses a G-M tube to detect beta and gamma. Probe 44-9 (Pancake Probe) detects low energy gamma, 0 to 200 mR/h.

Instrument	Capability	Type	Scale	Indicator
Ludlum Model 2220	Alpha	Scintillation	0 to 500K 4 ranges	cpm

The Model 2220 is an alpha detector electronics package that has a liquid crystal display and integral digital readout. The unit weighs 3.5 pounds and has an adjustable high voltage and adjustable lower level discrimination feature.

VIOLINIST II - HIVOLT-PREAMP FIDLER INSTRUMENT SET. This instrument set includes the FIDLER, high voltage power supply and preamplifier and the Violinist II. The Violinist II consists of a battery operated 256 multi-channel analyzer and a preprogrammed microprocessor. This instrument set, when calibrated appropriately, measures and determines surface contamination levels of plutonium and americium-241 in μCi/m^2.

RANGER. The instrument set 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. The microprocessor develops in near real time radiation readings, contamination density, and isopleths. The microwave ranging system is limited to near line-of-sight. Dense vegetation, building, and hilly terrain may effect the ranging signal.

BETA/GAMMA SURVEY INSTRUMENTS

Instrument	Capability	Type	Scale	Indicator
AN/PDR-27	Measures gamma on all scales. Detects beta two lower scales.	Geiger-Muller	0 to 500 4 ranges	mR/h

Low range; weighs eight pounds; beta window on probe to detect beta, and suitable for personnel monitoring. May saturate and read zero in high-radiation fields (over 1,000 r/hr).

Instrument	Capability	Type	Scale	Indicator
AN/PDR-43	Measures gamma. Detects beta on all scales.	Geiger-Muller	0 to 500 3 ranges	R/h

High range; weighs 4.5 pounds, and will not saturate in high-radiation area. Readings in gamma fields other than Co-60 may have inaccuracies greater than 20 percent.

Instrument	Capability	Type	Scale	Indicator
IM-174/PD	Gamma	Integrating ion chamber	0.1 to 10 0 to 500	R/h

High range; weighs 3 pounds; logarithmic scale, and temperature sensitive.

Instrument	Capability	Type	Scale	Indicator
Ludlum Model 19	Gamma	Scintillation	0 to 5 mr/hr	uR/h

APPENDIX 5-A.1

RADIATION DETECTION AND MEASUREMENT

(The Inference of Plutonium Contamination using the FIDLER)

5-A.1-1 OVERVIEW

a. 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 effected less by such overburden; however, these elements require special attention to field calibration techniques in order to convert meter readings to contamination estimates.

b. Field survey of uranium is best accomplished through measurement of x-rays in the 60-80 thousand 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.

c. Many of the factors which cannot be controlled in a field environment can be managed in a mobile laboratory which 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.

5-A.1-2 GENERAL

a. Scope. This appendix provides detailed information from LLNL Report M-161 and Steven G. Hamann, references (o) and (p) 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 radiations found at a nuclear incident/accident.

b. Detection versus Measurement.

(1) Nuclear radiation cannot be detected easily. 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 which 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.

(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.

(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 which influence the readings, those readings must be recognized as indications of the presents of activity (detection) only and not measurements.

(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.

5-A.1-3 TYPES OF RADIATION

a. 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.

b. 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 four (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.

c. Beta. Beta particles are energetic electrons emitted from the nuclei of many natural and man-made 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 ten 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 7).

d. 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.

e. Radiations from the Common Contaminants. The following table lists some of the commonly considered radioactive contaminants and their primary associated radiations.

TABLE 5-A.1-1. Commonly Considered Radioactive Contaminants and Their Primary Associated Radioactive Emissions

	Alpha	Beta	Gamma	X-rays
Ac-227		x		x
Am-241	x		x	x
Cd-109			x	
C-14		x		
Co-57			x	
Co-60		x	x	
H-3		x		
I-125			x	x
I-129		x	x	x
I-131		x	x	x
K-40		x	x	x
Pa-231	x			x
Pm-147		x		
Po-210	x			x
Pu-239	x			x
Ra-224	x			x
Ra-226	x			x
Ra-228		x	x	x
Sr-90		x		
Th-228	x			x
Th-230	x			x
Th-232	x			x
U (nat.)	x	x		x
U-235	x			x
U-228	x	x		x
Y-90		x		

5-A.1-4 ALPHA DETECTION

a. 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 the most common field instruments (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 ten (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 which keep the detector from contacting any surface. However, recall that the range of the alpha radiation is less than four (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 hotline or air sampler filters).

b. 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 25-60 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 current 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.

c. 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 40-50 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.

5-A.1-5 BETA/GAMMA DETECTION

a. 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.

b. 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 which 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.

c. 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 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 0.5-1.0m 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 (rads or rem), rather than in terms of activity:

this practice reflects the common use for beta/gamma detectors.

d. Typical of a beta/gamma detector is the Ludlum Model 3 with a Ludlum 44-9 "pancake" (Geiger-Muller) 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.

5-A.1-6 X-RAY DETECTION

a. For low energy (17-100 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 four 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.

b. 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 of 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.

c. 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 which 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 5-A.1-1. Thus, the setting of discriminator levels requires a qualitative judgment which 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.

d. In spite of the above complications, the scintillation detector remains the instrument of choice for detection

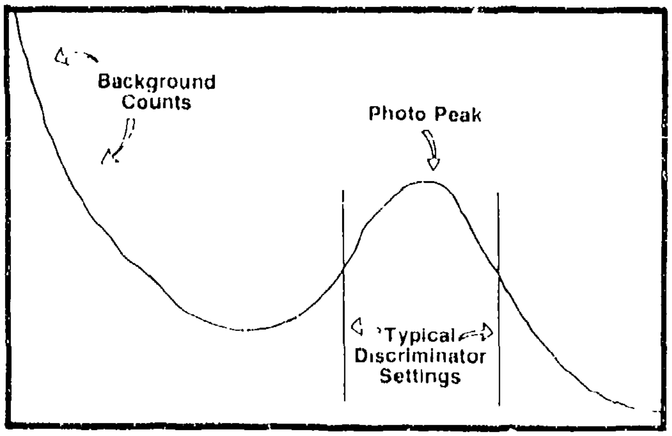


Figure 5-A.1-1: Spectral Plot (Showing Normal Spread Of Pulses From A Mono-energetic Source Mixed With A Typical Background Spectrum and Indicating Typical Discriminator Settings).

of x-ray emitting radioactive contamination. One such detector is the Field Instrument for Detection of Low Energy Radiation (FIDLER). A FIDLER (4"x1 mm. NaI (Tl)) 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 one 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 which influence his 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.

5-A.1-7 DETECTION OF URANIUM AND PLUTONIUM

a. 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.

b. 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. Set-up 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 μ/- 25 percent range.

c. The detection of plutonium is somewhat more complicated. Plutonium-239 and its daughters emit a 17 keV x-ray which 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.

(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.

(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.

d. To facilitate the calculations and calibration needed to measure plutonium contamination by x-ray detection in the field, the Lawrence Livermore National Laboratory has produced a series of utility codes called the HOT SPOT Codes.[1] Available for IBM-compatible computers, as well as the HP-41 calculator systems, the HOT SPOT Codes include an interactive, user-friendly utility routine called FIDLER which steps a user through the process of calibrating an x-ray detector (the Field Instrument for Detection of Low Energy Radiation), the FIDLER code is applicable to any x-ray detector if the full calibration technique, involving a known americium calibration source, is used.

e. 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 Lawrence Livermore National Laboratory[2] have shown that the value of K(h) for h = 30cm can vary from less than 0.4 m2 to over 1.0 m2, 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 m2. This value was chosen to give a relatively conservative reading indication of contamination per count rate.

[1]Steven G. Homann, *HOT SPOT Health Physics Codes*, Lawrence Livermore Laboratory Report M-161 (April 1985).
[2]Steven G. Homann, Hazard Control Department, Lawrence Livermore National Laboratory, private communication.

5-A.1-8 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 D[illegible] 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.

a. 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 a GeLi or selectively high resolution NaI) and a multichannel 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 (for example, 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 (F[illegible]LER) survey techniques.

b. Alpha-beta Counting.

(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.

(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 which is electronically amplified and counted.

(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.

c. Liquid Scintillation.

(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.

(2) Again, the outstanding difficulty with this process is in the sample preparation. Scintillation liquids are extremely sensitive to most impurities which 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 sp[illegible] 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.

APPENDIX 5-B

ENVIRONMENTAL SAMPLING

5-B-1 GENERAL

The collection and analysis of samples provides numerical data which describes 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.

a. Air Sampling. Air sampling is conducted to determine if airborne contamination is present. It provides a basis for estimating the radiation dose which 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 [illegible]rmation 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 which 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 h[illegible]h collection efficiency for particle sizes that will deposit readily in the lung (5 microns or less)

b. 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 5-B-1). Staplex air samplers use the CKHV calibrator for 4" filter and CKHV-810 calibrator for the 8" x 10" filters. Normally, 1000 CFM of air must be sampled for accurate results.

Table 5-B-1. Air Sample Calibration

Filter Type	Cal.Kit	Fl[illegible] 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	CK[illegible]V-810	50 CFM	20 min

5-B-2 AIR SAMPLING TIME

The period of time over which an air sample is collected determines the volume of air sampled. Variables which 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 cas[illegible] during decontamination and restoration operat[illegible]ns. During the initial re[illegible]nse, 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 1000 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.

5-B-3 AIR SAMPLER PLACEMENT

Sampler positioning is directed toward the first 24 - 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.

a. 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 which is accessible.

b. Figure 5-B-1 shows the recommended placement of air samplers. The sampler number indicates the priority which 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. Air Sampler Placement sampler No. 2 is placed downwind from the accident at a distance dependent upon the wind velocity, see Table 5-B-2. 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

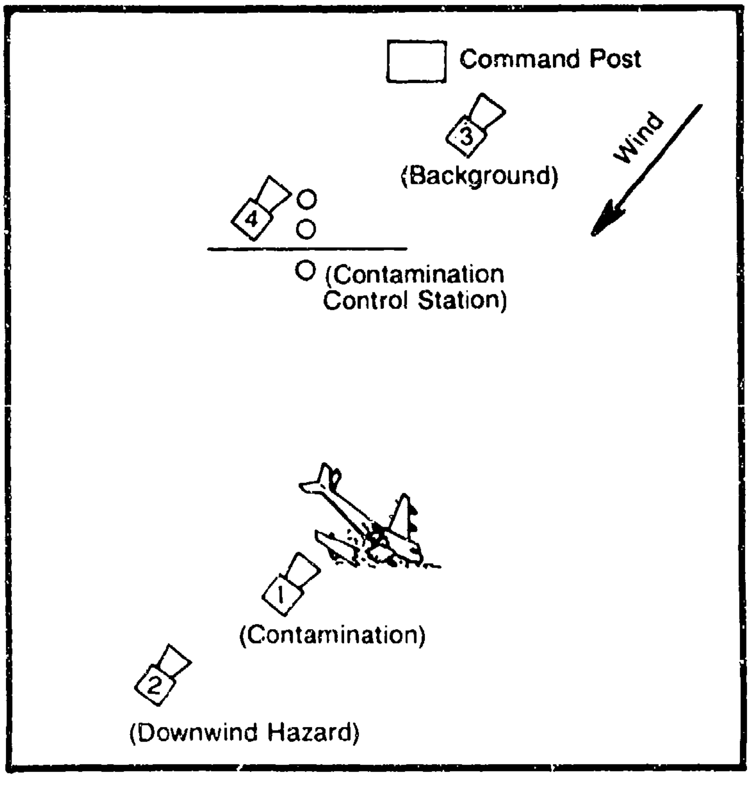


Figure 5-B-1. Air Sampler Placement.

Table 5-B-2. Air Sample Placement (No. 2)

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

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, as 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 contamination control station and operated continuously during contamination control station 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.

5-B-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 items a - f.

a. Type and serial number of sampler.

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

c. Average flow rate and/or volume of air.

d. Date.

e. Start and stop time of sample.

f. Wind direction and weather conditions.

g. Type of filter.

h. 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.

i. Laboratory facility to which the filter was sent for processing.

5-B-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 (for example, 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 four hours, and the thoron chain after almost three days. Re-measurement 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 three-day decay time precludes checking for thoron during the initial response.

a. 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.

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

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

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

T = Time in minutes the air sampler was running

CF = Conversion factor (1000 for AN/PDR-60, 4000 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.

b. If other alpha instruments or filters are being used the following equation should be used for field evaluation of air sampling data.

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

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

A_f = Area of filter used (any units)

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

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

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

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

E_c = Efficiency of counting instrument

5-B-6 ENVIRONMENTAL SAMPLES

a. 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:

(1) Gamma spectrometry plus gross alpha and/or gross beta—two kilograms of soil (approximately one square foot area three inches deep).

(2) Gross alpha and/or gross beta only —100 grams.

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

b. Water.

(1) Surface and/or waste discharge sources — two liters.

(2) Drinking water sources — one liter.

c. Vegetation. The minimum sample volume is three liters of densely packed sample and should be double plastic bagged or packed in a one-gallon wide-mouth plastic jar.

d. Swipes. Filter paper discs are used for taking swipe tests. Whatman No. 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 which 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.

APPENDIX 5-C

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

5-C-1 GENERAL

a. This appendix provides information on service radiation monitoring teams (health physics and bioassay specialists, a radiation equipment repair team) and on DoE and related monitoring and assessment capabilities.

b. 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 or preliminary data on the absence/presence of radiation for the OSC 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 site restoration.

c. 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 OSC.

5-C-2 DEPARTMENT OF DEFENSE

a. U.S. Army Radiological Control (RADCON) Team. The RADCON Team is a specialized team located at Aberdeen Proving Ground, Maryland, and organized to provide technical assistance and advice to the OSC in radiological emergencies.

(1) The RADCON Team is organized to:

(a) Perform detailed radiological surveys for alpha, beta, and gamma radiation.

(b) Control and supervise waste disposal measures.

(c) Provide health physics services.

(d) Control and supervise radiological safety services.

(e) Supervise and provide technical advice for decontamination operations.

(f) Supervise and provide technical advice for the control and containment of the radiological contamination at an accident site.

(2) The RADCON Team will consist as a minimum of a team leader, a qualified health physicist, and eight specialists qualified in air sampling and in monitoring for alpha, beta, and gamma radiation. All team members have a minimum security clearance of Secret and are authorized access to Restricted Data and Critical Nuclear Weapons Design Information.

(3) Requests for additional information should be directed to RADCON personnel. Radiological Control team assistance may be requested through the Army Operations Center or the JNACC.

b. U.S. Air Force Occupational and Environmental Health Laboratory (OEHL). The Occupation and Environmental Health Laboratory, Brooks AFB, Texas, 78235, provides many radiation protection services as follows:

(1) Conducts calibration, traceable to the National Institute of Standards and Technology, 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.

(2) Maintains the USAF stock of low energy photon field survey instruments with trained operators to support disaster operations.

(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.

(4) Conducts special projects dealing with long and short term evaluations of radiation exposures.

(5) Request for additional information should be directed to OEHL personnel. OEHL services may be requested through the Air Force Operations Center or the JNACC.

c. U.S. Air Force Air Transportable RADIAC Package (ATRAP). The Air Transportable RADIAC Package is located at Kelly AFB, Texas. It is a collection of RADIAC equipment, spare parts, and trained instrument repair technicians maintained in an alert status by the Air Force Logistics Command for airlift to the scene of a nuclear accident or radiological incident. The Air Transportable RADIAC Package is able to support forces responding to an accident or incident by providing spare RADIAC sets and an on-scene repair shop for instruments used in radiological surveys. The ATRAP team is prepared to repair, calibrate and issue RADIAC instruments to radiation survey teams at the scene of the accident on a twenty-four hours, seven days a week basis.

(1) The OSC will coordinate support for the ATRAP and accompanying technicians.

(2) The ATRAP will maintain in a ready status for deployment to the scene of a nuclear accident/ radiological emergency within four hours after notification by the Air Force Operations Center. The ATRAP will move over the road to sites within 150 miles of Kelly AFB, Texas. Beyond three hours driving time, the ATRAP will be airlifted by Military Airlift Command. For accident sites on inaccessible terrain or in water, ATRAP units will be moved by helicopter or by water/sealift means.

(3) Requests for additional information should be directed to ATRAP personnel. ATRAP services may be requested through the Air Force Operations Center or the JNACC. Phone numbers are listed in Appendix 1-G.

d. U.S. Navy RADCON Team. The Navy RADCON Team provides health physics assistance to the OSC or activity commander in the event of a nuclear weapons accident. The Navy RADCON Team is located at the Naval Sea Systems Command Detachment, Radiological Affairs Support Office (NAVSEADET RASO), Yorktown Virginia.

(1) The Navy RADCON Team can provide the following capabilities:

(a) Field survey and laboratory analysis for alpha, beta and gamma radiation emitters.

(b) Environmental sample analysis.

(c) Limited bioassay analysis.

(d) RADCON and radiation health expertise to the OSC.

(e) Reference library.

(f) Air deployable assets.

(g) Personnel dosimetry support, limited RADIAC repair, and Hot Line management.

(2) Request for additional information should be forwarded to the Director, Radiological Controls Program Office (SEA-06GN), Naval Sea Systems Command.

5-C-3 DEPARTMENT OF ENERGY (DoE)

Services of DoE capabilities will be requested by the DoE Team Leader, but requests may be made also through JNACC if the DoE Team Leader is not on-scene.

a. HOT SPOT Health Physics Codes.

(1) The HOT SPOT Health Physics Codes were developed for the Department of Energy's Accident Response Group (DoE ARG) to provide a quick initial assessment of accidents involving radioactive materials. These codes are run on the Hewlett-Packard HP-41 family of hand-held computers to allow for easy "field" use. Also, the codes are available in an IBM-PC compatible version. At present, 13 separate programs exist, ranging from general programs for downwind assessment following the release of radioactive material to more specific programs dealing with the release of plutonium, uranium, or tritium to programs that estimate the dose commitment from the inhalation of various radionuclides

(2) The HOT SPOT computer programs were created to provide Health Physics personnel with a fast, field-portable calculational aid for evaluating accidents involving radioactive materials. These codes provide a first-order approximation of the radiation effects associated with the atmospheric release of radionuclides

within minutes of data input. Although significant errors are possible, the HOT SPOT programs will provide a reasonable level of accuracy for a timely initial assessment. More importantly, the HOT SPOT codes will produce a consistent output for the same input assumptions, thus minimizing the potential errors associated with reading a graph incorrectly or scaling a universal nomogram during an emergency situation.

(3) The HOT SPOT Health Physics Codes operating instructions and information are contained in Lawrence Livermore National Laboratory (LLNL) Manual 161, reference (o). The manual is designed for users of the codes and therefore does not contain detailed descriptions of algorithms used in the codes; however, key assumptions (for example, particle-size distribution and release fraction) are noted as appropriate.

(4) Table 5-C-1 is a summary of the programs contained in reference (o). Several programs deal with the release of plutonium, uranium, and tritium, to expedite the initial assessment of accidents involving nuclear weapons. Three general programs: PLUME, EXPLUME, and RESUS allow for downwind dose assessment following the release of any radioactive material as a result of the continuous or puff release, explosive release, or an area contamination event. These three programs interact with a data-base containing 75 radionuclides selected from ICRP Publication 30. The source term can contain any or all of the radionuclides in the database, each with its independent release fraction, activity, and mitigation factor, if applicable. Should a desired radionuclide not reside in the database, a dose-conversion factor can be input by the user. Other programs estimate the dose commitment from inhalation of any one of the radionuclides listed in the database and estimate the effects of a surface-burst detonation of a nuclear weapon.

(5) The dosimetric methods of ICRP have been used throughout the HOT SPOT programs. Individual organ dose values (unweighted) are produced, along with the committed dose equivalent (weighted, equivalent whole-body dose commitment). Programs involving the atmospheric transport of radionuclides employ a Gaussian plume-dispersal model. Initial radionuclide distribution is modeled using virtual source terms as needed, for example, modeling the initial distribution associated with an explosive release or area.

TABLE 5-C-1. Programs Contained in the HOT SPOT Physics Codes

Program Name	Description
PUEXP	Downwind dose commitment and ground deposition estimates resulting from an explosive release of plutonium.
PUFIRE	Downwind dose commitment estimates resulting from a fire involving plutonium.
PURES	Downwind dose commitment estimates resulting from the resuspension of plutonium.
FIDLER	FIDLER calibration and data reduction. Also contains a subroutine for the determination of radionuclide weight fractions as a function of mix age.
TRIT	Downwind dose commitment estimates resulting from a tritium release.
UFIRE	Downwind dose commitment estimates resulting from a fire involving natural uranium of any enrichment of 235U.
LUNG	Lung screening for plutonium using a FIDLER detector.
BOMB	Effects of a surface-burst fission weapon.
RADWORK	Determination of recommended workplaces for the handling of radioactive materials.
PLUME	General Gaussian plume dispersion model, using ICRP-30 Library.
EXPLUME	General explosive release dispersion model, using ICRP-30 Library.
RESUS	General resuspension model, using ICRP-30 Library.
DOSE	Inhalation dose commitment, using ICRP-30 Library.

Resuspension Source Term Owing to the large uncertainties associated with the source terms and diffusion coefficients, additional fine tuning of the model with plume-rise algorithms and similar modifications was deemed unwarranted.

b. Atmospheric Release Advisory Capability (ARAC). ARAC is a DoE and DoD resource, directed by the Lawrence Livermore National Laboratory, that provides support to emergency response teams during accidents involving radioactive materials.

(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 dose 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.

(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 CONUS area, remote from an ARAC serviced DoD installation, notification of ARAC will come through the NMCC's JNAIR Team. However, ARAC should be contacted directly by the installation initiating the OPREP-3 report to NMCC, by calling ARAC's EMERGENCY number: commercial (415) 422-9100, FTS 532-9100, or through AUTOVON by asking the Albuquerque operator for the Livermore tie line extension 2-9100. At this time ARAC can't support OCONUS facilities in the same manner as CONUS facilities.

(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:

(a) Accident location.

(b) Time of accident.

(c) Type and quantity of weapons involved in the accident [weapon information should be transmitted using the line number(s) contained in TP-20-11, General Firefighting Guidance (C)].

(4) Responses outside the hours listed above are subject to an additional 60-90 minutes delay.

(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:

(a) Observed wind speed and wind direction at the time of the accident, and subsequent weather changes.

(b) Description of accident particulars, including line numbers for the specific weapon(s) releasing contamination, type and amount of fuel involved and measured contamination at specific locations with respect to the contamination source, if available.

(c) Specific details of accident fire or explosion, such as mechanism of the release (high explosive detonation or fire), duration of any fire, and height and size of the plume or cloud (if available from reliable observers).

(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, excluding insensitive high explosive (IHE) weapons, when exposed to unusual stress during the accident undergo a non-nuclear high-explosive detonation. Also, all the nuclear material at risk (except that of the IHE item[s]), is released in an aerosolized form. Similar conservative assumptions are made where specific accident information is missing or unknown. If the accident location isn't close to an ARAC serviced 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 site restoration efforts.

(7) Approximately 60 to 90 minutes after notification of ARAC, a more refined projection will be available in 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 known to have undergone a high-explosive 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.

(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 to any CCITT Group 3 telecopier machine. The following paragraphs provide information regarding the ARAC example "initial" projections shown in Figures 5-C-1 and 5-C-2.

(a) Geographic Contour Display. Release location is centered in this area (refined projections may have release location offset from center) with a 2000-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 which will, in most cases, overlay a geographic representation, showing road networks and waterways, etc., of the area around the accident site. The words "SEE NOTES" will be printed across the middle of the display directing the viewer to the ARAC Computer Estimation Notes on the right side of the graphics plot. 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.

(b) 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 (UTC) 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 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.

(9) The wording which accompanies the action levels in the legend follows:

(a) 50-Yr 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.

1. Greater than 150 rem - Immediate respiratory protection and evacuation recommended.

2. Greater than 25 rem - Prompt action required; respiratory protection required; consider sheltering or evacuation.

3. Greater than 5 rem - Respiratory protection required; recommend sheltering; consider evacuation.

4. Greater than 0.5 rem - Consider sheltering.

(b) Cumulative Deposition "Exposure Action Levels."

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.

2. Greater than 60 $\mu Ci/m^2$ - Supervised area; issue sheltering instructions; recommend controlled evacuation 2-14 days.

3. Greater than 6 $\mu Ci/m^2$ - Restricted area; access on need only basis; possible controlled evacuation required.

(c) The wording of the preceding deposition action levels was contracted because of space limitations on the ARAC plots. The full wording follows:

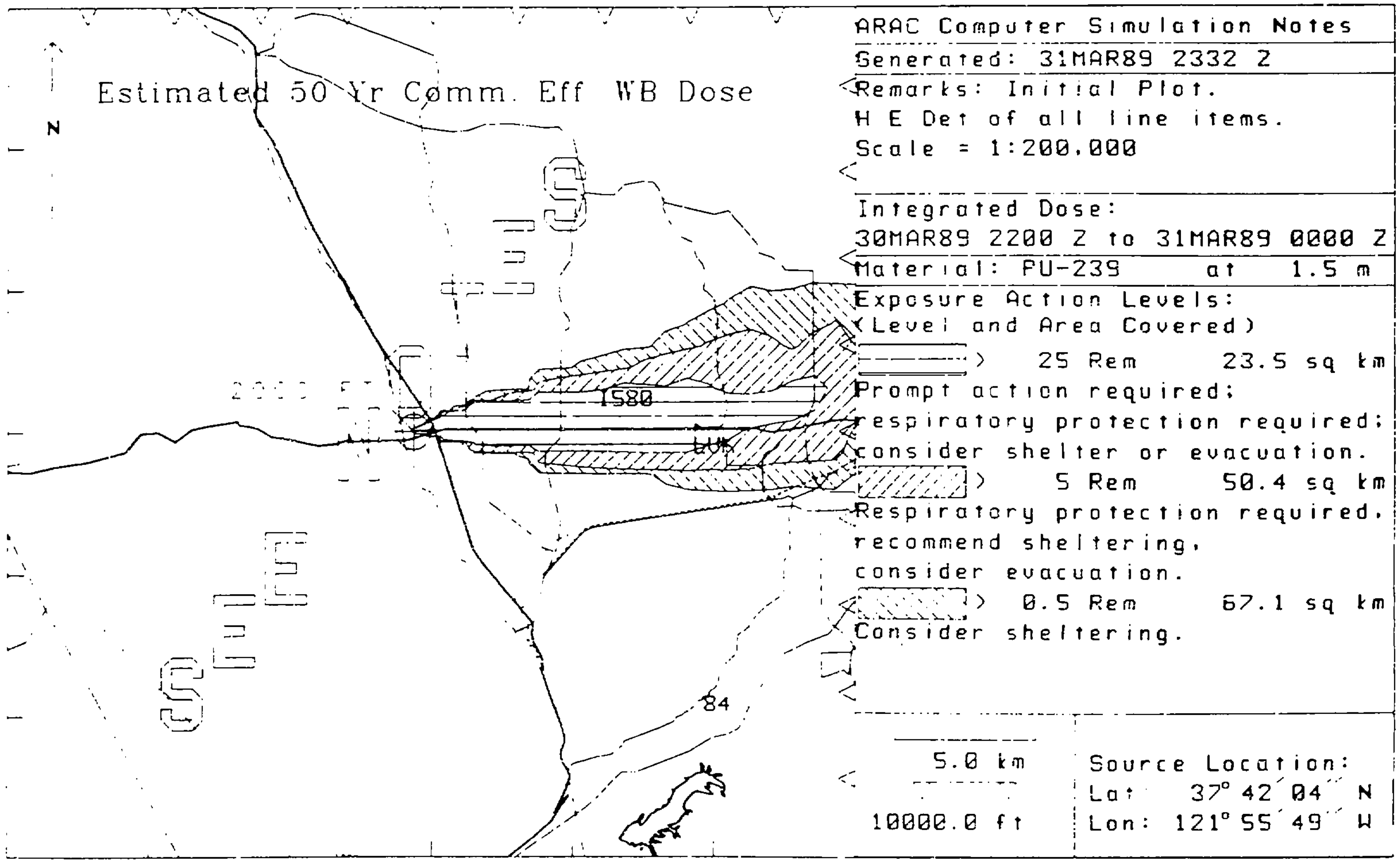


Figure 5-C-1: ARAC PLOT-Lung Dose.

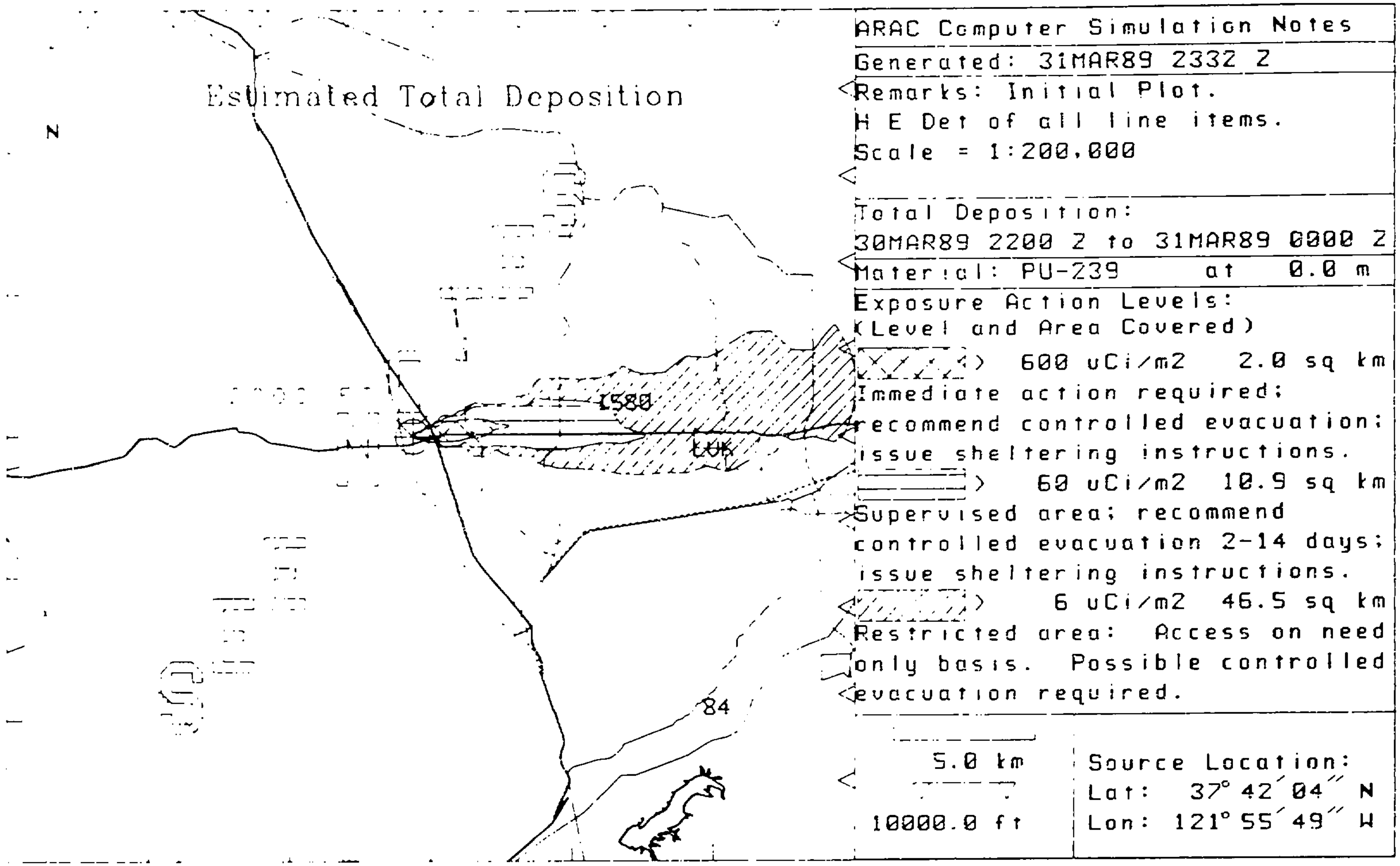


Figure 5-C-2. ARAC PLOT-Deposition.

1. Greater than 600 $\mu Ci/m^2$ - Immediate action required. Urgent remedial action may be needed from within a few hours up to two days. Full anti-contamination clothing and respiratory protection required by all emergency staff in this area. Residents should remain indoors with doors and windows closed. 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.

2. Greater than 60 $\mu Ci/m^2$ - Supervised area. Controlled evacuation should be considered and may have to occur between about two days and two 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.

3. Greater than 6 $\mu Ci/m^2$ - Restricted area. Entry restricted to those who live, work, and/or have a need to be there. Decontamination personnel and public health and safety staff should wear limited anti-contamination protective clothing. Controlled evacuation of residents, especially children, is possible during decontamination if there is a possibility of airborne contamination via resuspension.

c. Aerial Measurement System (AMS).

(1) General. The EG&G AMS has three capabilities available to support a weapon accident: aerial radiological mapping, aerial search for weapons and/or weapon components, and aerial photography.

(2) Aerial Radiological Mapping. Aerial radiological surveys provide rapid assessment and thorough coverage of large areas and yield average ground concentrations of the contaminant. The system can also be used to quickly prepare crude, 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.

(a) 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. Additional data processing will establish the identity and concentration of the isotopes involved. Subsequent surveys could provide data on the progress of clean-up operations.

(b) The first radiological photography survey conducted after a weapon accident is likely to follow this protocol and time frame:

1. The helicopter would arrive six to ten hours following notification.

2. The helicopter would then be refueled and the crew would obtain instructions within two hours.

3. A survey would then be conducted in a serpentine pattern of survey lines 0.5 to five miles apart to determine:

a. Radiological deposition outline.

b. Direction of the plume centerline.

c. Approximate radiation levels along the plume centerline.

d. Dominant isotopes.

4. Information from 3 would be transmitted by radio to base operations during the survey.

5. The analysis laboratory would arrive 4 hours (plus driving time) after notification.

6. Full analysis of flight results would be available 6 to 12 hours after the flight is completed or after the analysis laboratory arrives.

(c) After the first, broad survey is completed, a series of smaller area surveys would be initiated. The flight altitude would likely be 100 feet with 200 foot line spacings. 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 one to five days, depending upon the area to be surveyed and the weather.

(d) The results of an aerial survey of Area 13 of the Nevada Test Site is shown in Figure 5-C-3. This was the site of a "one-point" detonation in the 1950s to simulate a weapon accident. The aerial survey data were analyzed for the 60 keV photopeak of Am241. Detailed radiological contours, such as those shown in

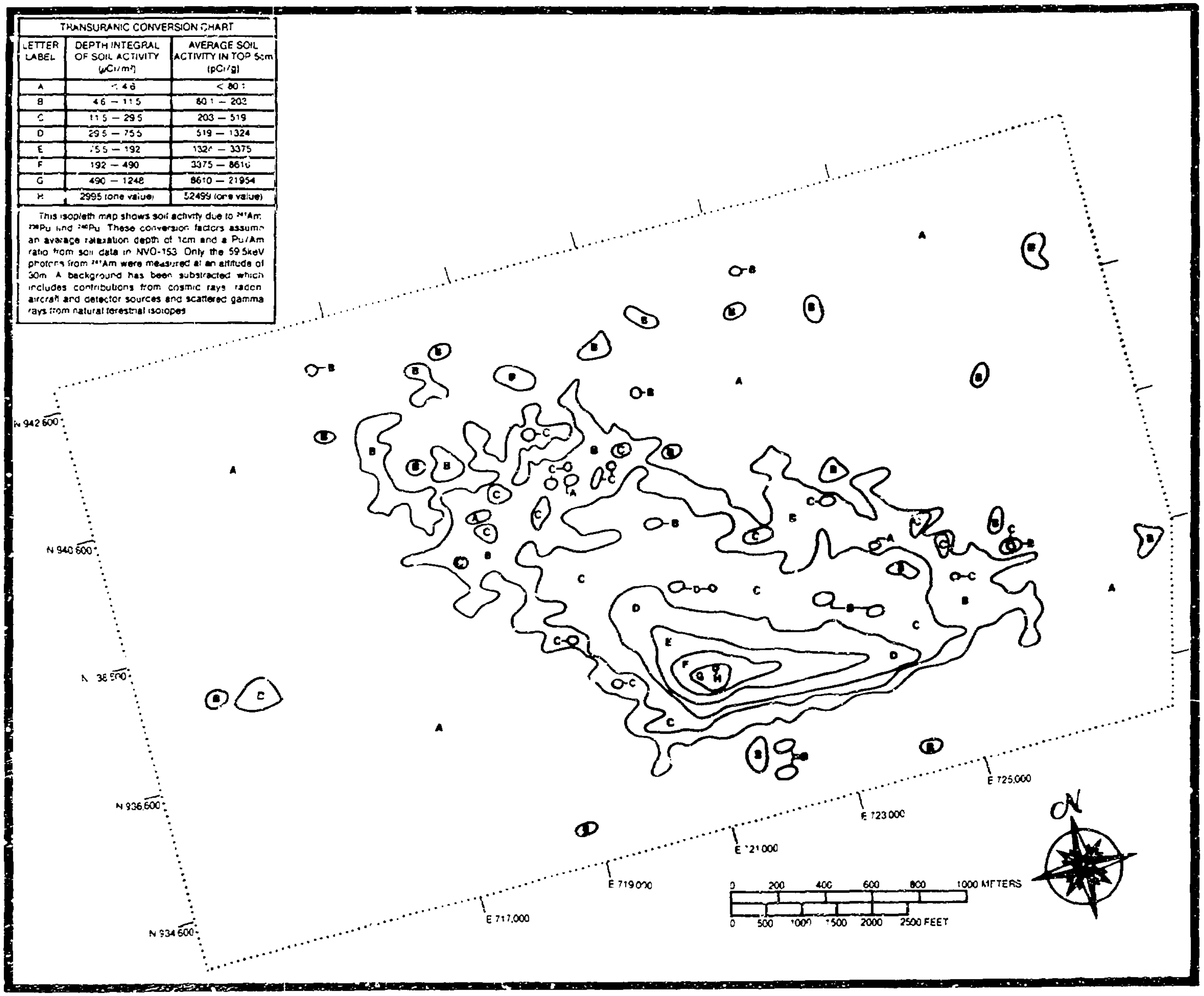
Figure 5-C-3 would be available five to eight hours after the completion of the previous survey flight.

(e) The sensitivity of the system depends upon the flight altitude, area of contamination and the interference of other isotopes (both natural and man-made). Experience has shown that the lower level of detectability of Am241 can be expected to be 0.03 to 1.0 $\mu Ci/m^2$, and 0.03 to 0.3 $\mu Ci/m^2$ for both Cs137 and I131. The americium concentrations indicated represents on the order of 1 to 10 $\mu Ci/m^2$ of plutonium.

(f) 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 one (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.

(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 helicopters or portable modules that can be used in helicopters, such as the UH-60 and UH-1. 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.

(4) Aerial Photography. Two major photographic systems are used to acquire detailed serial photos over a site. One system consists of a large format aerial mapping camera operated in fixed-wing aircraft, which produces detailed aerial photographs. The 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" produced to map scales can be printed on-site generally within hours of the completion of the flight.



TRANSURANIC CONVERSION CHART		
LETTER LABEL	DEPTH INTEGRAL OF SOIL ACTIVITY ($\mu Ci/m^2$)	AVERAGE SOIL ACTIVITY IN TOP 5cm (pCi/g)
A	< 4.6	< 80.1
B	4.6 — 11.5	80.1 — 203
C	11.5 — 29.5	203 — 519
D	29.5 — 75.5	519 — 1324
E	75.5 — 192	1324 — 3375
F	192 — 490	3375 — 8610
G	490 — 1248	8610 — 21954
H	2995 (one value)	52499 (one value)

This isopleth map shows soil activity due to ^{241}Am, ^{239}Pu and ^{240}Pu. These conversion factors assume an average relaxation depth of 1cm and a Pu/Am ratio from soil data in NVO-153. Only the 59.5keV photons from ^{241}Am were measured at an altitude of 30m. A background has been substracted which includes contributions from cosmic rays, radon, aircraft and detector sources and scattered gamma rays from natural terestrial isotopes.

Figure 5-C-3. AMS Plot (Example).

APPENDIX 5-D

AREA AND RESOURCES SURVEYS

5-D-1 SURVEYS

a. General. Extensive radiation predictions and surveys will be required to identify and characterize the area for decontamination and to develop and evaluate restoration 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.

b. 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.

(1) Selection of Instrumentation.

(a) Alpha Instruments. Alpha instruments can detect lower levels of contamination than low energy gamma instruments. 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.

(b) Low Energy Gamma Instruments. Instruments capable of detecting the low energy gamma- 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 five 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 over 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.

(2) Perimeter Contamination Levels. When alpha instruments are used to establish the perimeter, readings of 500 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 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.

(3) Fixing Survey Points.

(a) 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. Engineering survey 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.

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.

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.

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 which 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.

(4) Recording Survey Data.

(a) 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:

1. Team member names.
2. Type instrument and serial number.
3. Date and start/stop time of survey.
4. Data location mark (stake number or other marking) when used.
5. Estimated or surveyed position.
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 not subtracted from the instrument reading.

(5) Perimeter Surveys.

(a) 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 On-Scene Commander 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 which 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 unsecure nets.

(b) 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.

(6) Area Surveys.

(a) Radiological surveys of the contaminated area are required to identify areas requiring fixation, to support decontamination and restoration planning, and to determine decontamination effectiveness. The first survey covering the entire area will be provided most times by the Aerial Measurement System (AMS).

The initial AMS data will be available four-five hours after completion of survey flights. 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 decontamination 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 decontamination effectiveness may require several months to complete due to the low levels of contamination remaining, and the desired precision.

(7) Building Surveys.

(a) Radiological surveys of buildings within the contaminated area will be required to determine the appropriate decontamination actions. Alpha instruments may be used on most building surfaces, however, use of FIDLERs may be necessary on surfaces which 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 absorbed. 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.

(b) 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 which 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 are 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 decontaminated areas may minimize further contamination of the interior during contamination 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.

APPENDIX 5-E

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 that may be used to document and record this information.

Form 1 - Personal Data Form
This form contains data which should be obtained from all personnel who enter the radiological control area.

Form 2 - Radiological Control Area Log
This form is for use at the contamination control station.

Form 3 - Bioassay Screening Log
This form is for maintaining a record of all necessary bioassay screening performed and may be used for both response force personnel and civilians who may have been contaminated as a result of the accident.

Form 4 - Radiation Health History
This form is to assist in the screening of civilians who may have been contaminated as a result of the accident.

Form 5 - Field Monitoring Data Log
This form is to assist in documenting field monitoring measurements by survey teams.

Form 6 - TLD Measurements
This form is to be used to document TLD readings.

Form 7 - Weapons Accident Environmental Radiation
This form is to be used to log samples taken from the surrounding environment.

Form 8 - FIDLER Data Form
This form is used when logging readings from the FIDLER.

FORM 1

PERSONAL DATA FORM

(Please print or place "X" in boxes as appropriate)
See Reverse for Additional Instructions

(1) SOC SEC NO ______________ (2) NAME ______________________________________ (3) BIRTH DATE ____________
(last) (first) (m.i.) (day)(month)(yr)

(4) MALE ☐ or FEMALE ☐

(5A) MILITARY ☐ or (5B) CIVILIAN ☐

(6) USA ☐ (7) GRADE ________

USAF ☐ (8) SPECIALITY CODE ________ or

USN ☐ NEC/DESIGNATOR ________

USMC ☐

OTHER ☐ ____________ (Specify)

(9A) DOD ☐ (9B) USA ☐ USAF ☐ USN ☐ USMC ☐ OTHER ☐ (10) GRADE ______ (11) SERIES ________

DOE ☐ - - - - - - - - GRADE ______ SERIES ________

OTHER ☐ - - - - - - - - PROFESSION AGENCY ____________

	(Yes)	(No)
(12) HAVE YOU EVER WORN A FILM BADGE OR OTHER DOSIMETRIC DEVICE?	☐	☐
(13) HAVE YOU EVER BEEN CLASSIFIED AS A "RADIATION WORKER"?	☐	☐
(14) HAVE YOU HAD TRAINING IN RESPIRATORY PROTECTION EQUIPMENT (MASK)?	☐	☐
(15) HAVE YOU WORKED IN ANTI-CONTAMINATION CLOTHING AND RESPIRATORS?	☐	☐
(16) HAVE YOU RECEIVED A SIGNIFICANT DOSE OF RADIATION WITHIN THE LAST YEAR?	☐	☐
(17) HAVE YOU BEEN BREIFED ON PROCEDURES FOR WORKING IN A CONTAMINATED AREA?	☐	☐

(18) YOUR ORGANIZATION/BUSINESS ADDRESS

______________________ (Unit/Employer Name or Symbol) ______________________ (Street, P.O. Box, Mail Stop, etc.)

______________________ (City or Military Base) ______________ (State or County) ________ (ZIP Code)

(19) UNIT RESPONSIBLE FOR RECORDING YOUR RADIATION DOSIMETRY RESULTS ________ ______________ (Place "X" if unknown)

(20) YOUR ORGANIZATION/BUSINESS TELEPHONE ______________ (Area Code and Number)

______________________ (Signature) ________ (Date)

FOR RAD HEALTH CENTER USE
FILM BADGE NO __________
EXTERNAL DOSE __________
INTERNAL DOSE __________

PERSONAL DATA FORM ACCOUNTING NUMBER
____

THIS FORM SUBJECT TO THE PRIVACY ACT.

Figure 5-E-1. Personal Data Form.

INSTRUCTIONS FOR NON-SELF EXPLANATORY ITEMS

ITEM	COMMENT
3	Show day and year as numerical and month as alphabetical; e.g., 23 Jan 65 or 01 Jun 42.
5	Check either 5A or 5B.
6	Foreign military and US Coast Guard check "OTHER."
7	Show alphabetical/numerical grade; e.g., E3 or O5, rather than rank; e.g., PFC or CDR.
8	Show "MOS," "NEC," "AFSC," etc., of your current duty assignment.
9B	Civilians with DOD agencies check "DOD" and appropriate service or "OTHER."
10	DOD and DOE employees show pay schedule and level; e.g., GS-10, SES-79.
11	US government civilians other than DOD or DOE, show grade and series for profession; other civilians give short title for profession; e.g., health phys, rad monitor, or comp programmer.
12	Check "YES" if you were monitored by thermoluminescent dosimeter; i.e., TLD; check "YES" if you worked with soft beta emitters and were monitored by some means other than film badge or TLD.
13	Check "YES" if an occupationally exposed individual or radiation worker.
14	Check "YES" if trained in use of M17 or M17A protective masks.
15	Check "YES" if anti-C work was participation in training courses with or without actual radioactive contamination.
16	Check "YES" if you underwent medical treatment involving radiation or radioactive materials, if your occupational exposure is near permissible limits and/or if an accident response dose report is necessary to continue your regular radiation work.
19	Following codes may be used: "R" for Radiological Safety Officer or Radiological Protection Officer, "M" for Medical Department, "C" for Commander, "F" for USAF Master Radiation Registry.
20	In lieu of commercial number, show "AVN" for AUTOVON or "FTS" for Federal Telecommunications System.

FORM 2

RADIOLOGICAL CONTROL AREA LOG

DATE ________ PAGE ____ OF ____

TIME ________

RECORDER ________

SSN ________

SOC SEC NO	NAME (LAST, FIRST, M.I.)	CONTROL NUMBER	FILM BADGE NUMBER	DOSIMETER IN	DOSIMETER OUT	TIME IN	TIME OUT		FULL PROTECTION	NO RESPIRATOR	STREET CLOTHES		CONTAMINATION FOUND	DECONTAMINATED	REMARKS
1 2 3 4 5 6 7 8 9	10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44	45 46 47 48 49	50 51 52 53 54 55	56 57 58	59 60 61	62 63 64 65	66 67 68 69	70	71	72	73	74	75	76	77 78 79 80
1 2 3 4 5 6 7 8 9	10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44	45 46 47 48 49	50 51 52 53 54 55	56 57 58	59 60 61	62 63 64 65	66 67 68 69	70	71	72	73	74	75	76	77 78 79 80

THIS FORM SUBJECT TO THE PRIVACY ACT

Figure 5-E-2. Radiological Control Area Log.

RECORDER	DATE ________ PAGE ____ OF ____ START ________ STOP ________ RECORDER ________________ SSN ______________ RADIOLOGICAL CONTROL AREA LOG (CONTINUATION SHEET)

THIS FORM SUBJECT TO THE PRIVACY ACT

INSTRUCTIONS FOR THE USE OF THE RADIOLOGICAL CONTROL AREA LOG

a. Column 71 should be marked with an X if the person was wearing full anti-contamination clothing and a respirator.

b. Column 72 should be marked with an X if the person was wearing anti-contamination clothing without a respirator, or street clothing without a respirator.

c. Column 73 should be marked with an X if the person was wearing street clothing.

d. Column 75 should be marked with a Y if contamination was found on body or personal clothing when exiting the control area. If no contamination was detected state "none."

e. Column 76 should be marked with a Y if all detected contamination was removed from the person, N if not and remarks are mandatory. If no contamination was detected state "none."

f. Any unusual incidents or additional data deemed important for radiological safety should be described in the remarks section and sequentially numbered. The number should be inidcated in Columns 77-80. Remarks may also be used to indicate when recorders change in mid sheet. If personal clothing was confiscated during decontamination, articles taken should be noted in remarks.

g. Each day should be started with a new form and the total number of pages entered on each sheet of the previous days forms.

FORM 3

BIOASSAY SCREENING LOG

DATE ______ PAGE ____ OF ____

TIME ______

RECORDER ______

SSN ______

SOC SEC NO	LAST NAME	MIL/CIV	RAD WORKER	RESIDENT	HEALTH HISTORY	CONTAMINATION DETECTED: CLOTHING α γ	FACE α γ	HEAD α γ	HANDS α γ	BODY α γ	SHOES α γ	DECONTAMINATED	NOSE SWIPE: OBTAINED	NOSE SWIPE: COUNT	URINE SAMPLE	FECAL SAMPLE: OBTAINED	FECAL SAMPLE: COUNT	LUNG COUNT	GI TRACT COUNT	TIME	CONTROL NUMBER	FOLLOW UP		REMARKS
1–9	10–23	24	25	26	27	28–29	30–31	32–33	34–35	36–37	38–39	40	41	42–45	46	47	48–51	52–56	57–61	62–65	66–70	71	72–76	77–80

THIS FORM SUBJECT TO THE PRIVACY ACT

Figure 5-E-3. Bioassy Screen Log.

BIOASSAY SCREENING LOG (CONTINUATION SHEET)

DATE ________ PAGE ____ OF ____

START ________ STOP ________

RECORDER ________________

SSN ________________

REMARKS	

THIS FORM SUBJECT TO THE PRIVACY ACT.

INSTRUCTIONS FOR THE USE OF THE BIOASSAY SCREENING LOG

a. Columns 10-23. If more than 14 characters in last name truncate as necessary.

b. Column 24 indicate with M or C.

c. Column 25 should be marked with Y if person is normally classified as a radiation worker by the Nuclear Regulatory Commission, leave blank for all others.

d. Column 26 should be marked Y if person is not associated with a DOD, Federal or state accident response organization, leave blank for all others.

e. Column 27. Insure all persons marked Y in Column 26 have completed a Radiation Health History form and check, leave blank for all others.

f. Columns 28-39 should be marked Y where appropriate if contamination was found and column number and associated reading recorded in the remarks section. All personal articles and clothing retained for decontamination or disposal should be recorded in the remarks section. If no contamination was detected leave blank.

g. Column 40 should be marked Y if all detected contamination was removed from the person, N if not and remarks are mandatory. If no contamination was detected leave blank.

h. Columns 41, 46, and 47 mark with Y if bioassay samples collected, N if not.

i. Columns 42-45, 48-51, 52-56, and 57-61 enter units used in column headers and measurements in appropriate columns.

j. Columns 62-65 enter time bioassay sample was collected.

k. Column 71 mark Y if additional bioassay samples or other data is required and specify in remarks section.

l. Any unusual incidents or other data deemed important should be described in the remarks section and sequentially numbered. The number should be indicated in Columns 77-80. Remarks may also be used to indicate when recorders change in mid sheet.

m. Each day should be started with a new form and the total number of pages entered on each sheet of the previous days forms.

FORM 4

RADIATION HEALTH HISTORY

(Please print or place "X" in boxes as appropriate)

(1) SOC SEC NO ____________ (2) NAME ______________________ ______________ ___
(last) (first) (m.i.)

(3A) BIRTH DATE __________ (3B) MALE ☐ or FEMALE ☐
day/mo/yr

(4) TEMPORARY ADDRESS ____
TELEPHONE ______________________

(5) PERMANENT ADDRESS ____
TELEPHONE ______________________

(6) NAME & ADDRESS OF EMPLOYER ____

(7) HAVE YOU EVER BEEN TREATED WITH X-RAYS OR RADIOACTIVE ISOTOPES? YES ☐ NO ☐

(7A) REASON FOR TREATMENT ____

(7B) DATE OF TREATMENT ______________
mo/yr

(7C) PLACE OF TREATMENT ____

(8) HAVE YOU EVER HAD ANY CANCER OR OTHER MALIGNANCY? YES ☐ NO ☐

(8A) INDICATE TYPE

LEUKEMIA ☐ BREAST ☐ THYROID ☐ LUNG ☐ STOMACH ☐ BONE ☐

INTESTINES ☐ OTHER ☐ ______________________________
Specify type

(8B) DATE OF DIAGNOSIS ______________
mo/yr

THIS FORM SUBJECT TO THE PRIVACY ACT.

Figure 5-E-4. Radiation Health History.

(9) HAVE ANY BLOOD RELATED MEMBERS OF YOUR FAMILY (GRANDPARENTS, PARENTS, BROTHERS OR SISTERS) EVER HAD CANCER OR LEUKEMIA? YES ☐ NO ☐ TYPE ______________________

(10) ARE YOU NOW TAKING MEDICATION? YES ☐ NO ☐

(10A) WHAT MEDICATION ______________________

(11) DO YOU HAVE ANY ALLERGIES? YES ☐ NO ☐

(11A) WHAT ALLERGIES ______________________

(12) NAME & ADDRESS OF FAMILY PHYSICIAN ______________________

____

(13) DATE & TIME OF POSSIBLE OR ACTUAL EXPOSURE TO RADIATION/CONTAMINATION ________ AM ☐ or PM ☐

day/mo/yr time

(14) DURATION OF EXPOSURE HOURS ________ MINUTES ________

(15) ACTIVITIES DURING PERIOD OF EXPOSURE (Meals, type work, bathing, sleeping, etc.)

____

____

____

(16) LOCATION DURING PERIOD OF EXPOSURE ______________________

____

____

____

(17) DO YOU OWN A PET? YES ☐ NO ☐ TYPE ______________________

LOCATION ______________________

(18) WHO WAS WITH YOU WHEN YOU MAY HAVE BEEN CONTAMINATED?

NAME	ADDRESS	TELEPHONE

Form 5

Page ____ of ____

Incident ____________

Time Dispatched: ________

Time Returned ________

Orig /Team ____________ Ref. No. ____________

Date ____________ NAMES

Gr Serial #B ____________ 1. ____________

2. ____________

FIELD MONITORING DATA LOG
NOTE: REPORT ACTUAL BACKGROUND LEVEL OR MDL

TIME	LOCATION Grid Co ordinates Crossroads etc	SCINTILLATOR Model ____ Serial NO ____ Units ____	GM Model ____ Serial No ____ Units ____			ION CHAMSER Model ____ Serial No ____ Units ____	AIR MONITORING ____ CFM/ ____ Min Sample			SAMPLE COLLECTION			SMEAR	COMMENTS (Indicate Factors Such As Peak Reading, Cloud Passage Instrument and Weather Conditions and Other Date)
		Meter Reading	Meter Reading	Beta Window Open Closed	Height 4 In 3 ft	Meter Reading	Background (CPM)	Gross CPM with Particulate Filter	Gross CPM without Particulate Filter	Tag No	Type Soil, Milk Water	Quantity and Units	CPM Per 100 CM' Unless Noted	

Figure 5-E-5. Field Monitoring Data Log.

Form 6

TLD MEASUREMENTS

COLLECTION AND ANALYSIS

INCIDENT ______________________

PAGE ____ OF ____

LABORATORY ______________________

LAB MANAGER ______________________

ROUTE TO ______________________ DEA

LOCATION (BE SPECIFIC, GRID COORDINATES, ETC.)	TEAM/ ORGANIZATION	PLACED		RETRIEVED		READING	ASSUMED BACK-GROUND	NET READING	UNITS	READOUT		TRANSIT/ STORAGE DOSE	COMMENTS
		DATE	TIME	DATE	TIME					DATE	TIME		

Figure 5-E-6. TLD Measurement Collection and Analysis Form.

WEAPONS ACCIDENT ENVIRONMENTAL RADIATION
ALPHA PROBE DATA FORM
NOTE: REPORT ACTUAL BKG OR MDL

Incident | Date | Data Type: Alpha | Beta | Gamma

Agency/Org. | Team/Monitor

Detector Type | Model No. | Serial No.

Instrument BKG | Calibration Date | Conversion Factor

Instrument MDL

Time	Locations Grid Coordinates, Crossroads, etc.	Reading	Units	Sample Collection		Comments (Indicates Factors Such As Peak Reading, Cloud Passage, Instrument and Weather Conditions, and Other Data)
				Tag No.	Type: Soil, Milk, Water, Air Filter	

Figure 5-E-7. Weapons Accident Environmental Radiation Alpha Probe Data Form.

Form 8

FIDLER DATA FORM

Incident Date FIDLER S/N

Agency/Org Team/Monitor Check One Scaler Rate Meter

Calibration Date Radionuclide Check Source Quantity ... μCi

Background Counting Time Minutes RC Time Constant Minutes

Energy Window (keV)	Background (CPM)	Check Source (CPM)	K-Factor (m^2)
17			
60			
Other			

Self Shielding (17 keV) (0 - 1, 0 No Absorption in Check Source, 1 100% Aborption)

Source-to-Detector Height cm 1 μCi Am-241 = Alpha μCi Pu Mix (excludes Pu-241 (Beta))

Time	Location	Reading	CPM or Counts	If Scaler Counting Time (Min)	Alpha Activity Mix μCi/m^2	Alpha Activity Mix μg/m^2	Comments

Figure 5-E-6. FIDLER Data Form.

CHAPTER 6

RESPIRATORY AND PERSONNEL PROTECTION

6-1 GENERAL

This chapter addresses protective clothing and respiratory protection including protection factors, protective action guide and resuspension factors.

6-2 RESPIRATORY PROTECTION

Plutonium and uranium particulates are the most serious source of airborne radioactivity at an accident site. 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 self contained breathing apparatus (SCBA), or respirators which 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 paragraph 14-5 should be implemented when temperatures exceed 70°F.

a. Protection Factors (PF). The amount of protection from inhaling airborne particulate contaminants provided by a given device is called its protection factor. Protection factors vary primarily as a function of anthropometrical data, mask fit and mask design. Protection factors are determined by dividing the ambient air concentrations (AAC) of a contaminant by the inhaled concentration (IC) or amount of contaminant which 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. PF's 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 SCBA (air supplied on inhalation) cause negative mask pressure during inhalation and provide no more protection from contaminants than a respirator. Pressure demand SCBA (i.e., always under positive pressure) provide a nominal PF of 10,000.

b. Protective Action Guidelines (PAG). PAG developed to identify protective devices to limit exposure to the lungs from inhalation of contaminants to agreed upon limits. 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 a 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 ten (10) times greater than the one (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. 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 which is inhaled. Table 6-1 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 6-1. 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.
100-10,000 dpm/m^3	Full-face respiratory (M-series Protective Mask or civilian equivalent)
Above 10,000 dpm/m^3	Pressure demand SCBA or limited entry restricted to essential personnel wearing a full-face respiratory. 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. Table 6-2 provides guidelines for protective requirements based on measurements of surface contamination levels. Table 6-2 is based upon surface contamination levels which could produce the airborne contamination levels in Table 6-1 assuming a resuspension factor of 10^{-5} per meter (m^{-1}). Conversions from microcurie per meter squared ($\mu Ci/m^2$) to counts per minute (CPM) were made using the equation in Appendix 5 conversion factor charts for measurements on soil. Using Table 6-2 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 can be expected, wearing of respirators by people entering the contaminated area is recommended until air sampling data is available to assess the actual airborne hazard. Table 6-2 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 the explosion).

c. 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.

d. Resuspension Factors. 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 resuspension factors. The resuspension factor is defined as the activity in the air (μCi, pCi, 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 resuspension factor 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 over 30 mph, surfaces as much as 900 meters

TABLE 6-2. Protective Devices for Emergency Worker as a Function of Surface Contamination

FIDLER Determined Contamination $\mu Ci/m^2$	Alpha Reading CPM 60cm² Probe	17cm² Probe	Protection
Below 4.5	Below 10,000	Below 2,500	Shoe covers; gloves recommended
4.5-450	10,000 - 1,000,000	2,500 - 250,000	Anti-contamination clothing; full-face respirator.
Above 450	Above 1,000,000	Above 250,000	Pressure demand SCBA, or limited entry restricted to essential personnel wearing a full-face respiratory. Source of contamination should be fixed as soon as possible.

away may contribute. Averaging of ground activity levels from these areas may be considered when computing resuspension factors. Resuspension factors may provide a method of roughly estimating airborne contamination levels for use with Table 6-1 in areas where air sampling data is unavailable. When using resuspension factors to estimate airborne contamination levels,the types and levels of contamination on surfaces in the area where the resuspension factor was computed and those in the area of interest should be considered. Resuspension factors may vary from 10^{-5} to 10^{-7} for plutonium newly deposited on soil and up to 10^{-3} on pavement. Resuspension factors are affected by the following:

(1) Soil Disturbing Operations. Mechanical disturbance, such as vehicular traffic may increase resuspension factors by as much as 100 times in the vicinity of the disturbance.

(2) Wind. Resuspension factors vary proportionally to the cube of the wind speed.

(3) Rain or Moisture. Leaching of plutonium into the soil by rain or sprinkling may reduce resuspension factors 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.

6-3 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. Dispcsable suit 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 their back and chest.

CHAPTER 7

CONTAMINATION CONTROL

7-1 CONTAMINATION CONTROL

a. General. Contamination control minimizes the spread of contamination; therefore, rigid, established operating procedures must be followed to achieve the objective of contamination control. It consists of:

(1) Initial monitoring upon arrival to determine the preliminary site characterization and personnel contamination.

(2) Anti-contamination procedures to minimize the spread of contamination.

(3) Strict contamination control line procedures to control contamination spread during response/recovery/restoration operations.

b. 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 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 the 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 Contamination Control Station (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 OSC 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.

(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 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 14-5 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 decontamination or other measures, as appropriate, to prevent the spread of contamination should be given the highest priority.

(2) Contamination Control Station (CCS).

(a) The CCS employs a contamination reduction area (CRA) concept. The CRA is used to eliminate (or reduce to an acceptable level) contamination of personnel operating in the contaminated area. With the processing of personnel through the CCS, there is the possibility of a movement of contamination upwind through the CCS. Therefore, the CCS should be set up in a facility or tent to minimize dispersing by the wind of contaminants on boots, gloves, or anti-contamination suits. The CCS employs kraft paper, plastic, or drop cloths to collect contamination that may fall from anti-contamination clothing. Also, the CCS uses supervised, structured, and meticulous anti-contamination suits and/or clothing removal procedures to preclude a mechanical transfer of contamination outside the CCS.

(b) 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 in paragraph 14-5. An example of a CCS is shown in Figure 7-1. When processing a large group of people, this type station will process a person about every four 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, monitor team leaders, and others whose presence or information is needed to facilitate other response operations. The location of the contamination control station should be governed by the following constraints:

1. It must be located in an area free of contamination.

2. It ideally 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.

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.

4. It should be in an area relatively free of weeds, bushes, and rocks. A paved or flat, compacted surface is recommended.

(3) Alternative Procedures. 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. 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. Although the contamination may be retained with the clothing, an over-riding 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.

c. Vehicle Monitoring. Vehicles used by the response force in the contaminated area will remain there for future use and not require immediate monitoring or decontamination. 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 7-2. 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, decontamination should be relatively easy to perform, if done before bonding between the contaminant and the vehicles paint occurs. Also, rapid decontamination and return of private vehicles may reassure the public that consideration is being given to their interests and property.

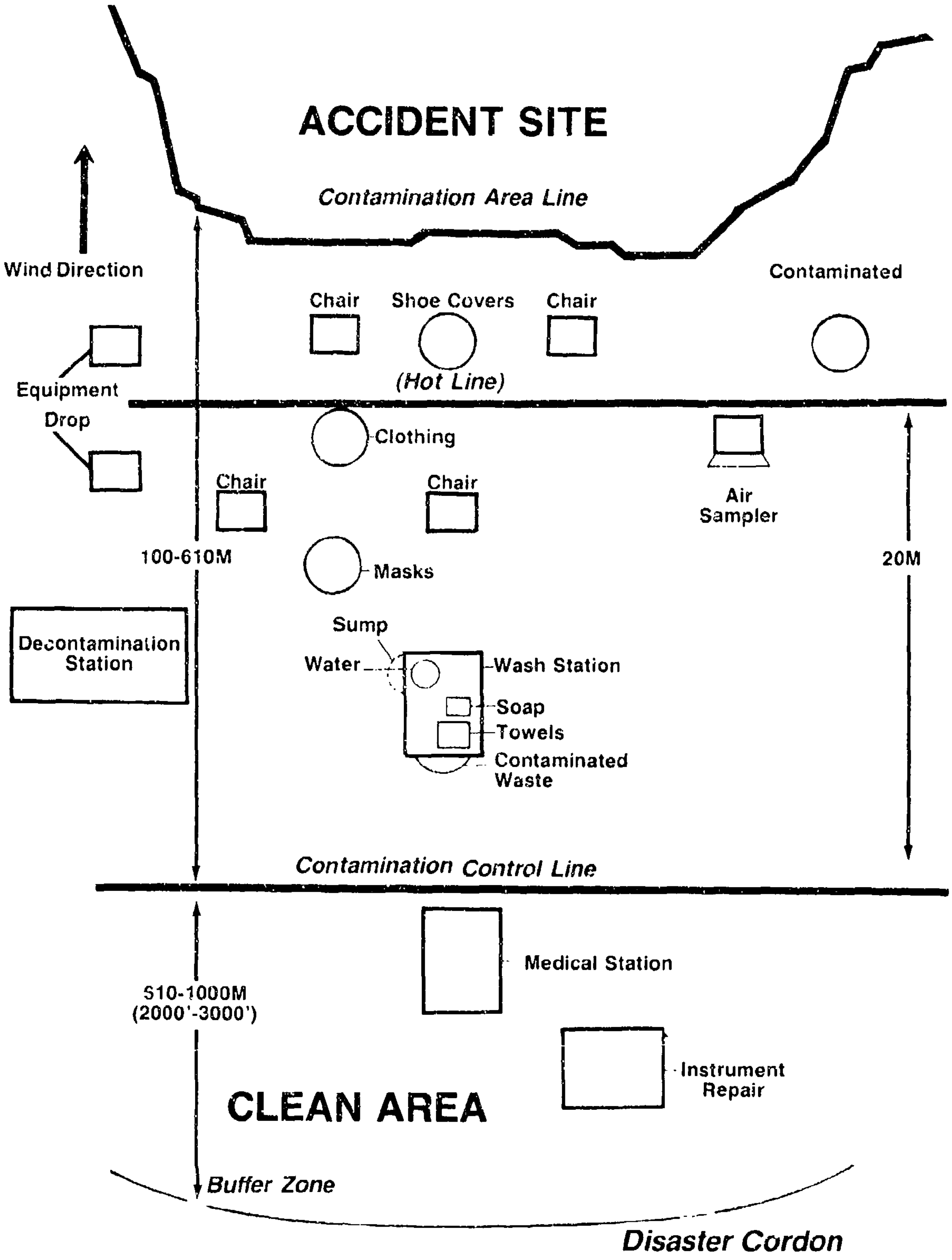


Figure 7-1. Contamination Control Station (Example).

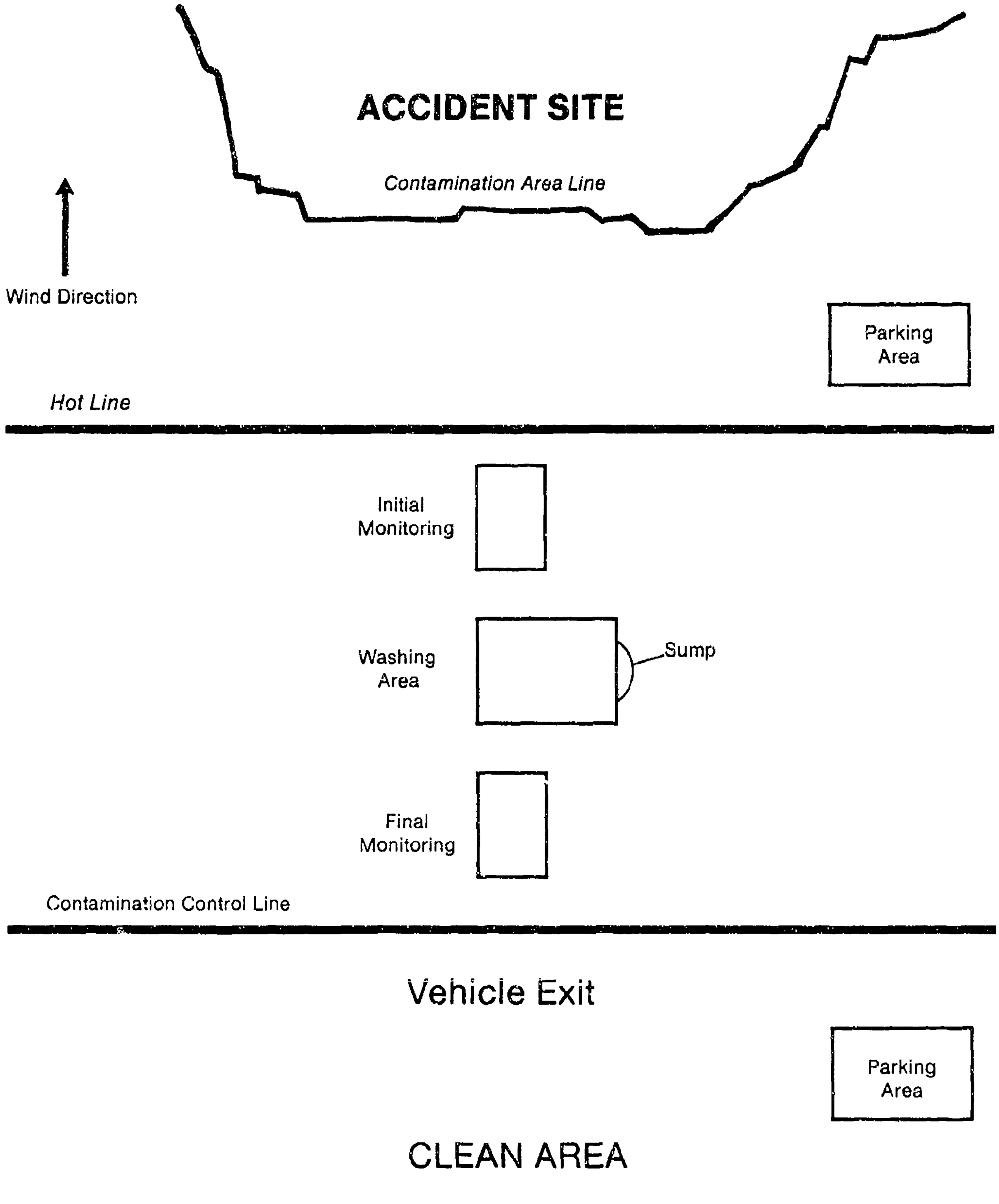


Figure 7-2. Vehicle Contamination Control Station Example.

CHAPTER 8

BIOASSAY PROCEDURES

8-1 BIOASSAY

a. Bioassays are procedures which 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 the 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.

b. 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.

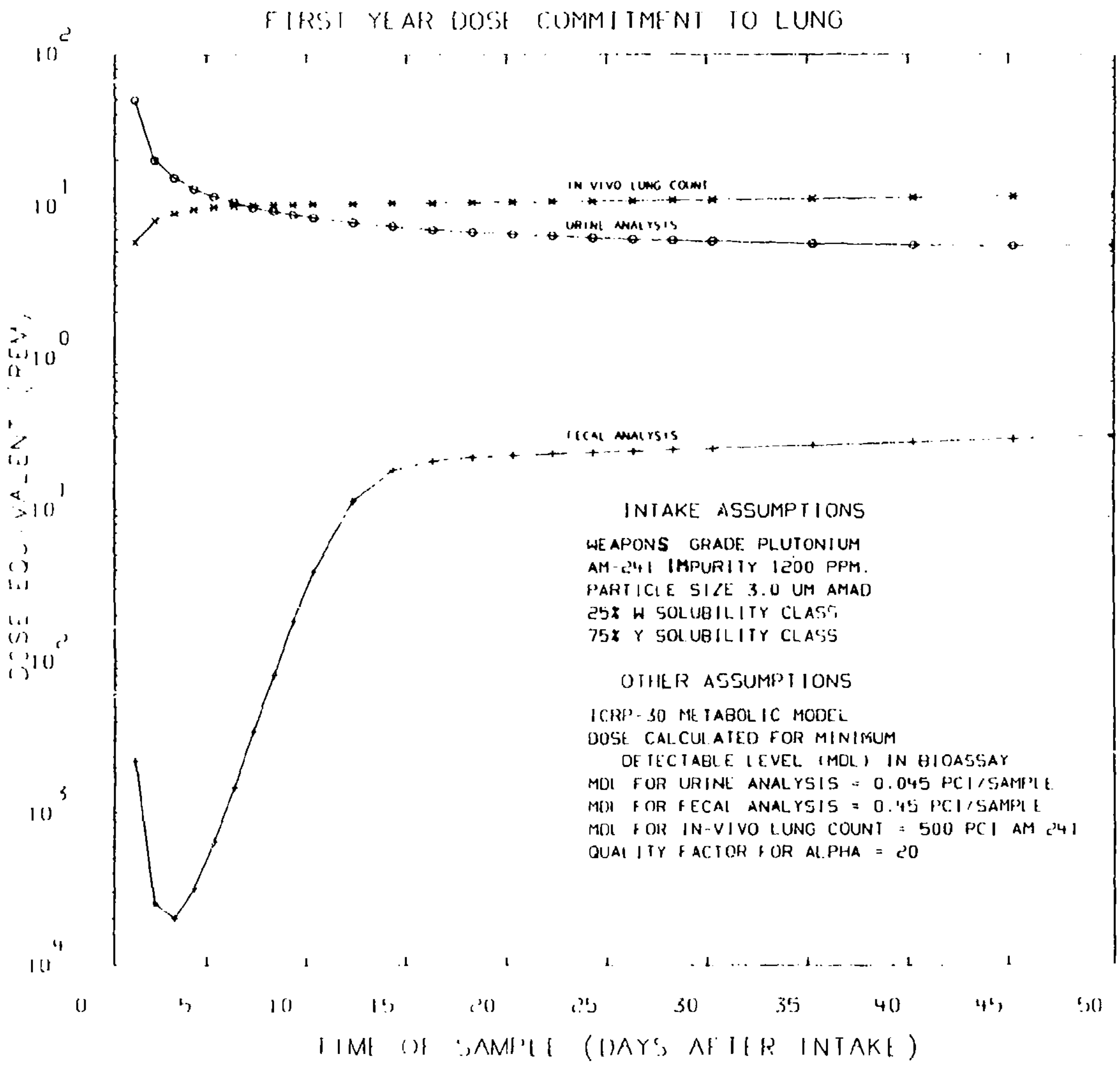
(1) Fecal Sampling. Fecal sampling is an effective bioassay method which has the advantage that samples can be evaluated in the field. Samples should not be taken until at least 48 hours after exposure to permit passage of the contamination through the intestinal tract and should be submitted in well-sealed plastic bags. Low energy gamma radiation sensors such as the FIDLER can be used to estimate the plutonium content. For more definitive results, chemical separation and low level counting techniques must be used. Fecal sampling is especially effective during the first few days, but can be done at any time during the first year after exposure. Figure 8-1 may be used to estimate the first year dose commitment to the lungs based on contamination detected in feces.

(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 five days after the exposure will not reflect the quantity of plutonium inhaled due to the time required for movement through the body. Urine samples taken up to 200 days after the exposure can be used for analysis. Urine samples must be processed in a chemistry laboratory before quantification is possible, but screening for very high levels can be done in the field. Samples should be submitted in plastic or glass bottles with well-sealed tops.

(3) Lung Counting. Lung counting is the direct measurement of emitted x-rays and gamma radiation from the body with a sensitive low energy photon detector. Probably, lung counting is the most accurate method of determining internal exposure. 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 the Department of Energy (DoE) in a few days), and the patient must be sent to the facility. Plutonium is retained in the lung for a very long time.

8-2 BIOASSAY PROCEDURES

a. Administration of a bioassay program for effected civilians may be the responsibility of the state or Federal agency or effected country. The guidelines in Table 8-1 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. 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



Use of Chart.

1. Enter chart with the time of sample.
2. Draw vertical line to curve for sample type.
3. Draw horizontal line to Dose Equivalent scale.
4. Divide the value obtained from the Dose Equivalent scale by the MDL for the sample type and multiply this value by the contamination level of the sample in picocuries to get the estimated first year dose to the lung.

Example: Measurement of a fecal sample taken 5 days after the accident read 1000 pCi.
1. Steps 1-3 give a Dose Equivalent Scale value of 4×10^{-4}.
2. The MDL for fecal samples is .45 pCi.
3. $\frac{4 \times 10^{-4}}{.45} \times 1000 = .889$ **rem** (The estimated first year dose to the lung.)

Analysis of a sample taken from the same person (same first year dose) 10 days after the accident would be expected to read only 20 pCi, assuming the individual inhaled contamination only on the day of the accident.

Figure 8-1. Estimated First-Year Dose Commitment to the Lungs.

TABLE 8-1. Guidelines for Bioassay Sampling.

Suspected Radioactive Material	Feces Optimum Sampling Time After Exposure	Urine Optimum Sampling Time After Exposure	Sample Quantity
Plutonium	2 days	2-3 weeks	24 hours total
Uranium	2 days	24 hours	24 hours total
Tritium	N/A	4-8 hours	1 voiding

contamination cannot be detected by CCS monitoring, anyone suspected of having been exposed to tritium should follow the guidelines in Table 8-1. 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 effected. To provide similar assurance to all people in the contaminated area, bioassays may be appropriate even for people who weren't found to be contaminated; moreover, some people never in contaminated areas will request tests to ensure they were not effected by the accident.

(1) Bioassay Priorities. If a nuclear weapon accident occurs near a populated area, obtaining bioassay samples from large numbers of people may be necessary.

NOTE: Since it is virtually impossible for a significant amount of plutonium to be incorporated into the body without gross contamination of skin or clothing also occurring, initial alpha monitoring which identifies contaminated personnel also can provide a method for assuring that those with the greatest possibility of radiation exposures which may affect their health are given priority treatment.

Table 8-2, 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 On-Scene Commander.

Personnel falling in the HI priority category in Table 8-2 may have had a substantial plutonium intake. Conversely, exposure to airborne contamination which 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 5-E should be considered.

(2) Nasal Smears. If initial alpha meter screening indicates probable plutonium inhalation, a nasal smear shall be collected for analysis by specialized teams when they arrive on-site. Contamination on a wipe (Q-Tip) from inside the nasal passage is a possible indicator of plutonium inhalation. 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. When medical personnel collect nasal smears, the Q-tip must be free from any gels or other material that will prohibit alpha particle counting.

b. Personnel Exposure and Bioassay Records. Documentation should be maintained on all personnel who enter the radiological control area, or who may have been contaminated prior to establishment of a radiological control area. Examples of forms used for recording data on personnel working in the radiological control area, or who may have been exposed to contamination downwind from the accident, are contained in Appendix 5-E. To ensure appropriate follow-up 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 Joint Hazard Evaluation Center 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 OSC's legal officer. Data obtained on DoD personnel will be needed to satisfy Service-specific requirements contained in AR 40-14, Control and Recording Procedures for Occupational Exposure to Ionizing Radiation; NAVMED P-5055, Radiation Health Protection Manual; AFR 161-8, Control and Recording Procedures Occupational Exposure to Ionizing Radiation; AFR 161-28, Personnel Dosimetry Program and the USAF Master Radiation Exposure Registry, references (q), (r), (s), and (t). These records shall be retained and become part of the individual's permanent medical record.

TABLE 8-2. Guidelines for Assignment of Priorities for Collection and Processing of Bioassays.

	Alpha Contamination Level on Clothing or Skin	
Priority	60 cm^2 probe	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

CHAPTER 9

RADIOACTIVE MATERIALS, CHARACTERISTICS, HAZARDS AND HEALTH CONSIDERATIONS

9-1 PLUTONIUM (Pu)

a. General Characteristics. Plutonium is a heavy metal with a shiny appearance (similar to stainless steel) when freshly machined. After exposure to the atmosphere for a short period of time, it will oxidize to a dark brown or black appearance.

b. Radiological Characteristics. The radiological half-lives of the plutonium isotopes and significant daughter products present in a nuclear weapon containing plutonium are as follows:

Isotope	Half-life (years)
Pu-239	2.41×10^4
Pu-240	6.57×10^3
Pu-241	14.4
Pu-242	3.76×10^5
Am-241	432

(1) All of the isotopes listed above are primarily alpha emitters except Pu-241, which is primarily a beta emitter. Pu-241 is an important consideration because of its daughter product, americium-241 (Am-241).

(2) Weapons grade plutonium (including americium) will emit two detectable photons, a 17 keV x-ray and 60 keV gamma ray. Surveys plotting the 17 keV x-ray data must be done within the first five days. After this time, or after rain, the measurable low energy radiation may be shielded as the contaminant migrates into the ground. Am-241 provides the 60 keV gamma radiation which is detectable even after such migration. Gamma radiation can be detected at distances of several meters by many survey instruments.

(3) A critical mass can range from several hundred grams, to several thousand grams, depending on the geometry of the container and the material surrounding, or near, the plutonium. Therefore, recovery personnel should consult EOD technical publications and/or coordinate with knowledgeable scientific advisors from the DoE ARG to ensure a critical mass is not being assembled.

c. Hazards and Health Considerations: Plutonium is considered the most significant radiological hazard associated with an accident involving nuclear weapons containing plutonium. The primary hazard of plutonium, an alpha emitter, results from entry into the body by inhalation and subsequent deposition in the lungs. Most of the plutonium that eventually enters the blood stream is deposited in the bone and liver. Bone deposition may produce bone diseases (including cancer) many years later. Because both the physical and biological half-lives of plutonium are extremely long, it will essentially be held within the body for a lifetime. The hazards from americium taken inside the body are comparable to those of plutonium.

(1) The elimination of plutonium from the body is a very slow process. However, if a person is given prompt hospital treatment with a chelating agent, some of the plutonium retained in the body may be reduced significantly.

(2) A properly sized and fitted protective mask and standard anti-contamination clothing will protect personnel against levels of plutonium contamination expected at an accident site.

9-2 URANIUM (U)

a. General Characteristics: Uranium is a heavy element which occurs in nature in significant quantities. When first machined, it has the appearance of stainless steel. When exposed to the atmosphere for a short period, it will oxidize to a golden-yellow color and from that to black.

b. Radiological Characteristics: Three forms of uranium have been used in nuclear weapons natural uranium, depleted uranium, and enriched uranium.

(1) Natural Uranium - When uranium is separated from its ore, the resulting mixture of uranium is referred

to as "natural uranium." Natural uranium consists of the following three alpha-emitting isotopes:

Isotope	Abundance	Half-life (years)
U-238	99.284	4.5×10^9
U-235	0.710	7.1×10^8
U-234	0.006	21.5×10^5

Natural uranium in a metal form has been called "tuballoy".

(2) Depleted Uranium - Uranium with some amount of its U-235 extracted is known as "depleted uranium" (for example, depleted in U-235). Depleted uranium is called "DU" and "D-38".

(3) Enriched Uranium - "Enriched uranium" is uranium containing more than the naturally--occurring amount of U-235. It is manmade and the enrichment--that is the concentration of the U-235 in the uranium--may vary up to over 90 percent U-235. Enriched uranium has been used as the nuclear material in some weapons and is called "oralloy" at certain enrichment percentages (for example, 40 percent and 93 percent). Like plutonium, care must be taken during the recovery of enriched uranium so that a critical mass is not assembled. Depending on the material associated with the uranium and the geometry of the container, a critical mass of enriched uranium can range from several hundred to several thousand grams. Therefore, recovery personnel should consult EOD technical publications and/or coordinate with knowledgeable scientific advisors from the DoE ARG to ensure that a critical mass is not being assembled.

c. Hazards and Health Considerations: The radiological hazards associated with any of the isotopes of uranium are less severe generally than those of plutonium. If uranium is taken internally, a type of heavy metal poisoning may occur, and lung contamination due to inhalation can cause a long term hazard. In general, when involved in a 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 protect against inhalation or ingestion. An M17 protective mask and standard anti-contamination clothing will protect personnel adequately against uranium hazards.

9-3 TRITIUM (T)

a. General Characteristics: Tritium is a radioactive isotope of hydrogen and diffuses very rapidly in the air with a measurable diffusion rate even through very dense materials such as steel. Tritium combines chemically with a number of elements liberating heat in the process, and like normal hydrogen, can combine combustively with air forming water and release great amounts of heat. Metals react with tritium in two ways: by plating (the process by which a thin film of tritium is deposited on the surface of the metal) and by hydriding (the chemical combination of tritium with the metal). In either reaction, the surface of the metal will become contaminated with radioactive material.

b. Radiological Characteristics: Tritium has a radiological half-life of 12.26 years and decays into a stable helium-3 atom by emission of a weak beta particle. With the proper catalyst i.e., 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.

c. Hazards and Health Considerations: Tritium constitutes a health hazard when personnel are engaged in specific weapon render-safe procedures, when responding to an accident that has occurred in an enclosed space, and during accidents which have occurred in rain, snow, or in a body of water. 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 (T0 or HTO) is readily absorbed by the body, both through inhalation and absorption through the skin. The radioactive water that enters the body is chemically identical to ordinary water and is distributed throughout the body tissue. Although it takes a relatively large amount of tritium to be a significant radiation hazard, caution should be taken. Tritium which has plated out on a surface or combined chemically with solid materials is a contact hazard. The human body normally eliminates and renews 50 percent of its water in about 8-12 days. This turnover time or biological half-life varies with the fluid intake. Since tritium oxide is water, its residence time in the body may be significantly reduced by increasing the fluid intake. Under medical supervision, the biological half-life may be reduced to about three days. If forced-fluid treatment is deemed necessary, and medical supervision is unavailable, a recommended procedure is to have the patient drink one quart of water within one-half hour after exposure. Thereafter, maintain the body's water content by imbibing the same amount as that excreted until medical assistance can be obtained. Medical assistance should be obtained as soon as possible.

Although the biological half-life of tritium is short, personal hazard results because of the ease with which tritium water vapor is absorbed and its rapid distribution throughout the body tissue. A self-contained breathing apparatus and protective clothing will protect personnel against tritium absorption for short periods of time. A filter mask such as M17 has no protective value for tritium.

9-4 THORIUM (Th)

a. General Characteristics: Thorium is a heavy, dense gray metal which is about three times as abundant as uranium. Thirteen isotopes are known, with atomic masses ranging from 223 through 235.

b. Radiological Characteristics: Thorium-232 is the principal isotope. It decays by a series of alpha emissions to radium-225, whose radiological half-life of 14.1 billion years. Thorium-232 is not fissionable, but it is used in reactors to produce fissionable uranium-233 by neutron bombardment. A non-nuclear property of thorium is that when heated in air, it glows with a dazzling white light. Because of this property, one of the major uses of thorium has been in the Welbach lantern mantel used in portable gas lights. An unburned mantle will provide an alpha indication of approximately 15,000 CPM on standard alpha survey instruments. Mantle ash from a single mantle will provide even higher readings.

c. Hazards and Health Considerations: Thorium presents both a toxic and radiological hazard. Toxicologically, it causes heavy metal poisoning similar to lead or the uranium isotopes. Biologically, thorium accumulates in the skeletal system where it has a biological half-life of 200 years, the same as plutonium. An M17 protective mask and standard anti-contamination clothing will adequately protect against thorium.

9-5 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.

CHAPTER 10

SHIPBOARD ACCIDENT RESPONSE

10-1 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 effecting 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 decontamination.

10-2 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.

10-3 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.

a. Explosive Ordnance Disposal (EOD) Detachment - Composed of one officer and four enlisted EOD specialists or detachments are embarked on CVs/CVNs, AEs, and AOEs during deployments. Also, detachments are permanently assigned to major U.S. port facilities throughout the world and are trained to respond to a nuclear weapon accident.

b. 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.

c. Radiation Monitoring Team - Comprised of members of the ship's crew, this response element is trained to operate RADIAC instruments and man the contamination control stations or decontamination stations.

d. The Navy Radiological Control (RADCON) Team - This team is located at NAVSEADET RASO, Yorktown, VA and can provide on-scene advice when radioactive contamination is released. The ability of the detachment to respond rapidly depends on the ship's location at the time of the accident. Again depending on the remoteness of the accident, the same response organizations described in Chapters 3 through 14 may be tasked to respond.

10-4 EQUIPMENT

The AN/PDR-73 and IC/T2-PAB(M) are 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 AN/PDR-43 high range beta-gamma survey instrument is also available and may be used to determine high beta-gamma dose rates, if required. The functions of these instruments are discussed in Appendix 10-B. 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.

10-5 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:

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

b. Station security forces in the immediate area of the movement.

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

d Establish a sound powered phone link between Damage Control Central, Damage Control parties and weapons handling personnel.

10-6 ACCIDENT

a. When an accident occurs in port, it should be handled similar to the one that occurs ashore. The initial response force will be derived from the activity in which the accident occurred (in this case the ship) and augmentation will be provided by a SRF. These procedures have been established in previous chapters. The major differences in port lay in the flexibility provided by the ship.

b. At sea, the possibility of augmentation by a Service Response Force 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 parachuted into the area.

(1) Initial Response Procedures. These procedures are the most crucial in gaining control of a nuclear accident or incident. Accordingly, all ships 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:

(a) When a nuclear accident or incident occurs, the senior person present shall take charge at the scene and direct available personnel to:

1. Attempt to save the lives of personnel involved.

2. Attempt, when required, to extinguish a fire involving weapons or radioactive material using the firefighting guidance provided in SWOP 20-11 and Appendix 10-A.

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, passageway, or hangar deck. In all cases, once the hatches have been secured, only personnel authorized by the senior person present shall be allowed at the accident scene.

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 hazardous materials and smoke.

5. Notify Damage Control Central, via most expedient means, that an accident has occurred in compartment/passageway/hangar deck (by compartment and frame number).

(b) Upon notification of an accident or incident, Damage Control Central shall:

1. Notify the bridge of the accident location and recommend to the commanding officer the state of readiness and heading to which the ship should be brought.

2. Initiate routine announcements over the 1MC as follows:

"NO EATING, DRINKING OR SMOKING IS ALLOWED UNTIL FURTHER NOTICE."

3. Initiate standard shipboard damage control procedures including initiating a radiation plot, identifying route(s) to 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.

4. Prepare to initiate battle dressing and decontamination station procedures.

(c) The bridge/strike operations center, upon notification of an accident or incident shall:

1. Initiate initial OPREP-3 report.

2. Make preparation if in an in-port status for assisting the OSC designated by the Fleet Commander.

3. Bring the ship to appropriate condition of readiness.

4. Act, as appropriate, on Damage Control Central recommendation.

5. Continue OPREP-3 situation reports, as required.

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

(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 at the scene until relieved by appropriately qualified damage control personnel or, in the case of an in-port accident, the shore establishments designated OSC.

(a) As soon as practicable after notification of an accident or incident, damage 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 to Damage Control Central.

(b) In the absence of EOD personnel, the ship's Weapon Safety Team may perform emergency procedures outlined in applicable SWOPs or technical publication, as directed by the CO, providing the weapons are not too severely damaged.

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

2. Identify the types of containers/materials accredited for packaging explosives and radioactive materials.

3. Report via sound powered telephone completion of EOD procedures to Damage Control Central and be available to assist and advise repair parties in the decontamination of affected areas.

(c) Public Affairs. At sea, Public Affairs will be the responsibility of the Fleet Commander. The Commanding Officer is responsible for informing the ship's crew regarding public affairs releases and prior to their debarking or using MARS, on procedures for responding to requests for information from the press or from families. When the ship is in port, public affairs will be coordinated by Fleet Commander or his designated area coordinator.

(d) 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.

(e) 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.

(f) 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 onboard or move the ship to suitable facilities, will all effect the specific follow-on response actions which the Commanding Officer 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 Chapters 5 and 17 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.

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

2. Ship Decontamination. The amount of decontamination 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 Contamination Control Station. Simple cleaning techniques are frequently effective in reducing, if not removing, contamination from many of the surfaces on a ship. Decontamination techniques are described in Chapter 19.

(g) 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 Chapters 4 through 19.

(3) Claims. Any contaminated personal property belonging to ship's personnel should be collected and marked with the owner's identification. The property must be replaced if it cannot be decontaminated. In general, decontamination of high value items, or items which the owner cannot easily replace, must not be attempted by ships personnel.

APPENDIX 10-A

SHIPBOARD FIREFIGHTING

10-A-1

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

(1) Extinguishing the fire has priority.

(2) Cooling of any weapons involved in the fire or in close proximity should be performed to the maximum extent that fire hoses permit.

(3) Cooling should be continued after the fire is extinguished until the weapon is at ambient temperature.

b. The primary suppressant for a fire involving a nuclear weapon is high velocity water fog (low velocity 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, Aqueous Filming Forming Foam (AFFF) or other suppressants on aircraft fuel, Navy Standard Fuel Oil (NSFO), or other petroleum fuel fires which involve a nuclear weapon.

c. High velocity water 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 high explosive 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.

d. For weather-deck fires, the nozzleman and number one hoseman will wear OBA's. Other hosemen and response personnel will be equipped with OBA's or gas masks. For below deck fires, all response personnel going below decks will wear a self-contained breathing apparatus (for example, 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 079-39.137, reference (p). 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.

e. Ordnance magazine sprinkling systems in or near the affected area shall be manned and made ready to be activated; however, the magazine sprinkling system must not be activated without specific orders from the Commanding Officer.

f. 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.

g. Fires involving nuclear weapons in enclosed shipboard spaces should be vented to the atmosphere as soon as practical to deplete toxic, caustic, and the presence of 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.

h. Upon extinguishing a fire involving a nuclear weapon, a reflash watch will be set to provide an immediate response to any reoccurrence of the fire.

i. Potentially contaminated equipment used to fight the fire should be placed in a designated area until monitoring and necessary decontamination can be performed.

APPENDIX 10-B

SHIPBOARD RADIOLOGICAL MONITORING AND CONTROL

10-B-1

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 decontamination, and to prevent the spread of radioactive material to uncontaminated parts of the ship.

a. 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, and material conditions ZEBRA and Circle WILLIAM set to prevent the spread of contamination and minimize the effects of structural damage. 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.

(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 decontamination 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.

(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 6-2, 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 0.00005 used to develop the table) which can be expected from shipboard surfaces.

b. Contamination Control Station (CCS). The contamination control station will be normally located at a compartment entrance for topside accidents and at a fire boundary for below deck accidents. Most ships will have insufficient RADIAC instruments to support more than one CCS. If potentially contaminated personnel are both above and below decks, routes to minimize their movement through clean areas should be established. Access to the CCS must be possible from both contaminated and uncontaminated areas. A shower and wash basin should be designated for use in decontamination procedures. The wash facilities need not be in the immediate vicinity of the CCS although such a location is preferable.

(1) Until the absence of gamma radiation is confirmed by monitoring at the accident site, personnel should be monitored at the CCS 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.

(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 1/8-1/16th inch 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.

(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 identified in OPNAVINST 3440.15, reference (u), are 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 those levels shown in reference (u) are found, the protective clothing should be removed and placed in a container marked for contaminated clothing.

(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 CCS 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 decontamination under medical supervision. BUMEDINST 6470.10, reference (r), provides detailed guidance on personnel decontamination 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 CCS log, and the Commanding Officer should be advised. Disposition of the contaminated individual(s) will be determined by the Medical Department cooperating with BUMED.

c. Protective Clothing. Any close knit clothing should prevent contamination of the skin and provide protection from alpha contamination. If anti-contamination clothing is unavailable, coveralls are recommended for personnel entering the contaminated area to repair damage or perform decontamination operations. Openings in the clothing should be taped. When working in a wet environment, waterproof clothing should be used for anti-contamination 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.

d. Clothing Decontamination. The limited stock of protective clothing on board a ship may be exhausted rapidly during decontamination 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 decontaminating 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 given in reference (u) 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.

CHAPTER 11

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 11-1. Conversion Factors for Weapons Grade Plutonium.

To Convert	Into	Multiply by
$\mu Ci/m^2$	$\mu g/m^2$	13
$\mu Ci/m^2$	dpm/m^2	2.2×10^{6}
$\mu Ci/m^2$	dpm/cm^2	220
$\mu Ci/m^2$	dpm/g	150
$\mu Ci/m^2$	$\mu Ci/g$	6.7×10^{-5}
$\mu Ci/m^2$	pCi/g	67
$\mu g/m^2$	$\mu Ci/m^2$	0.075
$\mu g/m^2$	dpm/m^2	1.7×10^{5}
$\mu g/m^2$	dpm/cm^2	17
$\mu g/m^2$	dpm/g	11
$\mu g/m^2$	$\mu Ci/g$	5×10^{-6}
$\mu g/m^2$	pCi/g	5
dpm/m^2	$\mu Ci/m^2$	4.5×10^{-7}
dpm/m^2	$\mu g/m^2$	6.1×10^{-6}
dpm/m^2	dpm/cm^2	10-4
dpm/m^2	dpm/g	6.7×10^{-5}
dpm/m^2	$\mu Ci/g$	3.0×10^{-11}
dpm/m^2	pCi/g	3.0×10^{-5}
dpm/cm^2	$\mu Ci/m^2$	4.5×10^{-3}
dpm/cm^2	$\mu g/m$	6.1×10^{-2}
dpm/cm^2	dpm/m^2	10^{4}
dpm/cm^2	dpm/g	0.67
dpm/cm^2	$\mu Ci/g$	3.0×10^{-7}
dpm/cm^2	pCi/g	0.3
dpm/g	$\mu Ci/m^2$	6.8×10^{3}
dpm/g	$\mu g/m^2$	0.091
dpm/g	dpm/m^2	1.5×10^{4}

TABLE 11-1: Conversion Factors for Weapons Grade Plutonium (Continued)

To Convert	Into	Multiply by
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:

$$\mu g/m^2 - \text{correction factor} \times \text{cpm}$$

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 11-2 and 11-3 were prepared from the preceding conversion table and equation for users of the AN/PDR-56 and AN/PDR-60, respectively.

TABLE 11-2. Conversion Table (CPM to $\mu g/m^2$ or $\mu Ci/m^2$) AN/PDR 56 Alpha Meter.

CPM	SOIL		CONCRETE		PLYWOOD		STAINLESS STEEL	
AN/PDR 56	$\mu g/m^2$ Pu-239	$\mu Ci/m^2$ Pu-239	$\mu g/m^2$ Pu-239	$\mu Ci/m^2$ Pu-239	$\mu g/m^2$ Pu-239	$\mu Ci/m^2$ Pu-239	$\mu g/m^2$ Pu-239	$\mu Ci/m^2$ 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
1,000	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	80.0	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	1200.0	90.00	1000.0	75.00	800.0	60.00	500.0	37.50
75,000	1800.0	135.00	1500.0	112.50	1200.0	90.00	750.0	56.25
100,000	2400.0	180.00	2000.0	150.00	1600.0	120.00	1000.0	75.00
150,000	3600.0	270.00	3000.0	225.00	2400.0	180.00	1500.0	112.50
200,000	4800.0	360.00	4000.0	300.00	3200.0	240.00	2000.0	150.00
300,000	7200.0	540.00	6000.0	450.00	4800.0	360.00	3000.0	225.00

NOTE: To convert $\mu Ci/m^2$ to Becquerels/m^2 (Bq/m^2) multiply by 3.7 x 10^{13}.

TABLE 11-3. Conversion Table (CPM to $\mu g/m^2$ or $\mu Ci/m^2$) AN/PDR 60 or AN/PDR 54 Alpha Meter

CPM	SOIL		CONCRETE		PLYWOOD		STAINLESS STEEL	
AN/PDR 60 AN/PDR 54	$\mu g/m^2$ Pu-239	$\mu Ci/m^2$ Pu-239	$\mu g/m^2$ Pu-239	$\mu Ci/m^2$ Pu-239	$\mu g/m^2$ Pu-239	$\mu Ci/m^2$ Pu-239	$\mu g/m^2$ Pu-239	$\mu Ci/m^2$ 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	1200.0	90.00	1000.0	75.00	800.0	60.00	500.0	37.50
300,000	1800.0	135.00	1500.0	112.50	1200.0	90.00	750.0	56.25

NOTE: To convert $\mu Ci/m^2$ to Becquerels/m² (Bq/m^2) multiply by 3.7×10^{13}.

TABLE 11-4. Conversion Table (MBq to mCi and uCi).

MBq	mCi	MBq	uCi
7000	189.	30	810
6000	162.	20	540
5000	135.	10	270
4000	108.	9	240
3000	81.	8	220
2000	54.	7	189
1000	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 11-5. 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)
Grey (Gy)

CHAPTER 12

COMMUNICATIONS

12-1 GENERAL

a. 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 command and control is the timely establishment of external communications to higher echelons, particularly in the Washington arena. Therefore, the communications officers of the Initial Response Force (IRF) and Service Response Force (SRF) must take immediate action to ensure that appropriate communications equipment is identified and requested early in response operations.

b. Effective response to a nuclear weapon accident relies heavily on a communications officer 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.

c. In addition to military communications at the accident site, the DoE, FEMA, State and/or civilian officials establish their own communications. Careful attention must be afforded these installations to ensure mutual support and eliminate interference.

12-2 PURPOSE AND SCOPE

This chapter provides guidance for establishing communications systems and capabilities to support response operations. The requirements of both the IRF and SRF are discussed, including personnel at the accident scene (internal communications) and at long distances (external communications). Also included are treatments of various capabilities and hardware (telephone, radio, satellite, and visual signal) that are available.

12-3 SPECIFIC REQUIREMENTS

The On-Scene Commander (OSC) requires internal communications with the operations center and with 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.

Communication requirements:

a. Establish internal communications.

(1) Telephone communications between fixed site locations, for example, the operations center and the Joint Information Center (JIC).

(2) Field phones for EOD operations (secure phones are desirable).

(3) UHF/VHF nets. Several minimum nets, command (secure desirable), weapons recovery operations (secure), radiological operations (secure desirable), security, public affairs will be required.

b. Establish external communications.

(1) Telephone communications with the Service operations center, the National Military Command Center, and the Office of the Assistant Secretary of Defense (Public Affairs). Conferencing may suffice early in the response.

(2) Multiple telephone lines to support response force elements.

(3) Secure voice via satellite, telephone, or HF.

(4) Access to the Defense Communications System for record communications.

c. 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.

d. Obtain frequency clearances, as necessary.

e. Prepare a Communication-Electronics Operating Instruction for use by all response organizations.

12-4 RESOURCES

The 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 presents a variety of communications 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 the DoD, other Federal organizations, or commercial sources.

a. 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 1-G.

(1) U.S. Army. U.S. Army signal units have communications assets to support battalion, brigade, and division operations including wire/telephone switchboards, multichannel radios, and record communication systems.

(2) U.S. Air Force. Tactical communications assets are available from both Combat Communication Groups and HAMMER ACE as described in paragraph (a) below.

(a) HAMMER ACE. HAMMER ACE is a rapidly deployable team of engineers and technicians equipped with advanced technology communications equipment. The team can deploy within three hours and establish communications within 30 minutes of arrival on-site. HAMMER ACE equipment can be transported on C-21, or equivalent-type aircraft, or commercial airliners. Capabilities include secure satellite system for voice, facsimile, and limited data communications. The secure satellite link can interface with AUTOSEVOCOM, STU-II, AUTOVON, and commercial telephone systems through the HAMMER ACE operations center at Scott AFB, Illinois. Record communications can be "air-gapped" to AUTODIN through the HAMMER ACE operations center. Other capabilities include air-to-ground communications and a privacy feature, land mobile radio network with a repeater/base station for local communications. The land mobile radios can interface with the secure satellite system. The limited capability provided by HAMMER ACE is an initial capability only. For this reason, HAMMER ACE personnel, in conjunction with the OSC, evaluate the situation and determine what, if any, additional capabilities are required. HAMMER ACE equipment is capable of battery operations, and enough batteries are deployed to sustain 72-hour operation. A follow-on deployment of generators or additional batteries is required for longer operations.

1. Requests for emergency HAMMER ACE support should be made directly to HQ AFCC/COXC (AFCC Command Center) or through the JNACC. Phone numbers are listed in Appendix 20-A. Any available communications media may be used to submit the request; however, verbal requests must be followed in writing within 24 hours. The requesting agency must provide the following information with the request.

a. Deployment location, including coordinates if available.

b. Situation, including type of emergency.

c. Points of contact.

d. Remarks concerning any unusual conditions for which the team should prepare.

2. Requests for additional information should be directed to HQ AFCC/DOXZ, Special Communications Division, Scott AFB, Illinois. Phone numbers are listed in Appendix 20-A.

(3) U.S. Navy. Each U.S. Navy Fleet Commanders-in-Chief has control of ashore mobile contingency communication units. These units are maintained in a state of readiness to permit deployment within 24 hours by COMMNAVSTA Philippines and NAVCAMSLANT Norfolk, VA, respectively.

(a) Ashore Mobile Contingency Communications (AMCC). The AMCC van is a small mobile communications unit contained in one transportable equipment shelter with two separately configured 55 kw mobile diesel generators. The van contains sufficient equipment to maintain the following circuits simultaneously:

1. Two secure full duplex teletype circuits (one via HF radio; or alternatively, two via HF radio).

2. One narrow band secure voice (CV-3333) via satellite with KG-36 security equipment.

3. Two UHF secure voice circuits with KY-28 voice security equipment.

4. HF High Command (HICOM) net.

5. UHF satellite fleet broadcast receiver (AN/SSR-1 receiver only).

6. One PARKHILL narrow band secure voice circuit via HF or UHF satellite.

7. Two VINSON secure voice devices.

(b) When deployed, the AMCC uses local power where available. Power source must be 440V, three phase, 60 Hz. Otherwise, mobile generators supplied with the AMCC units will be used. A complete AMCC unit can be transported via one C-130 aircraft, one CH-53 helicopter, or one 6x6 5-ton truck. The mobile generators for the AMCC, if needed, requires an additional lift if transported by helicopter. When transported via truck, an additional prime mover is required.

(c) The AMCC units are, at all times, under the operational control of the respective Fleet Commanders-in-Chief (CINCs). All deployments of the AMCC 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 AMCC is deployed, and until it returns to its host command, it is under the custody and operational control of the designated supported command.

(4) U.S. Marine Corps (USMC). The USMC signal units have multichannel radio, wire, and record communication systems.

b. Joint Chiefs of Staff (CJCS) Controlled Assets. JCS contingency support communications resources are requested according to procedures contained in "Mobile/Transportable Communications Assets Controlled by the Joint Chiefs of Staff" (CJCS MOP 3) and in Allied Communications Publication 134, Supplement 1, references (w) and (x). Additional information regarding these assets can be obtained from the JCS Contingency and Crisis Management Division.

(1) Joint Communications Support Element (JCSE). Details of the JCSE deployment/employment concepts capabilities and logistics requirements, reference (y), can be obtained by contacting the JCSE at McDill AFB, Florida. The JCSE is a contingency support unit consisting of Army, Navy, Air Force, and Marine Corps personnel and a variety of communications equipment including:

(a) Switchboards.

(b) HF radio.

(c) Microwave/troposcatter radios.

(d) UHF and VHF radios (secure and non-secure).

(e) Secure record communications terminals.

(f) Weather dissemination equipment.

(g) UHF and SHF satellite terminals.

(h) Secure TELEFAX (DACOM 412).

(i) KY-65, KY-70 and KY-75 secure voice devices, and

(j) The AN/URC Joint Airborne Communications Center/Command Post (JACC/CP).

1. The Joint Airborne Communications Center/Command Post (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.

2. The JACC/CP can provide one high frequency, single sideband (HF/SSB) voice or teletype communication channel over its one-kilowatt transceivers or high frequency, double independent sideband (HF/ISB) with a total of four independent three-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, a AN/ARC-73 (VHF/AM), AN/ARC-54 (VHF/FM) and AN/ARC-51BX (VHF/AM), for ground-to-ground and ground-to-air communications.

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.

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.

5. The JACC/CP can be deployed within 24 hours from the time the JCS issues deployment approval messages.

(2) JCS-Joint Controlled Tactical Communications Assets. Details on the JCCSA are in the U.S. Army plans for deployment of mobile/transportable communications assets controlled by the JCS. During normal duty hours, additional information can be obtained from the U.S. Army Information Systems Command Contingency Branch, Ft Huachuca, Arizona, or from their EOC. Phone numbers are in Appendix 20-A. The

JCCSA consists of heavy mobile/transportable equipment which can be deployed separately or in packages by C-141 C-5 aircraft. Equipment includes:

(a) Switchboards
(b) HF radio
(c) Trop scatter radios
(d) Medium speed AUTODIN terminals
(e) Manual secure voice switch and terminals
(f) SHF satellite terminals

(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 U.S. Army 235th Signal Company, Ft. Monmouth, New Jersey, maintains UHF and SHF research and development satellite terminals which can be deployed for contingency operations and exercises. Also, the U.S. Air Force has communication assets similar to those in the JCCSA. They are located at 3rd Combat Communications Group (CCG) and the 281st CCG, Air National Guard, Tinker AFB, Oklahoma. Equipment in the van includes a secure cord switchboard (SECORD), KY-3 secure voice terminals, and a narrow band (HY-2) trunk which will interface with AUTOSEVOCOM. The van is outsized and requires C-5 aircraft transport.

c. DoE Assets. The DoE maintains emergency response, air transportable communications services and hardware. Systems include a multi-point telephone switch, facsimile, HF/VHF radio networks (with pagers), video teleconferencing, a point-to-point microwave system, and data communications to include local area networks 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, facsimile, data, teletype, and still video operations.

d. 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:

(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.

(2) VHF radio to support on-scene 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.

e. Commercial Assets In the 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.

12-5 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 command and control 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 SRF communications officer takes the action. Incumbent upon the SRF communications officer is the responsibility to ascertain what has been accomplished prior to arrival, and to carry on from that juncture.

a. 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.

(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.

(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 National Military Command Center (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, DoD JNACC arranges for transportation of specialized communications resources.

(3) The OSC may spend considerable time away from the command post. The response force communications officer must, therefore, plan communication methods to support the mobility of the OSC. Radio nets provided for OSC 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.

(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 U.S. Army FM 24-2, "Radio Frequency Management," or U.S. Air Force Regulation 700-14, Air Force Radio Spectrum Frequency Management, references (z) and (aa). 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.

(5) One of the more complex problems facing the response force communications officer is preparation of a Communications-Electronic Operating Instruction (CEOI). The CEOI 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 CEOI is at Figure 12-1.

(6) Although COMSEC instructions are a part of the CEOI, COMSEC deserves additional emphasis. Enemy or dissident elements may be able to intercept and exploit command and control 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.

b. 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 build-up. As this build-up 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.

(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

Communications-Electronics Operating Instruction (CEOI)

(Sample Contents)

Figure 12-1. Communications-Electronics Operating Instruction (CEO).

the form of telephones and VHF/FM radios, are needed for effective operation of the JIC, and to support radiological monitoring and site restoration operations.

(2) As the response operations peak, so will the communications support required. As the response transitions into site restoration, the primary communications should be routine situation reports, supply (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 site restoration.

12-6 ACCIDENT RESPONSE PLAN ANNEX

Procedures and information appropriate for the communications annex to the accident response plan include:

a. A description of actual or projected requirements and the location of assets to fill requirements.

b. Procedures for establishing communications links with the NMCC and Defense Communications System from remote locations.

c. Procedures for obtaining leased commercial communications.

d. Procedures for obtaining Service and JCS deployable communications assets.

e. Procedures for establishing local radio nets and assignment of call signs.

f. Procedures for obtaining frequency clearances.

g. Procedures for coordinating communications with non-DoD agencies.

h. Procedures for using secure/clear fax resources.

i. Prepare an integrated communications plan.

CHAPTER 13

SECURITY

13-1 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 a National Defense Area (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 a NSA. Overseas, there is no equivalent to the NDA. The On-Scene Commander will establish a disaster cordon or Security Area, to restrict entry and to provide for public safety.

13-2 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.

13-3 SPECIFIC REQUIREMENTS

The security program at the accident scene should meet the following requirements:

a. Provide effective control of the accident area.

b. Protect nuclear weapons and components.

c. Protect other classified materials and information.

d. Protect government property.

e. Provide effective coordination with civil law enforcement agencies/host nation law agencies.

f. Provide necessary operational security (OPSEC).

g. Counter potential terrorist and/or radical group activities or intelligence collection efforts.

13-4 RESOURCES

a. Initial Response Force (IRF). 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 radiological control area. 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.

b. Service Response Force (SRF). The SRF security officer should assess manpower requirements and ensure that sufficient additional security personnel are included in the SRF. IRF security personnel may become part of the SRF 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.

c. 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.

d. Department of Energy. The DoE Nuclear Emergency Search Team (NEST) communications pod is equipped with a slow scan TV system. This system may be very useful in surveillance operations; however, care must be taken to ensure that classified components or activities are not transmitted in the clear.

13-5 CONCEPT OF OPERATIONS

a. 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 Chief of Mission. 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 National Defense Area (NDA) which may not yet be established and may be different in size. The security officer should consider the following elements in his assessment:

(1) Threat (real and potential danger to the secure area).

(2) Location (on or off military installation).

(3) Demographics and accident environment (remote, rural, suburban, urban).

(4) Terrain characteristics (critical or dominating features).

(5) Contamination (radiation intensity and extent and other hazardous materials).

(6) Accident hazards (high explosives, rocket motors, or toxic chemicals).

(7) Local meteorological conditions (include prevailing winds).

(8) Transportation network in accident area (access routes, types and quantities of vehicles).

(9) Structures in accident area (type and quantity).

(10) Safety of security personnel (fragmentation distances, contamination, cold/hot weather).

b. National Defense Area (NDA).

(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 radiological control area. Security of any portion of the radiological control area existing outside the NDA is a matter of public safety and should be provided by civilian authorities/officials; however, military assistance may be requested.

(2) DoD Directive 5200.8, and Section 21 of the Internal Security Act of 1950, references (e) and (ab), provides 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. Only IRF and SRF OSCs are authorized to designate an NDA, and then only to safeguard government resources, irrespective of other factors. The OSC should seek legal advice on any decisions regarding establishment, disestablishment, or modification of the NDA.

(3) The OSC designating the NDA must clearly define and mark its boundary. 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 DoD 5210.41-M 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.

(4) The OSC who establishes the NDA should advise civil authorities/officials of the authority and the need for the NDA and the security controls in effect. If possible, the OSC should secure the landowners' consent and cooperation. However, obtaining such consent is not a prerequisite for establishing the NDA.

(5) 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.

(6) 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 Senior FEMA Official (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 which prohibits use of DoD personnel to execute local, State, or Federal laws, unless authorized by the Constitution or an Act of Congress.

(7) When all government resources have been located, the OSC should consider reducing the size of the NDA. When all classified government resources have been removed, the NDA could 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.

c. 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.

d. Security Procedures.

(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-man rule. Lighting should be provided, 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.

(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 life saving, fire suppression, and other emergency activities may temporarily take priority over security procedures. However, as response operations progress, standard security measures specified in DoD Directive 5210.41, reference (ad), 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 the accident area made and retained.

(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.

(4) A security alert force should be considered, although early in the accident response, sufficient personnel may be unavailable to form such a force.

e. Security Considerations.

(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.

(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 DoD Directive 5200.1-R, reference (ae), 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.

(3) Critical Nuclear Weapon Design Information (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 DoD Directive 5210.2, AR 380-150, OPNAVINST 5510.1F, and AFR 205-1, references (af), (ag), and (ah), should prevail.

(4) The two-person policy is addressed in DoD and Service directives, and defined in the GLOSSARY. The

security officer must ensure that procedures provide for two-man rule compliance for all nuclear weapons and applicable components at the accident site.

(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 which 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.

(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.

(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.

f. Military Intelligence. Intelligence personnel should be used to the fullest extent and incorporated actively in the overall security posture, including, but not limited to:

(1) Advice and assistance in counterintelligence to the OSC and security staff.

(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).

(3) Coordination and advice to the OSC and security staff regarding operations security.

(4) Investigating and reporting incidents of immediate security interest to the OSC and the security staff (in cooperation with the local Federal Bureau of Investigation (FBI).

(5) Advice and assistance to the OSC and the security staff on matters of personnel and information security necessary to maintain high standards of security.

(6) Requests for large scale photographic coverage of the accident site.

13-6 ACCIDENT RESPONSE PLAN ANNEX

The security annex should describe the responsibilities and procedures of the security forces. IRF and SRF forces may prepare an annex in advance which could be modified to fit the circumstances. The security annex should include:

a. Security operating procedures to include perimeter access/entry procedures, establishing and maintaining a National Defense Area or Security Area, information security, rules of engagement, and use of deadly force.

b. 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.

c. Procedures for locating and operating the security operation center.

d. Guidance for handling unprotected personnel encountered in contaminated areas.

e. Procedures for coordinating with radiological control personnel to ensure that sentry posts outside the radiological control area are not affected by the resuspension of contaminants during wind shifts.

f. 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.

g. 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.

CHAPTER 14

MEDICAL

14-1 GENERAL

a. 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, Arkansas), the medical requirements were greatly simplified. Specifically, emergency life saving procedures in any major disaster are applicable to a nuclear weapon accident where radioactive contamination is not a factor. Even without the presence of radioactive contamination, other weapon specific nonradioactive toxic hazards may exist. However, life-saving procedures should not be delayed or omitted due to radiation contamination.

b. 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 as done for highly contagious patients. 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.

14-2 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.

14-3 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:

a. Promptly treat accident casualties and injuries, or illnesses.

b. 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.

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

d. Implement the collection of bioassay samples from response personnel, and ensure that bioassay and external exposure data becomes part of the health records.

e. Establish a heat/cold exposure prevention program.

f. Assist in casualty decontamination and supervise the decontamination of personnel when initial decontamination efforts fail to achieve desired results.

g. 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.

14-4 RESOURCES

Medical support assistance, specialized in radiological health matters, is available from the Department of Defense (DoD) and the Department of Energy (DoE) through the DoD Joint Nuclear Accident Coordinating Center (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.

a. U.S. Army Radiological Advisory Medical Team (RAMT). RAMTs are located at Walter Reed Army

Medical Center, Washington, D.C., and the 10th Medical Laboratory, Landstuhl, FRG. The teams are specially trained to assist and furnish guidance to the On-Scene Commander (OSC) or other responsible officials at an accident site and to local medical authorities concerning radiological health hazards.

(1) The RAMT provides the following functions:

(a) Guidance relative to the potential health hazards to personnel from radiological contamination, or exposure to ionizing radiation.

(b) Evaluation of survey data to provide technical guidance to the responsible officials utilizing radiologically contaminated areas.

(c) Monitoring medical facilities and equipment where contaminated patients have been evacuated.

(d) Advising the commander regarding the potential health hazards from exposure to sources of ionizing radiation and the decontamination of personnel, medical treatment facilities, and medical equipment.

(e) Advising on early, and follow-up, laboratory and clinical procedures.

(f) Assisting the OSC with the bioassay program.

(2) Each RAMT is comprised of a team leader, who is a nuclear medical science officer with training in monitoring and radiation dose evaluation, and a medical officer with appropriate training and experience. Also, two qualified 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.

(3) Additional information can be obtained from the Commander, Walter Reed Army Medical Center, HSHL-QHP/RAMT, Washington, D.C., 20307 or by referring to AR 40-13, reference (ai). RAMT services should be requested through the Army Operations Center, or the JNACC.

b. Armed Forces Radiobiology Research Institute. The Armed Forces Radiobiology Research Institute 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 OSCs 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 OSC 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 DNAAT.

c. Department of Energy. Major DoE installations have medical support capabilities which, if needed, may assist. Additionally, DoE facilities that handle radiological material routinely are equipped to administer medical treatment for radiological casualties. The Radiation Emergency Assistance Center Training Site (REAC/TS), Oak Ridge, Tennessee, 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 chelating agents as a part of the DoE Accident Response Group (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.

14-5 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 Initial Response Force (IRF) and Service Response Force (SRF).

a. Pre-Accident Preparation. Before an accident occurs, the response forces (IRF or SRF) 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 SRF 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 which 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 14-A.

b. 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, Explosive Ordnance Disposal (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 shall be worn by emergency medical personnel. Respiratory protective devices shall be worn based on the non-radiological hazards (smoke or fumes) or as required by the guidelines in Chapter 5 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:

(1) Assess and assure an open airway, breathing, and circulation of the victims. Administer CPR if necessary, using a bag-mask, positive pressure ventilator, or, mouth-to-mouth resuscitation.

(2) Move victims if possible, away from the contaminated area by scoop stretchers. Take routine precautions. Do not delay customary life saving procedures (drugs, MAS Trousers) because of radiological contamination.

(3) Administer intravenous fluids for shock. (Prophylactic precautionary IV's should be delayed because of possible contamination of the skin).

(4) Control hemorrhage and stabilize fractures.

(5) If a victim is unconscious, consider medical or toxic causes since radiation exposure does not cause unconsciousness or immediate visible signs of injury.

(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.

(7) After the immediate medical needs are met, monitor the victim for possible contamination before transporting to the hospital. Note and record the location and extent (in cpm) of the contamination 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.

(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.

(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 to monitor or decontaminate him.

(10) Attendant medical personnel will then process the patients through the Contamination Control Line. **AS LONG AS THE PATIENT REMAINS WRAPPED IN THE SHEET, HE DOES NOT POSE A THREAT OF SPREADING CONTAMINATION AND COMPROMISING THE CONTAMINATION CONTROL LINE.** Hence, the NAICO will allow these patients to be evacuated without decontamination. 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 Contamination Control Line. The patient can then be loaded into the ambulance or evacuation vehicle, and be transported to the receiving medical facility.

(11) To ensure that the receiving facility is prepared for the arrival of the victims, notify the facility of the following:

(a) Number of victims.
(b) Area of injuries, vital signs (if known), and triage category.
(c) Extent of contamination, if known.
(d) Areas of greatest contamination.
(e) Any evidence of internal contamination.
(f) The radionuclide and the chemical form, if known, and by what instrument it was measured.
(g) Any exposure to non-radiological toxic materials.

Note: Procedures listed in above paragraphs (c), (d), and (e) may be determined enroute 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.

(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:

(a) The room used has an isolated air supply.
(b) Covering the area with plastic sheeting or "chucks" to contain loose contamination.
(c) Ensuring that personnel have the appropriate radiation detection instrumentation, i.e., alpha scintillation detectors, and they are versed in the use of this equipment.
(d) 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.

(13) The decontamination of the patients may then begin. These measures include:

(a) Carefully opening the sheet or plastic wrapping surrounding the patient avoiding spreading any contamination.
(b) 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 an 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.
(c) 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.

(14) 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 the RAMT team.

c. 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, liaison must be conducted 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.

(1) Use rooms with an isolated air supply.
(2) Use scrub clothes, shoe covers, and rubber gloves, and bag them and any other clothing, sheets or materials which may have come in contact with the patient when leaving the room.
(3) Obtain radiation monitoring assistance for detecting plutonium or uranium.
(4) Use plastic sheeting on floors to facilitate decontamination and cleanup.
(5) Use contagious disease control procedures (for example, limiting the access and numbers of people involved in the treatment of patients).

d. 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 decontamination 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, AFR 30-25, and BUPERS Manual Article 4210100, references (aj), (ak), and (al). Civil authorities must be notified of any civilian casualties as quickly as possible, and if required, aid in identification of the deceased prior to decontamination. 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, reference (am).

e. Medical Clearing Facility. A medical clearing facility should be established near the contamination control station with supplies for medical treatment of response force injuries, and to assist in decontamination of skin. Minimum response force medical staffing after the initial emergency response should include a medic, with a physician, and medically trained health physicist, on call. Should an injury occur within the radiological control area and injuries permit, the injured person should be brought to the contamination control station and clearing facility by personnel and vehicles already in the area. A separate first aid station may be needed to support the base camp.

f. Collection of Bioassay Samples. Bioassay programs and techniques are discussed in Chapter 8. Collection of required bioassay samples from response force personnel is normally a responsibility of medical personnel. Procedures for collecting and marking samples should be coordinated with the Joint Hazard Evaluation Center (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 radiological control area, or of those who have a positive nasal wipe.

g. Hot Cold Weather Operational Conditions.

(1) The reduction in natural cooling of the body caused by wearing full anti-contamination 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° 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 14-1 is taken from DA Circular 40-82-3, reference (an), 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 substracting ten (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.

(2) Specialized personnel cooling equipment (for example, cooling vest) should be used to allow additional stay-time for personnel in extreme heat conditions.

(3) The use of cold weather gear, anti-contamination clothing, and respiratory equipment presents severe demands on personnel. Personnel must be monitored closely to prevent frostbite and other cold weather effects.

h. 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 OSC and coordinated with the JIC as discussed in Chapter 16. 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 non-medical information are referred to public affairs personnel.

i. Base Camp Medical Support. Base camp support requirements include treatment of on-the-job injuries

TABLE 14-1. Heat Injury Prevention Guidelines.

Botsball Temperature	Heat Condition	Water Intake (qts/hr)	Work/rest Cycle (min)
80-83	Green	0.5-1.0	50/10
83-86	Yellow	1.0-1.5	45/15
86-88	Red	1.5-2.0	20/30
Above 88	Black	2.0	20/40

and sickness; inspection of field billeting and messing facilities, and evaluation of the adequacy of latrine facilities, sewage disposal; and water supply. Those personnel treated for cuts or open sores should be prohibited from entering the contaminated area and their supervisors notified of the restriction.

14-6 ACCIDENT RESPONSE PLAN ANNEX

The medical annex should describe responsibilities and special procedures used by the medical staff. This annex should include procedures for:

a. Differentiating between medical and radiological safety/health physics personnel.

b. Receiving and treating contaminated patients.

c. Establishing and operating a medical clearing facility at the accident scene, including isolation of contaminated patients.

d. Identifying and locating facilities for treating radiological health problems.

e. Evacuating contaminated casualties to major medical facilities.

f. Decontaminating and processing the remains of deceased.

g. Establishing the relationship of the response force medical staff and specialized medical teams responding to the accident.

14-7 SPECIALIZED COURSES FOR MEDICAL RESPONSE PERSONNEL

a. Nuclear Hazards Training Course. Several classes are scheduled each year at the Interservice Nuclear Weapons School, 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.

b. Medical Effects of Nuclear Weapons. Week-long classes are scheduled each year by the Armed Forces Radiobiology Research Institute 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.

APPENDIX 14-A

NON-RADIOLOGICAL TOXIC HAZARDS

14-A-1 GENERAL

Several weapon specific non-radiological hazards may be present as a result of a nuclear weapon accident.

14-A-2 PURPOSE

This appendix provides information useful in implementing training programs for medical personnel responding to nuclear weapon accidents.

14-A-3 NON-RADIOLOGICAL TOXIC HAZARDS

a. Beryllium (Be).

(1) Beryllium is a light, gray-white non-radioactive metal, hard and brittle, and resembles magnesium.

(2) Hazards and Health Considerations. 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 beryliiosis. 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. Beryllium or its compounds, when in finely divided form, should ever be handled with the bare hands but always with rubber gloves. An M17, or equivalent protective mask/respirator, and anti-contamination clothing must be worn in an area known, or suspected, to be contaminated with beryllium dust. Self-contained breathing apparatus is necessary when beryllium fumes or smoke are present. Decontamination of personnel, terrain, or facilities will be similar to radiological decontamination. 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.

b. Lithium (Li).

(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.

(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 which affects the body, especially the eyes, in the same manner as lye (sodium or potassium hydroxide). Respiratory protection and fire fighters clothing are required to protect personnel exposed to fires involving lithium or lithium hydrides. A self-contained breathing apparatus is necessary if fumes from burning lithium components are present. Protection for the eyes and skin is necessary for operations involving these materials.

c. Lead (Pb). 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 Mask will protect personnel against inhalation of lead compounds.

d. 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 which 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.

e. High Explosives (HE). Information on pressed, cast, and insensitive HE will be extracted from EOD Training Publication 60-1, reference (ao), after a DoE classification review.

f. 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. Self-contained breathing apparatus is required in vapor/liquid concentrations.

g. Fuming Red Nitric Acid. Red nitric acid is an oxidizer for some missile systems. It is 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. Self-contained breathing apparatus is required in vapor/liquid concentrations.

h. 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.

i. Composite Fibers (CF). CF are carbon, boron, and graphite fibers that are milled into composite epoxy packages which are integral aircraft structural members. Upon fire or breakage of the epoxy outer layer, CF strands can be emitted into the environment. The CF strands do not present a health hazard. However, 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.

CHAPTER 15

WEAPON RECOVERY OPERATION

15-1 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.

15-2 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 hazardous materials.

15-3 SPECIFIC REQUIREMENTS

Service responsibilities for weapon recovery operations include all actions through transfer of weapon custody to a designat Department of Energy (DoE) representative. During weapon recovery operations, personnel:

a. Determine the status and location of the weapon(s), including whether high explosive detonations occurred.

b. Assess weapon(s) damage.

c. Perform render safe procedures on the weapon(s).

d. Initiate a systematic search until the location for the weapon(s) and all weapon components is known.

e. Establish an area and develop procedures for processing/packaging contaminated weapon(s) and components.

f. Perform necessary actions for transport or shipping of the weapon(s) and components for interim storage and/or final disposition.

15-4 RESOURCES

The On-Scene Commander (OSC) can request many types of support during the accident response operation. The principal resources available to meet weapon recovery responsibilities are Explosive Ordnance Disposal (EOD) Teams and the DoE Accident Response Group (ARG).

a. Explosive Ordnance Disposal. 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:

(1) The Service or Unified Commander having primary responsibility for command and control on-site at the accident provides, or obtains from the appropriate Service, EOD teams that are Service certified on the weapon(s).

(2) All Service or Unified Command EOD teams provide emergency support until the designated EOD team arrives.

(3) Navy EOD teams recover weapons located under water because only Navy EOD personnel are trained in diving techniques.

(4) EOD personnel, officer and enlisted, are graduates of the Navy School, Explosive Ordnance Disposal at Indian Head, MD. They are trained in access techniques and are the only personnel qualified to perform render safe procedures. 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 render safe procedures for weapons unique to their individual Service.

(5) The EOD team provided, or obtained, by the Service having primary command and control 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. The continuation of any render safe procedures are conducted by an EOD team qualified on the particular weapon(s) involved.

(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 radiological control 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. Navy EOD teams maintain a complete inventory of all U.S. nuclear weapon publications, and Army EOD units maintain publications for render safe procedures (RSP) for all Services nuclear weapon systems. 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 OSC.

(7) The EOD teams actions, by priority are:

(a) Prevention of nuclear detonation.

(b) Prevention of a nuclear contribution or a high explosive detonation.

(c) Identification, detection, containment and, if required, the elimination of explosive and radiological hazards resulting from the accident or incident.

(d) Protection of personnel against hazards noted in (a) through (c) above.

b. 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 render safe and recovery procedures. Each nuclear weapon has render safe procedures developed, evaluated, coordinated, and authenticated as binding jointly by the DoD and DoE. Since weapons may have been subjected to extreme stress during an accident, consideration may be give to the DoE unique equipment to assess the applicability of these procedures.

(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. LLNL has an equivalent radiographic capability which serves as a back-up to the LANL unit.

(2) DoE aerial radiological surveys by the Aerial Measurement System (AMS) assist in locating weapons and weapon components. This capability is addressed in Appendix 5-C.

(3) Additional information concerning the ARG, DoE radiographic capabilities, the AMS, and other DoE capabilities may be obtained from the JNACC.

15-5 CONCEPT OF OPERATIONS

Weapon recovery begins with the initial reconnaissance, proceeds through the conduct of render safe procedures, and ends with hazard removal and disposal of the weapons and components. These operations are discussed in this concept of operations. The two-person policy 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 OSC should implement necessary security procedures as soon as possible.

a. Initial Entry. During the initial entry, weapons and the aircraft, vehicle, or missile wreckage present several hazards. Nuclear weapons and some components contain conventional explosives and other hazardous materials. 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 which 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 initial reconnaissance team should mark hazards clearly.

b. Render Safe Procedures. The OSC is responsible ultimately for the proper implementation of any render safe procedures. The EOD team evaluates and analyzes the accident situation and advises the OSC of the safest and most reliable means for neutralizing weapon associated hazards. Render safe procedures 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 OSC 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:

(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.

(2) Consequences should be evaluated before exposing personnel to hazards.

(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.

(4) Staging, decontamination, packaging, and the method, type, and final disposition of shipment should be an integral part of the RSP planning phase.

(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.

c. Nuclear Weapon Security. The two-man rule must be enforced strictly when working with nuclear weapons. The OSC should ensure that all personnel are familiar with the rule 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 critical nuclear weapon design information (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.

d. 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 OSC 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 OSC concerning additional search procedures which can be tried, and at what point the search for components will cease. Search techniques that may be employed are:

(1) Coarse 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.

(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 to provide high resolution photography.

(3) Instrument Search. Metal and radiation detectors monitor those areas where weapons or components were found previously. This method may supplement the visual search.

(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.

(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 Joint Hazard Evaluation Center (JHEC) prior to implementing techniques to assess personnel protection requirements due to resuspension and the potential impact on site decontamination and restoration.

e. Hazard Removal. Another major step in weapon recovery begins with the removal of identified hazards. The OSC 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 high explosives.

f. 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.

(1) On-site disposal of high explosives 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.

(2) If open storage is used, protection from the elements and information sensors, including satellite surveillance, must be provided for weapons and weapon components.

g. 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.

h. 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 the DoE. Therefore, close coordination between the OSC and the DoE team leader is necessary throughout the weapon recovery phase. Custody of damaged weapon(s) and components is transferred to the DoE at a point determined jointly by the OSC and the DoE team leader.

i. 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 DoT.

j. 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.

15-6 ACCIDENT RESPONSE PLAN ANNEX

The weapon operations annex/recovery plan should establish the procedures used during weapon operations. This annex should include:

a. Definition of the relationship between EOD personnel and DoE weapon experts and their respective responsibilities.

b. Procedures for locating and identifying weapon components and debris.

c. Procedures for establishing a secure staging/storage area.

d. Procedures for moving weapons and components to the secure staging/storage area.

e. Procedures for packaging weapon components.

f. Procedures for shipping weapons and components.

g. Guidelines for establishing electromagnetic radiation hazard areas.

h. Procedures for re-establishing accountability for weapons and weapon components.

CHAPTER 16

PUBLIC AFFAIRS

16-1 GENERAL

a. A nuclear weapon accident, whether in a remote or populated area, has immediate public impact. Public affairs activities during the initial accident response are perhaps among the most critical aspects of the entire response effort. Within hours of the accident, news media will be at the scene. Local citizens will seek information as to how the accident affects them. Given the public's apprehension and the news media's widespread coverage of radiation incidents/accidents, a dynamic, comprehensive public affairs program must be conducted to ensure credibility of the response effort. Timely, accurate information and frequent updates are essential to keep the public informed and to maintain credibility.

b. All Department of Defense (DoD) response element commanders will face a wide range of complex public affairs issues which require immediate attention. The On-Scene Commander (OSC) communicates or ensures communication with the Office,Assistant Secretary of Defense (Public Affairs) (OASD(PA)). The OSC should devote considerable time to meetings with news media, public officials, and private citizens. To gain the public confidence, public information and community relations programs must be established.

c. An internal information program should be conducted to provide information about policies and daily operational status to all response elements. Cognizant public affairs staffing is required to assist the commander with these programs.

d. The Joint DoD, Department of Energy (DoE), and Federal Emergency Management Agency (FEMA) Agreement, reference (a), contains public affairs related information. If conflicts exist between guidance contained in this manual and DoD directives and agreements, guidance in the DoD document(s) should prevail.

16-2 PURPOSE AND SCOPE

This chapter provides public affairs guidance on procedures and issues which may be encountered at the scene of a nuclear weapon accident or significant incident (occurring in the United States, its territories and possessions or overseas). Included are contingency press releases extracted from the DoD Directive 5230.16, reference (b), and fact sheets on radiation.

16-3 SPECIFIC REQUIREMENTS

The OSC has specific public affairs responsibilities as indicated below. The military Services may have imposed additional requirements contained in appropriate Service regulations. The OSC will:

a. Establish or ensure direct communications with OASD(PA) from the accident scene.

b. Establish a Joint Information Center (JIC) coordinating with DoS, and/or FEMA, DoE, state, and local authorities at the scene of the accident.

c. Provide news media support at the accident scene.

d. Protect classified information.

e. Assess public understanding and identify concerns about nuclear issues.

f. Provide internal information/guidance.

g. Identify and respond to community relation needs.

16-4 RESOURCES

The DoD response element commander should have qualified public affairs officers from the supporting installation and/or staff as members of the response force. These PAOs form part of the DoD element of the JIC. Other public affairs support is available from the following:

a. Department of Defense: The OASD(PA), as the senior DoD public affairs organization, coordinates with the White House Press Office and other departments and agencies at the national level. The OASD(PA) may be represented at the Crisis Coordination Center (CCC) or the accident scene during emergencies. Members of the military Service headquarters and major command public affairs staffs may augment the OSC's public affairs staff. The Defense Nuclear Agency (DNA) PAO is knowledgeable on nuclear weapons issues and will assist as a part of the DNA Advisory Team.

b. Department of Energy: A DoE public affairs officer will accompany the DoE Team Leader to the accident scene and be present in the JIC. Other DoE public affairs personnel from DoE field operation offices, national laboratories, and DoE contractors may also be requested to augment the JIC operations. DoE PAOs are knowledgeable in nuclear weapons matters.

c. Department of State: The DoS exercises diplomatic control of the U.S. response to a nuclear weapon(s) accident outside the U.S., its territories, and possessions or if the accident has trans-boundry implications. The U.S. Chief of Mission (COM) will be the focal point for diplomatic and political decisions of the U.S. government. The COM will provide significant public affairs expertise and information on the host country's public reaction. The COM will be assisted by a team from the embassy's Emergency Action Committee (EAC) with augmentation as required by the situation. Additionally, liaison officers will be provided to the OSC and the JIC.

d. Federal Emergency Management Agency: Public affairs personnel will accompany the senior FEMA official to the accident scene. They will be present in the JIC and provide a wide variety of skills in all public affairs operations dealing with disaster and emergency operations. Additional FEMA resources are available from FEMA headquarters, regions, and FEMA's corps of reserve PAOs.

e. Other: Public affairs officers from other Federal agencies involved in the Federal response effort (for example, Health and Human Services, Department of Transportation) also may be present at the scene, and should be integrated into the JIC. Local and state public affairs personnel, although not part of the response element, should be invited to participate in the JIC to provide coordinated responses to the media and general public.

16-5 CONCEPT OF OPERATIONS

A nuclear weapon accident and subsequent response operations, whether in a remote or a populated area, will generate immediate public interest. The public must be notified immediately in the event their safety or welfare is endangered. All senior Federal officials, both military and civilian, and responsible State and local authorities and foreign government officials must be fully informed of conditions and actions at the accident scene so they may be prepared to respond accurately to queries from the media and the public. To gain the confidence of the public, a credible public affairs program should be implemented immediately. The public affairs personnel must handle media and public inquiries about the accident and its consequences, provide internal information to the members of the response force, and implement community relations support to the affected communities. Information released about the accident must be both accurate and consistent. Information to be released should be coordinated with the OSC's legal representative (or officer) to ensure that legal implications are considered. The OSC should use technical advisors to respond to and/or address unclassified issues of a technical nature.

a. Policy. DoD policy is stated in DoD Instruction 5230.16, reference (b), which outlines specific procedures for announcements of accidents in the U.S., its territories and possessions or overseas. It is the DoD policy to provide effective public affairs activities at the scene of a nuclear weapon accident. It is also the DoD policy to neither confirm nor deny the presence of nuclear weapons or nuclear components at any specific location. Two exceptions to this policy are:

(1) The OSC *is required to confirm* the presence of nuclear weapons or radioactive nuclear components in the interest of public safety. 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. The OASD(PA) will be advised of the notification as soon as practical if this exception is used.

(2) The OSC *may confirm* or deny the presence of nuclear weapons *to reduce or prevent widespread public alarm*. Any statement confirming the presence of nuclear weapons should contain information about the possibility of injury from high explosive weapon components and/or potential radiation exposure. If injury or radiation exposure is unlikely, it should also be stated. The OASD(PA) should be notified in advance, if practical, or as soon as possible thereafter, if this exception is used.

(3) In locations outside the U.S., its territories and possessions, unless bilateral agreements exist, the OSC must have the concurrence of the appropriate theater

CINC, and the host government, through the U.S. Chief of Mission, prior to exercising the exceptions above.

(4) Contingency releases for the above exceptions are contained in Appendix 16-A.

(5) Radiation information fact sheets for the general public and medical personnel are in Appendix 16-B.

b. Public Affairs Responsibilities. The OSC has specific public affairs responsibilities. These are:

(1) Establish communications with OASD(PA). The OSC should ensure that the public affairs office establishes direct communications with OASD(PA) as expeditiously as possible (Area Code (202) 697-5131, AV 227-5131). Any means available should be used (for example, the pay telephone if military communication is unavailable). Communications are essential since the OSC is the senior DoD representative at the scene and must have access to current policy guidance and statements issued at the national level. Moreover, the Service chief of public affairs must be kept fully informed. Also, direct communications ensures that timely, accurate information can be provided at the national level.

(2) Establish a JIC. The OSC establishes a JIC in coordination with DoS, DoE, FEMA, state and local agencies officials, as appropriate. Local officials should be invited to provide representatives to the JIC. All public affairs activities should be coordinated in advance with DoS and/or FEMA, DoE and other agencies represented in the JIC. Located in an area near the accident scene, the JIC serves as the focal point for information about the accident. A location in a permanent facility (for example, hotel, motel, office building) is preferred due to support requirements. The OSC should provide dedicated administrative, communications, and logistical support for the JIC. The minimum communications required by DoD in the JIC are two dedicated telephone lines and a facsimile reproduction capability. However, intense media interest likely will necessitate the installation of additional phone lines. The OSC provides primary leadership and direction to the JIC until such time as responsibility may transition to the appropriate agency and/or affected country to complete the near and long-term follow-up monitoring duties.

(3) Provide Support for News Media. The OSC is authorized to provide support to the news media covering a nuclear weapon incident/accident. Support will be the same as that authorized on a military reservation (for example, transportation, logistical, and administrative). Specific support will depend upon the situation and available resources. The media should be briefed on the extent of support available.

(4) Protect Classified Information. The OSC is responsible for reviewing all material, news releases, and information released to the public. Information on nuclear weapons and their storage is classified Restricted Data/Formerly Restricted Data and is very sensitive (for example, information concerning design of nuclear weapons and components, disclosing whether or not a weapon contains tritium, and its physical state and chemical form). If declassification of information is needed, it should be referred to DoD for consideration and coordinated with DoE, as required. When the JIC responsibility and authority is transferred to FEMA, to an agency following a U.S. territory accident or to the involved government following an overseas accident, all public affairs matters pertaining to the technical response are coordinated in advance with the OSC, who has final clearance responsibility in the classification area.

(5) Assess Public Understanding. The OSC should identify public concerns about DoD nuclear matters and take appropriate action in the public affairs arena. This is a continuing effort, before, during, and after an accident. During the accident, the JIC should be responsible for public affairs planning and analyzing feedback received from the media, the general public and through community relations programs to ensure that the public affairs program is meeting the needs of the affected public. Programs should be initiated, modified, or stopped based on the data obtained.

(6) Personnel Guidance. The OSC should ensure that all response force personnel (including civilian personnel working with the response force) are briefed on accident response and public affairs policy through an internal information program. Specific guidance should be provided to response force personnel, especially those who may come in contact with the general public (for example, security personnel, medical personnel, and radiological survey or monitoring teams) on how to respond to queries about the accident and response operations.

c. The OSC should consider forming a Community Emergency Action Team (CEAT) composed of public affairs, legal, medical, security, communications, administrative, logistics, and other personnel from DoD and civil resources. The CEAT should function under the OSC and operate out of the JIC to facilitate coordination. The purpose of the team is to make experts in various functional areas available to assist the affected civilian community. The CEAT activities should be coordinated through the Senior FEMA Official (SFO) and/or U.S. Chief of Mission to assure a unified approach in working with the community. Phone lines should be established with a published number for public questions and information.

APPENDIX 16-A

PUBLIC AFFAIRS GUIDANCE

CONTINGENCY RELEASES

CONTINGENCY RELEASE NUMBER 1

"No Danger to the Public"
(Confirms to reduce public alarm)

(Format of sample release to be used when no danger exists to the public from contamination or blast, but when confirmation of the presence of a nuclear weapon or nuclear components significantly prevents or reduces widespread public alarm).

A U.S. (type) aircraft (other type of transportation) carrying hazardous material (classified cargo or unarmed nuclear weapon(s), for example) crashed (or other circumstances) approximately (location and time).

The public is requested to stay out of the area under surveillance by guards to preclude any remote possibility of hazard from the accident (or conventional high explosives detonation) and to aid removal operations. There is no need for evacuation. There is no danger of nuclear detonation.

CONTINGENCY RELEASE NUMBER 2-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 hazardous material 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.

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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

Military personnel have been dispatched (will be dispatched) and will arrive (are scheduled to arrive) soon at the site.

CONTINGENCY RELEASE NUMBER 2-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 hazardous material 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 enroute 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.

CONTINGENCY RELEASE NUMBER 3

"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 explosive 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 OSC 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 the 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 which 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 enroute 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 4-6 hours.

A U.S. (Service) team from (name of installation) is enroute 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 enroute from (name of facility) to (name of facility).

The cause of the accident is under investigation.

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 or deny the presence of nuclear weapons at any particular location."

APPENDIX 16-B

RADIATION FACT SHEETS

FACT SHEET 1

CHARACTERISTICS, HAZARDS AND HEALTH CONSIDERATIONS OF PLUTONIUM

(For release to the general public)

The accident at ________________ 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 which 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 which 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 penetrate materials very substantially. 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 two (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 ethylene diamine trichlor acetic acid (EDTA) or diethylene triamine pent acetic 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 over 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 a 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 all those who need it.

FACT SHEET 2

MEDICAL DEPARTMENT FACT SHEET ON PLUTONIUM

(Use with Characteristics, Hazards and Health Considerations of the Plutonium Fact Sheet)

Plutonium is a highly reactive element, which can exhibit five oxidation states, from 3 to 7. 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, which 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 Radiation Emergency Assistance Center Training Site (REAC/TS) because of the hazard of the substances involved. DTPA compounds are defined as investigational new drugs which require the advice and concurrence of REAC/TS before administration. REAC/TS can be contacted at the following 24-hour number: (615) 481-1000.

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 nCi 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 OSC 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 relative 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 which 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 Atmospheric Release Advisory Capability (ARAC) plots which 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. Department of Energy (DoE) can calculate a dose equivalent [illegible]ersons in the area of the initial cloud passage. Gene[illegible]y, 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 recommen[illegible]d 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 Public Affairs Office (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 in [illegible] the control boundaries and may help in making the eventual clean up 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 which 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 anyway, or are within the National Defense Area (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 (ap). The Service/DoE health physicists should be consulted to give the best approximation of the public risk, and this can be compared with the risks in the guide.

CHAPTER 17

LOGISTICS SUPPORT

17-1 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 weapons 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 which are directly chargeable to, and caused by, the incident/accident. DoD 4000.25.1-M, reference (aq) 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, decontamination and restoration operations involving up to 1,000 people may require six months or more to complete.

17-2 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.

17-3 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:

a. Messing and billeting facilities for response force personnel and news media.

b. Sufficient water, potable and or non-potable, to support personal by response force personnel, equipment and personnel decontamination stations, temporary fixation of contamination by sprinkling, and leaching operations.

c. Sanitation facilities for response force personnel and news media.

d. Laundry facilities for contaminated and uncontaminated clothing.

e. Petroleum, oil, and lubricants.

f. Transportation.

g. Maintenance support.

h. Heavy equipment for base camp construction and recovery/restoration operations.

i. Electrical power.

j. Anti-contamination and other specialized clothing climate dependent).

k. Packaging and shipping materials for weapons, components, and contaminated waste.

l. Rapid transport (air or ground) from the airhead or the nearest military installation during early stages of accident response.

m. Documentation of accident-related costs.

n. Logistical support unique to the Joint Information Center (JIC) (see Chapter 16, Public Affairs).

o. Airhead cargo support for air delivery of supplies to remote sites.

p. Medical evacuation of acute casualties.

17-4 RESOURCES

Response to a nuclear weapon accident is a high priority operation, and all required resources from the Department of Defense (DoD), Department of Energy (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.

a. Base Camp Support. If accident location dictates the establishment of a base camp for response personnel, HARVEST EAGLE, a mobile messing and billeting package maintained by the Air Force, may be used. Details on HARVEST EAGLE capabilities and request procedures are in Appendix 17-A

b. Anti-Contamination Clothing. Sources of anti-contamination clothing are in Appendix 17-A.

c. Contaminated Laundering Facilities. A listing of DoE contaminated laundering facilities is in Appendix 17-A.

d. General Services Administration (GSA) Support. A GSA representative may accompany Federal Emergency Management Agency (FEMA) personnel and can assist in obtaining telephone service, office and other building spaces, and other administrative and support services.

17-5 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 restoration 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.

a. 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:

(1) A materiel control officer.

(2) Three or four administrative supply personnel to maintain the document register and submit requisitions.

b. Project Code Generation. Immediately upon notification of a nuclear weapon accident, the Service Response Force (SRF) logistics staff officer should request assignment of a Joint Chiefs of Staff (JCS) project code from the Joint Material Priorities and Allocations Board, an Agency of the Joint Chiefs of Staff, through the On-Scene-Commander (OSC), 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:

(1) The type of project code required (always 9 Alpha Alpha).

(2) Project name.

(3) Service monitor or coordinator.

(4) Proposed effective date.

(5) Proposed termination.

(6) Force/activity designator.

(7) Brief narrative background on the nature of the requirement.

(8) Where available, units and forces using the project code should be included.

c. 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 two to three hours 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.

d. 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 may be requested from the Air Force. 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.

e. 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 reduce the number of maintenance personnel on-site to a minimum, rotation of vehicles with the providing organization is recommended. As a alternative, consideration may be given to replacing tactical vehicles with GSA rental vans with six-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 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 site restoration 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 should be addressed in the contract.

f. Support for the Department of Energy. The DoD is responsible for providing logistics support to the DoE Accident Response Group (ARG). OSCs should be prepared to support from 7-12 persons in the ARG advance party who arrive within 12-24 hours after the accident. Up to 70 ARG personnel may be at the site within 48 hours following the accident, depending on the level of DoE support required. Early coordination with the Joint Nuclear Accident Coordinating Center (JNACC) will help identify numbers of personnel and type of support required by the ARG. The ARG has a support coordinator who will work with the logistics staff to ensure that all ARG requirements are identified. The support coordinator will normally accompany the advance party of the ARG to the accident site. Other agencies should arrive on-site with an organic capability to support their personnel and operations a minimum of three days.

g. Local Service Contracts. Use of local service contracts to facilitate logistics support is recommended for the following services:

(1) Petroleum, oil, and lubricants (POL).
(2) Water.
(3) Sanitation.
(4) Maintenance.
(5) Laundry of non-contaminated clothes.

h. Contaminated Laundry Support. Decontaminating and cleaning anti-contamination 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. Appendix 17-A provides a reference list of DoE contaminated laundry facilities. Assistance in arranging for work by these facilities, additional information on their capabilities, and information on commercial facilities may be requested from the JNACC. Phone numbers are listed in Appendix 1-G.

i. 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 who the approval authority is. The status of all requests should be monitored and any problems encountered reported to the requesting person or organization.

j. News Media and JIC 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 Public Affairs Office (PAO) to determine specific requirements. The Joint Information Center (JIC) should be provided full logistical support including transportation, expendable and non-expendable equipment, and supplies. Specific requirements will be determined by the PAO.

17-6 ACCIDENT RESPONSE PLAN ANNEX

The Logistic Support annex should provide procedures for establishing and maintaining support for response force operations. This annex should include:

a. Procedures for obtaining appropriate JCS and/or Service project codes.

b. Procedures for establishing and supporting a base camp in remote areas.

c. Procedures for establishing maintenance support or equipment rotation during extended operations.

d. Procedures for laundering contaminated clothing, including shipping, if required.

e. Sources of anti-contamination clothing.

f. Procedures for delivery of requisitioned material to the accident site.

APPENDIX 17-A

LOGISTICS RESOURCES

17-A-1 HARVEST EAGLE KITS

a. HARVEST EAGLE kits are air transportable operations support sets for supporting units that operate in remote locations where prepositioning is not politically or economically feasible. The kits include tents, field kitchens, cots, and similar housekeeping items. Additional equipment includes generators, NF-2 "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 kits are designated war reserve materials and maintained in a ready-to-deploy status in CONUS by the 4400 Mobility Support Flight, Robbins AFB, Georgia. These kits are under the operational control of HQ TAC/LGX.

b. Each kit can support 1,100 people, and the 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 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.

c. HARVEST EAGLE kits are designated war reserve material and are maintained by TAC, USAFE, and PACAF. Each command has four kits.

17-A-2 ANTI-CONTAMINATION CLOTHING SOURCES

a. Either permanent or disposable anti-contamination clothing is used for nuclear accident response.

b. Disposable Anti-Contamination Clothing. Sources for disposable anti-contamination clothing area as follows:

(1) Defense Apparel
247 Addison Road
Windsor, CT 06095
Comm (800) 243-3847

(2) Nuclear Power Outfitter
P.O. Box 737
Crystal Lake, IL 60014
Comm (815) 455-3777

(3) Euclid Garment Manufacturing Company
333 Martinel Drive
Kent, OH 44240
Comm (216) 673-7413

(4) Durafab Disposables, Inc.
P.O. Box 658
Cleburne, TX 76031
Comm (817) 645-8851

(5) Elwood Nuclear Safety
2180 Elmwood Ave
Buffalo, NY 14216
Comm (716) 877-6621

c. Permanent Anti-Contamination Clothing. National stock numbers (NSN) for permanent anti-contamination 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
Gloves Shells, Radioactive	8 through	8415-00-782-281
Contaminant 10	8415-00-782-2814	
Shoe Covers	Small through	8430-01-712-2872
	Extra Large	8430-01-721-2876
Overshoe, Combat	Small	8430-01-048-6305

17-A-3 CONTAMINATED LAUNDERING FACILITIES

a. The Department of Energy (DoE) operates facilities capable of laundering plutonium contaminated clothing at the following locations:

(1) Savannah River Operations Office
Savannah River Plant (DuPont)
Aiken, SC
Contamination Limit: 200 dpm/cm2
Capacity: 12,000 suits/day

(2) Richland Operations Office
Rockwell Hanford
Richland, WA
Contamination Limit: 667 dpm/cm2
Capacity: Very large quantities (currently servicing 3-5,000 radiation workers per day)

(3) Chicago Operations Office
Brookhaven National Laboratory
Brookhaven, LI New York
Contamination Limit: Case-by-case basis
Capacity: 15 suits/hr

(4) Nevada Operations Office
Reynolds Electrical & Engineering Co., Inc.
Las Vegas, NV
Contamination Limit: 33 dpm/cm2
Capacity: 1,800 suits/day

(5) Albuquerque Operations Office
Mound Facilities
Miamisburg, OH
Contamination Limit: 100,000 dpm (average)
Capacity: 1,500 suits/day

(6) PANTEX Plant (Mason & Hanger-Silas Mason Co)
Amarillo, TX
Contamination Limit: None established
Capacity: 1,000 suits/day

b. 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.

Note: DoE laundry services should be arranged through the DoE JNACC.

NOTE: Additional information on Radiac Equipment and assets can be found in DNA 5100.52.1L, reference (ar).

CHAPTER 18

LEGAL

18-1 GENERAL

The occurrence of a nuclear weapon accident will present a myriad of complex legal problems for the On-Scene Commander (OSC) of the Initial Response Force (IRF) and the Service Response Force (SRF). The OSC represents the U.S. Government 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 OSC in resolving these issues. The Senior military member of the legal element responding with the staff of the OSC is the Department of Defense (DoD) Principal Legal Advisor (PLA) to the OSC.

18-2 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.

18-3 SPECIFIC REQUIREMENTS

The PLA will:

a. Advise the OSC and functional staff elements on any matters related to the accident.

b. Organize and supervise the legal functional element at the site of the accident, including establishing and operating a claims processing facility.

c. Coordinate technical legal matters with a higher authority when required.

d. Coordinate legal issues with the principal legal advisors of other participating departments or agencies as required.

e. Provide legal advice and assistance to other Federal officials upon request.

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

g. Review proposed public statements for legal sufficiency and implications.

18-4 RESOURCES

a. 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 SRF response force 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 which evolve from a nuclear weapons accident as well as managing and administering a claims processing facility.

b. 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.

c. The General Counsel, Defense Nuclear Agency (DNA), is a member of the DNA Advisory Team (DNAAT), and will deploy to the accident site to provide expert advice and assistance to the PLA.

18-5 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.

a. 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, 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 18-A. These references provide the authority and some background for subject areas, such as establishment of the National Defense Area (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.

b. Initial Actions

(1) The OSC and staff must have immediate access to the PLA; accordingly, the legal element should be located in or near the operations center/command post.

(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 OSC's staff to make all elements aware of the need for coordination of planned actions.

(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 Joint Information Center (JIC) for inclusion in a news release.

(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 Public Affairs Officer (PAO).

(5) Response efforts may necessarily result in the disturbance and/or destruction of physical evidence which may prove later 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.

(6) The PLA must identify and establish liaison immediately with local law enforcement officials, legal authorities, and local and state emergency response organizations.

(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.

c. Follow-on Actions. The PLA, or a representative remains at the scene until the response operation is complete. The PLA advises the OSC when the claims processing facility should cease operation.

d. Public Affairs. Adverse publicity is inherent to a nuclear weapon accident simply by its occurrence. Mishandling of public affairs may impact on claims and litigation, result in a loss of confidence by the public in the actions of the U.S. Government 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:

(1) Public statements are coordinated prior to release to ensure that no hidden legal implications will impact on response efforts.

(2) All personnel involved in the response effort are required to refer all queries for information to the PAO.

18-6 ACCIDENT RESPONSE PLAN ANNEX

Accident response plans should include a Legal Annex which:

a. Identifies the resources to be deployed with the legal element.

b. Provides a checklist or synopsis of the actions to be taken by the PLA immediately upon arrival at the site.

c. Establishes a policy requiring all functional elements to coordinate actions with the PLA.

d. Provides guidelines for documentation of physical evidence which may be significant in the resolution of claims or litigation.

e. Describes procedures for establishing and operating a claims processing facility.

f. Identifies technical channels of communication.

APPENDIX 18-A

PERTINENT STATUTES AND INSTRUCTIONS

AUTHORITY FOR RESPONSE TO ACCIDENT

1. Executive Order (EO) 12656, "Assignment of Emergency Preparedness Responsibilities."

2. White House Memorandum, 19 January 1988, Subject "National System for Emergency Coordination."

3. 42 U.S.C.A. Sec. 5121 et. seq., (Public Law 93-288, amended by Public Law 100-107), "The Robert T. Stafford Disaster Relief and Emergency Assistance Act."

4. EO 12148, "Federal Emergency Management."

5. EO 12241, "National Contingency Plan."

6. 50 Fed. Reg. 46542, "Federal Radiological Emergency Response Plan (FRERP)."

7. DoD Directive 5100.52, "DoD Response to an Accident or Significant Incident Involving Radioactive Materials."

8. DoD Directive 3025.1, "Use of Military Resources During Peacetime Civil Emergencies Within the United States, Its Territories, and Possessions."

9. DoD Directive 5230.16, "Nuclear Accident and Incident Public Affairs Guidance."

10. DoD Directive 5410.14, "Cooperation with U.S. News Media Representatives at the Scene of Military Accidents Occurring Outside Military Installations."

AUTHORITY TO ESTABLISH RESTRICTED AREA TO PROTECT CLASSIFIED INFORMATION

1. 50 U.S.C.A. Sec. 797, "Security Regulations."

2. 42 U.S.C.A. Sec. 2271, "General Provisions."

3. DoD Directive 5200.8, "Security of Military Installations and Resources."

4. DoD Directive 5210.2, "Access to and Dissemination of Restricted Data."

5. DoD Directive 5210.41, "Security Criteria and Standards for Protecting Nuclear Weapons."

6. DoD Directive 5210.56, "Use of Force by Personnel Engaged in Law Enforcement and Security Duties."

CRIMINAL STATUTES

1. 18 U.S.C.A. Sec. 111, "Assaulting, Resisting or Impeding Certain Officers or Employees."

2. 18 U.S.C.A. Sec. 231, " Civil Disorders."

3. 18 U.S.C.A. Sec. 241, "Conspiracy Against Rights."

4. 18 U.S.C.A. Sec. 245, "Federally Protected Activities."

5. 18 U.S.C.A. Sec. 372, "Conspiracy to Impede or Injure Officer."

6. 18 U.S.C.A. Sec. 641, "Public Money, Property or Records."

7. 18 U.S.C.A. Sec. 793, "Gathering, Transmitting, or Losing Defense Information "

8. 18 U.S.C.A. Sec. 795, "Photographing and Sketching Defense Installations."

9. 18 U.S.C.A. Sec. 796, "Use of Aircraft for Photographing Defense Installations."

10. 18 U.S.C.A. Sec. 797, "Publication and Sale of Photographs of Defense Installations."

11. 18 U.S.C.A. Sec. 831, "Prohibited Transactions Involving Nuclear Materials."

12. 18 U.S.C.A. Sec. 1361, "Government Property or Contracts."

13. 18 U.S.C.A. Sec. 1362, "Communication Lines, Stations or Systems."

14. 18 U.S.C.A. Sec. 1382, "Entering Military, Naval or Coast Guard Property."

15. 18 U.S.C.A. Sec. 1385, "Use of Army and Air Force as Posse Comitatus."

a. 10 U.S.C.A. Sec. 331, "Federal Aid for State Governments."

b. 10 U.S.C.A. Sec. 332, "Use of Militia and Armed Forces to Enforce Federal Authority."

c. 10 U.S.C.A. Sec. 333, "Interference with State and Federal Law."

16. 18 U.S.C.A. Sec. 2101, "Riots."

17. 18 U.S.C.A. Sec. 2231, "Assault or Resistance."

18. 18 U.S.C.A Sec. 2381, "Treason."

19. 18 U.S.C.A. Sec. 2384, "Seditious Conspiracy."

AUTHORITY OF FEDERAL BUREAU OF INVESTIGATION

1. 18 U.S.C.A. Sec. 3052, "Powers of Federal Bureau of Investigation."

2. 42 U.S.C.A. Sec. 2271(b), "General Provisions."

AUTHORITY FOR MILITARY ACQUISITION OF LAND AND JUST COMPENSATION FOR PROPERTY

10 U.S.C.A. Sec. 2672a, "Acquisition: Interests in Land When Need is Urgent."

Amendment V - Constitution

AUTHORITY FOR PAYMENT OF CLAIMS

1. 10 U.S.C.A. Subsec. 2733-2737, "Property Loss; Personal Injury or Death: Incident to Noncombat Activities of Department of the Army, Navy or Air Force."

2. 28 U.S.C.A. Sec. 2672, "Administrative Adjustment of Claims."

NATIONAL ENVIRONMENTAL POLICY

1. 42 U.S.C.A. Sec. 4321, et. seq., "National Environmental Policy Act."

2. 42 U.S.C.A. Sec. 9601 et. seq., "Comprehensive Environmental Response, Compensation, and Liability Act of 1980."

3. EO 11514, as amended by EO 11991, "Protection and Enhancement of Environmental Policy."

4. EO 12580, "Superfund Implementation."

5. DoD Directive 5100.50, "Protection and Enhancement of Environmental Policy."

6. DoD Directive 6050.1, "Environmental Effects in the United States of DoD Actions."

MISCELLANEOUS

1. 5 U.S.C.A. Sec. 552, as amended, "Freedom of Information Act."

2. 5 U.S.C.A. Sec. 552a, as amended, "Privacy Act."

3. 5 U.S.C.A. Sec. 552b, "Government in Sunshine Act."

CHAPTER 19

SITE RESTORATION

19-1 GENERAL

a. Development of a site restoration plan to return the accident area to a technically achievable/acceptable condition begins early in the nuclear weapon accident response effort. However, site restoration becomes the dominant task only after classified weapons, weapon debris, classified components, and other hazards are removed, or more precisely, when the National Defense Area (NDA) or National Security Area (NSA) is disestablished, or when overseas the Security Area is dissolved.

b. Several factors have significant influence on site restoration decisions and procedures. Some of the more prominent factors are: size of the contaminated area, its topography/demographics, and the civil authority and prerogatives once the NDA is disestablished, or overseas, the Security Area is dissolved.

c. Some actions otherwise performed in support of the basic response effort are vital in site restoration. One example would be determining the extent of contamination. Such actions should be recognized, therefore, during development of the site restoration plan and the results incorporated into the plan.

19-2 PURPOSE AND SCOPE

This chapter provides guidance for accomplishing the restoration of a nuclear weapon accident site contaminated with radioactive materials. In this section, several decontamination considerations are discussed as well as the reoccupation of contaminated areas and follow-up activities.

19-3 SPECIFIC REQUIREMENTS

The accidents at Thule, Greenland, and Palomares, Spain, taught us that site restoration of an area contaminated with radioactive materials, though not easy, can be accomplished. The following actions will be required:

a. Coordination between responsible civil and military organizations.

b. Determination of agreed-upon cleanup and technically achievable/financially acceptable levels.

c. Determination and plotting of contaminated areas.

d. Completion of environmental assessment(s).

e. Completion of decontamination, fixing, reducing the concentration, or removing the contaminant.

f. Restoring the contaminated area to normal use.

g. Development of plans for post restoration radiation monitoring and assessment.

19-4 RESOURCES

a. Material resources necessary for site restoration will range from heavy equipment for soil and vegetation removal, to materials such as soaps and detergents for scrubbing lesser amounts of contamination from surface areas. These resources are, for the most part, available both commercially and within DoD. A specific list of all possible resources at this juncture could be misleading and is, therefore, not included. The precise resources required will depend on the specific contamination problem and the decontamination method(s) selected.

b. As described in other sections, each response force staff element will contribute to the site restoration effort. However, four response force elements are the key to the On-Scene Commander's (OSCs) effort to plan and execute site restoration. The four elements are the Radiological Safety, Logistics, Legal, and Engineer response elements. In addition to site restoration, the Radiological Safety, Logistics, and Legal officers each have extensive responsibilities described in Chapters 5, 17, and 18, respectively. Specifically, the Staff Engineer provides expert advice on the capabilities of various pieces of heavy equipment to accomplish specific types of decontamination, recommend procedures, determine support requirements for restoration tasks, and coordinate the conduct of engineering surveys discussed later in this chapter. Supporting Staff Engineers responsibilities in this area. DNA provides the model site restoration computer program which operates in an interactive mode on an IBM PC or IBM compatible and requires 256K RAM. This program was designed to address a radiological contamination problem providing information ranging from methods costs to efficiencies. The primacy and rights of civil authorities officials concerning site restoration cannot be overemphasized. Accordingly, the Senior FEMA Official (SFO), a Department of Energy (DoE) representative, and State and local authorities or foreign government officials are critical in planning site restoration as well as to the accomplishment of site restoration.

19-5 CONCEPT OF OPERATIONS

The OSC's responsibilities do not end with disestablishment of the NDA or overseas the dissolution of the Security Area. Specifically, the OSC must continue to assist in protecting the public from radiological hazards and support the DoD contribution to returning the area to an acceptable condition.

a. Coordinated Activities. Site restoration activities are undertaken in coordination with the Federal Emergency Management Agency (FEMA), State, and local authorities or foreign government officials. There are no guidelines, national or international, for restoration of areas contaminated with radioactive nuclear materials, which means technically achievable acceptable cleanup levels vary from locale to locale.

(1) The OSC will develop various restoration strategy options. These options should be derived from his staff and advisors. Consideration is given to request the DNA Advisory Team to assist in preparing these options. The team will use data from the Joint Hazard Evaluation Center (JHEC), Federal Radiological Monitoring and Assessment Center (FRMAC), and local demographics with a Site Restoration computer Program (SRP) to develop restoration options. Once these options are developed on-site, they should be forwarded for national-level review Specifically, to utilize the SRP mentioned above, the advisory team must be provided extensive information in the following area:

(a) RADIOLOGICAL.

1. Detailed mapping of the contaminated area (Aerial Measurement System (AMS), Ground Surveys).
2. Listing of any fixatives used to minimize resuspension.
3. Established cleanup level.

(b) DEMOGRAPHIC TOPOGRAPHIC.

1. Size of affected area (m2).
2. Population Household size.
3. Land use.
4. Land value.

(c) The information provided by the computer includes

1. DECON method used on each surface.
2. Rate at which the DECON method is applied.
3. Type of labor used in the method.
4. Type of equipment used in the method.
5. Major materials required.
6. Efficiency of the method in reducing inhalation and external dose.
7. Dose to radiation workers.
8. Dose commitment from surface exposure.

(2) An ad hoc committee at the national level is established which includes representatives from DoD, FEMA, DoE, DoS, state and local governments, EPA, and other Federal agencies and representatives which may have statutory responsibilities with regard to site restoration. This committee will formulate the scope, policies, and concepts to be included in site restoration. The OSC should provide the committee through the SFO the strategy options along with radiological map data for negotiations and final governmental resolution approval.

(3) The final set of strategy options will be used by the OSC and staff to build the final site restoration plan.

b. Radiological Safety Standards. In the absence of Federal guidance, DoD has adopted the policy that radiological contamination resulting from accidents involving U.S. nuclear weapons or devices posing an actual or potential threat to populations, or to the environment, shall be reduced to a minimal practical level or at least to a level which recognized scientific practice and knowledge indicates is safe for current and reasonable projected use.

c. Procedures. The procedural recommendations in the following paragraphs are limited to site restoration actions dealing with the locating, handling, and disposing of radioactive contamination. Because site restoration depends heavily on civil engineering procedures, the staff engineer plays a major role in development of the site restoration plan.

(1) Identifying the Contaminated Area. The first step in site restoration identifies the contaminated or affected area. This step is accomplished by conducting systematic radiological surveys and engineering studies. Data used in determining the contaminated area may be obtained during initial ground monitoring, aerial measurement surveys, follow-on ground monitoring, and air sampling.

(a) The outer perimeter of the contaminated area is determined by measuring either low energy gamma radiation, or alpha radiation, and corroborated by laboratory radioanalysis. Initial techniques employed may involve both ground monitoring and aerial measurement survey to determine the main areas of contamination. All initial measurements should be completed in the first few days of the response operation before contamination migrates into the soil or surfaces and becomes difficult to measure. Control measures should be implemented immediately if there is any possibility that the contaminants may be spread, or as soon as the initial radiological survey has been completed. As additional information becomes available, re-evaluation must be made of the situation for possible modification of control measures in effect.

(b) Soon after the perimeter of the contaminated area has been established, detailed surveys should be conducted to accurately determine the location of various intensities of radiation. Such surveys may involvecollecting samples of air, soil, water, plants, and animals for laboratory analysis, as well as obtaining detailed ground radiation measurements. These detailed surveys provide additional data from which site restoration planning can be initiated. Further surveys, including collection of samples and radiation measurements, should continue to be made until site restoration has been completed.

(2) Environmental Assessment. The principal objectives of the environmental assessment are to identify the effects on the ecosystems at the accident site and to identify various decontamination techniques used in restoring the accident site. Radiological surveys are key to the environmental assessment because they establish the level and extent of contamination and are the basis for determination of possible decontamination techniques.

(3) Decontamination Considerations. A substantial portion of the site restoration effort will be to remove or reduce the level of contamination to return the affected area to an achievable/acceptable condition. If the contamination is contained exclusively on government property, the decontamination effort is planned and supported solely by military assets. If, however, the contamination is on public or private property, the decontamination effort must be planned jointly by the OSC, local and/or State officials and the Federal agencies or foreign government officials concerned. In all situations, the SRF can expect to be involved in the initiation of site restoration.

(a) In accidents, the bulk of the contamination is contained normally in the upper stratum (within one inch of the surface); therefore, immobilizing or "fixing" contamination may be necessary to prevent spreading and/or to facilitate removal. Specifically, immobilizing the contamination in heavily contaminated areas, (for example, craters) will decrease significantly the subsequent spread of contamination. Other methods may be used such as spraying with water or fixative and/or covering the concentration with plastic sheeting. Covering the concentration with fresh earth could provide a temporary fixative. Advice should be obtained from the Radiological Safety Officer and Staff Engineer about using a particular fixative and its impact on both the environment and on subsequent site restoration operations. Constructing physical containment features may be necessary, such as dams, dikes, or ditches, to prevent the contaminants from spreading or being eroded.

(b) Decontamination methods used to cleanup an accident area may vary widely. Some factors that will influence the method chosen are type and use of the soil, type and amount of vegetation in the area, type and level of contamination present. Other factors are type and number of buildings. Effective decontamination begins with the use of the simplest method. For example, when high levels of contamination are present, repetitive use of a simple method may be effective, or a more sophisticated technique may be required to remove the contamination. Normally, lower levels of contamination are removed first, but under certain environmental considerations, removing the highest level first may be advisable to reduce the spread of contamination.

1. Vegetation in the area should be washed or removed. Decomposition of plant material can be accelerated by shredding and using quicklime. If shredders are used, care must be taken to control resuspension.

2. Scraping is probably the most effective method for removing contamination from land surfaces. This method should be used when high contamination levels will not permit use of other methods. Contaminated soil removed by this method should be processed through a mechanical and/or chemical separator for removal of the contaminant to achievable/acceptable levels. The soil may then be returned to the location from which removed; however, if difficulty is encountered in removing the contaminant, it must be transported from the site to an acceptable radiological disposal facility. The quantity of material packaged and shipped may also create a large scale logistic problem. The logistics officer and/or DoE personnel assist in identifying and locating suitable shipping containers

3. In areas with lesser contamination levels, plowing may be an effective method of achieving permissible levels of contamination in the proximate surface. The depth of the proximate surface varies even within similar environments. The proximate surface may be within one or two inches of the surface in a forest or field, not planned for development, while the proximate surface for agricultural land generally is generally defined by the depth of agricultural plowing. If dilution within the proximate surface is contemplated, burial action of plowing is enhanced further if the area is wetted before plowing as surface dust will be kept from rising and collecting on previously turned furrows. Wetting and plowing will also tend to mix the contaminant in depth so that it is not left in a single stratum.

4. Contaminated buildings and other structures should be decontaminated and, in severe cases, removed and re-built.

5. Table 19-1 provides guidelines on the permissible levels of fixed and removable contamination. The fixation and/or decontamination efficiency of the methods discussed above, when used singly or in combination, are contained in Tables 19-2. Methods to decontaminate various surfaces are contained in Table 19-3.

(4) Contaminated Waste Disposal. The methods and procedures for disposing of contaminated waste material will require coordination between the OSC, the SFO and appropriate civilian authorities/officials.

(a) Early identification of a waste disposal site and its acceptance criteria are necessary to determine packaging and transportation requirements.

(b) Contaminated soil and building materials may require packaging in containers. The type of container selected depends on the material to be packaged and the mode of transportation. Containers used must meet the requirements of applicable DoD, DoE, and Department of Transportation (DoT) regulations and/or country involved. Containers varying in size from 55-gallon drums to large containers, for example, 5,000-gallon fuel tanks, have been used in previous restoration efforts. Because the shipments will consist of contaminated materials, advice must be obtained from transportation specialists. Moreover, the method of shipment selected should ensure that the materials are moved in a safe and efficient manner and that all regulations/requirements are followed.

(5) Reoccupation of Evacuated Areas. Levels of surface and airborne contamination remaining in an area will be factors determining when the area is safe for reoccupation.

(a) Resuspension, and resuspension factors, will be major considerations. In light of this, the Nuclear Regulatory Commission guidance states that airborne activity may be averaged over all of the air inhaled for a whole year to determine the annual dose to the lung. Recognizing that cleanup will continue, and that the magnitude of resuspension will decrease with time, reoccupation may be possible at a time when airborne activity is still two to three times the maximum permissible steady state concentration.

(b) Surface contamination on objects with which people come in contact must be at acceptable levels before the items can be released for unrestricted use, or before reoccupation can be permitted. Surface contamination is divided into two categories: "fixed" and "removable," when determining if personal possessions may be released to their owners. Fixed contamination is that which has settled into a surface and cannot be wiped off, removable is that which can be expunged if the surface is rubbed.

(6) Follow-Up Activities. After site restoration is complete, the site should be inspected to ensure that all aspects of the site restoration plan have been accomplished. Continued monitoring and analysis of material, such as soil and vegetation, and people is necessary for long periods to ensure that radiation, environmental, and health standards have been permanently and successfully achieved. Normally, a civil agency will be responsible for long term radiological monitoring.

19-6 ACCIDENT RESPONSE PLAN ANNEX

A separate Site Restoration Plan (SRP) will be developed in coordination with representatives from Federal, State, and local agencies, or the host country, government officials representatives. The Site Restoration annex of the accident response plan should identify possible methods to restore an accident site and contaminated areas. Information and procedures which may be appropriate for the Site Restoration annex to the accident response plan include:

a. Procedures for collection of environmental samples required to support restoration operations.

b. Procedures for decontamination and/or fixation of contaminated areas.

c. Procedures for the disposal of contaminated material.

d. Identification of requirements for site restoration planning with State, Federal, and civil authorities and host government officials.

TABLE 19-1. Radioactive Contamination Guides.

Contaminated Items and Indications for Actions	Fixed or Removable	Contamination Level				Method of Measurement
		Alpha		Beta-gamma [1]		
		dpm per 100 cm^2	dpm per 100 cm^2	mrad/hr @ 1 in.	dpm per 100 cm^2	
1. Containers. Prior to nonradioactive use, should be	F	200		0.2		Probe
decontaminated if above:	R		None		100	Smear [2]
2. Facilities and Equipment [3] [4]						
a. Uncontrolled. Requires decontamination	F	1000		0.2		Probe
If above:	R		100		100	Smear [2]
b. Controlled						
(1) Facilities	F	1000		.05		Probe
	R		200		400	Smear [2]
(2) Equipment Items:	F	1000		2.0		Probe
	R		200		2000	Smear [2]

1 Measured through not more than 7 milligrams per square centimeter of total absorber and averaged not more than 1 square meter.

2 Smears analyzed with a calibrated counting system.

3 For U-natural, U-depleted, and U-238; levels for alpha contamination should be increased by factors of 5. (In accordance with NRC guidelines

4 If Radium 226 is a contaminant, levels for alpha contamination should be reduced by a factor of 2.

F Fixed
R Removed

TABLE 19-2. Efficiencies for Decontamination of Land Areas and Selected Resources

The table includes decontamination efficiencies for the following land areas and resources.

Vacant Land
Agricultural Fields
Wooded Land/Lawns
Orchards
Asphalt Streets/Parking and Other Paved Asphalt
Concrete Streets/Parking and Other Paved Concrete

Exterior Wood Walls/Brick Walls
Concrete/Wood Floors
Interior Concrete Walls and Wood/Plaster Walls
Carpeted and Linoleum Floors
Roofs
Automobiles, Auto Tires, Engine Drive Train, and Interior

TABLE 19-2. **Efficiencies for Decontamination of Land Areas and Selected Resources (Continued)**

DECONTAMINATION OF VACANT LAND

DECONTAMINATION METHOD	EFFICIENCY INHALATION	EFFICIENCY EXTERNAL
Clear; Harvest	30	40
Surface Sealer/Fixative-Clear; Harvest	40	40
Surface Sealer/Fixative-Clear; Harvest-Scrape 4″ to 6″	96	96
Low Pressure Water	55	25
Low Pressure Water (x2)	79.8	43.8
Low Pressure Water (x3)	90.9	57.8
Low Pressure Water (x4)	95.96	68.4
Surface Sealer/Fixative, Plow	92	55
Surface Sealer/Fixative, Deep Plow	98.5	65
Surface Sealer/Fixative, Clear; Harvest Double Scrape	99.44	99.44
Surface Sealer/Fixative, Clear; Harvest Double Sc ape, Scrape 4″ to 6″	99.92	99.92
3″ Asphalt & Cover with 6″ Soil	60	40
Surface Sealer/Fixative, 3″ Asphalt & Cover with 6″ Soil	86	42
Low Pressure Water, 3″ Asphalt & Cover with 6″ Soil	82	55
Clear; Harvest, 3″ Asphalt & Cover with 6″ Soil	72	58
Surface Sealer/Fixative, Clear; Harvest 3″ Asphalt & Cover with 6″ Soil	76	64
Low Pressure Water (x2), 3″ Asphalt & Cover with 6″ Soil	91.9	66.3
Low Pressure Water (x3), 3″ Asphalt & Cover with 6″ Soil	96.4	74.7
Surface Sealer/Fixative, Plow 3″ Asphalt & Cover with 6″ Soil	96.8	73
Surface Sealer/Fixative, Deep Plow, 3″ Asphalt & Cover with 6″ Soil	99.4	79
Surface Sealer/Fixative, Clear; Harvest, Double Scrape 3″ Asphalt & Cover with 6″ Soil	99.78	99.66
3″ Asphalt & Cover with 6″ Soil (x2)	84	64
Surface Sealer/Fixative	65	00
Plow	98	95
Surface Sealer/Fixative, Clear; Harvest, Double Scrape (x2)	99.99	99.99

DECONTAMINATION OF AGRICULTURE FIELDS

DECONTAMINATION METHOD	EFFICIENCY INHALATION	EFFICIENCY EXTERNAL
Low Pressure Water	55	25
Low Pressure Water (x2)	79.8	43.75
Low Pressure Water (x3)	[illegible]0.9	57.8
Low Pressure Water (x4)	95.9	68.4
Surface Sealer/Fixative	65	00
Leaching, EDTA	92	35
Clear; Harvest	30	30
Scrape 4″ to 6″	86	86
Plow	90	50
Deep Plow	98	60
Surface Sealer/Fixative-Clear; Harvest	40	40
Surface Sealer/Fixative-Clear; Harvest-Double Scrape	99.44	99.44
Surface Sealer/Fixative-Clear; Harvest-Double Scrape-Scrape 4″ to 6″	99.92	99.92
Three-Inch Asphalt and Cover with 6″ Soil (No Trees)	60	40
Low Pressure Water-Three Inch Asphalt and Cover with 6″ Soil (No Trees)	84.7	55
Surface Sealer/Fixative-Three Inch Asphalt and Cover with 6″ Soil (No Trees)	89.5	42
Leaching, $FeCl^3$-Three Inch Asphalt and Cover with 6″ Soil (No Trees)	97.6	70
Scrape 4″ to 6″-Three Inch Asphalt and Cover with 6″ Soil (No Trees)	94.4	91.6
Plow-Three Inch Asphalt and Cover with 6″ Soil (No Trees)	97	91
Deep Plow-Three Inch Asphalt and Cover with 6″ Soil (No Trees)	99.4	97
Clear; Harvest-Three Inch Asphalt and Cover with 6″ Soil (No Trees)	72	58

TABLE 19-2. Efficiencies for Decontamination of Land Areas and Selected Resources (Continued)

DECONTAMINATION OF VACANT LAND

DECONTAMINATION METHOD	EFFICIENCY INHALATION	EFFICIENCY EXTERNAL
Three Inch Asphalt and Cover with 6" Soil (No Trees) (x2)	88	64
Three inch Asphalt and Cover with 6" Soil (No Trees) (x3)	96.4	78.4
Low Pressure Water (x2)-Three Inch Asphalt and Cover with 6" Soil (No Trees)	93.9	66.3
Surface Sealer/Fixative-Scrape 4" to 6"	96	96
Surface Sealer/Fixative-Double Scrape	99.44	99.44
Surface Sealer/Fixative, Double Scrape, Scrape 4" to 6"	99.92	99.92
Surface Sealer/Fixative-Plow	92	55
Surface Sealer/Fixative-Deep Plow	98.5	65

DECONTAMINATION OF ORCHARDS

Low Pressure Water	33	15
Low Pressure Water (x2)	47.9	26.3
Low Pressure Water (x3)	54.5	34.7
Low Pressure Water (x4)	57.5	41
Scrape 4" to 6"	48	48
Plow	51	27
Surface Sealer/Fixative-Defoliate-Scrape 4" to 6"	80	68
Surface Sealer/Fixative-Defoliate-Double Scrape	90.32	78
Surface Sealer/Fixative-Scrape 4" to 6"	75	51
Surface Sealer/Fixative-Defoliate-Scrape 4" to 6" - Low Pressure Water	77.3	71
Surface Sealer/Fixative-Remove and Replace-Scrape 4" to 6"	93.6	93.6
Surface Sealer/Fixative-Plane, Scarify; Radical Prune	72.5	18
Surface Sealer/Fixative-Plane, Scarify; Radical Prune-Plow	93.3	45
Surface Sealer/Fixative-Remove and Replace-Scrape 4" to 6" - Three Inch Asphalt and Cover with 6" Soil (No Trees)	95	94.56
Cover with 6" Soil (Trees in Place)	30	24
Surface Sealer/Fixative-Cover with 6" Soil Trees in Place	33	25.2
Low Pressure Water, Cover with 6" Soil (Trees in Place)	47.9	33
Surface Sealer/Fixative, Remove & Replace Scrape 4" to 6", Plow	95.7	95.1
Surface Sealer/Fixative	50	0
Surface Sealer/Fixative-Plane, Scarify; Radical Prune-Plow	93.3	45

DECONTAMINATION OF WOODED LAND

Surface Sealer/Fixative, Defoliate	48	00
Surface Sealer/Fixative, Clear; Harvest	65	40
Surface Sealer/Fixative, Clear; Harvest Scrape 4" to 6"	85	85
Surface Sealer/Fixative, Clear; Harvest Double Scrape	89.25	89.25
Surface Sealer/Fixative, High Pressure Water	67.5	42.5
Surface Sealer/Fixative, Defoliate, High Pressure Water	77.5	69.5
Surface Sealer/Fixative, Clear; Harvest, 3" Asphalt & Cover with 6" Soil	70	60
Surface Sealer/Fixative, High Pressure Water, 3" Asphalt & Cover with 6" Soil	72	45.5
Surface Sealer/Fixative	50	00
Surface Sealer/Fixative, Scrape 4" to 6"	67.5	42.5
Surface Sealer/Fixative, Clear; Harvest High Pressure Water	85	85

TABLE 19-2. Efficiencies for Decontamination of Land Areas and Selected Resources (Continued)

DECONTAMINATION OF EXTERIOR WOOD WALLS

DECONTAMINATION METHOD	EFFICIENCY INHALATION	EFFICIENCY EXTERNAL
Low Pressure Water	90	85
Wash and Scrub	95	90
Low Pressure Water, Wash and Scrub	94	90.25
Vacuum	99	94
Vacuum, Low Pressure Water	99.3	94
Vacuum, Wash and Scrub	99.6	95.5
High Pressure Water	98	93
Vacuum, High Pressure Water	99.7	97.9
Surface Sealer Fixative, Remove and Replace	99.9	99.9
Vacuum, Surface Sealer Fixative, Remove and Replace	99.98	99.98
Double Vacuum, Surface Sealer Fixative, Remove and Replace	99.99	99.99
Vacuum, Foam	99.8	98.5
Strippable Coating	85	84
Double Vacuum, Foam	99.83	98.65
Double Vacuum, Foam, Remove and Replace	99.94	99.6
Surface Sealer Fixative, Remove Structure	99.99	99.99
Vacuum, Strippable Coating	99.6	97.3
Surface Sealer Fixative	65	00
Vacuum, Surface Sealer Fixative	99.5	

DECONTAMINATION OF EXTERIOR BRICK WALLS

DECONTAMINATION METHOD	EFFICIENCY INHALATION	EFFICIENCY EXTERNAL
Vacuum	29	25
Double Vacuum	36.1	30.25
Low Pressure Water	90	85
Vacuum, Low Pressure Water	91.48	86.5
Vacuum, Foam	92.9	88.75
Double Vacuum, Foam	92.97	88.84
Double Vacuum, Low Pressure Water	91.69	86.75
Vacuum, Surface Sealer Fixative, Remove and Replace	99.72	99.7
Double Vacuum, Surface Sealer Fixative, Remove and Replace	99.74	99.72
Double Vacuum, Foam, Remove and Replace	99.86	99.93
Vacuum, High Pressure Water	91.48	87.25
Double Vacuum, High Pressure Water	91.69	87.45
Double Vacuum, Foam, High Pressure Water	95.78	92.75
Strippable Coating	40	35
Vacuum, Hydroblasting	96.45	92.5
Double Vacuum, Hydroblasting	96.49	92.67
Vacuum, Wash and Scrub	92.19	88.38
Double Vacuum, Wash and Scrub	92.33	88.49
Vacuum, Plane, Scarify	99.29	99.25
Double Vacuum, Place, Scarify	99.30	99.26
Vacuum, Surface Sealer Fixative, Remove Structure	99.72	99.7
Surface Sealer Fixative	65	00
Foam	92	87

TABLE 19-2. Efficiencies for Decontamination of Land Areas and Selected Resources (Continued)

DECONTAMINATION OF LINOLEUM FLOORS

DECONTAMINATION METHOD	EFFICIENCY INHALATION	EXTERNAL
Vacuum	99	95
Double Vacuum	99.3	96.25
Wash & Scrub	97	95
Vacuum, Wash & Scrub	99.85	99
Vacuum, Foam	99.9	99.25
Double Vacuum, Foam	99.9	99.25
Double Vacuum, Wash and Scrub	99.86	99.06
Vacuum, Surface Sealer/Fixative, Remove and Replace	99.99	99.99
Double Vacuum, Surface Sealer/Fixative, Remove and Replace	99.99	99.99
Double Vacuum, Foam, Surface Sealer/Fixative, Remove and Replace	99.99	99.99
Strippable Coating	98	97
Vacuum, Strippable Coating	99.6	97.85
Surface Sealer/Fixative	80	00

DECONTAMINATION OF WOOD FLOORS

Vacuum	90	85
Double Vacuum	94.5	91
Wash and Scrub	92	87
Vacuum, Wash and Scrub	95	91
Vacuum, Foam	97.5	95.5
Double Vacuum, Foam	98.08	96.4
Double Vacuum, Wash and Scrub	95.9	92.8
Vacuum, Surface Sealer/Fixative, Remove and Replace	99.97	99.96
Double Vacuum, Surface Sealer/Fixative, Remove and Replace	99.98	99.97
Double Vacuum, Foam, Surface Sealer/Fixative, Remove and Replace	99.99	99.99
Vacuum, Surface Sealer/Fixative, Resurface	99.96	99.94
Double Vacuum, Surface Sealer/Fixative, Resurface	99.98	99.96
Double Vacuum, Foam, Surface Sealer/Fixative, Resurface	99.99	99.98
Strippable Coating	80	75
Vacuum, Strippable Coating	97	94.5
Surface Sealer/Fixative	85	00
High Pressure Water	95	90

DECONTAMINATION OF CARPETED FLOORS

Vacuum	60	55
Double Vacuum	72	66.25
Vacuum, Foam	80	75.25
Double Vacuum, Foam	83.2	78.06
Double Vacuum, Foam (x2)	86.56	81.35
Vacuum, Surface Sealer/Fixative, Remove and Replace	99.52	99.46
Double Vacuum, Surface Sealer/Fixative, Remove and Replace	99.63	99.56
Vacuum, Steam Clean	72.8	67.2
Vacuum, Wash and Scrub	76	70.8
Double Vacuum, Steam Clean	78.16	72
Double Vacuum, Wash and Scrub	79.9	73

TABLE 19-2. Efficiencies for Decontamination of Land Areas and Selected Resources (Continued)

DECONTAMINATION OF CONCRETE FLOORS

DECONTAMINATION METHOD	EFFICIENCY INHALATION	EXTERNAL
Vacuum	74	69
Double Vacuum	83.1	78.61
Wash and Scrub	85	80
Vacuum, Wash and Scrub	94.8	92.56
Vacuum, Foam	97.4	95.66
Double Vacuum, Foam	97.63	96.15
Double Vacuum, Wash and Scrub	95.78	94.01
Vacuum, Surface Sealer/Fixative, Resurface	99.79	99.75
Double Vacuum, Surface Sealer/Fixative, Resurface	99.86	88.83
Double Vacuum, Foam, Surface Sealer/Fixative, Resurface	99.97	99.96
Strippable Coating	95	90
Vacuum, Hydroblasting	98.96	97.52
Double Vacuum, Hydroblasting	98.99	97.65
Vacuum, High Pressure Water	96.1	94.11
Double Vacuum, High Pressure Water	96.79	95.29
Vacuum, Strippable Coating	96.62	94.42
Double Vacuum, Strippable Coating	97.30	95.5

DECONTAMINATION OF INTERIOR WOOD/PLASTER WALLS

Vacuum	99	95
Double Vacuum	99.3	96.25
Wash and Scrub	97	95
Vacuum, Wash and Scrub	99.85	99
Vacuum, Foam	99.9	99.25
Double Vacuum, Foam	99.9	99.25
Double Vacuum, Wash and Scrub	99.86	99.06
Vacuum, Surface Sealer/Fixative, Remove and Replace	99.99	99.99
Double Vacuum, Surface Sealer/Fixative, Remove and Replace	99.99	99.99
Strippable Coating	98	97
Vacuum, Strippable Coating	99.6	97.85
Surface Sealer/Fixative	80	

DECONTAMINATION OF INTERIOR CONCRETE WALLS

Vacuum	70	65
Double Vacuum	79	74.1
Wash and Scrub	80	75
Vacuum, Wash and Scrub	92.5	89.95
Vacuum, Foam	95.5	93.35
Double Vacuum, Foam	95.8	94.04
Double Vacuum, Wash and Scrub	93.7	91.43
Vacuum, Surface Sealer/Fixative, Remove and Replace	99.76	99.41
Double Vacuum, Surface Sealer/Fixative, Remove and Replace	99.83	99.79
Double Vacuum, Foam, Surface Sealer/Fixative, Remove and Replace	99.96	99.94
Strippable Coating	90	85
Vacuum, High Pressure Water	94	91.6
Double Vacuum, High Pressure Water	94.96	93.01
Vacuum, Hydroblasting	97.3	95.45
Double Vacuum, Hydroblasting	97.69	95.61
Vacuum, Strippable Coating	91.3	88.45
Double Vacuum, Strippable Coating	93.28	90.6

TABLE 19-2. Efficiencies for Decontamination of Land Areas and Selected Resources (Continued)

DECONTAMINATION METHOD	EFFICIENCY INHALATION	EFFICIENCY EXTERNAL
DECONTAMINATION OF ASPHALT STREETS/PARKING		
Vacuum	50	45
Double Vacuum	67.5	61.5
Low Pressure Water	95	85
Vacuum, Low Pressure Water	95.5	86.25
Vacuum, Foam	97.5	91.75
Double Vacuum, Foam	98.05	91.92
Double Vacuum, Low Pressure Water	95.78	86.53
Vacuum, Remove and Replace	99.5	99.45
Double Vacuum, Remove and Replace	99.68	99.62
Double Vacuum, Foam, Remove and Replace	99.98	99.92
Vacuum, Resurface	99.25	98.9
Double Vacuum, Resurface	99.51	99.23
Double Vacuum, Foam, Resurface	99.97	99.84
Strippable Coating	97.5	93
Vacuum, Thin Asphalt/Concrete Layer	99	49.4
Double Vacuum, Thin Asphalt/Concrete Layer	99.35	64.58
Vacuum, 3" Asphalt with Cover with 6" Soil	99.25	71.4
Double Vacuum, 3" Asphalt and Cover with 6" Soil	99.51	79.98
Vacuum, Strippable Coating	98	96.15
Surface Sealer/Fixative	97.75	02
Double Vacuum, Strippable Coating	98.38	93.46
Foam	97	90
Double Vacuum, Strippable Coating, Foam	99.84	98.36
DECONTAMINATION OF CONCRETE STREETS/PARKING		
Vacuum	50	45
Double Vacuum	67.5	61.5
Low Pressure Water	95	85
Vacuum, Low Pressure Water	95.5	86.25
Vacuum, Foam	97.5	91.75
Double Vacuum, Foam	98.05	91.92
Double Vacuum, Low Pressure Water	95.78	86.53
Vacuum, Remove and Replace	99.5	99.45
Double Vacuum, Remove and Replace	99.68	99.62
Double Vacuum, Foam, Remove and Replace	99.98	99.92
Vacuum, Resurface	99.25	98.9
Double Vacuum, Resurface	99.51	99.23
Double Vacuum, Foam, Resurface	99.97	99.84
Strippable Coating	97.5	93
Vacuum, Thin Asphalt/Concrete Layer	99	53.8
Double Vacuum, Thin Asphalt/Concrete Layer	99.35	67.66
Vacuum, 3" Asphalt and Cover with 6" Soil	99.25	71.4
Double Vacuum, 3" Asphalt and Cover with 6" Soil	99.51	79.98
Vacuum, Strippable Coating	98	96.15
Surface Sealer/Fixative	97.75	02
Double Vacuum, Strippable Coating	98.38	93.46
Foam	97	90
Double Vacuum, Strippable Coating, Foam	99.84	98.36

TABLE 19-2. Efficiencies for Decontamination of Land Areas and Selected Resources (Continued)

DECONTAMINATION OF ROOFS

DECONTAMINATION METHOD	EFFICIENCY INHALATION	EFFICIENCY EXTERNAL
Vacuum	60	50
Sandblasting	99	96
High Pressure Water	97	93
Foam	93	90
Strippable Coating	85	80
Low Pressure Water	90	85
Low Pressure Water (x2)	98	96.25
Remove and Replace	99.9	99
Vacuum, High Pressure Water	98	95
Vacuum, Low Pressure Water	92	87.5
Surface Sealer Fixative, Remove and Replace	99.94	99.81

DECONTAMINATION OF LAWNS

Double Vacuum	30	20
Low Pressure Water	85	75
Low Pressure Water (x2)	91	84
Low Pressure Water (x3)	93	86.88
Low Pressure Water (x4)	94	88.06
Close Mowing	65	65
Remove and Replace	98	98
Leaching, $FeCl^3$	85	80
Surface Sealer Fixative, Remove and Replace, Low Pressure Water	99.9	99.7
Surface Sealer Fixative, Remove and Replace, Leaching, $FeCl^3$	99.92	99.9
Surface Sealer Fixative, Remove and Replace	99	99

DECONTAMINATION OF OTHER PAVED ASPHALT

Vacuum	50	45
Double Vacuum	67.5	61.5
Low Pressure Water	95	85
Vacuum, Low Pressure Water	95.5	86.25
Vacuum, Foam	97.5	91.75
Double Vacuum, Foam	98.05	91.92
Double Vacuum, Low Pressure Water	95.78	86.53
Vacuum, Remove and Replace	99.5	99.45
Double Vacuum, Remove and Replace	99.68	99.62
Double Vacuum, Foam, Remove and Replace	99.98	99.92
Vacuum, Resurface	99.25	98.9
Double Vacuum, Resurface	99.51	99.23
Double Vacuum, Foam, Resurface	99.97	99.84
Strippable Coating	97.5	93
Vacuum, Thin Asphalt/Concrete Layer	99	49.4
Double Vacuum, Thin Asphalt Concrete Layer	99.35	64.58
Vacuum, Strippable Coating	98	96.15
Surface Sealer Fixative	97.75	02
Double Vacuum, Strippable Coating	98.38	93.46
Foam	97	90
Double Vacuum, Strippable Coating, Foam	99.84	98.36

TABLE 19-2. Efficiencies for Decontamination of Land Areas and Selected Resources (Continued)

ENGINE-DRIVE TRAIN AND INTERIORS AUTO EXTERIORS

DECONTAMINATION METHOD	EFFICIENCY INHALATION	EFFICIENCY EXTERNAL
Water Wash	85	80
Water Wash (x2)	96.25	93
Wash & Scrub	95	94
Wash and Scrub (x2)	99.5	99.28
Repaint	99.9	99.8
ENGINE-DRIVE TRAIN		
Steam Clean	75	65
Steam Clean (x2)	92.5	86
Clean Engine with Solvent	95	90
Steam Clean, Clean Engine with Solvent	97.5	94.75
Steam Clean, Clean Engine with 4 Solvent (x2)	99.63	98.95
INTERIORS		
Vacuum	75	70
Double Vacuum	92.5	89.5
Detailed Auto Cleaning	95	90
Detailed Auto Cleaning (x2)	96	92
Replace Reupholster	99	99
Vacuum, Remove Interior Clean Replace	98	97
TIRES		
Water Wash	80	50
Wash and Scrub	90	85
Replace	99.9	99.9
Sandblasting	95.9	88

TABLE 19-3. Decontamination Methods

METHOD	SURFACE	ACTION	TECHNIQUE	ADVANTAGES	DISADVANTAGES
CAUSTICS: Lye (sodium hydroxide) Calcium hydroxide Potassium hydroxide	Painted surfaces (horizontal)	Softens paint (harsh method)	Lye paint removal solution: 10 gal. water, 4 lb lye, 6 lb boiler compound, 0.75 lb cornstarch. Allow lye paint remover solution to remain on surface until paint is softened to the point where it may be washed off with water. Remove remaining paint with longhandled scrapers.	Minimum contact with contaminated surfaces. Easily stored.	Personnel hazard (will cause burns). Reaction slow; thus, it is not efficient on vertical or overhead surfaces. Should not be used on aluminum or magnesium.
Trisodium phosphate	Painted surfaces (vertical, overhead)	Softens paint (mild method)	Apply hot 10% solution by rubbing and wiping procedure (see DETERGENTS)	Contamination may be reduced to tolerance in one or two applications.	Destructive effect on paint. Should not be used on aluminum or magnesium.
ABRASION	Nonporous surfaces	Removes surface	Use conventional procedures, such as sanding, filing, and chipping; keep surface damp to avoid dust hazard.	Contamination may be reduced to as low a level as desired.	Impractible for porous surfaces because of penetration by moisture.
SANDBLASTING	Nonporous surfaces	Removes surface	Keep sand wet to lessen spread of contamination. Collect used abrasive or flush away with water.	Practical for large surface areas.	Contamination spread over area must be recovered. Contaminated dust is personnel hazard.
VACUUM BLASTING	Porous and nonporous surfaces	Removes surface; traps and controls contaminated waste.	Hold tool flush to surface to prevent escape of contamination.	Contaminated waste ready for disposal. Safest abrasion method.	Contamination of equipment.
VACUUM CLEANING	Dry surfaces - - - - -	Removes contaminated dust by suction	Use conventional vacuum technique with efficient filter	Good on dry porous surfaces. Avoids water reactions.	All dust must be filtered out of exhaust. Machine is contaminated.
WATER	All nonporous surfaces (metal, painted, plastics, etc.)	Dissolves and erodes	Hose with high pressure water at an optimum distance of 15 to 20 feet. Spray vertical surfaces at	All water equipment may be utilized. Allows operation to be carried out from a distance	Drainage must be controlled. Not suitable for porous materials. Oiled surfaces cannot

TABLE 19-3. Decontamination Methods (Continued)

METHOD	SURFACE	ACTION	TECHNIQUE	ADVANTAGES	DISADVANTAGES
WATER (Continued)			an angle of incidence of 30° to 45°; work from top to bottom to avoid recontamination. Work from upwind to avoid spray. Determine cleaning rate, experimentally, if possible; otherwise, use a rate of 4 square feet per minute.	Contamination may be reduced by 50%. Water equipment may be used for solutions of other decontaminating agents.	be decontaminated. Not applicable on dry contaminated surfaces (use vacuum). Not applicable on porous surfaces such as wood, concrete, canvas. Spray will be contaminated.
STEAM	Nonporous surfaces (especially painted or oiled surfaces)	Dissolves and erodes	Work from top to bottom and from upwind. Clean surface at a rate of 4 square feet per minute. The cleaning efficiency of steam will be greatly increased by using detergents.	Contamination may be reduced by approximately 90% on painted surfaces	Steam subject to same limitations as water. Spray hazard makes the wearing of waterproof outfits necessary.
DETERGENTS	Nonporous surfaces (metal, painted, glass, plastic, etc.)	Emulsifies contaminant and increases wetting power of water and cleaning efficiency of steam	Rub surface 1 minute with a rag moistened with detergent solution; then wipe with dry rag. Use clean surface of the rag for each application. Use a power rotary brush with pressure feed for more efficient cleaning. Apply solution from a distance with a pressure proportioner. Do not allow solution to drip onto other surfaces. Moist application is all that is necessary.	Dissolves industrial film and other materials which hold contamination. Contamination may be reduced by 90%.	May require personnel contact with surface. May not be efficient on long-standing contamination.

TABLE 19-3. Decontamination Methods (Continued)

METHOD	SURFACE	ACTION	TECHNIQUE	ADVANTAGES	DISADVANTAGES
COMPLEXING AGENTS Oxalates Carbonates Citrates	Nonporous surfaces (especially unweathered surfaces, i.e., no rust or calcareous growth).	Form soluble complexes with contaminated material	Complexing agent solution should contain 3% (by weight) of agent. Spray surface with solution. Keep surface moist for 30 minutes by spraying with solution periodically. After 30 minutes, flush material off with water. Complexing agents may be used on vertical and overhead surfaces by adding chemical foam (sodium carbonate or aluminum sulfate).	Holds contamination in solution. Contamination may be reduced by 75% in 4 minutes on unweathered surfaces. Easily stored Carbonates and citrates are nontoxic, noncorrosive.	Requires application for 5 to 30 minutes. Little penetrating power; of small value on weathered surfaces.
ORGANIC SOLVENTS	Nonporous surfaces (greasy or waxed surfaces, paint or plastic finishes, etc.)	Dissolves organic materials (oil, paint, etc.)	Immerse entire unit in solvent or apply by wiping procedure (see DETERGENTS).	Quick dissolving action. Recovery of solvent possible by distillation.	Requires good ventilation and fire precautions. Toxic to personnel. Material bulky.
INORGANIC ACIDS	Metal surfaces (especially with porous deposits, i.e., rust or calcareous growth); circulatory pipe systems.	Dissolves porous deposits	Use dip-bath procedure for movable items. Acid should be kept at a concentration of from 1 to 2 normal (9 to 18% hydrochloric, 3 to 6% sulfuric acid). Leave on weathered surfaces for 1 hour. Flush surface with water, scrub with a water-detergent solution, and rinse. Leave in pipe circulatory systems 2 to 4 hours; flush with plain water, a water-detergent solution, then again with plain water.	Corrosive action on metal and porous deposits. Corrosive action may be moderate by addition of corrosion inhibitors to solution.	Personnel hazard. Wear goggles, rubber boots, gloves, and aprons. Good ventilation required because of toxicity and explosive gases. Acid mixtures should not be heated. Possibility of excessive corrosion if used without inhibitors. Sulfuric acid not effective on calcareous deposits.
ACID MIXTURES. *Hydrochloric* Sulfuric Acetic Acid Citric Acid Acetates Citrates	Nonporous surfaces (especially with porous deposits); circulatory pipe systems.	Dissolves porous deposits	Same as for inorganic acids. Mixture consists of 0.1 gal. hydrochloric acid, 0.2 lb sodium acetate, and 1 gal. water.	Contamination may be reduced by 90% in 1 hour (unweathered surfaces). More easily handled than inorganic acid solutions.	Weathered surfaces may require prolonged treatment. Same safety precautions as required for inorganic acids.

CHAPTER 20

SUMMARY OF SPECIALIZED CAPABILITIES

20-1 GENERAL

Numerous units and organizations with specialized capabilities are discussed throughout this document. This chapter summarizes these units and organizations and the capability or service they offer.

20-2 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.

20-3 UTILIZATION

A summary of the capabilities of organizations and specialized units is provided. Table 20-1 lists functions and services provided by organizations or specialized units. Appendix 20-A provides telephone numbers for requesting services, or additional information on organizational or specialized unit capabilities discussed in this document.

20-4 DEPARTMENT OF DEFENSE (DoD)

a. Joint Chiefs of Staff (JCS) Controlled Assets.

(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.

(2) Joint Communications Support Element (JCSE). The JCSE is a contingency support unit consisting of Army, Air Force, and Marine Corps personnel and a variety of communications equipment. A part of this equipment, the AN/URC Joint Airborne Communications Center/Command Post (JACC/CP), consists of several pieces of equipment mounted in air transportable vans.

(3) Defense Nuclear Agency's (DNA)s Nuclear Weapon Accident Advisory Team. The DNA Advisory Team was established and trained to assist an On-Scene Commander (OSC) and his staff in the management of recovery operations following a nuclear weapon accident. A part of the DNA capability is the Armed Forces Radiobiology Research Institute's Medical Radiobiology Advisory Team (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.

(4) Other Joint Chiefs of Staff (JCS) Controlled Communication Assets. Super High Frequency satellite terminals, Ground Mobile Force terminals, and other communications assets can also be deployed on request.

b. United States Air Force.

(1) U.S. Air Force Air Transportable RADIAC Package (ATRAP). ATRAP is a collection of RADIAC equipment, spare parts, and trained instrument repair technicians.

(2) HARVEST EAGLE Kits. HARVEST EAGLE kits consist of air transportable operations support sets with tents, field kitchens, collapsible cots, and other housekeeping items.

(3) Occupational and Environmental Health Laboratory (OEHL). This organization has a deployable team of health physicists, health physics technicians and equipment, collectively called the Air Force Radiation Assessment Team (AFRAT). AFRAT provides assistance in radiological health matters.

(4) HAMMER ACE. HAMMER ACE consists of a rapid deployment team of engineers and technicians equipped with advanced technology communications equipment. See Chapter 12 for further discussion.

c. United States Army.

(1) Radiological Advisory Medical Team (RAMT). This team is trained specially in radiological problems and can assist and furnish guidance to the OSC, other officials, and local medical authorities.

(2) Radiological Control (RADCON) Team. This team is organized to provide technical assistance and advice to the OSC in all kinds of radiological emergencies.

TABLE 20-1. Organization/Team Capabilities/Service Matrix

Listed down the left side of this matrix are paragraph references in Chapter 20. Across the top are capabilities and services that may be needed to respond to a nuclear weapons accident. An X at the intersection of a line and column indicates that the capability or service may be provided by the referred to organization or team.

	AERIAL PHOTOGRAPHY	CIVIL EMERGENCY PLANNING	COMMUNICATIONS	CONTAMINATED FOOD	CONTAMINATED LAUNDRY	CONTAMINATION CONTROL	CONTAMINATION DISPOSAL	DECONTAMINATION	GSA REPRESENTATIVE	HEALTH PHYSICS	HOUSEKEEPING/MESSING	LABORATORY ANALYSIS	LOGISTICS	MANAGEMENT ASSISTANCE	MEDICAL CARE, EMERGENCY	POLICIES, FEDERAL	PROPHYLACTIC DRUGS	PUBLIC AFFAIRS	RADIAC INSTRUMENTS	RADIATION EXPOSURE	RADIOGRAPHICS/X-RAYS	RADIOLOGICAL HEALTH	RADIOLOGICAL MONITORING	RADIOLOGICAL PROTECTION	RADIOLOGICAL SURVEYS	RECOVERY OF CLASSIFIED	RESPONSE COORD, FED	TRANSPORTATION, ARRANGE	WEAPONS RECOVERY
DEPARTMENT OF DEFENSE																													
JOINT CHIEFS OF STAFF																													
20-4a(1)			X																										
(2)			X																										
(3)														X															
(4)			X																										
U.S. AIR FORCE																													
20-4b(1)																			X										
(2)											X																		
(3)										X		X							X	X		X	X	X	X				
(4)			X																										
U.S. ARMY																													
20-4c(1)															X							X							
(2)						X	X	X		X										X			X		X				
NAVY						X		X		X									X	X			X	X	X				
DEPARTMENT OF ENERGY																													
ACCIDENT RESPONSE MGT TEAMS																													
20-5a(1) & (2)			X							X								X					X						X
OTHER ACCIDENT RESPONSE RESOURCES																													
20-5b(1)	X																								X				
(2)					X																								
(3)																									X				
(4)								X																	X				
(5)																					X								
(6)																				X									
FEDERAL EMERGENCY MGT AGENCY																													
20-6	X	X							X				X			X		X									X		
OTHER FEDERAL AGENCIES																													
20-7a				X																									
b				X													X					X							
c																												X	
d												X																	
e																										X			

d. United States Navy. The RADCON Team can provide expert health physics (radiation control and safety) assistance to the OSC at a radiological accident.

20-5 DEPARTMENT OF ENERGY (DoE)

a. Department of Energy Accident Response Teams.

(1) Accident Response Group (ARG). The ARG is the primary DoE response element for a nuclear weapon accident and will be composed of the DoE Team Leader, a senior scientific advisor (assigned by the design laboratory), design specialists, high explosive specialists, health physicists, packaging, and other technical specialists as needed.

(2) Nuclear Emergency Search Team (NEST). This team is the primary DoE response element for threat incidents involving improvised nuclear devices and lost or stolen nuclear weapons. NEST assets may be included as part of the DoE ARG.

b. Other DoE Accident Response Resources. Requests for these services should be coordinated with the DoE ARG Team Leader.

(1) Aerial Measurement System (AMS). A system that can provide aerial radiological surveys and aerial photography.

(2) Contaminated Laundering Facilities. DoE operated facilities are capable of laundering plutonium contaminated clothing.

(3) Atmospheric Release Advisory Capability (ARAC). This unit can provide computer generated estimates of the distribution of radioactive contaminants released to the atmosphere.

(4) Mobile Accident Response Mobile Laboratory (HOT SPOT). Two air transportable trucks and trailers with equipment to analyze, identify, and document radioactive contamination.

(5) Radiolographic Response Capability. Two units capable of taking and developing radiographs of weapons using cobalt or x-ray sources.

(6) The Radiation Emergency Assistance Center Training Site (REAC/TS). A DoE facility specializing in treatment of all types of radiation exposure and capable of providing advice and assistance.

(7) RANGER. A ground based system used for environmental monitoring sample tracking, and archive purposes.

(8) Mobile Decontamination Station. Equipment to perform field personnel decontamination.

(9) RASCAL. An air sampling system contained within a cargo van.

20-6 FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

FEMA is responsible for coordinating the overall Federal response in support of State and local authorities. FEMA will dispatch a Senior FEMA Official (SFO) (or designate a FEMA Region Official to act as the Deputy SFO) and an emergency response team (ERT) to complete interface requirements.

20-7 OTHER FEDERAL AGENCIES

a. Department of Agriculture (USDA). The USDA has the responsibility and the ability to determines the safety of meat and poultry products for human consumption.

b. Department of Health and Human Services (DHHS). The DHHS has the capability to analyze food and environmental samples for radioactivity content and provide radiological advice.

c. Department of Transportation (DoT). The DoT can arrange special transportation activities and assistance in contacting consignors and consignees of shipments.

d. Environmental Protection Agency (EPA). 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.

e. Federal Bureau of Investigation (FBI). The FBI is responsible for recovery of off-site classified nuclear weapon material. The FBI is the lead federal agency for improvised nuclear devices, incidences, and terrorist nuclear-related activities in the U.S, territories, and possessions.

APPENDIX 20-A

POINTS OF CONTACT

20-A-1 MILITARY COMMAND CENTERS:

National Military Command Center (NMCC)	AUTOVON 227-6340 Commercial 703-697-6340
U.S. Air Force Operations Center	AUTOVON 225-7220 Commercial 703-695-7220
U.S. Army Operations Center	AUTOVON 227-0218 Commercial 703-697-0218
U.S. Navy Operations Center	AUTOVON 225-0231 Commercial 703-695-0231
U.S. Marine Corps Operations Center	AUTOVON 225-7366 Commercial 703-695-7366

20-A-2 COORDINATION CENTERS:

Office of the Secretary of Defense Crisis Coordination Center	AUTOVON 364-9320/22 Commercial 202-769-9320/22
Office of the Assistant Secretary of Defense (Public Affairs)	Commercial 703-697-5131
Joint Nuclear Accident Coordinating Center Department of Defense*	AUTOVON 221-2102/2103/2104 Commercial 703-325-2102/2103/2104
Department of Energy	AUTOVON 245-4667 Commercial 505-845-4667 FTS 844-4667
FEMA Emergency Information & Coordination Center	Commercial 202-646-2400 FTS 646-2400
FEMA National Emergency Coordination Center	AUTOVON 380-6100 Commercial 202-898-6100

20-A-3 INFORMATION ON DoD SPECIALIZED CAPABILITIES:

JCS Contingency and Crisis Management Division (JCS-Controlled contingency communications)	AUTOVON 227-0007
Joint Communication Support Element (JCSE)	AUTOVON 968-4141 968-3851/3852
JCS-Controlled Tactical Communications Assets	AUTOVON 879-6591/6925
U.S. Army Radiological Control (RADCON) Team (0800-1630) (1630-0800	AUTOVON 298-4500 Commercial 301-678-4500
U.S. Army Radiological Advisory Medical Team (RAMT)	AUTOVON 291-5107 Commercial 301-427-5107

*DoD organizations should normally use DoD numbers even though requested services or information may relate to DoE.

AFRRI Medical Radiobiological Advisory Team (MRAT)	Commercial 202-295-3909
U.S. Navy Radiological Control (RADCON) Team	AUTOVON 332-7527 Commercial 703-602-7527
U.S. Air Force Transportable RADIAC Package (ATRAP)	
Information	AUTOVON 945-6906
Emergency Request	AUTOVON 945-6906
SA-ALC/MAW Emergency Operations Center	AUTOVON 945-3046
U.S. Air Force Occupational and Environmental Health Laboratory (OEHL)	AUTOVON 240-2001
Headquarters Air Force Communications Command (HAMMER ACE)	
Emergency Operations Requests	AUTOVON 576-2591 Commercial 618-256-2591
Information	AUTOVON 576-3431 Commercial 618 256-3431
Headquarters Tactical Air Command/LGX (HARVEST EAGLE)	AUTOVON 432-5435/5436

20-A-4 OTHER AGENCIES:

Radiation Emergency Assistance Center Training Site (REAC/TS) Oak Ridge Associated Universities REAC/TS P.O. Box 117 Oak Ridge, Tennessee, 37830	Commercial 615-482-3131 (24 Hours) Commercial 615-481-1000 Pager 241
Department of Health and Human Services** Food and Drug Administration Center for Devices and Radiological Health 5600 Fishers Lane Rockville, Maryland 20857	(Duty Hours) 301-443-1241 (24 Hours) 202-857-8400
Environmental Protection Agency (EPA)** EPA Headquarters Office of Radiation Programs Waterside East Tower 401 M Street S.W. Washington, DC 20460	Commercial 703-557-2380 (24 Hours) 202-475-8383

**Accident response services should be requested through the FEMA EICC. Points of contact are provided for coordination and requests for information.

CHAPTER 21

TRAINING

21-1 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 On-Scene Commanders (OSCs), and other key personnel should attend appropriate courses offered by the Interservice Nuclear Weapon School (INWS) and the respective Services at the earliest opportunity.

21-2 PURPOSE AND SCOPE

This section informs senior staff planners and potential OSCs about training courses available in nuclear weapon accident response.

21-3 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 Joint Nuclear Accident Coordinating Center (JNACC) is willing to participate in organizational training, operational commitments permitting.

21-4 TRAINING COURSES

a. Interservice Nuclear Weapons School. The INWS at Kirtland AFB, New Mexico, 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 INWS is in Table 21-1.

b. Service Schools. Specific course information for Service schools is found in the following:

(1) Department of the Army Pamphlet 351-4, U.S. Army Formal Schools Catalog.
(2) Catalog of Navy Training Courses (CANTRAC), Vol.SPII, NAVEDTRA 10500.
(3) Air Force Regulation 50-5, Vol. II, USAF Formal Schools Catalog.
(4) DoD Directive 5010.16, Defense Management Education and Training Catalog, July 28, 1972.
(5) Course Catalog. U.S. Army Defense Ammunition Center School, Savanna, Ill.

c. The Federal Emergency Management Agency, National Emergency Training Center, Emmittsburg, Maryland offers the Federal Radiological Emergency Response Plan Workshop (Course E358).

TABLE 21-1. Nuclear Weapon Accident Response Training Courses

COURSE	GIVEN TO	GRADE*	DURATION	SPECIAL FEATURES
Flag Officers Nuclear Accident Course (FONAC)	Service response force on-scene commander and appropriate staff personnel as participants.	O-7+	2 days	• 4 hour CPX • 2 hour field orientation
Senior Officers Nuclear Accident Course (SONAC)	On-scene commander's immediate staff	O-4 to O-6	3 days	• 3 hour CPX • 1 day field exercise
Nuclear Hazards Training Course (NHTC)	Medical personnel	E-4 to O-4	4 days	• 2 hour CPX • 1 day field exercise
Nuclear Emergency Team Operations (NETOPS)	Initial response team leader and members	E-3 to O-3	9 days	• 3 hour CPX • 4 day field exercise
Nuclear Emergency Team Exercise (NETEX)	Team Training	E-3 to O-5	4 days	• 3 day field exercise

*Grade waivers will be considered.

Information concerning class schedules and quotas for these Interservice Nuclear Weapons School courses can be obtained from Headquarters, Air Training Command//TTPP//, Randolph AFB, Texas. 78148.