Chapter 24

MEDICAL DISASTER PREPAREDNESS FOR NUCLEAR, BIOLOGICAL AND CHEMICAL (NBC) OPERATIONS

The Air Force Disaster Preparedness Program is the consolidation, in a single, comprehensive Air Force-wide program of all plans, programs, and measures essential for effective, timely, and professional response in potential and actual disaster situations. Disaster situations include enemy attack with nuclear, biological, chemical, or conventional weapons; accidents involving nuclear, biological, chemical, or conventional weapons, or components thereof; other accidents resulting in fire, explosion, or uncontrolled environmental release of toxic materials or hazardous electromagnetic radiation; and natural disasters. Although over-all management of the Air Force Disaster Preparedness Program is the responsibility of Operations elements within the Air Force, the Medical Service, obviously, plays a major supporting role.

This chapter concerns medical disaster preparedness, from the Flight Surgeon's point of view, for operations involving nuclear, biological and chemical (NBC) weapons. Since detailed policy, directive, guidance, and technical information concerning NBC weapons or agents are found in numerous Air Force publications, this chapter is designed to tell the Flight Surgeon where to find specific information that he will require for the effective accomplishment of his particular job.

Air Force policy and guidance on NBC disaster preparedness are in the 355 series of regulations and manuals, with which all Flight Surgeons should be familiar. These are listed below:

AFR 355–1	The Air Force Disaster Preparedness Program
AFR 355–5	The National Civil Defense Program
AFR 355–6	The National Plan for Emergency Preparedness
AFR 355–7	Response to Accidents Involving Nuclear Weapons and Materials
AFR 355–8	Military Support in a Civil Defense Emergency
AFM 355–1	Disaster Preparedness—Planning and Operations
AFM 355–2	Armed Forces Doctrine for Chemical and Biological Weapons Employment and Defense

(*Note:* Frequently, Air Force directives are revised, combined, or deleted, and new directives are published as required. The Flight Surgeon must be continuously aware of current directives in the disaster preparedness area.)

USAF Medical Service responsibilities in nuclear, biological and chemical (NBC) operations are broadly covered in the above directives and are specifically delineated in AFR 160–88.

Most, if not all, Flight Surgeons assigned at base level will become involved in local training programs concerning NBC disaster preparedness. Military training requirements in this area are contained in the following:

AFR 355–4	Disaster Preparedness—Training
AFM 50–15	General Military Training
AFP 50–15–2	Disaster Actions and First Aid
UTS 160–1	Disaster Medical Training

Although protective personal equipment for use in NBC operations is not a medical responsibility, the Flight Surgeon is expected to be familiar with the items and their use. A current list of the items is in USAF Table of Allowances 459—Chemical, Biological and Radiological Defense. Information on using this equipment is in AFM 160–37.

Nuclear Warfare

To effectively execute his responsibilities for medical operations prior to, during, and following strategic and or tactical use of nuclear weapons, the Flight Surgeon must be familiar with the physical and biological effects of nuclear warhead detonation. His best reference source for this information is AFP 136–1–3, that covers in detail the physical as well as the acute and chronic biological effects of heat, blast, prompt ionizing radiation, and delayed ionizing radiation (radioactive fallout). Additional background information on nuclear weapon effects (expressed in less technical terms) is in AFM 160–37, which will also provide the Flight Surgeon with basic guidance for preparation of his input to medical disaster preparedness plans for nuclear warfare.

Detailed information on military fallout shelters, home fallout protection surveys, issuance of AF Form 1173, "Emergency Action Data Card," wartime radiological exposure control procedures, and radiological decontamination is contained in the following:

AFM 88–27	Planning, Design, and Construction of Radioactive Fallout Protection
AFM 160–37	Medical Planning for Disaster Casualty Control
AFM 355–1	Disaster Preparedness—Planning and Operations
AFR 355–16	Emergency War Operations (EWO) Shelters
AFR 355–17	Public Fallout Shelter

Guidance on triage and clinical treatment of nuclear warfare casualties is in the following:

AFM 160–37	Medical Planning for Disaster Casualty Control
AFP 160–2–4	Medical Management of Casualties in Nuclear Warfare

The Air Force medical materiel program for nuclear casualties (MMPNC) is published in section B, volume V, AFM 67–1. This section also contains directives concerning Survival Sited Casualty Treatment Assemblage (SCATA), in which some Flight Surgeons may become involved.

Nuclear Accidents

Because of an intensive safety program involving all aspects of nuclear weapon design and handling procedures, the United States has never experienced an accidental nuclear detonation, although occasional rare accidents involving nuclear weapons have occurred. Such accidents, known as *Broken Arrows*, are ordinarily secondary to crash burning of aircraft transporting nuclear weapons. As a result of the aircraft crash and fire, the conventional high explosive contained in a nuclear weapon may detonate without producing a nuclear detonation. The result is an immediate personnel hazard of the same magnitude as that caused by the detonation of a conventional high-explosive bomb under the same circumstances. However, Broken Arrows have an associated, potential, long-term personnel hazard in that a nuclear weapon, ruptured from whatever cause, may release unfissioned nuclear fuel into the environment. This unfissioned nuclear fuel consists of solid plutonium and uranium, in the form of finely dispersed airborne particles. Uranium has such insignificant radioactivity that it may be dismissed as a radiation hazard. Plutonium, on the other hand, may constitute a low-level but long-term radiation hazard under certain circumstances. Roughly 24,000 years is required for the radioactive disintegration of 50% of a given quantity of plutonium-239, the plutonium isotope usually associated with Broken Arrows. Therefore, an area contaminated with plutonium-239 may remain

a low-level radiation hazard for many years, unless decontamination procedures are undertaken. Plutonium (and uranium) undergo radioactive decay through emission of an alpha particle, which is incapable of penetrating the dead, cornified layer of human skin. Thus, the ionizing radiation emitted by plutonium constitutes no external radiation hazard for the human body. Emission of the alpha particle in the decay of a plutonium or uranium atom is accompanied by the emission of a low-energy gamma ray, which also constitutes no external hazard to the human body. However, this low-energy gamma radiation is often a source of confusion and alarm to inexperienced radiation-monitoring personnel who, believing plutonium and uranium to decay solely by alpha particle emission, erroneously assume that a nuclear detonation must have occurred when they detect gamma radiation at the site of a Broken Arrow. Nuclear fission need not be suspected unless gamma radiation levels in excess of 100 milliroentgens per hour are measured throughout a large area around a Broken Arrow site.

Once plutonium-239 gains access into the human body through inhalation of dust-borne particles or fumes from burning plutonium (or through open wounds), it constitutes a chronic internal ionizing radiation hazard, due to alpha particle irradiation of sensitive tissues, primarily lung and bone. (Because plutonium-239 is relatively insoluble in the gastrointestinal tract, oral intake of this isotope constitutes an insignificant internal radiation hazard.) Most of the plutonium-239 taken into the human body will be eliminated through normal body functions over a period of time — *i.e.*, in urine, feces, and respiratory-tract secretions. However, some fraction of the plutonium-239 will become fixed in tissue, where, after some years of constant alpha irradiation, neoplastic disease may result. A tentative diagnosis of plutonium inhalation can be made immediately after exposure by the simple process of nasal swabbing and subsequent assay for the type and quantity of radioactivity on the swab. Confirmation is made by qualitative and quantitative radioanalysis of the urine or feces. It is important for the Flight Surgeon to realize that a single urine specimen drawn within hours to a few days following exposure, is of little or no value in determining the quantity of plutonium which has been taken into the body, since equilibrium between a body burden of plutonium and the amount excreted in the urine will not be reached until approximately 1 month has elapsed.

Thus, from a medical standpoint, a Broken Arrow ordinarily does not constitute a medical emergency of any greater magnitude than any other aircraft crash/fire involving conventional high explosives. From a preventive medicine standpoint, however, personnel involved in plutonium-239 decontamination operations require intensive medical monitoring to prevent plutonium inhalation. If accidental inhalation of plutonium-239 does occur, the patient must be closely monitored to determine the quantity of plutonium in his body and, when possible, provided with clinical treatment to assist in the elimination of the plutonium from his body.

The maximum permissible quantity of plutonium-239 in the body is 0.44 microcuries. This quantity is called 1 body burden, and laboratory assays of body excretions to determine plutonium-239 levels are expressed in terms of body burdens. A fractional body burden less than 1 is expressed in terms of percent of 1 body burden.

A single permissible contamination level for plutonium-239 which is valid in all geographical locations under all circumstances cannot be established, due to a variety of factors determining the actual hazard in each case. Such factors include terrain, soil composition, annual rainfall, intensity and direction of prevailing winds, population density, and amount of normal vehicular traffic which resuspends deposited plutonium-239 in the resulting dust. Whether or not the contaminated area remains under Federal control is another important consideration. Every feasible attempt must be made to de-

contaminate to zero level. Often, however, low levels of residual plutonium-239 contamination become "fixed," particularly on coarse surfaces, in which case, further decontamination cannot be accomplished without extensive damage. In such instances, the following contamination limits apply on Air Force installations, but only after repeated attempts have been made to decontaminate to a zero level:

Maximum Permissible Contamination Limits of Fixed Plutonium-239 (or Equivalent Alpha-Emitting Radioisotopes) Which Remain Under Air Force Control

1. *Equipment and Materiel:* 450 counts per minute recorded on the PAC–1S alpha radiation survey meter.
2. *Clothing, Shoes, and Personal Equipment When Worn:* 450 counts per minute recorded on the PAC–1S alpha radiation survey meter.
3. *Human Skin:* 450 counts per minute recorded on the PAC–1S alpha radiation survey meter.
4. *Geographically Isolated Areas:* 1000 micrograms per square meter of ground surface recorded on any alpha radiation survey meter.

Detailed policy, guidance and background information on the Air Force nuclear safety program and handling of Broken Arrows are contained in the following:

AFR 122–1	Responsibilities for the AF Nuclear Safety Program
AFR 355–7	Response to Accidents Involving Nuclear Weapons and Materials
AFM 35–99	Human Reliability Program
AFM 122–1	The Nuclear Weapon Safety Program
AFM 160–37	Medical Planning for Disaster Casualty Control
AFM 355–1	Disaster Preparedness—Planning and Operations
AFP 92–1–1	Fire Fighting Guidance —Nuclear Weapons

Since many of the medical operations during and following a Broken Arrow are routine procedures under the USAF Health Physics Program, the Flight Surgeon must be familiar with the following directives, all of which also apply to the routine occupational medicine program on any base:

AFR 160–132	Control of Radiological Health Hazards
AFR 161–8	Control and Recording Procedures — Occupational Exposure to Ionizing Radiation
AFR 161–11	Film Dosimetry Program
AFR 161–17	Environmental Health, Forensic Toxicology, and Radiological Health Professional Support Functions

The Flight Surgeon who becomes involved in Broken Arrow operations must be aware of the extensive specialized assistance that is available to him through the USAF Radiological Health Laboratory, Wright-Patterson Air Force Base, Ohio. The services available through this Laboratory consist of both bio-assay procedures and clinical consultation. Procedures for forwarding bio-assay samples and for obtaining professional consultation are in AFR 161–17. Assistance and consultation in the nuclear accident area are also available through Bioenvironmental Engineers (AFSC 9121 and 9124), Health Physicists (AFSC 9171 and 9176) and Medical Officers, Special Weapons Defense (AFSC 9646).

Biological and Chemical Warfare

In planning medical preparedness for biological and chemical warfare, it is important that the Flight Surgeon bear in mind that he is not being confronted with a new and previously unknown entity. Physicians regularly see and treat infectious disease as part of their normal clinical practice, and problems in diagnosis are common, particularly when diagnosing infectious diseases which are of rare occurrence in a given geographical area. By the same token, the average physician routinely sees and treats cases of poisoning from toxic chemicals. For the most part, biological and chemical warfare agents, or at least the type of disease or poisoning which they produce, are not unique to this form of warfare.

Guidance and background information on potential biological and chemical warfare agents are in the following:

AFM 160–37	Medical Planning for Disaster Casualty Control
AFM 355–1	Disaster Preparedness—Planning and Operations
AFM 355–2	Armed Forces Doctrine for Chemical and Biological Weapons Employment and Defense
AFM 355–4	Employment of Chemical and Biological Agents
AFM 355–5	(S) (Gp–1) Employment of Biological Agents
AFM 355–6	Military Biology and Biological Agents
AFM 355–7	Military Chemistry and Chemical Agents
AFM 355–9	(C) Employment of Chemical Agents

Guidance on clinical diagnosis and treatment of biological and chemical warfare agents can be found in detail in the following:

AFM 160–37	Medical Planning for Disaster Casualty Control
AFM 160–12	Treatment of Chemical Warfare Casualties
AFM 355–6	Military Biology and Biological Agents
AFM 355–7	Military Chemistry and Chemical Agents

Guidance on the Air Force medical materiel program for defense against biological and chemical (BW/CW) warfare agents is in section C, volume V, AFM 67–1, USAF Supply Manual.

Biological and chemical decontamination procedures for use on contaminated materiel and ground areas, are in AFM 355–1.

Biological and Chemical Agent Accidents

In terms of local disaster preparedness, accidental release of biological and chemical agents into the environment will produce the same clinical effects as intentional release from a weapon in warfare. Thus, the policy guidance and background information contained under the preceding section on Biological and Chemical Warfare, are also applicable to the accident situation. The Air Force conducts an intensive safety program to prevent accidents involving biological and chemical agents and to handle such accidents should they occur. Responsibilities under this program are in AFR 136–4, "Responsibilities for Technical Escorts of Chemical, Biological and Etiological Agents." Additional background information of value to the Flight Surgeon may be found in AFM 71–4, "Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft," and 160–39, "Handling and Storage of Liquid Propellants."