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 11 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 70⁰ 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 subtracting 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 (rein)
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 berylliosis. Other commonly occurring signs and symptoms are ulceration and irritation of the skin, shortness of breath, chronic cough, cyanosis, loss of weight and extreme nervousness. Beryllium or its compounds, when in finely divided form, should ever be handled with the bare hands but always with rubber gloves. An M 17, 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 M 17 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 (so), 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.