Objectives:

2.13.01 Describe the general response and responsibilities of an RCT during any incident.

2.13.02 Identify any emergency equipment and facilities that are available, including the location and contents of emergency equipment kits.

2.13.03 Describe the RCT response to a Continuous Air Monitor (CAM) alarm.

2.13.04 Describe the RCT response to a personnel contamination monitor alarm.

2.13.05 Describe the RCT response to off scale or lost dosimetry.

2.13.06 Describe the RCT response to rapidly increasing, unanticipated radiation levels or an area radiation monitor alarm.

2.13.07 Describe the RCT response to a dry or liquid radioactive material spill.

2.13.08 Describe the RCT response to a fire in a radiological area or involving radioactive materials.

2.13.09 Describe the RCT response to other specific site incidents (as applicable).

2.13.10 Describe the response levels associated with radiological emergencies.

2.13.11 Describe site specific procedures for documenting radiological incidents.

2.13.12 Identify the structure of the emergency response organization at your site.

2.13.13 Identify the available offsite incident support groups and explain the assistance that each group can provide.

2.13.14 Discuss radiological incidents at the plant or other plants, including cause, prevention, and recommended incident response.

INTRODUCTION

Many people believe "it can't happen here" or "it won't happen to me" and do not take incident response planning seriously. But, incidents do occur, and experience has shown
that the best response comes from workers who have prepared themselves with a plan for
dealing with incidents. Each incident may be unique and no plan can be expected to give
an exact solution to every problem, but a step-by-step approach for responding to a
problem will help assure an appropriate response.

References:

2. DOE Order 151.1, “Comprehensive Emergency Management Systems”
3. Site-specific emergency preparedness manuals
4. BJC-PQ-1220, ‘Occurrence Notification and Reporting’
   Information’
RADIOLOGICAL INCIDENTS AND EMERGENCIES

A radiological incident is an unplanned event involving radiation or radioactive materials (part of an emergency). The response taken to an incident is usually governed by normal procedures.

Emergencies are classified as either an Alert, Site Area Emergency, or General Emergency, in order of increasing severity, when events occur that represent a specific threat to workers and the public due to the release or potential release of significant quantities of radiological and non-radiological hazardous materials. Classification aids in the rapid communication of critical information and the initiation of appropriate time-urgent emergency response actions.

Causes of radiological incidents and emergencies could be one or more of several reasons:

- Ignorance
- Forgetfulness
- Oversight
- Unforeseen circumstances
- Communications failures
- Mechanical failures
- Human error
- Natural disasters

Having general guidance on response and a general plan of approach is good ALARA philosophy, because part of an appropriate response is the risk incurred by the responders and those involved as well as what is deemed to be an "acceptable" risk.

2.13.01 Describe the general response and responsibilities of an RCT during any incident.

GENERAL RESPONSE TO EMERGENCIES

Although Health Physics personnel respond to an emergency using basic guidelines, an area or site may have specific procedures which have priority over these guidelines. Health Physics personnel must be familiar with the emergency procedures applicable to each site and the types of equipment to which they are assigned. The basic guidelines can then be used in conjunction with the specific procedures. Even with general or
specific guidelines one's actions may change depending on the severity of an incident or whether one is a first responder, one of many responders, or a backup person.

The basic emergency response guidelines are:

- Define and assess the problem. Typically, personnel at the scene are a good source of information; however remote instrumentation and other resources should not be overlooked.

- Attempt to **stop** the cause of the emergency. No undue risks should be taken. One must always be aware that careless action may cause them to become part of the problem.

- Notify facility management and safety personnel. Minor incidents that can be handled by a single responding person may only require a telephone call when the opportunity presents itself. If more than one person is needed for an appropriate response, activation of a site emergency response network (such as dialing "911") is the manner in which notification should be given.

- **Warn** personnel in the area of the emergency. This keeps unnecessary personnel away from the event site, minimizing their exposure and risk.

- **Isolate** the area. Install barriers as quickly as possible to establish an exclusion area. The exclusion area may be very large initially. In determining the size of the exclusion area, internal and external exposure rates, potential for criticality, possible spread of radioactive contamination or other hazardous material, weather conditions, non-radiological hazards, and security (site security may assist in establishing boundaries). Outside the exclusion area normal operations may continue. Enlist whatever resources and personnel that are available to accomplish isolation and be prepared to help others in this endeavor even if there is no radiological risk.

- **Minimize** personnel exposure. During the initial response, remember to use ALARA concepts, as practical. Plan supplementary operations as necessary to assure personnel exposure is minimized. All planned exposures above the occupational limits (5 rem) are voluntary. The following are guidelines for control of emergency exposures:

  - Up to 10 rem for protecting major property and where lower dose limit is not practicable.

  - Up to 25 rem for lifesaving or protection of large populations where lower dose limit is not practicable.
- Above 25 rem for lifesaving or protection of large populations. Only on a voluntary basis to personnel fully aware of the risks involved.

- **Secure** ventilation. Close entrances, windows, and the supply ventilation systems as necessary. Remember that most facilities are designed for proper ventilation and frequently one merely has to ensure that the design condition are being met such as closing doors, windows, and other openings that should not be open. One should only alter designed ventilation if it is obvious that ventilation and improper air flow patterns are contributing to the incident and impeding bringing it under control. Even with the conclusion to change ventilation, one should consult with facility management to determine the impact of changing ventilation on other activities that may be affected.

- Perform surveys. Health Physics personnel are trained to perform emergency surveys. The types of surveys will vary with the nature of the emergency. Good quality surveys take time. Do not short cut or speed up surveys unless a real need such as a medical need exists.

- Initiate the recovery. This includes clean-up operations, decontamination and moving the exclusion area barricade inward.

The RCT is the Health Physics person on site that has the experience, instruments, and the responsibility for radiation safety and other personnel will seek them out for answers. Be prepared to respond with answers, directives, and/or suggestions. Don't assume others will automatically know what to do. Debriefings for lessons learned typically obtain good information from the initial responders to incidents.

**NOTE:** Currently at PORTS, DOE Health Physics do not provide direct emergency response. USEC personnel provide emergency response with DOE Health Physics providing assistance. If a DOE RCT is present when an emergency situation starts, the RCT should notify supervision and call for assistance, then perform those actions outlined above until USEC arrives on site, at which time the RCT should give a turnover to the USEC personnel and stand by to provide assistance.

2.13.02 Identify any emergency equipment and facilities that are available, including the location and contents of emergency equipment kits.
FACILITIES AND EQUIPMENT

RCT's should always know the resources and equipment available to them in the area where they are working. These resources include the physical location, people, equipment, and communications.

Facilities

RCTs should have a thorough knowledge and understanding of processes and hazards of their assigned facility. This should include a knowledge of the Site Emergency Response Plan. These plans usually contain information concerning evacuation routes, staging areas, handling of contaminated personnel, and information concerning off-site support organizations.

Equipment

Typically, facilities maintain "emergency kits/cabinets" which contain supplies used in responding to emergencies. These kits/cabinets usually contain smears, gloves, bags, supplies for posting, dosimetry, respiratory equipment, and a copy of facility emergency procedures.

EMERGENCY MONITORING STATION #8

DOE Health Physics is responsible for manning and operation of Emergency Monitoring Station #8 (at E-Vehicle Portal) when it is activated. Various equipment is in the yellow box (just inside the north door) and in a plastic container (beneath the table). This equipment includes:

- RMS II area radiation monitor
- RO-2 and E-140 portable dose rate meters
- Various paperwork
- Megaphone
- Key to plastic container (in yellow box)
- Air sampler
- Various safety equipment
- Personnel identification equipment (i.e. vests, hats, stickers)

USEC Maintained and Manned Facilities

Emergency Operations Center (EOC) – Onsite facility for the overall management of emergency response. It is a dedicated facility in the X-1020 building, with appropriate controls, communication and display equipment to monitor and direct onsite emergency response actions.
Alternate EOC – If the X-1020 is unavailable the alternate location for the EOC is the X-300 building.
Medical Facilities – Onsite medical facilities are provided at the X-101.

**RESPONSE TO A CONTINUOUS AIR MONITOR (CAM) ALARM**

Airborne radioactivity may be caused by a breach in a system or resuspension of particulate radioactivity due to work evolutions such as welding, grinding, or other heavy work. Indications that an airborne contamination event is occurring include CAM alarms, air samples exceeding limits, and increasing radiation levels.

**Initial Response**
- Stop operations that may be causing airborne radioactivity
- Warn others to evacuate
- Secure unfiltered ventilation
- Contact line or facility management for support

**Supplementary Actions (re-entry)**
- Upon re-entry, don respiratory equipment and protective clothing based on conditions of the event
- Evaluate the affected area by taking an air sample, measuring radiation levels, and checking for CAM malfunction
- Obtain additional air samples as necessary to determine boundaries and maintain access control
- Identify isotope(s) to help determine problem source and protective measures
- Consider additional ventilation to minimize personnel exposure and reduce the need for respiratory equipment (HEPA)
- Measure and control surface contamination to minimize the spread of contamination
- Survey exhaust systems, ventilation filters, and ducts. Have decontamination performed as necessary to minimize contamination spread
- Evaluate the potential for internal exposure and contact facility dosimetrist for proper internal dosimetry protocol
- Personnel should be interviewed for information on any off-normal event which could have caused the alarm
- Take air samples, once operations resume, verifying that the cause of airborne activity has been corrected
RESPONSE TO PERSONNEL CONTAMINATION MONITOR ALARM

Initial Response

- Instruct affected worker to remain in area (stand fast).
- Report to the scene with at least portable instruments for direct surveys and smear media.
- Perform whole body surveys (frisk) for the appropriate type of radiation (alpha and/or beta-gamma).
- Take actions to minimize cross-contamination, such as covering or placing a glove over a contaminated hand.

Supplemental Actions

- Survey affected area to characterize the extent of contamination.
- Suspect an up-take if contamination is verified and survey facial area for contamination, taking nasal smears or nose blows. If positive, contact RCT supervision and refer to your facility specific procedures.
- If contaminated, follow-up actions include saving any radioactive material pertaining to the contamination event, as this may help characterize the event at a later time.
- Refer to facility specific procedures if contamination persists.
- Document all surveys and estimate skin dose on proper forms. Do not unduly delay any decontamination efforts by taking too long in documenting contamination for skin dose estimates. Remember that dose is being incurred all the time that the skin is contaminated. Think ALARA especially in the case of high energy beta emitters.
- Report all confirmed skin contaminations to RCT supervision and refer to your facility specific procedures if transporting to a medical facility.
- Gather appropriate information for follow-up surveys.

Follow-up actions

Shall be in accordance with the site procedure. These typically include:
• Removal of contaminated clothing or decontamination of minor skin contamination. Decontaminate skin using mild non-abrasive soap and tepid water or decon towelets. Continue decon as long as significant reduction in activity is occurring after each decon. Do not irritate the skin.

• Verification that personnel monitoring equipment is working properly. Equipment should not be returned to service until all problems are resolved. Alarms can be caused by a variety of equipment failures or by "nuisance" non-work related situations such as environmental radon resulting from local conditions.

2.13.05 Describe the RCT response to off scale or lost dosimetry.

RESPONSE TO OFF-SCALE OR LOST DOSIMETRY

Off-scale Self Reading Personal Dosimeter

• Assure that the worker is placed in as safe an area as possible (low dose area) and that the work has been left in a safe condition where possible.

• Alert others working in the area.

• Evaluate the situation. All dose indicated by the dosimeter is assumed to have been received by the individual until it can be clearly demonstrated otherwise.

• Gather data for dose estimate. Data typically includes work area dose rates, work activities, worker position, co-worker dose readings, and travel path conditions. For High exposures, the official permanent dosimetry (TLD or film badge) should be retrieved for processing.

Lost Dosimetry

For lost dosimetry, typical actions include:

• Individual(s) must leave the area if dosimetry is required.

• Contact RCT supervision for reissue of dosimetry.

Supplemental Actions

• Notify workers supervision

• Restrict additional entries until a dose assessment can be completed
RESPONSE TO RAPIDLY INCREASING, UNANTICIPATED RADIATION LEVELS OR AN AREA RADIATION MONITOR ALARM

Initial Response

· Evacuate personnel as quickly as possible to a safe area (low dose area).

· Measure radiation levels in affected area.

· Notify line/facility management. Whether or not to activate a site emergency response program (such as dialing 911) is determined by the nature of the incident. Activation usually automatically fulfills this requirement. When a situation is confusing, not fully understood, or may not be controllable; over reacting is better than under reacting.

· Evaluate the situation. The best contact is people at the scene.

· Verify postings and boundaries are adequate.

Supplemental Actions

· Verify personnel staging area dose rates are acceptable and check individual exposures. Notify RCT supervision of results.

· Re-occupy area upon approval of line/facility management.

· Document all surveys using appropriate forms.

RESPONSE TO DRY OR LIQUID RADIOACTIVE SPILL OF KNOWN MATERIAL AND ORIGIN REQUIRING SWIMS

· STOP the spill. Take appropriate precautions that are dependent on the situation. All spills are different. Correct the situation immediately if possible without taking undue risks.
WARN other personnel. Let people around know what is going on. If the situation warrants, evacuate the area. Notify your supervisor, facility management, and emergency response network if appropriate. As before, whether or not to activate a site emergency response program (such as dialing 911) is determined by the nature of the incident. Activation usually automatically fulfills this requirement. When a situation is confusing, not fully understood, or may not be controllable; over reacting is better than under reacting.

ISOLATE the area. Establish boundaries and post the area around the spill area for exposure and contamination control.

MINIMIZE exposure to yourself as well as others. Practice ALARA principles and use all protective gear available.

SECURE ventilation by controlling HVAC (heating, ventilation, air conditioning). Unless one is certain that ventilation is contributing to the incident, this may involve no more than just ensuring that conditions are correct for normal designed ventilation.

FOLLOW THROUGH as necessary by starting and collecting air samples as may be indicated, surveying for contamination, and decontaminating. The cleanup of major spills may very likely involve many people and require Radiation Work Permits and ALARA reviews of activities. Do not try to clean up a major spill by yourself, just keep it contained and isolated until the entire clean up operation is formulated. Complete all documentation of surveys and logs.

If you are unsure if you can contain the spill, or if you do not know the nature of the spill, use the “WIN” process:

Warn others

Isolate the area, keep personnel out

Notify authorities

2.13.08 Describe the RCT response to a fire in a radiological area or involving radioactive materials.

RESPONSE TO A FIRE IN A RADIOLOGICAL AREA OR INVOLVING RADIOACTIVE MATERIALS

Typically Radiological Control will supply support to the Fire Department and will be represented at the Command Post.
Initial Response

- Evacuate personnel as quickly as possible to a safe area.
- Measure airborne levels in affected area.
- Notify line/facility management. Whether or not to activate a site emergency response program (such as dialing 911) is determined by the nature of the incident. Activation usually automatically fulfills this requirement. When a situation is confusing, not fully understood, or may not be controllable; over reacting is better than under reacting.
- Evaluate the situation. The best contact is people at the scene.
- Verify postings and boundaries are adequate.
- Do not hinder firefighter actions.
- Attempt to prevent firefighting water from being discharged to the environment.

Supplemental Actions

- Verify personnel staging area airborne rates are acceptable and check individual exposures. Notify RCT supervision of results.
- Survey firefighters and their equipment when the fire is extinguished.
- Obtain samples of firefighting water.
- Document all surveys using appropriate forms.

RESPONSE TO OTHER FACILITY SPECIFIC INCIDENTS

Release of UF₆

- When a suspected release of UF₆ is detected ALL personnel should SEE and FLEE the immediate area.
- Once a safe area has been reached make notification to Emergency Response personnel and supervision.
EMERGENCY RESPONSE LEVELS

ALERT

An Alert shall be declared when events are predicted, are in progress, or have occurred that result in actual or potential substantial degradation in:

- Level of control over hazardous materials.
- Safety or security of a nuclear weapon, component, or test device that would not pose an immediate threat to workers or the public.
- Safety or security of a facility or process that could, with further degradation, produce a Site Area Emergency or General Emergency.

Site Area Emergency

A Site Area Emergency shall be declared when events are predicted, in progress, or have occurred that result in actual or potential situations that could include one or more of the following:

- Major failure of functions necessary for the protection of workers or the public.
- Threat to the integrity of a nuclear weapon, component, or test device that may adversely impact the health safety of workers in the immediate area, but not the public.
- Major degradation in level of safety or security of a facility or process that could, with further degradation, produce a General Emergency.

General Emergency

A General Emergency shall be declared when events are predicted, in progress, or have occurred that result in actual or likely situations that could result in one or more of the following:

- Catastrophic reduction of facility safety or security systems with potential for the release of large quantities of hazardous materials to the environment.
Catastrophic failures in safety or security systems threatening the integrity of a nuclear weapon, component, or test device that may adversely impact the health and safety of workers and the public.

PORTS Event Categorization

Events at PORTS are categorized based on procedure BJC-PQ-1220, *Occurrence Notification and Reporting* and DOE M 232.1-1A and DOE Order 151.1.

Emergency (Level I)

Emergencies are the most serious occurrences and require an increased alert status for onsite personnel and, in specific cases, for offsite authorities.

Unusual Event (Level II)

An unusual event is a non-emergency occurrence that has significant impact or potential for impact on safety, environment, health, security or operations.

Off-Normal (Level III)

Off-normal events are abnormal or unplanned events or conditions that adversely affect, potentially affect, or are indicative of degradation in the safety, security, environmental or health protection performance or operation of the facility.

2.13.11 Describe site specific procedures for documenting radiological incidents.

**DOCUMENTATION OF RADIOLOGICAL INCIDENTS AND EVENT CATEGORIZATION**

BJC-PQ-1220 and its references define and give guidance on documenting and reporting of radiological incidents and events.

With respect to RCTs, all surveys taken during an incident shall be formally document immediately, and detailed notes/logs shall be made. If conditions prevent immediate documentation and taking notes is impractical, then as soon as possible the RCT shall record this information. Making a set of notes with a time line (just of what the RCT they did or saw) may save hours of work later and will help the RCT answer questions about the incident.
EMERGENCY RESPONSE ORGANIZATION

The emergency response organization is headed by the PSS. The PSS will direct all emergency response actions (unless the EOC is manned). He will be assisted and advised by the Fire Department, Security, Health Physics, Medical and Safety & Health.

OFFSITE SUPPORT GROUPS

Numerous mutual aid agreements are in effect between the plant and offsite agencies. A partial list of groups that may provide assistance during an emergency includes:

- Scioto Township Fire Department
- Waverly Fire Department
- Pike Community hospital
- Southern Ohio Medical Center
- Pike County Emergency Medical Services

Many other city, county, state and federal agencies/groups would provide assistance based on the type and severity of the emergency.

SITE SPECIFIC LESSONS LEARNED

The worst Radiological Incident at PORTS was the dropping of a 14-ton UF₆ cylinder (in liquid state) in 1978. The dropped cylinder ruptured and released more than 20,000 pounds of UF₆ in less than 5 minutes, directly to the atmosphere. This event is notable in that no personnel, including the straddle carrier operator, suffered irreversible health effects. Environmental conditions were favorable since the temperature was 32°F, winds were about 5 mph and precipitation was occurring at the time of the release (snow).