



Response Guidelines for Inadvertent Movement or Illicit Trafficking of Radioactive Material

In the world after September 11, 2001, radiological attacks are a real and viable threat. The best way to handle this threat is to prevent those who would stage an attack from obtaining the necessary radioactive material. While most countries have processes in place to regulate and track their stores of radioactive material, there are still many orphaned radioactive sources available to terrorists. To prevent this material from being surreptitiously imported for terrorist uses, it is critically important to monitor for radioactive material movement at a country's borders.

Radioactive material can move across borders in three ways. The first is in a legitimate shipment, accompanied by a proper manifest documenting the exact amount and type of material. The second is inadvertent movement—for example, transporting steel contaminated by a melted radioactive source that was lost from proper accounting controls. The third method, deliberate, illegal movement of radioactive materials, is considered to be illicit trafficking. The last two scenarios require strategic action from a response organization.

The goal of any response to inadvertent movement or illicit trafficking of radioactive material is to minimize possible health hazards, gain control over the radioactive material, and to investigate, gather evidence, and prosecute any offenders in the incident.

The response structure described in this Application Note is based on the International Atomic Energy Agency (IAEA) TECDOC "Response To Events Involving The Inadvertent Movement Or Illicit Trafficking Of Radioactive Materials."

Response Levels

Three levels of response are recommended in order to address the number of possible events. In increasing order of seriousness, these response levels are Operational, Tactical, and Strategic. Most events are dealt with on the Operational level, as most incidents involve inadvertent, not illicit, movement of radioactive material, and present no substantial inherent health hazard. Some cases necessitate a higher Tactical level of response, and require several organizations to work together. A Strategic response is reserved for the rare, most serious events, and can involve activation of a regional or national emergency response plan.

Operation and Tactical response methods and considerations are covered in this Application Note. Strategic responses require cooperation between organizations on a national level and are outside the scope of this Application Note.

Response Types

Two types of response can be identified: *reactive*, in which radioactive material is found and then evaluated, and *proactive*, in which information regarding radioactive material is received, leading to a search for and evaluation of the material.

General Response Structure

On-the-Scene Initial Response (for those personnel at the scene when the incident occurs)

1. Evaluate the need for border radiation monitoring.
2. Purchase and install the needed equipment.
3. Determine the appropriate response actions for each equipment alarm.
4. Verify and evaluate the alarm and respond appropriately, according to the plan.
5. Evaluate the radioactive material.



Steps 1 through 3 should be performed prior to an incident, during the setup of a response structure. Steps 4 and 5 are performed by those

responders at the scene when the incident occurs, and is likely to be repeated by the first responders activated by an Operational response.

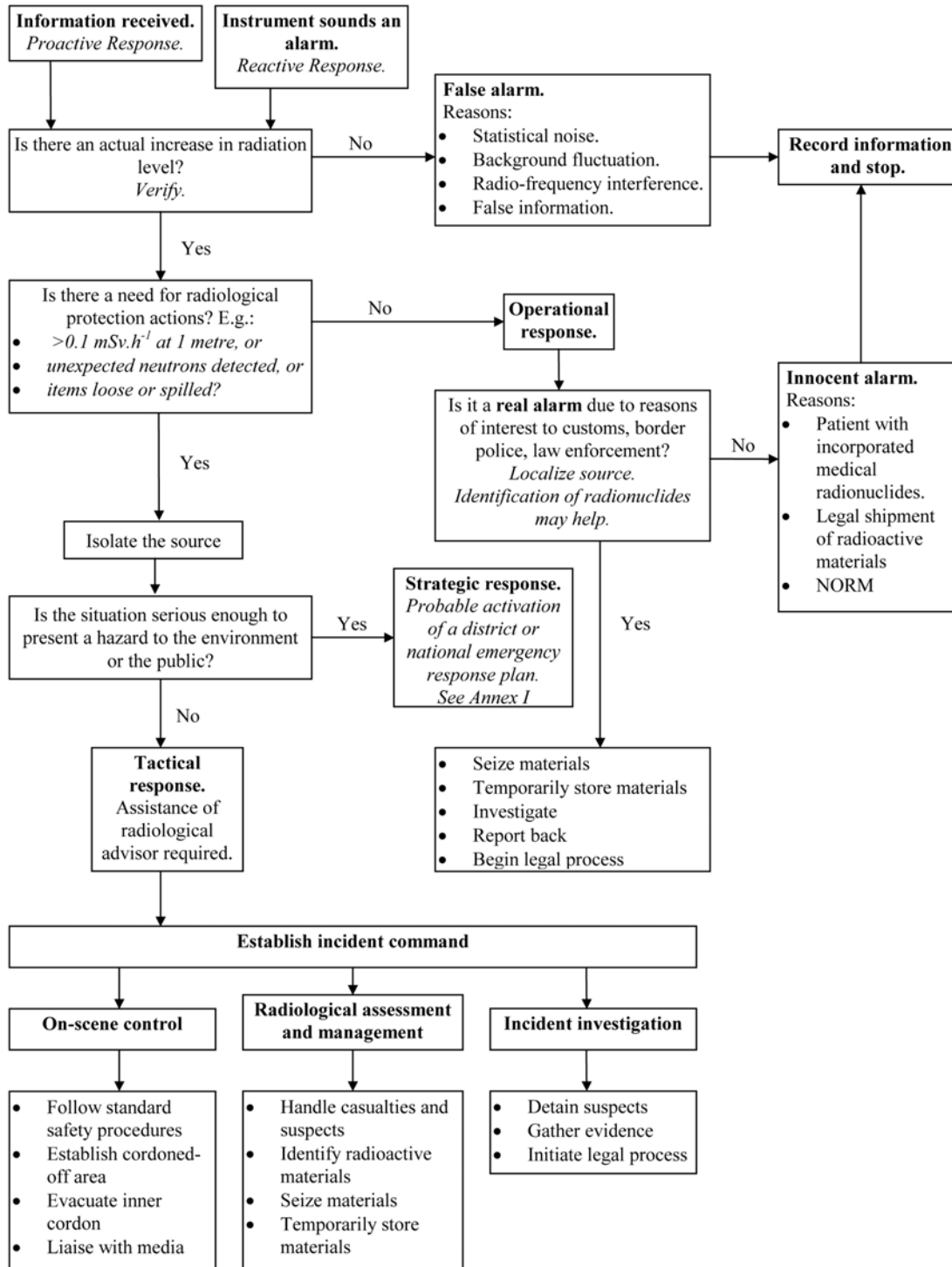
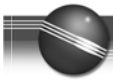


FIG. 1: Flowchart showing the initial response to inadvertent movement or illicit trafficking of radioactive materials.



Operational Response

1. Verify and evaluate the alarm.
2. Assess the radiological situation to ensure the appropriate further response.
3. Notify senior staff or the appropriate organization.
4. Locate the radioactive source.
5. Identify the radioactive material.
6. Take control of and temporarily store the radioactive material.
7. Investigate the situation.
8. Report back to senior staff or the appropriate organization.

Verifying And Evaluating The Alarm

Use a second set of equipment to verify the alarm and the increase in radiation dose rate.

Assessing The Radiological Situation

Assess the radiological situation and find the general location of the source using dose rate meters (detectors or survey meters). If any of the following three conditions are noted, notify senior staff immediately, as further evaluation by a radiological specialist is needed. A higher-level response may also be required. The first responder should then withdraw to a safe distance.

- A dose rate level greater than 10 mrem/h (0.1 mSv/h) at one meter from any surface or object.
- Neutron radiation that is not confirmed to be from a legal shipment of radiological material.
- Loose, spilled, or leaking radiological material, indicating contamination of the area.

At any scene where radiological contamination is suspected, personnel should *never* eat, drink, or smoke, as it is possible to ingest the radiological material by doing so.

Notifying Senior Staff

When notifying senior staff and other appropriate organizations, include as much of the following information as possible:

- Dose rate measurements and locations.
- Presence and location of packages with radiation warnings or symbols.
- The specific packaging of the suspected radiological material, including its condition (e.g., is it damaged or leaking?).
- Any labels, placards, shipping documents, and so forth, to indicate the nature of, or to identify, the radiological material.

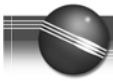
The supervisor should then evaluate the situation based on the report and call for a higher-level response, if needed.

Locating The Source

If the source's location has not already been found, and it is safe to do so, the first responder should locate the radioactive source. After the materials are located, they should be isolated, if necessary, for safety measures. It is important to note that it is *not* necessary to open any items containing radioactive material. This only increases the chance of creating loose contamination.

Identifying The Radioactive Material

If no considerable health hazards are associated with the incident, the first responder should attempt to identify the radioactive source. In the vast majority of legal radioactive material shipments, the responsible parties possess authentic documentation to support the shipment. All materials are appropriately labeled and shielded for safety considerations. Lack of this documentation, incorrect labeling, and/or inadequate packaging or shielding typically indicate inadvertent movement or illicit trafficking.



It is also possible that the material is an innocent source. If this is the case, terminate the response and record the details.

Taking Control Of And Storing The Radioactive Material

If illicit trafficking is suspected, the area should be treated as a crime scene so that evidence may be gathered later. If the radioactive material is not hazardous, it should be removed from the scene and temporarily stored in a secure place. When moving the material, *never* touch the source directly. Use a tool, such as tongs or forceps, to move the material.

Investigate The Situation

Carry out an investigation into the incident. This is required regardless of whether the incident is a case of inadvertent movement or illicit trafficking.

Report Back To Senior Staff

Report to senior staff or the appropriate organization at any point when noteworthy additional data becomes available, especially if the event can be categorized as an innocent alarm, inadvertent movement, or illicit trafficking of radioactive material.

Tactical Response

For more hazardous radiological situations, a higher-level response is required, and management of the incident should be passed on to a predefined command structure. If the incident is serious enough to pose a threat to the public or the environment, a full Strategic response should be initiated.

A command structure should be developed by each region/area to fit its own organizational needs and skills. In addition, this structure can vary, dependent on the radiological situation and location. Key people in any command structure should be:

- **Incident Commander:** Responsible for deployment and management of resources at the scene.
- **Radiological Advisor:** Responsible for radiation surveys, contamination control, radiological protection support to responders and the public, and expert advice to the Incident Commander.
- **Incident Investigation Officer:** Responsible for incident investigation, interviewing and arresting suspects, gathering evidence from the scene, and preparing for future prosecutions.

Command Center

A Command Center should be established at the scene of the incident and should be a central point of contact for all responders and responding organizations. The Command Center should be:

- Located away from external radiation hazards, and upwind of any radioactive sources.
- Accessible to the scene of the incident.
- Clearly marked.
- Secure and accessible only authorized personnel. The media should not be allowed into the Command Center.
- Large enough to accommodate all responding organizations.

If mobile phones and radios are to be used for communications, they should be encrypted for security.

Cordoned-off Areas

Restricted-access areas should be established to maintain control of the incident scene:

- **Inner cordon:** Around the radioactive source. The dose rate at the border and outside of this area should be no greater than 10 mrem/h (0.1 mSv/h). Expand this area if airborne contamination is suspected or known. There should be a single access point where personnel are

logged in and out of the area. No unnecessary personnel should enter this area. The principles of ALARA (As Low As Reasonably Achievable; see discussion under “General Health And Safety Considerations) should be followed.

- **Outer cordon:** “Security” cordon. This area should encompass the inner cordon completely, and contain a decontamination station, as well as a single access point where personnel are logged in and out of the area.

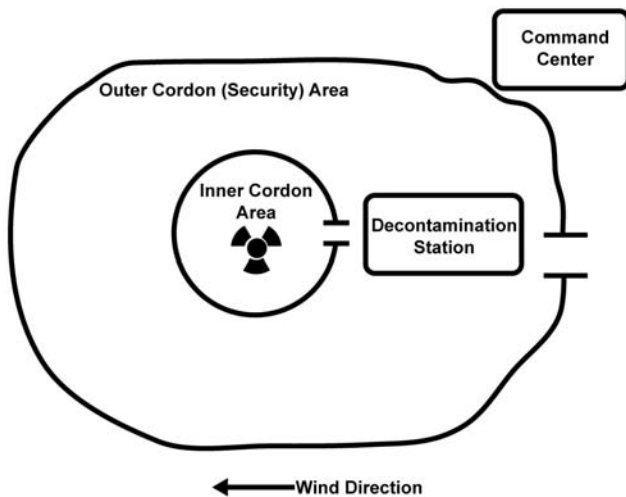


FIG. 2: Area cordoned off, with command center and decontamination station.

Suspects

If loose contamination is suspected or confirmed, it's possible that any suspects detained at the scene may be contaminated, and may in turn contaminate the arresting officers. The suspects and officers should be monitored for contamination, and decontaminated if necessary.

Decontamination

A person or piece of equipment should be decontaminated if monitoring yields a reading equal to or twice the background level. Trauma should be treated first if the person's condition is life-threatening.

Note that untrained individuals can make their contamination situation worse by attempting to improperly decontaminate themselves. The radiological advisor, or his/her appointee, should monitor decontamination procedures to ensure safe and effective decontaminations.

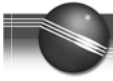
Seizure And Storage Of Radioactive Materials

The IAEA recommends that the Investigation Officer initiate the request to seize the radioactive materials and remove them from the immediate scene under the supervision of the Radiological Advisor. The Radiological Advisor should approve all seizure plans to ensure that all precautions are taken to protect the public, responders, and environment.

The location of the scene plays a key role in determining when the radioactive materials should/can be seized. If the scene is located in a place where cordon controls can be maintained for extended periods of time, the site and materials can be fully analyzed and a plan for later seizure made prior to removal. However, if the scene is located at a place where maintaining cordon controls for long periods of time is expected to be difficult, such as an airport or border crossing point, a plan for quick seizure of the material should be made, and the material removed as soon as possible.

If the radioactive material needs to be seized quickly, it may be possible to temporarily store it at the scene. The radioactive material storage area should be secure and shielded, and the material should be placed in appropriate containers.

Seizing and disposing of loose or unshielded materials, particularly those in powder or liquid form, may require extensive resources over a longer period of time to reduce health hazards and unnecessary exposures, and to prevent the further spread of contamination.



Investigation Of The Incident

An investigation into the incident is required in all cases of inadvertent movement and illicit trafficking. A full investigation should include interviews/arrests of suspects, evidence collection, and initiation of the legal process to prosecute any suspects.

When gathering evidence at the scene, the investigative officer should be accompanied by a radiation safety officer equipped with personal dosimetry, survey meters, and protective clothing. Care should be taken to safely handle any item gathered from the scene.

General Health And Safety Considerations

The Radiological Advisor is responsible for ensuring that all activities are undertaken in the safest way possible with regard to radiological exposure. All doses should be maintained ALARA (see below).

ALARA

All radiation doses to personnel should be maintained As Low As Reasonably Achievable (ALARA). This means that the following three principles shall be applied when possible:

- **Time:** Personnel should minimize their radiation dose by remaining near the source (in the inner cordon) for as little time as possible.
- **Distance:** Personnel should minimize their dose by staying as far away from the source as possible.
- **Shielding:** Personnel should minimize their dose by keeping other items between themselves and the source as much as possible. This includes walls, furniture, and any other solid objects at the scene.

Casualties and injuries

If there are casualties at the scene, radiological contamination considerations must be taken into

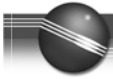
account when treating the injured individuals. If injuries are not life-threatening, monitor individuals for contamination and decontaminate them if necessary before medical treatment, if possible. If an individual's condition is life-threatening, follow the following steps:

1. Perform any life-saving procedures.
2. Monitor the individual for contamination.
3. Remove contaminated clothing, if possible.
4. If not possible, contain the contamination by wrapping the individual in a blanket. This prevents the spread of contamination to the ambulance and hospital emergency room.
5. Take the individual to a hospital for treatment.
6. Monitor the individual and the emergency personnel for radiological contamination, and decontaminate if necessary.

Contamination And Exposure

If any personnel are contaminated at the scene, they should be decontaminated as soon as possible. Contamination is indicated by a reading equal to or exceeding twice background levels when an individual is monitored. Internal and external contamination and exposure should be reduced in the following manner:

- Do not disturb any leaking or spilled materials, particularly those from suspicious containers.
- Do not disturb the contents of any suspicious containers.
- *Never* eat, drink, or smoke in the cordoned-off areas, or before being monitored for contamination after working at the scene.
- Do *not* touch any suspicious substances or radioactive sources.
- Protective clothing can be worn to prevent skin contamination. Note that arrangements must be made for the disposal of contaminated protective clothing.



- If airborne contamination is suspected or confirmed, personnel working at the scene may need to use respiratory protection. Note that many respirators require special training and fitting, and that only those who are trained should use the equipment.
- When surveying an area for radiation, make sure that you know the limits of your equipment—dose rate ranges, response times, and the types of radiation the equipment detects. For maximum safety, make sure that your survey equipment is turned on when approaching any suspicious objects.

Conclusions

Radiological terrorism is a threat. Preventing terrorists from obtaining the radioactive material needed for a radiological attack is key in preventing the attack itself. In order to effectively do this, international borders and other points of entry into a country should be monitored for radioactive material. Personnel working at these locations, as well as responders and response organizations in the community, should be aware of the possibilities and how to respond to an incident.

The information contained in this Application Note is intended as a brief overview of the response mechanisms needed in a case of inadvertent movement or illicit trafficking of radioactive material. It is not intended to be a replacement for emergency response planning,

training, and practicing. Additional information about emergency response planning can be found in reference 1, IAEA-TECDOC-953, “Method for the Development of Emergency Response Preparedness for Nuclear or Radiological Accidents.”

References

1. International Atomic Energy Agency, “Method for the Development of Emergency Response Preparedness for Nuclear or Radiological Accidents,” IAEA-TECDOC-953, Vienna (1997).
2. International Atomic Energy Agency, “Response to events involving the inadvertent movement or illicit trafficking of radioactive materials,” IAEA-TECDOC-1313, Vienna (2002).

Resources

1. International Atomic Energy Agency (IAEA), www.iaea.org.
2. US Department of Homeland Security, www.dhs.gov.
3. Federal Emergency Management Agency (FEMA), Emergency Management Institute (EMI), www.training.fema.gov/EMIweb.
4. U.S. Nuclear Regulatory Commission (NRC), <http://www.nrc.gov/what-we-do/radiation.html>.
5. FEMA, www.fema.gov.