

# **EMERGENCY RESPONSE CONTINGENCY MEASURES TO RESPOND TO UNAUTHORIZED REMOVAL OF RADIOLOGICAL/NUCLEAR MATERIAL IN A NUCLEAR SECURITY EVENT**

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## **Abstract**

A Nuclear Security Event can result in the unauthorized removal of radioactive material. The radioactive material could ultimately be used in a malicious criminal act or nuclear/radiological terrorism. Radiological or nuclear material out of regulatory control is of great concern throughout the world and significant international cooperation has been focused on securing borders from trans-national shipments of illicit materials, especially radiological materials. From the technology perspective, these efforts have provided radiation portal monitors and trained personnel to detect, interdict, adjudicate, and recover illicit radioactive material being smuggled through international gateways such as shipping ports, land borders (pedestrian, vehicle and train conveyances), and airports. A Nuclear Security Event may be initiated by a security force or law enforcement response to a security alarm or a physical barrier penetration; but it can quickly turn into a radiological incident with national and international consequences. The paper will outline the U.S. Department of Energy/National Nuclear Security Administration's national emergency preparedness and response posture for radiological and nuclear incidents and accidents and provide an overview of the international reach back capabilities and partner national capacity building programs to aid in enhancing radiological emergency preparedness and response worldwide.

## **1. INTRODUCTION**

Radiological emergency response operations to search, detect, locate, identify, and recover radioactive materials can be very complex, requiring technical cooperation between Competent Authority technical specialists and law enforcement security officials. The unauthorized removal of radioactive materials can be considered a malicious act, with the intent being to use the material to harm or terrorize the public. As such, the urgency for an effective, coordinated response is high and must be part of emergency response contingency planning and preparedness. Highly trained experts with specialized radiation detection and radioactive material identification instruments are required to conduct these emergency response operations. The specialized capabilities required for a response of this nature, however, may not be resident in all countries or a country may require supplemental assistance from the international community. International assistance is available through the IAEA Response and Assistance Network (RANET), bilateral/multi-lateral cooperation agreements, regional partnerships, and international agencies to support Contingency Planning and Preparedness for Response to Nuclear Security Events (IAEA Nuclear Security Series No. 13, Fundamental Principle K). Contingency plans should integrate the specialized capabilities of the Competent Authority with security forces to ensure timely resolution of the incident with recovery of the radioactive material to ensure the safety of the public.

The U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) is actively involved in assisting, promoting, educating, and training partner nations and international organizations in nuclear and radiological emergency preparedness and response throughout the world. The DOE/NNSA maintains a

national emergency preparedness and response posture to respond to a wide range of radiological and nuclear incidents and accidents. This posture provides the flexibility to tailor a response to almost any situation, including the unauthorized removal of radiological or nuclear material in a Nuclear Security Event, and provide highly trained response personnel with advanced detection equipment. The DOE/NNSA Office of Nuclear Incident Policy and Cooperation leverages these national resources to provide 24/7 reach back capabilities to the international community for technical advice and assistance, analysis and interpretation of radiological data, medical consultation for radiation injuries, and consequence management support to assist with the safe recovery of radiological and nuclear material. In addition, international cooperation programs are also available for partner nation capacity building to enhance radiological emergency preparedness and response capabilities through national program assistance, technical workshops, advanced training courses, and radiation detection resources. The paper will provide an overview of the U.S. DOE/NNSA national radiological emergency preparedness and response posture and the international assistance resources and capabilities available to assist partner nations in the resolution of unauthorized removal of radiological or nuclear material in Nuclear Security Events.

## 2. U.S. DOE/NNSA NATIONAL EMERGENCY PREPAREDNESS AND RESPONSE

The U.S. DOE/NNSA maintains 24/7 on-call emergency response assets to respond to a wide variety of nuclear and radiological incidents and accidents. The emergency response capabilities were originally developed over 50 years ago during the early weapons testing program and have been continuously re-evaluated, refined, and enhanced since then to the capabilities that exist today. The DOE/NNSA national emergency preparedness and response posture, in cooperation with the Federal Bureau of Investigation (FBI) and State and County first responders, police, fire, and hazardous materials teams, enables the U.S. to be ready to respond to the unauthorized removal of radiological or nuclear material in a Nuclear Security Event. Some of the key initial response assets of the DOE/NNSA national emergency response system are outlined below for both crisis response and consequence management perspectives.

In the U.S., the FBI is the lead agency for the investigation of unauthorized removal of radiological or nuclear material in a Nuclear Security Event. The DOE/NNSA is a key partner in the investigation providing technical advice through its extensive network of national laboratory technical experts and emergency response assets. The DOE/NNSA first line of response is the Radiological Assistance Program (RAP), which provides technical experts to support Federal, State, Local and Tribal governments for incidents involving radiological emergencies. The RAP teams are strategically located in nine regions throughout the U.S. and stand in readiness to support an incident or accident anywhere in the country. The RAP teams can respond within four hours to a radiological incident or accident and have the expertise and specialized detection equipment to conduct foot and mobile searches, identify radioactive materials, advice on radiation safety and assess health risks, survey for contamination, aid in crime scene investigation, and conduct source recovery operations. All of these technical specialties could be required for a response to the unauthorized removal of radioactive material in a Nuclear Security Event. As the nature of the response evolves, the RAP teams can request additional specialized assistance from the DOE/NNSA.

The DOE/NNSA Nuclear/Radiological Advisory Team (NRAT) provides a worldwide response to nuclear and radiological incidents in support of the Department of State. The NRAT teams have similar expertise and equipment capabilities as the RAP teams but receive additional training to respond in an international environment. A Senior Energy Official leads the team which provides command and control, technical advice and assessments, radiological search and identification, health physics support, and access to a wide range of reach back capabilities. The NRAT team also has the capability to support maritime missions for the investigation of suspect cargo aboard a ship at sea. The NRAT and RAP teams routinely work with their Federal and State law enforcement counterparts to hone their skills through training courses, tabletop and field exercises, nuclear security support to Major Public Events, and real world responses.

If the response to a Nuclear Security Event involves a large search area, the Aerial Measuring System (AMS), based in Washington, D.C. and Las Vegas, Nevada, can provide rapid response to radiological incidents and accidents with helicopters and fixed-wing aircraft equipped with specialized radiation detection systems to detect, locate, and identify radiation point sources or dispersed radioactive material on the ground. The AMS team

of scientists, technicians, pilots, and ground support personnel combine their expertise to maintain the capability in a constant state of readiness for deployment. The AMS has been used to search for radioactive materials, but also to conduct aerial radiological environmental surveys of nuclear power plants, national laboratories and industrial facilities. More recently, the AMS has been deployed to acquire baseline radiological surveys prior to Major Public Events.

The Radiation Emergency Assistance Center/Training Site (REAC/TS) maintains a 24-hour response center to provide direct support, including deployable medical and health physics experts experienced in the treatment of radiation exposure, to assist Federal, State, Local and Tribal organizations, and DOE/NNSA radiological emergency response assets. During a radiation incident or accident, first responders, law enforcement, and emergency managers routinely have questions about the health risks of high radiation exposure and/or internal/external contamination. REAC/TS provides medical advice and consultation, specialized training, and the unique capability of on-site assistance for the treatment of all types of radiation exposure accidents. REAC/TS is an active partner with the International Atomic Energy Agency (IAEA), the World Health Organization (WHO) and the Center for Disease Control (CDC). The REAC/TS is located at Oak Ridge Institute for Science and Education in Tennessee and also provide on-site and international training courses on medical management of radiation injuries.

In any evolving incident, it is prudent to begin consequence management planning and assessment in the event of a dispersal of radioactive materials. The National Atmospheric Release Advisory Center (NARAC), located at the Lawrence Livermore National Laboratory in Livermore, California provides timely and accurate real-time assessment advisories to emergency managers for the potential hazards of radiological or nuclear material releases into the atmosphere. The NARAC experts use sophisticated plume models to provide realistic radioactive material deposition maps based on current or forecasted meteorological conditions. The maps can be used to advise first responders on radiation safety guidance, provide local health and safety officials emergency phase protective action recommendations, and provide long term health risks for the recovery phase. In the event a long term presence is required for an on-going recovery operation, the Federal Radiological Monitoring and Assessment Center (FRMAC) will coordinate and manage all Federal radiological monitoring and assessment activities during a major radiological emergency in support of State, Local and Tribal governments.

### 3. INTERNATIONAL REACH BACK ASSISTANCE

The DOE/NNSA has developed several national reach back capabilities through its national laboratory complex for use by first responders, DOE emergency response experts, and other government agencies with response missions. The reach back capabilities provide the responders the opportunity to obtain 24/7 assistance with radiation data analysis and interpretation, medical consultation for radiation injuries, and predictive modeling of radioactive dispersals. The Office of Nuclear Incident Policy and Cooperation provides these reach back capabilities to member states of the IAEA and through bilateral/multi-lateral cooperation agreements, regional partnerships, and international agencies to assist in resolving nuclear or radiological incidents or accidents. IAEA member states can request direct access to these reach back capabilities through the Incident and Emergency Center (+43-1-26-32-000), the U.S. Department of State Operations Center (+1-202-647-1512), or the DOE/NNSA Emergency Operations Center (+1-202-586-8100) in Washington, D.C. The DOE/NNSA reach-back capabilities outlined in this section are registered resources in the IAEA RANET system.

The Radiological TRIAGE reach back capability provides technical analysis and interpretation for radiation detector data. Radiological TRIAGE is located at the Los Alamos National Laboratory in Los Alamos, New Mexico, with consultation from Lawrence Livermore National Laboratory and Sandia National Laboratory. In an emergency situation, the activation by a partner nation will result in a call back by a DOE/NNSA response officer in 15 minutes. The response officer will take your request for assistance and provide you with the process for submitting the data files and supporting information. Within one hour, the requester will receive a call back with the results of the data analysis and interpretation by emergency managers and science experts. Radiological TRIAGE helps prevent an unnecessary full-scale response when there is no threat, or can “pull the fire alarm” if the threat appears to be serious. The TRIAGE scientists from the national laboratory complex are experts in the

analysis and interpretation of radiation data, including spectral data, and will provide radioisotope identification, activity estimates, and potential safety and health risk assessments.



*FIG. 1. Radiological TRIAGE for assistance with radiation detector data.*

The DOE/NNSA also provides assistance with highly specialized data collected during aerial radiological measurements. The data collected in a radioactive material release from a nuclear power plant accident, Radiological Dispersal Device, or other radiological dispersal incident can be quite complex and difficult to analyze and interpret. The Aerial Measuring System (AMS) reach-back capability provides assistance with technical advice, and data analysis and interpretation of radiological data collected during an aerial radiological survey. The AMS scientific, technical, and aviation teams routinely conduct training for a variety of emergency response missions. Data analysis and interpretation can include the overlay and contouring of radiation data on geo-referenced maps, dose rate and activity assessments at ground level, and radioisotope identification.



*FIG. 2. Aerial Measuring System provides assistance with data analysis and interpretation.*

If there is a concern of a radiation injury, the REAC/TS program described in the previous section is another reach-back capability available to the international community to provide medical advice and consultation. The on-call staff of medical doctors, health physicists, and nurse paramedics can provide consultation and advice for the assessment and treatment of potential over exposure or contamination cases.



FIG. 3. REAC/TS provides medical advice and consultation.

And lastly, in the event of a radiological plume release, the NARAC program, as previously outlined, maintains the International Exchange Program (IXP). The IXP utilizes the same plume modeling codes as NARAC to provide real-time computer predictions for atmospheric transport and deposition of radioactivity from a nuclear accident or incident. International partners, through their Competent Authority, can request access to the web-based application via the IXP website at <https://ixp.llnl.gov>. The application allows users to run the plume model for a variety of scenarios from a nuclear power plant release to a Radiological Dispersal Device in about 15 minutes. The application has real time access to worldwide meteorological data, street maps and satellite images, and census population data. The typical products include maps of the 1-meter exposure rate, ground activity concentration, and protective action recommendations based on the U.S. Environmental Protection Agency Protection Actions Guides (PAGs) or IAEA Protective Guidance.

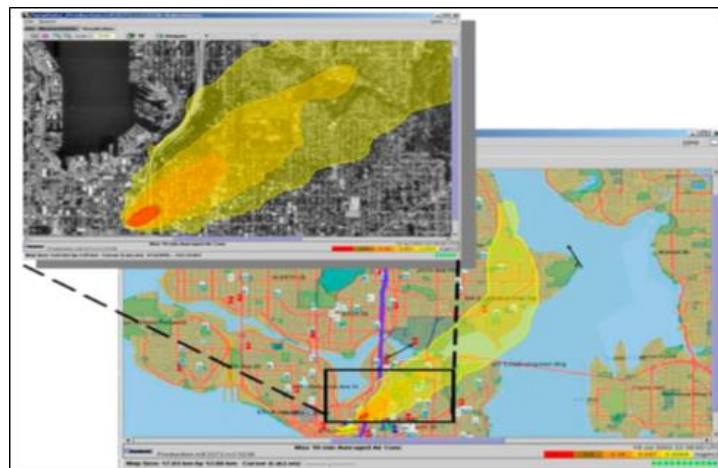


FIG. 4. NARAC/IXP plume modelling predictions for consequence management planning.

### 3. INTERNATIONAL EMERGENCY PREPAREDNESS AND RESPONSE CAPACITY BUILDING

The DOE/NNSA implements its wide-ranging international emergency management programs through the Office of Nuclear Incident and Policy and Cooperation. Based on discussions with a partner nation, the program jointly develops an action plan to address identified needs. The goals of the cooperative efforts are to improve the ability of countries to respond effectively to nuclear or radiological emergencies thus protecting the health and safety of workers, the public, and the environment. The program offers capacity building with partner countries

to enhance radiological and nuclear safety and security worldwide. The capacity building includes assisting foreign governments and international organization in establishing the core elements of an emergency response program: assistance with national program development and implementing policy, plans and procedures; providing technical workshops and train-the-trainer courses; planning and execution of table top and field exercises, providing specialized detection equipment, and technical assistance for nuclear security at a Major Public Event.

Each year, 10-12 international technical workshops and training courses are conducted in cooperation with the IAEA Incident and Emergency Center and the Nuclear Security Division as well as through bilateral agreements. The workshops and training courses are in support of international emergency response as established by the Conventions on Early Notification of a Nuclear Accident and Assistance in the Case of a Nuclear Accident or Radiological Emergency. The training courses are very interactive with practical exercises with detection equipment and radiation sources in realistic environments. The instructor team is drawn from experts from the DOE/NNSA national laboratory complex, many who lead or serve on emergency response teams. The technical workshops and training courses are designed to address all aspects best practice of an emergency response operation to include:

- Radiation basics and health physics
- Emergency response planning and operational procedures
- Radiation search, detect, locate, and identify
- Aerial radiological search operations
- Alarm interdiction and adjudication
- Personal protective equipment
- Contamination surveys and assessment
- Source recovery operations
- Consequence management planning
- Medical response to radiation injuries

The technical workshops and training courses are designed for Competent Authority technical experts, senior security and law enforcement officers, emergency management, and other key federal agency officials. The technical workshops and training courses provide an opportunity for government agencies to work together on national radiological emergency response practical exercises and learn from each other and share experiences and expertise.

The courses are designed to enable a partner nation to learn the operational best practices to develop a national response capability or enhance an existing national capability. The focus of the technical workshops and training courses is on the response to radiological and nuclear incidents and accidents, including a Nuclear Security Event which results in the unauthorized removal of radiological or nuclear material. The planning, preparation, and execution of an emergency response to recover a lost or stolen radiation source, a smuggled radiation source interdicted at a port of entry or international border, an orphaned or abandoned source, a terrorist threat with radioactive material, or a Material Out of Regulatory Control (MORC) is similar to that of the unauthorized removal of radiological or nuclear material in a Nuclear Security Event.



FIG. 5. International training course on radiological emergency response demonstration on personal protective equipment.



FIG. 6. International training course on radiological emergency response practical field exercise using radiation backpacks and mobile systems for radiological search operations.

The technical workshops and training courses are typically 4.5 days and consist of classroom instruction, equipment demonstrations, hands-on proficiency with detection equipment, and practical field exercises with radiation sources. The Office of Nuclear Incident Policy and Cooperation will work with partner nations to customize the technical workshops and training courses to a specific need if requested. The instructor team provides a large suite of radiation detection equipment to include personal radiation detectors, radiation backpacks and mobile systems, radioisotope identification equipment, and health physics instruments, so all participants have ample opportunity for the training experience. The host country is requested to provide the radiation sources and training facilities.

#### 4. SUMMARY

The unauthorized removal of radiological or nuclear material in a Nuclear Security Event can trigger a response that involves radiological search to detect, locate, identify, and recover the radioactive materials. The response can be highly complex in nature and requires a cooperative partnership between the federal law enforcement and competent authority technical experts. The U.S. DOE/NNSA, through the Office of Nuclear Incident Policy and Cooperation, provides a two phased approach to assist foreign governments with radiological emergency response capacity building. First, through an extensive technical reach back program, foreign partners can obtain immediate assistance for a variety of needs to include data analysis and interpretation, plume modelling, and medical consultation. And second, through bilateral or multilateral agreements on a cooperative basis, or in

conjunction with the IAEA, the DOE/NNSA can provide in-country technical workshops and training courses on radiological emergency response. These international resources and assistance programs will help ensure that radioactive material can be safely recovered to protect the public and the environment.

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