DOE/NV/25946--3399

Emergency Response Contingency Measures to Respond to Unauthorized Removal of Radiological/Nuclear Material in a Nuclear Security Event

R. Maurer[1], S. Buntman[2], and J. Butler[1]

[1]Remote Sensing Laboratory, National Security Technologies, LLC
[2]Department of Energy, National Nuclear Security Administration,
Office of Nuclear Incident Policy and Cooperation

This work was done by National Security Technologies, LLC, under Contract No. DE-AC52-06NA25946
with the U.S. Department of Energy

Nuclear Security Event

A Nuclear Security Event can result from a) the unauthorized removal of nuclear material from a secure facility, which could then be used in a malicious criminal act or nuclear/radiological terrorism, or b) an act of sabotage on a nuclear facility or nuclear material in transit which could result in severe radiological consequences to the public.

The response to a Nuclear Security Event could be very complex and require a practiced, coordinated effort between the facility guards, operator, response forces, and technical experts from the Competent Authority. The primary goal is to secure the nuclear material and mitigate or minimize the radiological consequences.

Complex Nuclear Emergency Response

Radiological emergency response operations to search for, detect, locate, identify, and recover radioactive materials can be very complex, requiring technical cooperation and contingency planning between Competent Authority technical specialists and law enforcement security officials. NSS 13 recommends the following:

Planning and Preparedness for and Response to Nuclear Security Events

Contingency (emergency) *plans* to respond to *unauthorized removal* of *nuclear material* or *sabotage* of *nuclear facilities* or *nuclear material*, or attempts thereof, should be prepared and appropriately exercised by all license holders and authorities concerned. (Fundamental Principle K: *Contingency Plans*)

Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities, IAEA NSS No. 13

Nuclear Security Event Concerns

Categorization of Nuclear Materials				
Material	**Form**	**Category I**	**Category II**	**Category III**
Plutonium	Unirradiated	2kg or more	Less than 2kg but more than 500 g	500g or less but more than 15g
U-235	Unirradiated, 20% or more	5kg or more	Less than 5kg but more than 1kg	1kg or less but more than 15g
U-235	Unirradiated, 10% to <20%	5kg or more	10kg or more	Less than 10kg but more than 1kg
U-235	Unirradiated, >nat to <10%	5kg or more	10kg or more	10kg or more
U-233	Unirradiated	2kg or more	Less than 2kg but more than 500kg	500g or less but more than 15g
Irradiated Fuel			Less than 10% fissile content	

Unirradiated or irradiated with radiation level <1 Gy/h at 1 m unshielded

Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities, IAEA NSS No. 13

National Nuclear Security Administration

Nuclear Security Event

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.

Contingency planning between security forces and Competent Authority experts should be in place and exercised in order to efficiently and effectively coordinate the emergency response operations.

U.S. DOE/NNSA Contingency Planning, Preparedness, and Response to Nuclear Incidents

The U.S. DOE/NNSA incorporates a multi-faceted approach to contingency planning to prepare for and respond to a Nuclear Security Event. The approach includes:

Education and Awareness Training

Engineering Controls and Security Enhancements

Facilitated Tabletop Exercises

Radiological Emergency Response Capabilities

International Training Courses and Reachback Capabilities

Table Top Exercises

The Office on Nuclear Incident Policy and Cooperation in coordination with the Defence Nuclear Nonproliferation's Global Material Security Program and the Federal Bureau of Investigation Weapons of Mass Destruction Directorate, provide facilitated, scenario-based exercises for locations with civil nuclear material or radiological sources. The program includes:

1. Nonproliferation and counterterrorism awareness training

2. Security enhancements at the facility to reduce potential theft or misuse of radioactive materials

3. Capstone tabletop exercise at the facility regarding security alarm response and crisis/consequence managements capabilities

DOE/NNSA Emergency Response Capabilities

The DOE/NNSA Office of Emergency Operations maintains emergency response teams on-call 24/7 to respond to radiological incidents and accidents, including Nuclear Security Events. Several key response elements will be reviewed. The capabilities include search and recovery operations, medical advice and consultation, and dispersal modelling for consequence management.

Radiological Assistance Program (RAP)

Nuclear/Radiological Advisory Team (NRAT)

Aerial Measuring System (AMS)

Radiological TRIAGE

Radiation Emergency Assistance Center/Training Site (REAC/TS)

National Atmospheric Release Advisory Center (NARAC)

Regional Radiological Assistance

Radiological Assistance Program (RAP)

The RAP Teams provide a regional radiological hazmat and nuclear search capability and routinely trains and exercises with Federal Law Enforcement Agencies to respond to nuclear incidents.

Worldwide Nuclear Emergency Response

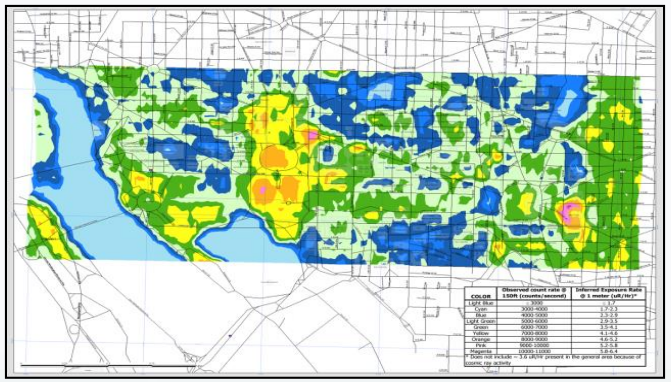
Nuclear Radiological Advisory Team (NRAT)

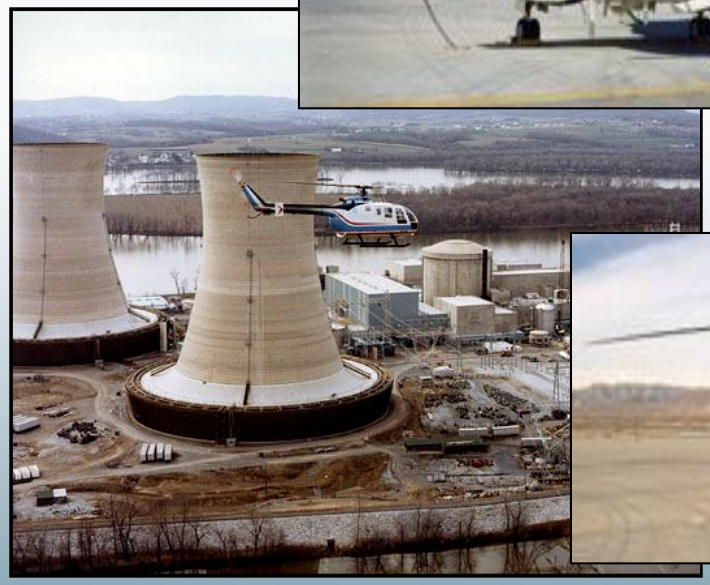
In the event of an international nuclear incident, the NRAT Team is on-call 24/7 with trained responders and equipment to deploy to a nuclear incident in support of law enforcement.

National Nuclear Security Administration

Consequence Management

Aerial Measuring System (AMS)

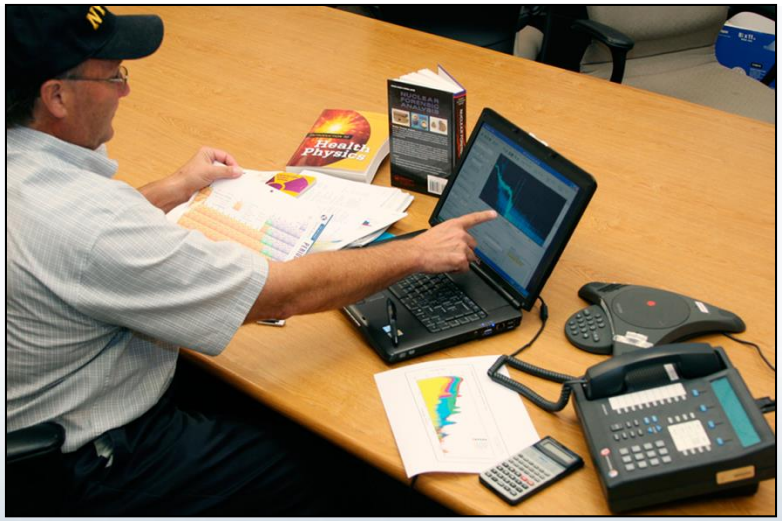




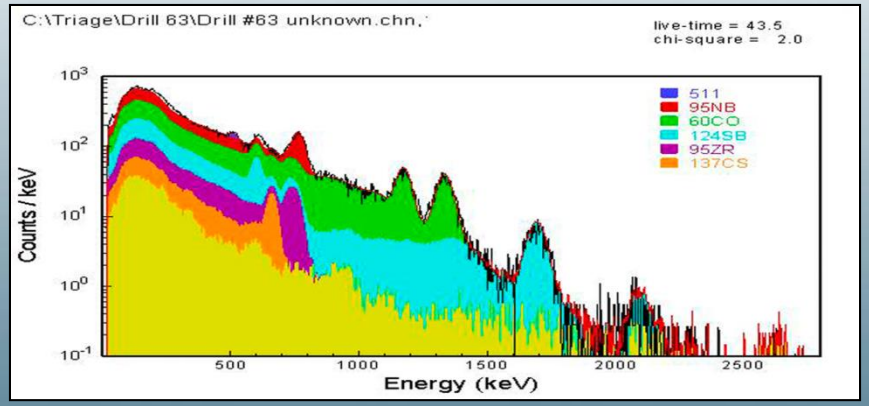
The AMS program routinely conducts proficiency training and emergency response exercises with Nuclear Power Plants in the event of a radiological release from an incident or accident.

National Nuclear Security Administration

Radiological TRIAGE



Radiological TRIAGE is a web-based reachback capability that provides emergency responders remote support for radioisotope identification in the event of a nuclear or radiological emergency. Triage provides 24/7 support to include:



- Analysis of spectral data
- Radionuclide identification
- Isotopic analysis
- Activity estimates
- Analysis of neutron data
- Risk assessments
- Health and safety guidance

National Nuclear Security Administration

Radiation Emergency Assistance Center/Training Site (REAC/TS)

The Radiation Emergency Assistance Center/Training Site is on-call 24/7 to provide medical assistance in radiation emergencies to include:

- Advice and consultation
- Ready access to a cadre of medical professionals
- Medical training
- Cytogenics biodosimetry laboratory
- Radiation Accident Registry

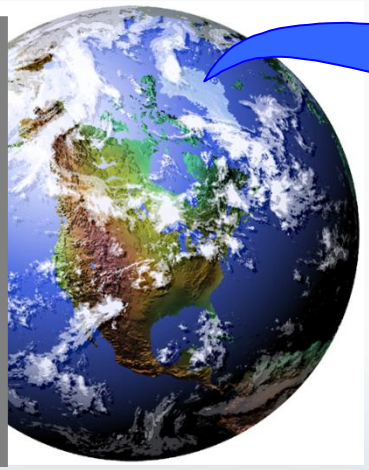
- ***Physician***
- ***Health Physicist***
- ***Nurse Paramedic***

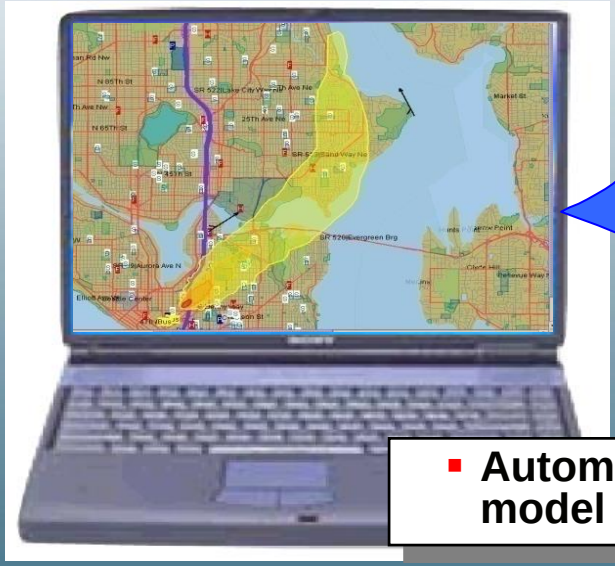
National Nuclear Security Administration

National Atmospheric Release Advisory Center (NARAC)

World-wide weather data and geographical information:

- Observed & forecast weather data
- Terrain & land surface
- Maps
- Population





National Atmospheric Release Advisory Center (NARAC)

- Advanced 3-D weather and dispersion models
- 24/7 technical and scientific support center

- Automated real-time access to NARAC 3-D plume model predictions using the IXP

Nuclear Security Event Scenario

The following hypothetical scenario was developed to demonstrate the U.S. DOE/NNSA contingency plan for preparedness, response, and recovery.

A Nuclear Security Event results in the unauthorized removal of Category II irradiated U-235 from a nuclear facility. A thorough search of the complex indicates the nuclear material is no longer at the facility. The FBI is notified.

- The FBI contacts the DOE Emergency Operations Center and requests assistance in search and recovery operations.
- The DOE Nuclear Incident Team alerts and mobilizes the regional NRAT, RAP, and the AMS teams for ground and aerial search operations.
- The TRIAGE, REAC/TS and NARAC reachback teams are alerted and begin consequence management planning.
- Based on intelligence reports, the FBI/DOE teams conduct mobile and pedestrian radiological search operations at an abandoned warehouse complex in an industrial park.

Nuclear Security Event Scenario

- The teams use sensitive radiation detection systems to detect the passive emissions from nuclear and radiological materials.
- The AMS system conducts a low altitude survey of the area around the nuclear facility and the roadways leading from the nuclear facility to the warehouse complex.
- One of the FBI/DOE mobile search teams detects a radiation alarm near a group of cargo containers.
- The FBI/DOE mobile team acquires a gamma-ray spectrum near the highest radiation reading and sends it to DOE TRIAGE for analysis.
- DOE TRIAGE analyzes the data and confirms the signature is consistent with enriched U-235 which had been irradiated.
- The FBI and local law enforcement secure the area and requests assistance for recovery operations.
- A joint FBI/DOE team conducts the recovery operations to secure and transport the material to secure location for further assessment.
- Evidence collected in the cargo container indicates planning for a criminal act and leads to the arrest of a nuclear facility employee.

International Cooperation and Assistance

The DOE/NNSA implements its wide-ranging international nuclear security engagement and emergency management programs through the Office of Nuclear Incident and Policy and Cooperation and the Office of Radiological Security.

Based on discussions with a partner country, the program jointly develops an action plan to address identified needs. The goals of the cooperative efforts are to improve the ability of partner countries to strengthen physical security practices at fixed nuclear/radiological facilities and sources in transit/mobile devices, remove disused radioactive sources, and through focussed training courses and workshops, enhance radiological emergency response capabilities to effectively respond to nuclear or radiological incidents, including Nuclear Security Events.

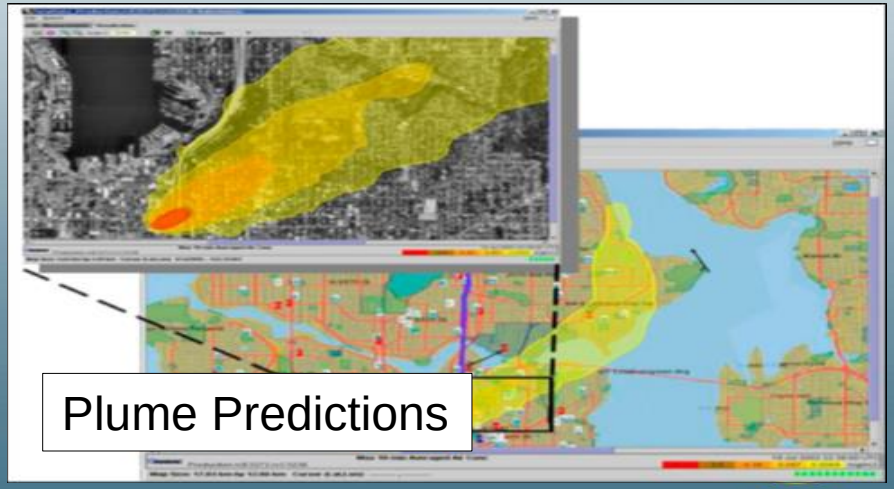
Technical Training Courses and Workshops

The technical training course and workshops are designed to address best practices 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

International Technical Reachback Assistance

DOE/NNSA reachback capabilities are also available to the international community



Summary

The DOE/NNSA's Contingency Planning for Nuclear Security Events includes awareness training, security enhancements, scenario-based tabletop exercises, and emergency response coordination with federal law enforcement. In addition, the DOE/NNSA collaborates with international partners to share security enhancements and emergency response best practices, and technical reachback to expand nuclear security worldwide.

For more information contact:

Rick Maurer, Principal Scientist
U.S. DOE/National Nuclear Security Administration
Remote Sensing Laboratory, National Security Technologies, LLC
Maurerrj@nv.doe.gov

Steven Buntman, Program Manger
U.S. DOE/National Nuclear Security Administration
Office of Nuclear Incident Policy and Cooperation
Steven.Buntman@nnsa.doe.gov

National Nuclear Security Administration