A Briefing on the Preparedness Impacts of the Recent Radiological Poisoning Events

The University *of* Texas
Health Science Center at Houston

Robert Emery, DrPH, CHP, CIH, CSP, RBP, CHMM, CPP, ARM
Assistant Vice President for Safety, Health, Environment & Risk Management
The University of Texas Health Science Center at Houston

Associate Professor of Occupational Health
The University of Texas School of Public Health
Center for Biosecurity and Public Health Preparedness

Robert.J.Emery@uth.tmc.edu

Work Initiated in 2000

Operational Topic

REPORTED EVENTS OF STOLEN RADIOACTIVE SOURCES IN TEXAS FROM 1956 TO 2000

M. Korshukin and R. J. Emery*

Abstract—Incident reports describing stolen source events in Texas from the years 1956 to 2000 were obtained from the Texas Department of Health–Bureau of Radiation Control and recorded into a computerized database using a pre-established set of codes. The data were then analyzed for the identification and characterization of trends. Over the 45-y period of analysis, 113 sources were reported as stolen. The radionuclides most commonly reported in theft events were ^{241}Am, ^{137}Cs, and ^{192}Ir. The proportion of sources including ^{241}Am as the sole source or ^{241}Am combined with Be, or as a companion source with ^{137}Cs, represented 56% of the total reported as stolen. Key risk factors identified as associated with source theft appear to include portability status, transportation status, transporter status, and radionuclide type. Based on the observations noted,

international levels that focus on safety and security, mandating training requirements, secure locations for storage, and frequent inventories to ensure that sources are stored and used appropriately (Karam 2003).

Maintaining the security of radioactive materials to prevent unauthorized use, loss, or intentional misuse is a regulatory requirement, as described in 10 CFR 20.1801 and 1802 (U.S. NRC 2005a). The U.S. NRC currently authorizes 33 states to regulate the use of certain radioactive materials within the state's boundaries, commonly referred to as "Agreement States." The State of Texas is an agreement state, and as such, the Texas Department of

Korshukin M, Emery RJ. Reported events of stolen sources of radioactivity in Texas from 1956 to 2000 Health Phys. 90(3):266-272; 2006.

Objectives

- Provide a brief background on the recent radiological poisoning event in London
- Describe how this event impacts the current radiological threat scenarios
- Discuss what steps might be taken to adjust for the lessons learned to date
- Reserve time for questions and answers

Valuable Key Resource

- A primary reference for this briefing is NCRP Report No. 138 *Management of Terrorist Events Involving Radioactive Materials*, issued 24 Oct 2001

Emphasis on Education!

- The underlying objective of any terroristic act is to invoke uncertainty
- The key to preventing or reducing the effects of terrorism is education
- Hence, education is crucial in our homeland defense efforts
- Classic example: radiological terrorism

Case Summary

- 1 November 2006, Alexander Litvinenko suddenly fell ill and was hospitalized. He died three weeks later.
- Symptoms initially suggested thallium poisoning, but later determined to be Polonium-210 (approximately 50 mCi)
- Investigations revealed ^{210}Po contamination in several sites visited by Mr. Litvinenko, including restaurants, hotels, airplanes, and about 10 individuals who had contact with him.
- The detection of contamination resulted in the need for the effective management of individuals concerned about exposure, and the monitoring and triaging of individuals with actual uptakes of material.

Polonium-210

- Polonium-210 (^{210}Po) is a naturally-occurring radionuclide that emits a weak gamma but an energetic alpha particle. Half life of 138 days

- ^{210}Po is used in common commercial applications as a static eliminator. The substances used in the poisoning is thought to come from a specialized nuclear facility given its purity and concentration.

- External to the body, ^{210}Po does not represent a significant risk because the alpha particle cannot penetrate the skin. However, if ingested or inhaled, the risk can be significant because the alpha emission deposits its energy in living cells and tissues

- The unique characteristics of the alpha emission necessitates the use of specific detection equipment

Polonium-210

- Key take home point:
  - ^{210}Po would likely not be detected when using standard radiation monitoring equipment (e.g. Geiger counters, Ion chambers, etc.)
  - Field detection is typically accomplished using a solid state detector such as ZnS
  - Relying on the wrong instrument can result in false negative results

Lessons from Previous Experience with Incompatible Detection

- 17 January 1966, USAF B-52 bomber crashed into a refueling KC-135 and three of the four hydrogen bombs being carried fell into tomato fields in Palomares, Spain

- Early responders surveyed the area and did not detect elevated radiation levels.

  But subsequent responders with appropriate (alpha detecting) equipment found the area significantly contaminated (over 500 acres of land affected)

Importance of Alpha Emission Detection

- Our retrospective study showed that 56% of the reported cases of stolen sources involved ^{241}Am, which is predominantly an alpha emitter

- US NRC data since 1990 reveals similar findings

- Largely moisture or density gauges in the 40-50 mCi range

Risk Communications & Personnel Screening

- The subsequent tracking of Mr. Litvinenko's whereabouts resulted in the need for surge radiation monitoring capacity.
- Interesting that no health care workers were noted in reports as contaminated – standard precautions work!
- Swift and effective public communications were key to address concerns of possibly contaminated individuals.
- Meeting the voracious appetite for "content" for the media crucial to maintaining "rumor control" especially in situations involving uncertain exposures.

Lessons from Previous Experience with Population Screening

- 13 September 1987 an abandoned 2,000 Ci ^{137}Cs source in Goiania, Brazil was sold as scrap metal and broken open.

- Radioactive contents were dispersed:
  - 249 individuals exposed
  - 54 hospitalized
  - 8 sick
  - 4 died

  - 112,000 individuals monitored!

Lessons from Previous Experience with Population Screening

- 24 January 1978, Soviet nuclear powered satellite Cosmos 954 crashed in Canada, spreading radioactivity from Great Slave Lake south to Alberta and Saskatchewan.

- Response activities included efforts to recover radioactive debris and the monitoring of populations for possible contamination.

Contact History

- U.K. Health Protection Agency contacts public health agencies in 48 countries regarding potentially contaminated persons ,centering around the Pine Bar located in the Millennium Hotel

- US CDC works with health officials in 20 states to contact 160 persons

- 17 persons chose to submit urine samples, no significant results

  » Source: CDCHAN-00257-07-02-05-UPD-N

Lessons from Previous Experience with Back-Tracking Contact History

- Previous experience with product contamination/tampering cases where "back tracking" was necessary, some recurrent response elements become evident (adapted from US FSIS):
  - Public notices of possible contamination/risk communications
  - Notifications to local health care organizations and public health agencies to prepare for possible presentation of symptomatic and non-symptomatic patients, transported by various means
  - Creation of hotlines or reporting mechanisms
  - Procedure for returning of products or merchandise? Preservation as evidence? Chain of custody?
  - Creation of registries for persons possibly exposed (even persons not sick now, but possibly affected in the future)
  - Signs and symptoms of exposure, what to do if exhibiting same
  - Longer term follow up?

Previous Experience with Radiological Exposure Device (RED)

- In November 1995, Chechen rebels contact a Russian television station and boasts of its ability to construct a radiation dispersal device (dirty bomb).

- The rebels report that they have buried a cache of radiological materials in Moscow's Ismailovsky Park.

In the very spot where the rebels indicated it would be, authorities find a partially buried container of ^{137}Cs. Neither the persons who planted the device nor the original source of the cesium are ever identified.

Existing Ranking of Foreseeable Threats Involving Radioactivity

- In rank order of probability
  - 1. Radiological Dispersal Device “Dirty Bomb”
    - conventional explosive dispersing radioactive sources
  - 2. Conventional explosion at “nuclear facility”
    - Leading to release of radioactivity rather than a criticality or nuclear fission event
  - 3. Tactical nuclear device
    - device capable of criticality, or fission
    - self-built or stolen

NCRP 138 Recommendations

- Prevention, education
- Monitoring at any explosion
- Clear emergency command and control system
- Clear communication channels
- Address psychosocial effects
- Prepare for medical response
- Exposure control and guidance
- Late phase consideration

Possible Modified Ranking of Threats Involving Radioactivity

- In rank order of probability
  - 1. Radiological Dispersal Device "Dirty Bomb"
    - conventional explosive dispersing radioactive sources
    - Now include Radiological Exposure Device (RED) and/or purposeful contamination
  - 2. Conventional explosive at "nuclear facility"
    - Leading to release of radioactivity rather than a criticality or nuclear fission event
  - 3. Tactical nuclear device
    - device capable of criticality, or fission
    - self-built or stolen

Possible Enhancement of NCRP 138 Recommendations?

- Prevention, education
- Monitoring at any explosion (also include unexplained clinical symptoms?)
- Clear emergency command and control system
- Clear communication channels
- Address psychosocial effects
- Prepare for medical response
- Exposure control and guidance
- Late phase consideration

Impact on Health Care Needs

- Means for mass screenings for contamination for alpha, beta, and gamma radiations
- Decontamination systems
- Rapid means of estimating doses
- Clinical care space, isolation, supplies, staff
- Means for previous contact follow up investigations – coordination with public health agencies, etc.
- Access to technical assistance
- Effective risk communication vehicles and mechanisms

Does Houston, Texas Remain a Possible Terrorist Target?

- Examples of characteristics of terrorist targets:
  - Large population
  - Key national oil refining resource
  - Key national port facility
  - Key aerospace capabilities
  - Other key financial or industrial infrastructure
  - Facilities or individuals of iconic value

Will It Happen Here?

- Based on recognized risk parameters, Houston possesses most, if not all, risk characteristics

- Cannot predict with certainty if an event will occur in Houston, but can be absolutely certain that…….

- If an event occurs anywhere, Houston will surely be impacted:
  - Uncertainty about next event might prompt closings, evacuations

- So preparation is prudent – our collectively ability to respond appropriately in all instances is crucial!

Lessons Learned to Date

- Clinical awareness of the possible unknown ingestion or inhalation of radioactive materials must be instilled
- If radiation is suspected, it can be detected, (but the correct detector is needed)
- Existing healthcare standard precautions appear to provide adequate protection for healthcare workers in such contamination events
- Inventories of local bioassay detection capabilities are needed
- Active risk communication and contact history programs are needed to address the public's apprehension – these program must work closely with various media outlets

A Reassuring Thought

- Best to think of this threat like an earthquake:
  - Can’t be predicted
  - Best to make preparations
  - Carry on with normal life functions

- *“Chance favors the prepared mind”*

Radiological Threat Resources

- NCRP Report No. 138 *Management of Terrorist Events Involving Radioactive Materials,* October 2001. available at www.ncrp.com
- Landesman, L.Y. Public Health Management of Disasters, The Practice Guide. American Public Health Assoc. 2001, Washington, DC, available at www.apha.org
- Center for Defense Information at www.cdi.org/terrorism
- Office of Technology Assessment: *The Effects of Nuclear War*, May 1979, available at www.wws.princeton.edu/cgi-bin/byteser.prl/~ota/disk3/1979/7906/790604.PDF
- Armed Forces Radiobiology Research Institute, available at www.afrri.usuhs.mil
- Texas Division of Emergency Management at www.txdps.state.tx.us/dem/
- Texas Department of Health Bureau of Radiation Control at www.tdh.state.tx.us/ech/rad
- Health Physics Society at www.hps.org
- US Department of Agriculture Food Safety and Inspection Service at http://www.fsis.usda.gov

THE UNIVERSITY *of* TEXAS

HEALTH SCIENCE CENTER AT HOUSTON