Responses to Radiation Detection Questions
Colorado Department of Public Health and Environment
Radiation Management Unit

Background

The Colorado Department of Public Health and Environment, Radiation Management Unit (CDPHE RAM), responds to numerous questions monthly regarding radioactive material identification and disposal. We routinely receive questions from scrap facilities, solid waste landfills, school districts, businesses and individuals. Scrap metal facilities and some landfills have gate alarms, and when the alarm is activated, the facility informs us about the shipment and disposition. In some cases, we arrange for a provisional license or U.S. Department of Transportation exemption. If the facility is close to Denver or Grand Junction where we have offices, we may deploy staff to the facility to identify the material in the load to facilitate disposition.

Calls from businesses and individuals generally relate to found material in old residences or vacated properties. Most of the time we can identify the material from the description or packaging, however, in some cases we have responded, and less frequently, taken possession of errant material.

Schools create a different set of problems in terms of material identification. Generally, we can help identify the materials by phone or email with attached photos; however, the presence of some radioactive materials in labs can result in uncertainty about material identification. Furthermore, we have experienced school chemical collection programs where overzealous school district or county staff have created a great sense of alarm around the presence of any amount of radioactive material.

Historically, the U.S. Department of Energy (DOE) Rocky Flats Plant personnel and response teams were local and able to support the need to respond to questions, field surveys and incidents. With the closure of the Rocky Flats Plant, DOE staff is very limited locally, although some capability exists through the DOE Radiological Assistance Program, which can draw on a couple of local members. Incident response can also be supplemented by the Colorado National Guard Civilian Support Team; however, their focus is truly incident and emergency response and field surveys, rather than providing technical radiation information.

It should be noted that Colorado has active and inactive uranium mines, has been a major player in the radium and uranium milling industries, and has hosted a nuclear weapons plant and a nuclear power plant, and currently hosts an interim fuel storage facility. Individuals involved with these activities have collected and distributed shelf and pocket radiation knick-knacks, and geologists and miners across the state routinely retain samples of radioactive ore.

Thus, the range of possible radioactive sources that we could encounter transcends the routine exempt sources, generally licensed sources, licensed sources, and individuals receiving radiation treatment or therapy or their wastes.

Enclosure

For incident response purposes, CDPHE RAM instituted a 24/7 pager rotation accessible directly or through the CDPHE 24/7 spill line. At the U.S. Nuclear Regulatory Commission's (NRC's) request, we have added a dedicated flash drive to accompany the pager that contains current Colorado license information, so as to provide 24/7 support to the NRC and U.S. Customs and Border Patrol (CBP).

Purpose

CDPHE RAM has the responsibility to ensure the safe and proper use and management of radioactive materials in Colorado. NRC has determined, and CDPHE has concurred, that many radioactive materials do not represent a significant risk, including exempt and generally licensed materials.

Furthermore, the NRC has discretely defined the quantities of radioactive materials suitable for the creation of a radiation dispersal device capable of causing significant radiation exposure (quantities of concern). Colorado law has exempted uranium ore from regulation as a radioactive material, until it is received at a uranium mill, and NRC does not consider even refined yellowcake as a material of concern.

The Department of Homeland Security Domestic Nuclear Detection Office (DNDO) plans to deploy a nationwide nuclear detection system. It is unclear how this system will be deployed or supported. Three likely approaches have been discussed in Colorado:

1. Provide all law enforcement and emergency response (fire and EMT) staff with pager-type detectors that will alarm when any amount of radiation is detected as the staff approaches an incident or vehicle. In the event of an alarm, the staff would query involved individuals as to likely sources of radiation and determine if additional investigation is necessary. Base staff would have enhanced detection capability, and support would have to be available on a 24/7 basis. Consultation with remote experts is also anticipated.

   Two incident organizations in Colorado are taking this approach to radiation detection.

2. Provide area or portal-type detectors at fixed locations, such as ports of entry, toll booths or hospital emergency room entrances. Triggering the alarm will alert attendants, who will consult with the involved individuals as to likely sources of radiation and determine if additional investigation is necessary. Base staff would have enhanced detection capability, and support would have to be available on a 24/7 basis. Consultation with remote experts is also anticipated.

   Twenty-three hospitals in Colorado are planning to install such systems to detect radiation on incoming patients to the emergency room. The primary objective is to identify the first wave of patients from a previously undetected radiation event, such as a Radiological Dispersal Device.

   A handful of scrap metal dealers and landfills have installed portal monitors; however, it is not expected that a terrorist would attempt to smuggle radioactive materials into a landfill or scrap yard.

3. Install area monitors in the vicinity of potential terrorist target areas, such as government buildings, sports or event venues, or heritage or recreational sites. In the event of an alarm, staff would query involved individuals as to likely sources of radiation and determine if additional investigation is necessary. Base staff would have enhanced detection capability, and enhanced detection and security support would have to be available during operational or accessible hours. Consultation with remote experts is also anticipated.

   CDPHE RAM is unaware of specific locations in Colorado; however, Denver is currently being considered for the next Democratic National Convention. Federal facilities may have installed such systems.

DNDO Objectives

Radiation detection devices exist for detection of different types of radioactivity to different degrees using different mechanisms. It is important in selecting the device to be obtained and deployed that the goal of the radiation detection be defined. Although some detectors can accommodate several objectives, failure to specifically align the device with the objective can create dangerous situations and waste time and resources.

At the NRC State Liaison Officers' meeting in August 2006, the DNDO representative appeared to indicate that the goal of the detection program was to identify the presence of all radioactive materials. Given that objective, and the wide variety of devices being distributed, the systems being implemented will likely detect a wide variety of materials.

Screening of Detections

Once an alarm is triggered, staff would need to be available to identify the specific individual, container or vehicle that triggered the alarm, segregate them from others, and conduct the initial query. In addition, the alarm may disrupt the activities of other nearby individuals or vehicles that may require attention to resolve.

If the screening cannot determine the radiation source based on the initial interview, base staff may need to conduct more thorough measurement or investigation. If base staff are not co-located with the detection devices, as for pager-type devices, base staff, line staff and the involved individuals/vehicles will be tied up until the situation is resolved. At this point, access to the remote experts may be necessary.

It is difficult to determine what frequency of detection will be with such little definition of the objective and method of implementation. However, if the goal were to identify all radioactive materials moved about in Colorado, the level of effort would be enormous. Colorado has approximately 375 specific licenses, and might have another 20 reciprocity licensees on any given day. We have accounted for approximately 800 general licensees, but have no indication of the number of entities with exempt materials. Not all of these materials are moved about the state; however, many are in nearly constant movement. It is impossible to determine the degree to which naturally occurring radioactive materials would be moved around the state.

It is also difficult to determine which Federal agencies will require information regarding detection program implementation and what state agencies will be required to provide that information. Currently, the state radiation program receives multiple calls from

various NRC staff regarding each radiation incident. If there were multiple Federal agencies following up on detections, this additional distraction could be significant.

Level of Effort

We can create an estimate using some assumed values:

- A recent estimate noted that between 100 and 150 individuals that had received radiation diagnosis or treatment and still had detectable residual radiation were released every day in a Colorado city of 300,000 population. If we extrapolate this to the rest of Colorado, we could estimate approximately 1500 such individuals statewide at any given time.
- We can also assume that three-quarters of the medical facilities that use radioactive materials receive a shipment of radiopharmaceuticals daily, and that the remainder receive a shipment twice a week. In Colorado, that implies that every week there are on the order of 400 trips of radiopharmaceuticals in the state, or approximately 80 per day.
- Currently most gauge, well logging and industrial radiography licensees are in the field at multiple locations. The 170 licensees in these categories probably cause about 400 radioactive materials movements each day.
- We can assume that the majority of the reciprocity licensees move through the state daily, thus approximately twenty large sources (well logging or industrial radiography) could be detected.

These individuals and these trips could trigger alarms under all three approaches discussed above.

If we assume that one in ten of each trip or person would pass an alarm station and trigger the alarm, we can estimate (1500 + 400 + 80 + 20 = 2000; 2000/10 = 200) approximately 200 alarms per day just from specifically licensed materials.

We have attempted to estimate the level of effort based on differing assumptions, below:

Case 1

Our understanding is that the DNDO is supplying resources, as follows:

- Remote expertise that will be available both by phone and email on a 24/7 basis.
- Initial purchase, installation and calibration of equipment.
- Initial training of staff responsible for initial detection and for base staff support.

In addition, NRC will provide access to the National Source Tracking System (NSTS), which will include all licensed materials down to Category 3.5. NRC has also discussed developing a data base of all NRC and State licenses for use by the detection system users.

Under these conditions, state RAM staff should be able to provide information related to specific licenses in the same manner that we are available to provide support to CBP. If we assume that 75 percent of the license-related alarms can be resolved without involving the state, only 50 calls would be made to CDPHE RAM staff daily. If calls could be resolved in an average of 15 minutes each, then a total of about 12 man-hours

per day would be required. This translates to 1½ Full Time Equivalent (FTE) or approximately $165,000 per year.

It is expected, however, that CDPHE staff will need to be involved from a public information perspective, also. The systems envisioned will likely cause significant disruption in public areas, and raise concerns among the media and the public about radiation dangers and terrorist activities. This disruption will be unrelated to the identity of the radioactive material, but to the fact of alarms being triggered.

As has been seen with the Polonium-210 poisoning incident, the impact on the public extended far beyond individuals with direct contact. Even in Colorado, we were asked to survey individuals and luggage that had flown on one of the British Airways airplanes involved in the incident. Luckily, no local media attention was generated by this matter, which would have increased our level of effort. This level of effort cannot be estimated due to the large number of unknowns.

Case 2

DNDO is supplying limited resources, as follows:

- Remote expertise that will be available both by phone and email on a business hours basis.
- Initial purchase, installation and calibration of equipment.
- Initial training of staff responsible for initial detection.

DNDO will not provide:

- Remote expertise outside of normal business hours.
- Training for base staff support.

NRC will be unable to provide access to the NSTS or a national license data base.

Under these conditions, state RAM staff would become the remote experts, and should be able to provide information related to specific licenses in the same manner that we are available to provide support to CBP. However, CDPHE RAM staff would also have to provide expertise for all other unresolved alarms outside of normal business hours. CDPHE RAM staff would also be required to provide training for base staff.

If we assume that 25 percent of the license-related alarms can be resolved without involving the state, only 150 calls would be made to CDPHE RAM staff daily. If calls could be resolved in an average of 15 minutes each, then a total of about 36 man-hours per day would be required. This translates to 4½ FTE, or approximately $495,000 per year.

In addition, the CDPHE RAM staff level of effort in resolving the alarms not resolved by line staff and base resources would need to be included. This potential level of effort cannot now be reasonably estimated due to the large number of unknowns.

CDPHE staff involvement from a public information perspective is similarly not estimated.

Case 3
This case combines Case 1 and Case 2, in that the program is initiated with intent of full funding as described in Case 1, but after a year or two, Federal funding is redirected and the detection system implementation is shifted to the state and local governments, as reflected in Case 2. Thus Case 1 estimates suffice for the first year or so, then Case 2 estimates are applicable, except that all license-related alarms fall to the state.

Level of Effort Summary

Case	Description	State Estimated LOE	State Estimated Annual Cost	Unestimated State LOE
1	DNDO and NRC Resources fully engaged	1.5 FTE +	$165,000+	Public information Ongoing training
2	DNDO and NRC Resources limited	4.5 FTE +	$495,000+	Non-license related alarms Public information Ongoing training
3	Initially DNDO and NRC Resources fully engaged; then resources limited	Initially: 1.5 FTE + Long Term: 6 FTE+	$165,000+ $660,000+	Initially: Public information Ongoing training Long Term: License and Non-License related alarms Public information Ongoing training

Unresolved Questions
Several questions about the DNDO detection program remain unresolved:

- Is the program established to provide long-term funding for system implementation?
- As detection technology advances, who will pay for replacing old detectors with improved devices and additional training?
- Is national consistency on detector usage envisioned?
- What authority will be used to interrogate, detain or search individuals or vehicles where radioactive materials are detected?
- If a detection system identifies potentially illicit material, who will determine that the material is illicit, and how?
- What happens to unresolved detections?
- What documentation will be required and who will be responsible for data collection, management and reporting?
- How will public and media responses to the program or individual uses be handled, and by whom?