A REVIEW OF RADIATION INCIDENTS AT THE SOLID WASTE AUTHORITY OF PALM BEACH COUNTY

Prepared For

Solid Waste Authority of Palm Beach County Florida
7501 N. Jog Road
West Palm Beach, Florida, 33412

By

Doug Nelson and Robert Madden
(561) 687-1100 (561) 687-1103 Fax

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Purpose

This summary report applies to the period February 18, 1993 to January 10, 1997. It is intended to 1) provide an overview of Authority response operations for those unfamiliar with these activities, 2) discuss real events so that others may learn from our experiences, and 3) make some general and specific recommendations that may be useful by others in creating standard response guidelines.

Introduction

The Authority has installed radiation detectors at the entrance to each of its transfer stations, landfill, and waste to energy facilities to prevent the acceptance of radioactive materials that may be improperly disposed. A small group of staff from the Hazardous Waste Services section is responsible for responding to and coordinating all activities related to radiation alarms. The Authority has a response plan in place and it is assumed that the procedures outlined in the plan are followed except where noted and are not repeated here. The HRS Office of Radiation Control (ORC) is an integral partner and has asked to be notified of all such incidents in the event that radioactive materials are discovered.

It should be noted that as of January 1997 the Authority has implemented new procedures to landfill and monitor radioactive loads rather than sorting and removing the contaminated materials. This is based partly on the results of this report and as an effort to minimize the response and investigation time.

A Typical Response and Investigation

Initial Response

A typical incident begins with a phone call from a scalehouse attendant to report a detector alarm. The HWS staff obtains and records the appropriate information about the load from the attendant and make a decision whether to accept the load or refuse it. Generally the only time a load is accepted is after it has been confirmed to be a false alarm, or the driver is setting off the alarm due to recent medical treatment.

If the load is refused, the hauler is informed that they may return the load to their own site, the original site, or utilize an offer of Authority services and facilities to have the load sorted. In any case HWS will notify the ORC in Orlando and request guidance and/or assistance. There can be a significant lag from the time of the initial call to the actual investigation while personnel are notified to respond for the incident investigation. The Orlando office will first contact the local or regional office personnel. These persons will then call HWS to confirm and then return to their office for appropriate equipment and finally travel to the landfill or site of the alarm.

Originally all responding personnel met to survey the load at the site at which it was detected and then decided whether to proceed to the landfill To save time, it was later decided to proceed directly to the landfill if the hauler chose to do so. In all cases the load will be directed to an isolated area of the landfill for unloading and investigation.

When the ORC and HWS persons meet the load at the landfill, the load is initially surveyed with more accurate handheld meters and the location of the highest reading is noted on the vehicle for subsequent steps in the investigation. The load is then directed to the Class I Landfill where HWS and ORC personnel will put on protective clothing and begin the actual investigation.

Locating the Source

The HWS and ORC staff together have refined techniques for locating radioactive materials in trucks or trailers. The key to efficiently investigating and saving time is to first locate the area with the highest reading with a handheld meter and then follow this 'hot spot' as the load is slowly discharged. In the case of live bottom trailers, the load can be walked right out the end of the trailer and monitored the entire way. When the hot spot nears the rear of the truck or trailer, unloading is paused and the truck is pulled forward several feet to a clean area. Personnel should stand back for the final unloading to avoid splashing or contamination by loose or falling material. Smaller amounts are now discharged and both the pile and the truck are monitored to locate the material. If necessary the truck is pulled forward again and this process is repeated until the hot spot is discharged to ground level. The truck is also surveyed to assure it is not contaminated prior to leaving the site.

HWS and ORC personnel, working together, will sort the wasteload material with rakes and shovels while one or two persons monitor the pile for the radiation source with the survey meters. Recovered items are carefully placed in heavy plastic bags, and set a safe distance away, so as not to interfere with the handheld detectors and ongoing monitoring. After all materials have been recovered, all personnel and equipment will be surveyed for contamination and any field disposables contaminated with radiation will also be bagged for disposal. All surveyed readings and findings are documented in the investigation forms. ORC will typically hold the recovered items for decay and disposal unless the originator can be discovered and notified. The Authority does not hold any radioactive waste for decay or disposal.

Recovered items are sometimes found inside trash bags or comingled with easily identifiable commercial waste. With a little searching personnel can often locate a clue as to the originator. For example, a commercial business address, or a residential address can be found indicating a likely source.

An incident response can take anywhere from one half hour (0.5) to five (5) hours from start to finish. An incident in which a load can be simply sent back to the originator would take the shortest amount of time, but is still documented. The longer amount of time depends upon ORC lag time and the ease of locating the material, and the extent of the load that is contaminated.

Incident Highlights

A wide array of experiences have been encountered during response incidents. Here are some of the highlights:

Contaminated shoes - The learning experiences of this incident are the primary reason for no longer investigating loads at transfer stations and for requiring that non-investigative personnel remain at a safe distance. The investigation was attempted inside the transfer station at one end of the tipping floor. A difficult to pinpoint source and an expanding zone of radiation readings led to the discovery that the substance was a liquid which had contaminated a large area of the transfer station floor. All activity on the floor was halted to control the spread, and all affected personnel were surveyed for contamination. With good intentions the driver had been assisting and had inadvertently contaminated his boots -which were promptly confiscated. After lengthy discussion it was agreed that the best action was to dilute the present contamination by hosing down the floor into the sanitary drains until no readings were detected and remove the identified items.

Density meter sealed source - Scrap metal is recycled on authority property by a private operation. An inbound radioactive device or source passed undetected at the landfill scalehouse and at the scrap metal recycling facility (which has its own detector). The device was processed with other scrap metal, and loaded into a rail car for transport several states away. When it arrived at its destination facility, radiation was detected and the rail car was shipped back to the Authority where response personnel unloaded and recovered a highly active radioactive item the size of a pencil eraser head. This was later determined to be a soil density meter source. It is likely that the device was intact and that processing exposed the source. A combination of circumstances - heavy shielding and poor position in the inbound load, and the lack of detectors on the outbound scales - led to an expensive and time consuming recovery process.

Radioactive driver - A resident delivering trash to the landfill activated the radiation alarm. The resident was asked to drive his truck past the detector again and the alarm was confirmed. The source appeared to be in or near the cab. The driver was questioned and he informed incident personnel he recently had radioisotopes implanted in him for medical treatment. His surveyed truck did not emit any radiation.

Cat litter - Response personnel typically recover outpatient radiation items i.e. tissues and diapers, but not radioactive animal waste. On two (2) occasions cat litter was recovered and held for disposal by ORC. Its readings were moderately significant. ORC phoned an area veterinarian located in the municipality the wasteload originated to get information. The vet said the cat probably had radioisotope treatment for medical purposes. ORC analyzed a sample which did confirm radioisotopes.

Hospital waste - On several occasions loads were rejected from transfer stations after being positively identified as originating from area hospitals. After sorting through the load at this site to locate the material, the standard procedure at those hospitals is now to let the load sit on hospital property until the material has decayed below detection levels. This has raised some health concerns.

Unable to locate or identify materials - A truck load of construction/demolition debris activated the detector. Low levels of activity were detected throughout the prolonged investigation however no source could be pinpointed. Steel pipe made with contaminated materials was suspected to have been the item which set off the radiation alarm.

Weather shortens investigation - Inclement weather forced one investigation to be aborted at the Class I landfill after some, but not all, of the material had been recovered. The remainder of the load was discharged and buried immediately. ORC personnel returned on three occasions for follow up monitoring of the discharge site which continued to be used for landfill. Activity was detectable during the first two trips but finally decayed to background levels as would be expected of I-131.

Friday incidents - Late on a Friday afternoon an authority transfer trailer activated a radiation detector. The time was near five o'clock, and ORC assistance could not respond to the incident until the following Monday morning. HWS personnel had to insure isolation of the wasteload for the whole weekend and insure containment of the transfer trailer (possible) leachate. Permission was obtained to isolate the transfer trailer inside the truck wash bay area and close-off the floor drains. Caution tape was erected and the area was secured until the investigation could proceed.

Problems Encountered

Hazardous Waste Services (HWS) personnel have to adjust to various problems which occur during an incident response emergency.

Liquid wastes - Can contaminate large volumes of mixed materials in a wasteload. The liquid waste can cause the material sorting procedure of an investigation to be much more difficult. PPE would be affected.

False alarms - Equipment can malfunction. Radiation meters at scalehouses can drift from presets and calibration can be offset. A surge of electricity can change the presets of a stationary radiation meter. Lightning storms have activated detectors and radiation meters causing false alarms.

Irate drivers - Drivers and handlers of wasteloads can get quite defensive at times. They sometimes get hard-headed and have difficulty comprehending the situation. Response personnel must talk with them and make sure they understand their options, the potential hazards and the disposal facility procedures.

Weather/landfill conditions - Sudden storms, lightning strikes, and high winds can make an incident response especially difficult and potentially spread contamination. General landfill conditions can also complicate vehicle mobility and/or personal safety. Trucks and heavy equipment operating at the landfill can make it hard to hear audible detection equipment. As any landfill operator knows, hundreds of birds overhead necessitate the need for a hard hat.

Detectors not seeing materials - Sometimes an item may activate the detector, then shift its position in the wasteload and become non-detectable prior to investigation. Low level emitters can be easily shielded by the truck body or load materials; passing through one set of detectors and be detected at another location.

Evening deliveries - After hour delivery of a wasteload containing radiation can cause a response problem. HWS response personnel availability may be a problem during an after hours response incident. Response personnel will have to be paged lengthening the entire process.

Statistical Summary

A detailed compilation of incident data is available in Table 1, Summary of Radiation Response Incidents, Appendix section.. Also, refer to the Appendix section, Figures 1 through 8, for a statistical breakdown of Table 1.

During this period, February 1993 to December 1996, there were a total of sixty-four (64) radiation detector response incidents. Forty-eight (48) of the responses required the assistance of the State Office of Radiation Control; and for thirty-three (33) of those forty-eight responses, HRS had to hold the recovered material for decay. The remaining twenty-three (23) responses were a combination of false alarms and malfunctioning equipment, driver / outpatient alarms, and various returned to generator / owner dispositions.

The following summarization of information are highlights of the Figures section located in the Appendix:

Seventy-three (73) percent of the total alarms at SWA facilities were confirmed as real alarms (not malfunctions).

The SWA facilities: Waste to Energy Plant (WTE) and Delray Transfer Station accounted for twenty-two (22) and sixteen (16) confirmed alarms, respectively; remaining ten (10) confirmed alarms were from other SWA facilities.

Seventy-three (73) percent of the incidents were routed to the Class 1 Landfill for investigation and a combined twenty-seven (27) percent returned to hauler, generator, or given to HRS.

Sixty-eight (68) percent of suspected items recovered during an investigation were identified by HRS to be of outpatient origin (manmade radioisotopes, Iodine trace elements).

The final disposition of items recovered from an investigation were as follows: Seventy-five (75) percent were retrieved by HRS and held for decay; Twenty (20) percent returned to owner / generator to dispose or hold for decay.

The lowest recorded handheld meter reading was fifty (50) microRads/hour., and the highest recorded was fifty (50) milliRads/hour (Iodine - 131). A value of 50 milliRads/hour is significant, workers should avoid these levels and limit time spent near source. These levels of radiation exposure are considered low. The highest reading of 50 mR/hr remains well below the federal standard of short term exposure levels. Almost all of the recovered radioactive material has been identified as manmade radioisotopes. These particular isotopes are used for cancer treatment processes. They have a short decay and a low exposure level; decaying in a matter of days to non-detectable levels.

Recommendations

Work with likely sources to establish detection criteria - For your county or area, establish a detection criteria with likely sources such as area hospitals. Find out who the contact people are and establish a dialogue with them. Discuss their methodology of detection, alarm levels, procedures and disposal techniques, and compare it to your own requirements and acceptance procedures.

Locate detectors properly - Install detectors properly and according to manufacturers recommendations. The goal is to survey the entire load at one time which may require detectors on both sides or overhead. In most cases detectors can be mounted in a number of ways without degrading the performance of the detector. Place the detector as close as practical to the load passing through the gate. Elevate the detector to the typical center of the load. For most truck loads, place the detector six (6) feet above the ground. The unit should be mounted in such a manner where the vehicle will not hit and damage the detector and/or cable. Place the radiation meter in full view of the gate supervisor. Multiple meters may be stacked.

Note: The use of two (2) units is the preferred method and allows both sides of the load to be scanned at the same time. Example, twenty-six (26) confirmed alarms were accounted for at the SWA WTE Plant and Landfill, this means the radioactive wasteload originated from a different SWA facility undetected. SWA transfer stations have only one detector mounted on the drivers side.

Create criteria to identify isotopes - Create a process or criteria to identify the radioisotopes involved and base the management of the load on the relative risk posed. Since most of the materials encountered are short half life diagnostic radioisotopes, i.e. Iodine-125, Iodine-131, Tc-99m, they may be considered low risk materials and possible candidates for landfill. Other materials will need to be removed by ORC and handled by other means. The problem is positively identifying the material to make the appropriate management decision. One proposed method would employ different shielding techniques to characterize the activity of the radiation (gamma, beta, alpha) and thus the isotope involved. Another method may be to hold the materials for a short time and measure the rate of decay.

Landfill low risk materials - A predetermined list of identified materials that exhibit decay within days or weeks could be landfilled. One supporting premise for landfill is that once the material is detected in a truck and delivered to the landfill, worker exposure can be controlled. There is no need for workers to directly contact the contaminated load and it could be directly buried anywhere in the working face of the active cell or at the site of the investigation. Alternately, a specific area could be set aside as an isolated holding area for radioactive materials to decay. The site location would be a fenced compound, with posted signs and require strict personnel access to the compound.

Create State Guidance Procedures - Form a committee of county, state and other representatives to create state guidelines for response, landfill disposal, and monitoring procedures for low levels of detectable radioactive materials.

APPENDIX

Costs

Equipment

Stationary Equipment -

The Authority has purchased eight (8) Ludlum Model 3502 gate monitor meters which include radiation detector units. These units are installed at each of the facility inbound scales. Each instrument has a push-and-set alarm point, audio and visual alarm, 0.500 microR/hr meter face, one shielded NaI crystal detector in a all weather enclosure, and 100 ft. of cable.
Cost.....$1750.00 each. Total.....$14,000.00

Hand held survey field meters -

(1) Mini Conrad II (Contamination and Radiation) survey meter. A pocket sized unit which measures alpha-beta and gamma contamination to 500,000 cpm. It includes an audible speaker.
Cost.....$754.03 each

(2) Ludlum Model 3-97 low intensity gamma radiation survey meter. It can monitor both internally and externally for low specific activity metered. The model includes a NaI scintillation crystal, audible speakers, scaled meter face of 0 microR/hr - 5 mR/hr and other features.
Cost.....$1000.00 each

Check Source -

The purpose of the instrument check source is to allow a radiation response check of the unit. The check source could prevent having to send the unit in for repair or calibration in the event of a suspected problem. The source does not require a license due to its size (5.0 microCi).
Cost .....$30.00 with container.

Labor

Response time / man hours -

HWS has recorded an estimated 120 hours expended for all response incidents during the period February 1993 to December 1996.

At $20.00/hr this translates into an estimated $2400.00. This reflects only HWS personnel - the man hours expended by ORC are expected to be roughly equivalent. The average man hours per response for this period was three (3) hours.

Table 1 Summary of Radiation Response Incidents

Figures 1- 8