LLRW MANAGEMENT CHALLENGES AT A LARGE RESEARCH UNIVERSITY

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ABSTRACT

In the performance of its mission as a world-class teaching and research institution, the University of Michigan (U-M) generates a variety of Low Level Radioactive Waste (LLRW) streams. The management of these wastes (i.e. packaging, transportation, processing and disposal) has a direct impact on a large research university that other, conventional generators may not appreciate. The university is actually a small generator compared with the likes of utility companies and government agencies. Yet experience has shown that universities require unique service support for the management of a wide range, albeit smaller quantities of LLRW streams. Unlike larger LLRW generators with specialized cadres of employees dealing with LLRW issues, a research university is likely to have these same responsibilities handled by a small team of specialists requiring a variety of skill sets.

The diversity of waste generated is reflective of the number and variety of waste generators on campus. With over 1500 medical research and teaching laboratories and a research reactor, the LLRW waste streams the U-M generates include significant volumes of solid, long- and short-lived waste as well as liquid mixed waste and non-hazardous aqueous waste. As a result of this diversity of waste streams, the U-M must meet compliance standards established by the NRC, EPA, DOT and the State of Michigan.

Like other LLRW generators within the State of Michigan, the U-M was unable to ship LLRW for disposal from late 1991 through mid-1995 due to political restrictions imposed by the federal government relating to the state compact legislation. This resulted in a large quantity of LLRW and mixed waste shipped for processing and disposal beginning in mid-1996. The U-M, along with other small quantity generators must compete for access to the diminishing space remaining at the Barnwell Disposal Facility. The key to success in this area requires a combination of institutional long-range planning and having a knowledgeable broker working on your behalf.

SOURCES OF LLRW

The University of Michigan (U-M) generates low level radioactive waste (LLRW) from a variety of areas. There are upwards of 1500 research laboratories operating under the direction of authorized users, teaching labs and a research reactor on campus, all of which contribute to the annual volume of waste generated on the U-M's Ann Arbor Campus.

The various sources on campus generate dry waste (DAW) typified by paper, plastic and glass which may contain long-lived (i.e. H-3, C-14 primarily) and typical short-lived isotopes (i.e. P-32, S-35, I-125). In 2001 a total of 4,976 ft^3 of long-lived solid waste was collected and processed. During the same period 11,851 ft^3 of short-lived solid

waste was collected and stored on-site for decay. A total of 1,131 ft^3 of decayed waste was shipped for survey and release.

Liquid waste generated consists of either mixed waste (containing a RCRA regulated chemical) or aqueous in nature. In 2001, approximately 440 gallons of mixed waste were shipped off-site for processing and disposal; while approximately 5 gallons of aqueous liquid was shipped off-site for incineration.

Other components of the LLRW waste stream consist of sharps, liquid scintillation counter (LSC) vials, stock vials and miscellaneous contaminated articles.

PROCESSING PROCEDURES

Solid Waste

DAW, sharps and empty stock vials are all handled in a similar fashion. Waste is collected from the generation sites and transported to a centralized processing area for segregation. Segregation is based upon several factors: physical form, and the longest isotopic half-life present.

Solid LLRW (DAW), with half-lives longer than 90 days, are packaged in B-25 boxes for bulk shipment to a LLRW waste processor for volume reduction prior to shipment for disposal. DAW is incinerated to achieve optimum volume reduction. The ash is sent for burial at Envirocare of Utah.

Solid waste with half-lives of less than 90 days are packaged in bulk and stored for a period of time equivalent to a 10 half-life period to allow for isotopic decay. At the conclusion of the decay period, the waste is shipped to a LLRW processing facility for survey and release. Following survey, the waste is shredded to destroy markings that could identify the generator and transported to a Type II solid waste landfill for disposal.

Liquid Waste

Mixed Waste

Following collection and transportation to one of two processing areas, liquids are further segregated depending upon whether or not a RCRA regulated chemical is present. Following segregation of liquid waste containing hazardous constituents and those that do not; the waste is evaluated to confirm the isotopic content and activity claimed by the generator. The waste containing RCRA regulated constituents is transported to a U-M owned Part-B permitted storage facility and stored according to RCRA waste characteristic (ignitable, corrosive, reactive or, toxic). The mixed waste is stored inside an engineered containment area in 55-gal drums. The Part-B permit requires the university to ship mixed waste on an annual basis.

The mixed waste is sent to DSSI/PermaFix in Kingston, TN where it is blended with other liquid waste with higher BTU values and used as a fuel for an industrial boiler. The ash from the boiler is sent for burial at the low level radioactive waste disposal facility in Clive Utah, operated by Envirocare of Utah.

Aqueous Waste

The non-hazardous liquid waste, consisting of aqueous solutions and low concentrations of radioactive components are processed for disposal by draining into the sanitary sewer (10 CFR 20.2003). This waste stream must not contain any bi-phase liquids or solids that are not readily dispersible biological material. The U-M further limits the amounts of waste disposed in this manner by imposing a 10% ALARA concentration threshold on a monthly and annual basis.

Other Liquid Waste

This category of liquid waste contains one or more of the following characteristics:

- Undrainable due to high activity;
- Insoluble constituents.

The high activity liquid waste can generally be drained following storage and decay. If not, it is sent with the liquid waste containing insoluble constituents for incineration at Duratek.

LLRW DISPOSAL IN MICHIGAN

From 1991 – 1995 LLRW generators within the State of Michigan were not permitted to dispose of LLRW at existing facilities (Envirocare or Barnwell). This was due to Michigan's decision not to participate in the State Compact System established by federal law (1). This resulted in a significant backlog of solid and liquid LLRW.

The U-M was no different from other generators in the State; it stored the waste until the political atmosphere had cleared sufficiently and disposal would be again permitted. By the time it was permitted to ship waste out of state for disposal, the university had accumulated 6,240 ft^3 of solid waste and 7040 gallons of mixed waste. The university had no broker under contract at the time to assist in transportation, processing and disposal. It took approximately a year to complete the procurement process.

LLRW Broker Selection

The U-M selected a broker to assist in managing the backlog of waste following a competitive bid process. In addition to possessing amounts of insurance (general liability, automobile, pollution liability, DOT) that the university felt was adequate, the selected broker had to demonstrate proficiency in meeting NRC, USEPA, DOT requirements dealing with management of LLRW. The U-M performed site tours to evaluate compliance with Federal, State and local requirements by each of three short-listed competitors. The selected broker was also expected to advise the university on ways to minimize waste generation.

SPECIAL PROJECTS

From time to time the University has a need for specialized technical support to characterize, package and transport for disposal LLRW that does not fit the profile of its

routine waste streams. In these cases, the U-M has the choice of utilizing its broker under contract, or in specialized cases, competitively bid the project. In the past several years, the University has completed the following special projects:

- Activated Metals Shipment – 6/1998
- Be-reflectors Shipment – 8/1999
- Pathological Incinerator D&D – 12/1999
- Fuel Pool Components – 5/2002

Activated Metals Shipment

In June 1998, the U-M shipped nose cones (13), top bales (64) and activation chambers (76) for burial at Barnwell, SC. The materials were encapsulated in a minimum of 4 inches of concrete inside of 55-gal steel drums. There were fifteen drums with a total activity of 5.7 Ci shipped as Class B waste to the Barnwell Disposal Facility.

Be-Reflectors

A 1973 "gift" of 20 Be-reflectors, from Babcock & Wilcox, was prepared for shipment and ultimate burial at Barnwell, SC. Each unit measured 3" x 38" and was packaged inside a small HIC. Resin from the fuel pool water filtration system was used as additional shielding to control exposures outside the package. The HIC was in turn placed inside a Type A Cask for transport to the Barnwell facility in South Carolina. The HIC weighed approximately 400 pounds with a total activity of 4.9 Ci and was shipped as Class B waste to the Barnwell Disposal Facility.

Pathological Incinerator D&D

A small incinerator had been used by the University from 1964 until December 1997 to dispose of small animals that had been used in laboratory research involving small amounts of radioactive isotopes. The incinerator was characterized prior to demolition. All visible asbestos was removed prior to demolition. In December 1999, the incinerator was demolished, generating a total of 118,330 pounds of contaminated waste. The waste consisting of metal with fixed contamination, metal with removable contamination and firebrick was transported to Duratek's Oak Ridge facility for processing (volume reduction, decontamination for survey and release).

The metal components with fixed contamination had the contaminated portions removed and sent to the metal melt operation, the remaining materials were surveyed for release as scrap metal. Metals with removable contamination were decontaminated by using abrasive techniques, surveyed and released as scrap materials.

The firebrick was shipped inside B-25 boxes and surveyed in bulk by Duratek in the Green is Clean (GIC) program. The GIC program… The boxes that failed this survey were sent for burial at Envirocare. The boxes that successfully passed this survey were disposed at a commercial Type II landfill.

The area occupied by the incinerator, including an area approximately 20 feet away, was surveyed for residual contamination. A few hot spots were detected, which were

removed by scarifying the concrete to a depth of approximately 1/8 inch. Final surveys were performed in accordance with survey protocols contained in NUREG-1575 (2) and NUREG-5849 (3).

Reactor Pool Components

The U-M has had a small (5-MW) research reactor in operation since the late 1950's. Recent housecleaning efforts have necessitated cleaning out the fuel pool area. Activated metal materials that had been placed in the pool, or stored in wall ports over time and no longer in use or needed; miscellaneous sources and a 215 mCi Cobalt-60 source were removed for packaging and disposal.

Duratek was selected to package, transport and dispose of these materials. The shipment was accomplished in 2 separate campaigns; the first was the solidification, packaging and transportation of a portion of the material was solidified, packaged and sent to Duratek's processing facility in Kingston, TN. After repackaging to meet Barnwell Site disposal criteria, it was shipped to the Barnwell facility for burial. The second campaign involved the higher activity materials. Duratek specified the system design and equipment for removing the irradiated hardware from the reactor pool and collecting the other items located in the reactor wall ports for packaging and disposal.

The design called for a 2-inch thick steel liner, loaded with the sources and hardware while in the reactor pool. The Co-60 source was placed in a DOT Specification 2R stainless steel container before placed inside the liner.

The liner was then placed into a Duratek Type A Cask for transportation to the Barnwell Disposal Facility in Barnwell, SC. The liner was buried in a "hot trench"; the total activity was 5 Ci, weighing 3,800 pounds. The package volume was approximately 23 ft^3.

DISPOSAL OPTIONS – WHAT'S OUT THERE?

The U-M conducts periodic audits of the LLRW processing and disposal facilities it utilizes. Since 1997, the U-M has sent its DAW to either Envirocare of Utah in Clive, UT or the Barnwell Disposal Facility in Barnwell, SC. Mixed waste is sent to DSSI/PermaFix in Kingston, TN. Liquid Scintillation Counter (LSC) and stock vials are sent to PermaFix in Gainesville, FL for processing and disposal.

The escalating price structure, coupled with space allocation limitations at the Barnwell facility has resulted in the U-M limiting the volume of waste it sends to Barnwell to the higher activity Class A waste, Class B or C waste. Recent increases to Envirocare's pricing schedule, is a perceived attempt to keep pace with the dwindling space available at Barnwell as it approaches it's 2008 deadline. At this time the Barnwell facility will only accept waste for disposal from members of the Mid-Atlantic Compact (Connecticut, Virginia and South Carolina).

REFERENCES

1. Low-Level Radioactive Waste Policy Act of 1980, Policy Amendments Act of 1985.

2. NUREG-1575, Multi Agency Radiological Survey and Site Investigation Manual (MARSSIM).

3. NUREG-5849, Manual for Conducting Radiological Surveys in Support of License Termination.