LOW-LEVEL RADIOACTIVE WASTE CONTROL AND MANAGEMENT AT TEXAS A & M UNIVERSITY

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ABSTRACT

As the world begins the countdown to the next millennium one of the most complex problems that faces our technical society is the safe long-term management of radioactive waste. Both federal and local governments have attempted to implement programs for the permanent disposal of both high and low-level radioactive waste. None of these programs has produced an operational permanent disposal facility.

Because of these failures the producers of the waste must create programs to not only limit the type of waste produced but limit the amount of waste that requires a special disposal facility. While the majority of the low-level waste stream that is produced is created at nuclear electric generating facilities, another portion of this waste stream is produced during research performed at universities and other research facilities. These generators are often the most heavily impacted by the high cost of permanent disposal of the waste they generate. With the great amount of uncertainty that surrounds the future of waste disposal in this country and the associated cost, these smaller generators must focus on the opportunity to control the radioactive waste stream.

In order to accomplish this goal the individual researchers and waste generators must be controlled and closely monitored. A proactive series of programs have proven to be effective at many of these research facilities. Not only can the amount and volume of waste be reduced but the volume of waste associated with these research activities can somewhat be predicated.

INTRODUCTION

The Texas A&M University System is one of the largest research institutions in the United States. Within the System, there are several different and unique research organizations. The use of the radioactive material that is associated with these research activities is managed and regulated by the University's Radiological Safety Office (RS). During these research activities large volumes of low-level radioactive waste could be generated. The RS is responsible for the control and permanent disposition of this radioactive waste. The University has a very small temporary, centralized storage facility for the low-level radioactive waste that is awaiting permanent disposal.

Due to the high degree of uncertainty which currently surrounds the siting and construction of Texas's permanent low-level radioactive waste disposal facility, and the cost associated with it, the University has implemented several programs to control radioactive waste generation. A comprehensive program has been established to control the type and amount of low-level radioactive waste generated during research and other activities associated with the University. This program includes several procedural measures to limit the quantity and type of waste produced from the three hundred sub-licensees associated with research and other activities within the System. The RS is responsible for the wide variety of low-level radioactive wastes produced by the System; these radioactive wastes can vary in form from liquid scintillation cocktail and vials to frozen animal carcasses.

CURRENT WASTE DISPOSAL POLICY

The main concern of the University is the permanent safe disposal of all low-level radioactive waste that is generated while using the most cost-effective means available. At the present time, the RS works with a private sector contractor to facilitate the permanent disposal of all the long-lived radioactive waste at a site located in South Carolina. This arrangement was expected to be the temporary solution until the State of Texas permanent disposal facility was licensed and built at Sierra Blanca in West Texas. But due to a recent decision by Texas Natural Resource Conservation Commission, this proposed site be rejected and will not be considered for any future facilities.

The federal government's initial guidelines for the permanent disposal of radioactive waste were generated in 1980 when U.S. Congress enacted the Low-Level Radioactive Waste Policy Act (LLWPA) (1). This act proposed a specific timetable for the construction of a series of permanent low-level radioactive waste disposal facilities. Each state was left to independently develop on its own a program for the permanent disposal of this waste generated within its border. In several areas of the country, a group of states have formed collective compacts in order to combine their resources and plan to construct joint facilities. Initially, the deadline for construction of these facilities was set for 1 January 1986. Since the progress of the compacts facilities were delayed, in 1985 the LLWPA was amended to extend this deadline to 31 December 1992 (1). Since this deadline is long since past, Congress is considering going back and reviewing the entire act. Currently none of the compact's permanent disposal facilities are even past the licensing phase of construction and are unlikely to be completed prior to 2005. Due to these circumstances, a crisis now exists for the permanent disposal of low-level radioactive waste in the United States. At this time the only operating permanent low-level waste disposal facility in this country open to all states is located in Barnwell, South Carolina. The present cost of disposal in this facility is in the range of $350-$400 per cubic foot. Due to political considerations in the state of South Carolina, this cost is projected to increase to over $700 per cubic foot (2).

The LLWPA and it's amendments also dictate a surcharge and penalty schedule per cubic foot of waste buried for all users of a remote waste disposal facility if a local facility was not bought on line. The intended purpose of the surcharges and penalties was to motivate the waste generators into pressuring local states and compacts to move forward in the construction of disposal facilities. This policy has been a complete and utter failure; the long-term effect has been a greatly increased cost for the disposal of waste and the forced temporary storage of waste. Many larger generators of waste including Texas A&M, have been forced to pay these higher fees since the availability of local storage is limited.

TEXAS LOW-LEVEL WASTE FACILITY STATUS

On October 22,1998, the Texas Natural Resource Conservation Commission voted to deny the Texas Low Level Radioactive Disposal Authority (TLLRWDA) license application for the Sierra Blanca facility. The same day Governor Bush released a statement that this site was out of any further consideration for a permanent disposal facility (3). TLLRWDA was created by the Texas Legislature in 1981 to finance, construct, operate and decommission a permanent disposal site for all the low-level radioactive waste that is generated in the state of Texas (4). Recently,

U.S. Congress and the President formally approved a new three-member compact, consisting of Texas, Maine and Vermont. This compact has the support of three state's legislatures and governors but its future at this point has yet to be determined. In the current session, the Texas Legislature must completely review and revise the bill used to create the TLLRWDA since the Authority sole province was to site, build and manage a permanent low-level radioactive waste disposal facility in Hudspeth County where Sierra Blanca is located.

The defeat of the TLLRWDA license application will have many long-term repercussions for all users of radioactive material and generators of radioactive waste in Texas, Maine and Vermont. The only options left open to these generators will be the continued short-term storage of the waste, shipment to Barnwell or a total stoppage of the work that is generating the waste. In many situations, this will be impossible so other solutions must be found. At this time Texas A&M University has implemented a comprehensive program to control and limit radioactive waste from the point it is generated to the point were it is ultimately disposed.

WASTE MANGEMENT PROCEDURES AT TEXAS A&M UNIVERSITY

With the failure of the licensing of the Sierra Blanca facility, a complete and comprehensive waste management program is a necessity at even the smallest of generator sites. In the mid 1980's with the cost of waste disposal constantly on the rise and the uncertainty surrounding a future permanent Texas disposal facility. The RS instituted several programs designed to minimize the amount and types of low-level radioactive waste produced from University research activities.

Training is a very important aspect of these programs, since the generator of the radioactive waste has the most direct control over the amount and type of waste created. All the users of radioactive materials at the University must have a sub-license issued by RS. As part of this process the material users and all other laboratory personnel must be properly trained in the handling and use of these materials. As part of this training process these personnel are completely briefed in the waste disposal techniques used by RS. The areas of training include the proper sorting, labeling and identification of generated waste, and segregation of short and long-lived waste. Each of these laboratories will have properly designated waste disposal bins and carboys for liquids for temporary on-site storage of the waste. Disposal procedures are issued to each laboratory and are required to be posted in areas were radioactive waste is generated. The users will contact RS when these temporary waste collection facilities are full, and at that time the RS personnel will remove the waste and inspect the laboratories to ensure compliance with the procedures. A rotating inspection schedule is also used to ensure all sub-licensees are properly following procedures.

One of the first programs to be placed into wide spread use at the University was the promotion of the use of short-lived radioisotopes. Under Texas law, any material contaminated with short-lived radioisotopes (less than 300-day half-life) may be disposed in a landfill under controlled conditions. Texas A&M University has a special amendment to its radioactive material license to allow for the controlled disposal of these short-lived radioactive waste. The University properly disposed of 3,395 cubic feet of this type of waste to the local landfill in 1997 (5).

This not only helps to limit the volume of waste produced that must go to a special facility but also allows for the more widespread use of these short-lived radionuclides. It should be noted that disposal limits do exist for each of the short-lived radioisotopes and these limits are clearly presented in the Texas Regulation for Control of Radiation Part 21. During the review

process for any new research involving the use of radioisotopes, the primary investigator must justify to RS personnel why short-lived radioisotopes are not being used. This program while increasing the volume of waste disposed in the landfill has helped to reduce the use of long-term radioisotopes as well as the amount of waste generated from their use.

In the mid-1980's the RS started another important program, the replacement of commonly used toxic liquid scintillation cocktail with a biodegradable substitute. Not only does this eliminate the need to dispose of the cocktail as a mixed waste, but also in most cases the remaining cocktail solution can be disposed down the drain. Special controls and limitations are in place for sink disposal for any of this material which is closely controlled by RS personnel. No samples, which contain hydrogen-3 or carbon-14, can be disposed of in this manner. Other liquid waste that is generated by the University during research activities must be segregated, sampled and disposed of by RS personnel only. No researcher is allowed to directly dispose any liquids that may contain radioisotopes to the common drain. These liquids are removed from the laboratory by RS personnel, and are then sampled and analyzed prior to disposal.

A laboratory waste separation and segregation program for both liquid and solid waste has proven to be a very successful waste reduction program. First off, the waste is placed into either a short-lived or long-lived waste container depending upon the radioisotope used. These waste containers are provided to each of the laboratories that generate radioactive waste at the University. Once full or no longer required RS personnel pickup the waste and placed them in a sorting area. Each bag of solid waste is sorted and surveyed to ensure that only truly contaminated solid waste is bagged for disposal. Once this task is completed the sorted waste is then compacted. These compactions lead to an additional volume reduction factor of 3-5 (6). This sorting and compaction normally lead to a reduction in waste volume on the order of 10 –20 from the initial volume of waste removed from the laboratories.

The short-lived waste is stored for decay, and then disposed of to a local landfill after approximately six months. The long-lived waste is placed in 55-gallon waste drums and is stored until it can be disposed. Each of these drums contains 7.2 cubic feet of dry low-level radioactive solid waste (6). The vast majority of the solid waste that has to be disposed of commercially contains hydrogen-3 and carbon-14. At times some other long-lived radionuclides are used by researchers, thus creating unique disposal problems.

WASTE STATUS AT TEXAS A&M UNIVERSITY

In an effort to store the least amount of low-level waste possible in temporary storage, shipments have been made to an off-site permanent storage facility about every two years. Since the current status of a permanent disposal facility in the state of Texas is uncertain the University will continue to ship waste to Barnwell for the foreseeable future. The University has a temporary storage capacity of 5,000 cubic feet, but current policy is to ship waste as often as possible to maintain as large as storage capacity as possible (6). Unfortunately the cost for waste disposal is constantly increasing. The disposal fees that are charged to the University by a private vendor have increased by a factor of 3 since 1991 (7).

The programs developed and implemented by RS at the University have had a dramatic effect on the volume of waste that requires disposal in a permanent facility. The annual volume of waste created through the use of liquid scintillation vials has decreased from 353 cubic feet in 1990 to 15 cubic feet in 1992 to 1 cubic foot in 1997. The volume of solid waste generated has also decreased greatly, prior to the RS programs the University generated 1,000 cubic feet of

waste annually that was designated for permanent disposal. The volume of solid low-level radioactive waste has been greatly decreased as can be seen in Table I.

Table I: Year vs. Volume Shipped (cubic feet)

1990	1991	1992	1994	1996	1998
359.8	489.6	22.67	577.5	223.2	116

The volumes in Table I vary due to several special considerations; the 1990 shipment contained 345.6 cubic feet of scintillation vials, the 1991 shipment contained 233.2 cubic meters of solid waste, resin and charcoal from the Nuclear Science Center Reactor. Cost has also been a limiting factor in the volume shipped. In 1992, some 309 cubic feet of waste, which was scheduled to be shipped, was placed back into temporary storage when funds were unavailable for disposal. This stored waste was shipped in the next scheduled shipment in 1994, raising the shipment total to 577.5 cubic feet of waste for disposal.

While the shipment of solid waste is down, several special shipments of sealed sources and mixed waste also were performed during this time period greatly adding to overall disposal cost. In the past, the University has attempted to initiate a program to add a disposal surcharge to all researchers that generated waste. This program proved to be impossible to enforce and was cancelled. Currently many of the older facilities at the University are being either shutdown or renovated. This activity has lead to the closure of some older research facilities, which has also added to the total waste stream.

CONCLUSION

The programs initiated by RS have proven to be very successful in managing the low-level radioactive waste stream. The effectiveness of the program can be seen in the reduced volume of waste needing permanent disposal in a facility. While the University setting has some unique advantages in the control waste the large number of generators limits the amount of direct control. Before radioactive material is used, the waste generators are trained in the proper laboratory procedures for the safe temporary containment of waste in the laboratory. While some interaction with RS personnel is required, for the most part the generators themselves dictate the success of the RS programs. With the ever-increasing cost of waste disposal and the uncertain future of a permanent facility in Texas, these programs must continue and be expanded in the future. Every users of radioactive material should have in place a waste management program of some type. The cost savings alone justify the added man-hours such a program would require. Since temporary storage is not a solution to the low-level waste crisis a positive step is for the generators themselves to lessen the amount of waste produced. Some highly successful reduction programs have been initiated by the nuclear utilities in Texas, but these programs must spread to the other major and minor generators in the state to avoid a larger crisis. When and if a state-wide facility becomes available.

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