AMERICAN NUCLEAR INSURERS: INDUSTRY RADIOACTIVE WASTE MANAGEMENT EXPERIENCES

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ABSTRACT

Nuclear liability insurance covers liability for damages directly caused by the nuclear energy hazard. This coverage includes offsite bodily injury and property damage sustained by members of the general public, and bodily injury to onsite third party personnel. Recent nuclear liability claims allege bodily injury and property damage resulting from releases of radioactive materials to the environment and occupational radiation worker exposures. Routine reactor operations involving radioactive waste have the potential to result in such claims. The nuclear insurance Pools believe that one way such claims can be minimized is through the implementation of an effective radioactive waste management program.

INTRODUCTION

As demonstrated in recent liability claim experience, both nuclear and non-nuclear, tort liability, particularly in the environmental area, has expanded dramatically in recent years. There is very little tolerance by the public, and under environmental laws, for even low levels of personnel exposure or radioactive contamination away from a nuclear facility. Routine operations involving radioactive waste have the potential to lead to both offsite and onsite radiation exposure and offsite environmental contamination. The purpose of this paper is to demonstrate the relationship between radwaste operations and tort liability, outline a radwaste program which should minimize exposure to claims, and point out areas where improvements are needed.

NUCLEAR LIABILITY INSURANCE OVERVIEW

In 1957, the Price-Anderson amendment was added to the Atomic Energy Act of 1954. Price-Anderson requires operators of certain nuclear facilities to furnish proof of financial protection for third party nuclear liability that might arise as a result of reactor operations. This financial protection had to equal that amount which was available through private insurance sources. Liability coverage beyond that amount was assumed by the Federal Government.

Since no one insurance company could afford to underwrite these potentially large sums, insurance associations called "Pools" were formed. The member companies of these Pools then pledge assets that in the aggregate would provide sufficient resources to underwrite these high capital risks. ANI (American Nuclear Insurers) and MAELU (Mutual Atomic Energy Liability Underwriters) are two such Pools.

In 1957, the Pools were able to provide an initial financial protection layer of $60 million. The Federal Government provided an additional $500 million for liability in excess of this amount. This is how the legal limit of liability, or cap, was initially set at $560 million. Over the years there have been several statutory revisions to the Price Anderson Act. In 1966, provisions for an ENO (Extraordinary Nuclear Occurrence) were added. In 1977, the SFP (Secondary Financial Protection) layer was added which, in 1982, resulted in eliminating the government's role in providing excess liability. At present, with a primary financial protection layer of $160 million, and the assets available through the SFP layer, the total nuclear liability financial protection available to an operating power reactor is $715 million. Private insurance companies and utilities both have substantial assets at risk. Proposed revisions to Price Anderson are expected to result in substantial increases in the amount of nuclear industry assets at risk.

The nuclear liability insurance covers third party liability for damages directly caused by the nuclear energy hazard. The nuclear liability coverage extends to insure the interest of contractors, vendors and manufacturers, and any other person who may be liable, except the U.S. Government or any of its agencies. Worker's Compensation claims are not covered.

This liability coverage includes offsite bodily injury and property damage sustained by members of the general public, and bodily injury to onsite third party personnel, e.g., nuclear workers who elect to sue someone other than their employer in tort. At the present time the nuclear Pools provide financial protection to all commercial nuclear reactors.

ROLE OF THE NUCLEAR ENGINEERING DEPARTMENT

Although ANI and MAELU are two separate insurance Pools, they share a unique working relationship. The ANI NED (Nuclear Engineering Department) performs the engineering functions for both nuclear liability Pools.

The NED is composed of approximately 30 staff engineers and health physicists whose major purpose is to provide technical assessment to the underwriters and minimize loss of the Pools' assets. In addition to its involvement with insureds, NED keeps abreast of technical developments with nuclear insurance significance. Its engineers participate in a variety of professional committees and groups that develop, review, and modify safety and technical standards for the nuclear industry.

In order to accomplish this, each staff member must function in two roles. As a Facility Engineer, the staff member is responsible for general insurance risk assessment activities at plants specifically assigned to him. He is the primary nuclear engineering contact between the insurance Pools and the insured facility. As a Cognizant Engineer, the staff member establishes and maintains an appreciable degree of expertise and updated awareness in a designated technical area. The cognizant engineer performs special in-depth inspections of nuclear facilities and acts as a technical consultant to fellow staff members on questions related to his area of concentrated knowledge.

RADIOACTIVE WASTE MANAGEMENT

In the process of conducting nuclear liability inspections throughout the industry, we have seen a wide diversity in the application of radioactive waste management programs. With few exceptions, the programs provide reasonable assurance of minimizing risk to the Pools' assets. We believe that

the major objectives of an effective radioactive waste management program should be to control, measure, and minimize the amount of radioactive material and effluents from a nuclear facility in order to minimize the possibility of bodily injury or property damage to third parties. Such a program should contain procedures and policies which address organization, staffing, training, operations, water management, regulatory requirements, Quality Assurance, solidification, dewatering, temporary/mobile processing systems, DAW (dry active waste), onsite storage, and gaseous waste processing. Emphasis should be placed on waste minimization and volume reduction including trending the generation of DAW, trending liquid inputs, water balancing, optimum reuse of water and exercising control and accountability over all radioactive waste material.

Historically, it has been observed that the radioactive waste management function was relegated to several departments within the plant organization as a collateral or secondary function during plant operations. In general this approach grew out of the fact that radioactive waste management was not viewed as an important contributor to the safe operation of the nuclear steam supply system. Moreover each plant operator tended to act independently to solve radioactive waste problems. Consequently practices and techniques used in radioactive waste management differ widely from plant to plant. In some instances it is difficult to identify the radioactive waste management function at a facility.

With the advent of stringent requirements and regulations regarding effluent discharges and radwaste packaging, and with the reduction of allocated burial space, the radioactive waste management function has taken on increased importance. This management activity has reached a point where it can no longer be managed as a collateral duty, and the formation of dedicated Radioactive Waste Management Groups are becoming the norm.

Wide divergence is found in organizational structure and staffing levels utilized to accomplish the management of radioactive waste generated at nuclear power plants. Organization and staffing levels will vary from plant to plant and at the same plant during different periods of time. The radioactive waste management program should define the organizational structure and should clearly delineate the responsibility and authority of the various personnel and organizations involved.

The radwaste department responsibilities encompass a wide range of tasks and associated equipment. Radwaste processing and system operation should be performed in accordance with approved written procedures. Changes or additions to radioactive waste processing systems should be subject to formal engineering and safety evaluations, and the processing instrumentation and equipment should be subject to formal calibration and preventive maintenance programs.

The management of liquid radioactive wastes is one cornerstone of an effective radioactive waste program. ANI/MAELU is concerned with water management and liquid waste reduction programs because of their direct effect on effluent discharges to the environment and number of shipments to the burial facilities. Key components to an effective water management program include water balancing, input trending and evaluation, optimum reuse of water, and aggressive input reduction measures.

Another key element of an effective radioactive waste management program is the processing and management of solid radioactive wastes. Waste classification and characterization are of prime concern to ANI/MAELU.

Compliance with these packaging requirements has a direct effect on both package and burial site stability, and therefore, a direct effect on personal exposure and releases to the environment.

Process control programs should be developed and implemented to assure complete compliance with the packaging, shipping and burial requirements. Process control programs should not be limited to the solidification process; dewatering/HIC use should be addressed as well.

Within the last decade, temporary or mobile radioactive waste processing systems have taken on increased importance in augmenting existing radioactive waste processing systems at nuclear power plants. Generally speaking, these temporary/mobile systems have not been subject to the detailed safety review typically conducted on permanently installed plant systems. As such, administrative controls governing operation of these systems takes on increased importance to limit the potential of exposure to unnecessary radiation and unplanned releases of radioactivity to the environment.

The management of DAW is another cornerstone of an effective radioactive waste management program. A key element to the DAW issue is volume reduction. Management policies and controls should be established to reduce the volume of radioactive waste generated during operation and maintenance. These policies and controls fall into two basic categories; those that minimize the generation of radwaste, and those that reduce the volume of radwaste already generated. As a minimum the program elements should include material entry controls, "clean" versus contaminated trash disposal containers, housekeeping programs, training, a mechanical volume reduction process, and sufficient resources to handle/process DAW. Administrative programs should include the trending of DAW generation. This information should be evaluated to identify and respond to high generation areas/tasks. The methods mentioned here should not be considered "all inclusive". There are many additional methods and acceptable alternatives in use today.

As a result of restrictions and reduced volume allocations at commercial burial sites, emphasis is being placed on radioactive waste volume reduction and increased onsite storage capabilities at nuclear facilities. With the advent of long term storage, a new set of concerns arises. These include the potential increase in occupational exposure, container degradation and inadvertent radioactive release to the environment.

Programs and procedures should be developed to ensure these concerns do not become reality. Control and accountability should be exercised over radioactive waste material stored onsite. Storage facilities should be designed to minimize occupational exposure and allow for easy removal of stored material. Container degradation can be prevented by ensuring that only DAW and solidified/dewatered wastes, which are processed and packaged for shipment, are placed in long term storage. Radioactive waste should not be stored (long term) outside, nor should containers come in contact with chemical substances or physical properties which will degrade container integrity. Surveillance programs should be established to detect container failure or degradation. The storage facilities should have provisions to collect and sample liquid drainage as well as other mechanisms to prevent releases to the environment.

The key element that rounds out the program is gaseous radwaste/ventilation. Since most gaseous radwaste processing systems are passive they can be operated with very little attention. This however, should not serve to divert a utility's attention from the importance of this processing path. Gaseous radwaste systems perform a wide range of vital functions. They assure the absence of explosive concentrations of gases, maintain occupational exposures ALARA, and maintain effluents ALARA. As such, HEPA filters and charcoal adsorbers should be subject to tests, inspections, lab analysis and periodic checks to assure they can efficiently carry out their intended function.

HEPA filters should be DOP tested (dioctyl-phthalate) and/or inspected upon installation and periodically (approximately 18 months) thereafter, to ensure proper installation and/or performance. Testing and/or inspection should also be performed following maintenance on the ventilation system that could effect HEPA filter performance. It is <u>not</u> our position that <u>all</u> HEPA filters be DOP tested. Those HEPAs functioning as a final release point should be DOP tested. In addition, sample sink and sorting table fume hoods should be monitored to ensure minimum flow requirements are met. This practice minimizes the possibility of contaminant ingestion by the sample technician and/or the spread of contamination.

INSPECTION HISTORY/INDUSTRY EXPERIENCES

Since the creation of ANI/MAELU engineering inspection criteria in 1981, there have been approximately 95 radwaste inspections at commercial nuclear power generating facilities. This has resulted in the issuance of approximately 115 recommendations and suggestions. These numbers, and the information which follows, pertain to radwaste management (generation, processing, packaging, handling) and do not include inspection/recommendation history in radwaste transportation.

A review of ANI/MAELU inspection history indicates a relatively high number of recommendations and suggestions in the following areas: water balancing and liquid input trending, radwaste handler training, the construction of curbs/dikes around radwaste pump and tank rooms, and fume hood calibration.

As stated earlier ANI/MAELU has a direct interest in water management and liquid waste reduction programs because of their direct effect on discharges to the environment and number of shipments to the burial facilities. The trending of liquid radwaste inputs and the performance of a radwaste water balance are fundamental components of an effective water management program. Approximately ten percent of the radwaste recommendations and suggestions issued are in this category. The purpose of input trending is to aide the utility in finding unidentified, "hidden", sources of inleakage. These trends should then be evaluated by a qualified individual and, where necessary, corrective action should be taken. The purpose of the water balance is to ensure the proper disposition of radioactive water thus preventing inadvertent discharge to the environment or loss of water in the plant.

The second item of concern, noted in the industry review, is the lack of training provided to the radwaste handlers. It is our position that specialized training and periodic retraining in DOT, NRC, burial site, and station requirements should be provided to all personnel involved in the transfer and packaging of radioactive material. The training should be commensurate with the job function. The number of recommendations made in this area is a small percent of the total, however, the significance of these recommendations is great. Training has a direct effect on package and burial site stability, thus reducing the risk of transportation releases, radionuclide migration, and population exposure.

The third item of concern noted is the lack of elevated thresholds/curbs at the entrance to pump rooms, tank rooms, and around temporary/mobile radwaste processing systems. These curbs contain and direct radioactive liquids during incidents such as hose ruptures, seal failures and packing leaks. They prevent inadvertent discharge and the spread of contamination. These curbs take on added importance when protecting tanks and/or systems located in truck bays or areas outside the physical confines of the plant. Approximately six percent of the radwaste recommendations fall in this category.

Fume hood air flow (face velocity) calibration/monitoring is the category where most ANI/MAELU radwaste findings have been made. Twenty six percent of all radwaste recommendations and suggestions fall in this area. Normally, for radioactive laboratory type hoods, one would expect an average face velocity of 125-200 lfpm with a minimum face velocity of 100 lfpm. One hundred lfpm is the minimum flow considered necessary to insure that no contaminants escape from the hood area. This precaution minimizes technician uptake and external contamination. Fume hood air flow should be calibrated annually. A mechanism should be established to ensure that the fume hood sash (window) is not raised to a height which will reduce face velocity to a level below the minimum required flow.

Verification of fume hood airflow should be performed prior to each use. This can be accomplished in a number of ways. Perhaps the most common is the hanging of a "tell tail" from the fume hood sash to indicate inward flow. Other utilities have been known to "smoke" their fume hoods on a daily basis. This daily verification is a qualitative not a quantitative check.

In the recent past it has come to our attention that several facilities continue to process radwaste outdoors. In our view, this practice increases the risk of facility contamination and/or inadvertent release to the environment. In the future ANI/MAELU radwaste inspections will focus on this concern.

Effluent and environmental monitoring are two areas which are closely related to radioactive waste management. Plants discharge low levels of radioactivity which disperse in the environment. We are focusing our loss prevention inspections on plants which have low dilution capabilities (and have a greater potential for gradual environmental pollution).

We believe that the industry is doing a good job protecting the public with routine releases of radioactivity from power reactor facilities, however, the industry could do a better job protecting itself from potential lawsuits. ANI/MAELU issued Environmental Bulletin 86-1 to address the Pools' concerns with projected doses to members of the public and gradual environmental pollution. The Bulletin focused on methods and assumptions used to project doses to the public, control of software used for offsite dose calculations, documentation for the Environmental Monitoring program and the effectiveness of Quality Assurance Audits.

We received over twenty written responses to the Bulletin and met with all but a few utilities to discuss the Bulletin. We found that models used for projecting doses to hypothetical members of the public are generally acceptable. The assumptions used in these models can be improved by making them reasonable rather than overly conservative. For routine operational conditions dose projections are not a problem because the projected doses to the public are very low and often times a fraction of a millirem. The Pools are more concerned with conservative dose modeling for abnormal releases of radioactivity. When higher levels of radioactivity are released, projected doses to the public could be misleading and appear to exceed the 10CFR50 Appendix I guidelines for maintaining effluent releases to the public ALARA. We have recommended that plants analyze the assumptions used for dose modeling, particularly the values used for atmospheric dispersion and liquid dilution, and use more reasonable site specific values, should information be available or cost effective to obtain.

Control of software use for offsite dose calculations has improved considerably over the past few years. Most plants verify and validate new software, control access to source codes, and maintain a library of software changes.

Documentation practices associated with the Environmental Monitoring Program are generally acceptable. The annual environmental monitoring reports provide the central location for information on radioactivity in the environment. The environmental report should include trending and analysis of current data and a comparison to preoperational conditions.

Environmental Monitoring programs were established prior to operation of facilities and often without a written technical basis. The environment around plants often changes. There is a need to assure that significant pathways are monitored and that there is no gradual environmental pollution. Because of these concerns we suggest that effectiveness audits be conducted every five years.

The last issue we are investigating is onsite burial of low level waste under the requirements of 10CFR20.203. Applications for burial of low level waste are reviewed by the insurance Pools to assure that the location for the burial site is within the site description and engineered to preclude groundwater contamination and offsite migration.

CONCLUSION

It is evident that tort liability, particularly in the environmental area, has expanded dramatically in recent years. There is very little tolerance by the public, and under environmental laws, for even low levels of radioactive contamination away from a nuclear facility. The engineering loss control programs at the nuclear insurance Pools are geared to minimize the impact on the environment.

ANI/MAELU cognizant engineers have developed inspection criteria to evaluate operational programs at reactor facilities to assist in assessing insurance risk. In general these criteria focus on programs that may cause incidents which have the potential to give rise to third party nuclear liability claims. In order to encompass the broad scope of the radioactive waste topic, ANI/MAELU has developed criteria in four significant areas.

These areas are: Radioactive Waste Transportation, Radioactive Waste Management, Environmental Monitoring, and Effluent Monitoring. The contents of ANI/MAELU Bulletin 86-1 have been incorporated into the inspection criteria. Adherence to the above mentioned criteria is one method of reducing insurance risk. It would be beneficial for each nuclear facility to review the ANI/MAELU criteria in comparison to their existing programs.

Through the nuclear liability insurance mechanism which has been established, both the nuclear industry and nuclear insurance Pools have large assets at risk. The ANI/MAELU Nuclear Engineering Department is tasked with assessing and reducing this risk. We believe the implementation of the ideas discussed in this paper will improve existing radioactive waste management programs.

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