MIDDLE SOUTH UTILITIES (MSU) LLRW VOLUME REDUCTION EVALUATION

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ABSTRACT

The waste volume reduction evaluation was a concerted radwaste review conducted by Middle South Utilities' (MSU) three operating companies and the MSU service company. The objectives of the evaluation were to identify areas of excessive radwaste generation and to make recommendations for cost effective volume reduction. The evaluation team conducted a survey of sixty-six reactor units to obtain data relating to the various waste types of concern. The data collected was used to establish waste type specific average generation rates for each reactor category of interest. The evaluation team was able to pinpoint specific areas of concern by comparing the waste volumes generated by the MSU plants to the industry average waste volumes for similar plants. The results of the evaluation indicated that the radwaste volume reduction efforts demonstrated at the MSU plants were effective; however, significant improvements could be made. In order to implement these improvements, a strong management commitment and active involvement by all concerned departments would be necessary.

INTRODUCTION

The strict waste disposal allocations mandated by the Radioactive Waste Policy Amendments Act of 1985, coupled with increased processing and disposal cost, have necessitated that radioactive waste volumes be maintained as low as reasonably achievable. Recognizing the need to review the effectiveness of the MSU radwaste management programs, the MSU Radiation Protection Subcommittee formed the Radwaste Management Task Force in October, 1985. The task force was comprised of four members representing each of the operating companies and Middle South Services. The first assignment of the task force was to evaluate the radwaste volume reduction efforts of each of the MSU operating companies. The established objectives of the task force were to identify areas of the waste management programs where improvements could be made and provide recommendations and references to identified good practices that would facilitate the implementation of such improvements.

EVALUATION METHOD

The evaluation focused on the sources of waste generation and the various volume reduction techniques utilized at the operating nuclear stations. Checklists were developed using information obtained from various Electric Power Research Institute (EPRI) and Institute of Nuclear Power Operations (INPO) publications and the combined radwaste experience of the task force members. The checklists outlined a number of proven volume reduction techniques for each type of waste and provided a baseline for initiating the review process. Evaluation visits were scheduled at each of the operating stations with an established duration of three days for each visit. Prior to visiting each station, applicable procedures relating to radwaste volume reduction were reviewed. The procedure review included Radwaste, Health Physics, Chemistry, Operations, and Training Department procedures.

At the beginning of each evaluation an entrance interview was conducted with appropriate members of the plant's staff. Interviews with members from various departments were held and conditions in the plant were directly observed during the evaluation. To facilitate a more comprehensive review, each member of the task force was assigned specific areas of the radwaste management program to evaluate. Additionally, radwaste generation reports were reviewed and radwaste volumes were compared to the industry averages for similar facilities. At the end of each evaluation the task force reviewed and discussed the observations in each area evaluated. A list of observations which were considered to be significant was complied and presented to appropriate members of plant staff at an exit meeting.

AREAS EVALUATED

The areas reviewed and major items considered were outlined in the checklists which were developed prior to the evaluation. Four major areas were examined in the review process.

General/Administrative Controls

Administrative procedures and company policies were reviewed to determine the extent of implementation of the radwaste volume reduction programs. This review was intended to cover the administrative aspects of all areas of the program and did not focus on the individual operational details. The review did provide an overall perspective of the administrative structure of the radwaste program.

Dry Active Waste Handling and Processing

Various functions involving dry active waste handling and processing were evaluated. The review included a detailed look at operational practices such as packaging techniques, waste sorting, front-end segregation, and radioactive material control. Program implementation and administrative controls were reviewed to determine the effectiveness of minimizing materials entering the radiological controlled area (RCA), tracking and trending of waste generation, and identification of dry active waste sources. Additionally, reviews of area and equipment decontamination programs and general health physics practices were conducted.

Wet Waste Handling and Processing

The review in this area focused on a number of operational and administrative aspects relating to the efficient operation of the waste processing systems. Good processing practices such as established resin/filter exhaustion criteria, chemical control, water management, minimization of oil in waste streams, and segregation of spent resins were considered. Also, systems operating philosophies were reviewed for appropriate considerations to radwaste generation.

Advanced Volume Reduction Systems/Equipment

In conjunction with established volume reduction techniques, a review of advanced volume reduction systems was conducted. The review considered the effectiveness of presently used advanced volume reduction systems and the potential benefits of acquiring other volume reduction systems or services. Advanced volume reduction techniques which were considered included supercompaction, metallic back-flushable filters, liquid abrasive systems, and advanced monitoring systems for sorting dry active waste.

ESTABLISHING INDUSTRY AVERAGE WASTE VOLUMES

To enable an objective comparison of an individual reactor unit to the industry averages, an extensive data base had to be compiled. The Radwaste Management Task Force conducted a survey of sixty-six reactor units to obtain data relating to the various waste types of concern. The results of the survey are presented in Tables I and II. INPO was contacted to obtain additional radwaste generation information; however, INPO does not collect data on specific waste types and could only provide overall radwaste generation averages. The results of the task force's survey compared well with the overall averages provided by INPO.

The industry averages were based on 1985 waste generation rates. To ensure the data base reflected "normal" waste generation volumes, units producing low quantities of waste due to initial startup conditions or extended shutdown conditions were omitted. Excessive waste volumes generated from unusual events, such as steam generator replacement or recirculation piping replacement, were also omitted from the data base.

A number of other considerations were taken into account to achieve representative averages for performing waste generation comparisons. First, the units were divided into the categories of boiling water reactors and pressurized water reactors. These categories were then subdivided into fresh-water and saltwater cooled reactors. Finally, consideration was given to the types of systems and equipment operated (i.e., powdered resin or bead resin condensate polisher and demineralization or evaporation of waste water).

In addition to the information on solid radwaste generation, the task force survey collected data on waste water generation. Information on the volumes of waste water processed and the degree of implementation of water management programs was used to develop an average water generation rate for each major category of reactors. In general, it was noted that plants which have instituted water management programs processed significantly less water than plants without well-defined water control.

TABLE I

1985 PWR Industry Average Waste Volume

Waste Type	All PWR's	Freshwater PWR's	Freshwater PWR's (Demineralizers)	Best Freshwater PWR's
Dry Active Waste (Compactible)	4,983	4,662	4,172	2,831
Dry Active Waste (Non-Compactible)	2,286	2,137	1,761	1,139
Bead Resin	1,058	1,219	1,406	796
Powdered Resin	560*	695*	769*	615
Evaporator Bottoms/Sludge	656**	1,119**	0	514
Filter Cartridges	342	403	412	170
Oils	430	358	436	118
Totals	10,315	10,593	8,956	6,183
Processed Water Volumes	1.52E6 gal/yr	1.20E6 gal/yr	1.37E6 gal/yr	6.80E5 gal/yr

NOTES:

* Not all units generate powdered resins. This volume represents the average for all units in the given category. The average volume for units that did generate powdered resin was: 1,633 cubic ft. for all PWR's, 1,777 cubic ft. for freshwater PWR's, and 1,999 cubic ft. for freshwater PWR's (demineralizers).

** Not all units generate evaporator bottoms/sludge. This volume represents the average for all units in the given category. The average volume for units that did generate evaporator bottoms/sludge was: 2,296 cubic ft. for all PWR's, and 2,239 cubic ft. for freshwater PWR's.

TABLE II

1985 BWR Industry Average Waste Volume

Waste Type	All BWR's	Freshwater BWR's	Freshwater BWR's (Demineralizers)	Best Freshwater BWR's
Dry Active Waste (Compactible)	11,209	10,348	10,277	6,559
Dry Active Waste (Non-Compactible)	6,474	5,929	6,024	4,731
Bead Resin	1,950	1,975	2,027	400
Powdered Resin	6,121	7,196	6,251	2,958
Evaporator Bottoms/Sludge	808*	909*	0	1,780
Filter Cartridges	0	0	0	0
Oils	1,555	1,556	1,710	210
Totals	28,117	27,913	26,289	16,638
Processed Water Volumes	1.72E7 gal/yr	1.68E7 gal/yr	1.89E7 gal/yr	1.21E7 gal/yr

NOTES:

* Not all units generate evaporator bottoms/sludge. This volume represents the average for all units in the given category. The average volume for units that did generate evaporator bottoms/sludge was: 3,433 cubic ft. for all BWR's, and 4,243 cubic ft. for freshwater BWR's.

METHOD OF COMPARISON

The 1985 waste volumes of the MSU pressurized water reactors (PWR's) were compared to the average waste volumes determined by the survey. Table I provides the waste stream specific averages for all PWR's, freshwater cooled PWR's and freshwater cooled PWR's utilizing demineralization rather than evaporation. The data base includes radwaste generation data obtained from twenty-two freshwater cooled PWR's and thirteen saltwater cooled PWR's. A "best" freshwater cooled PWR category is also provided. The waste volumes for the "best" category were derived by averaging the volumes generated by the various units with below average generation rates for each individual waste type in the freshwater PWR category.

The 1985 waste volumes generated by MSU's boiling water reactor (BWR) were compared to the industry averages for BWR's. Table II provides the average volumes generated by all BWR's, freshwater cooled BWR's, freshwater cooled BWR's that operate demineralizers rather than evaporators and the "best" freshwater cooled BWR's. The "best" freshwater BWR category waste volumes were derived in the same fashion as the "best" freshwater PWR waste volumes. The data base includes radwaste generation information from fourteen freshwater cooled BWR's and three saltwater cooled BWR's.

WASTE VOLUMES VS. PLANT SIZE

The data base was examined to determine if a correlation between radwaste volumes and unit electrical output exists. Direct comparison of average waste volumes for small units (<700 MW) and large units (>700 MW) indicated that small units generate less radwaste. This comparison, however, did not appear to truly represent how all large units compare to smaller units because it does not consider the varying degrees to which radwaste volume reduction programs are implemented. Therefore, the task force considered it more appropriate to compare the range of waste generation volumes for small and large units. The ranges of waste generation volumes for each waste type and unit size for both PWR's and BWR's are presented in Figures 1 and 2. These figures illustrate that in most cases the waste generation ranges for the large units overlap significantly with the waste ranges for small units. The percentages provided under the waste type represent the percentage of large units that generated waste volumes within the range of waste volumes generated by small units. Based on this comparison, it can be concluded that large units with well-implemented volume reduction programs are capable of maintaining waste volumes comparable to the volumes generated by smaller units.

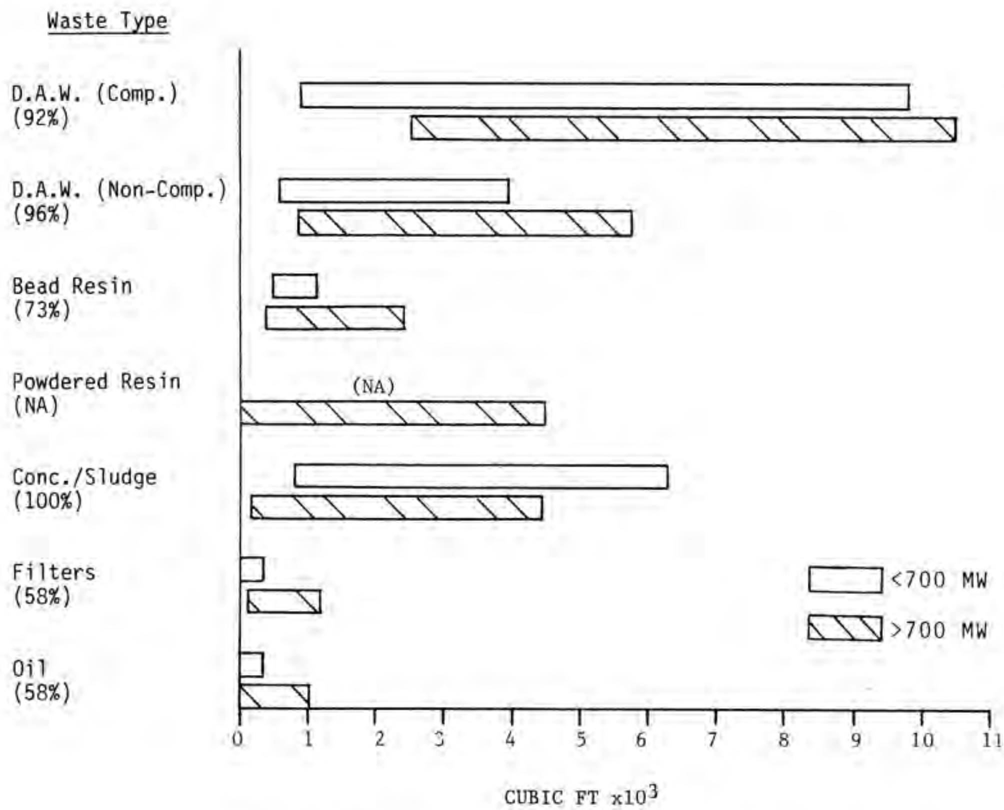

Fig. 1. Waste Range Comparison for All PWR's.

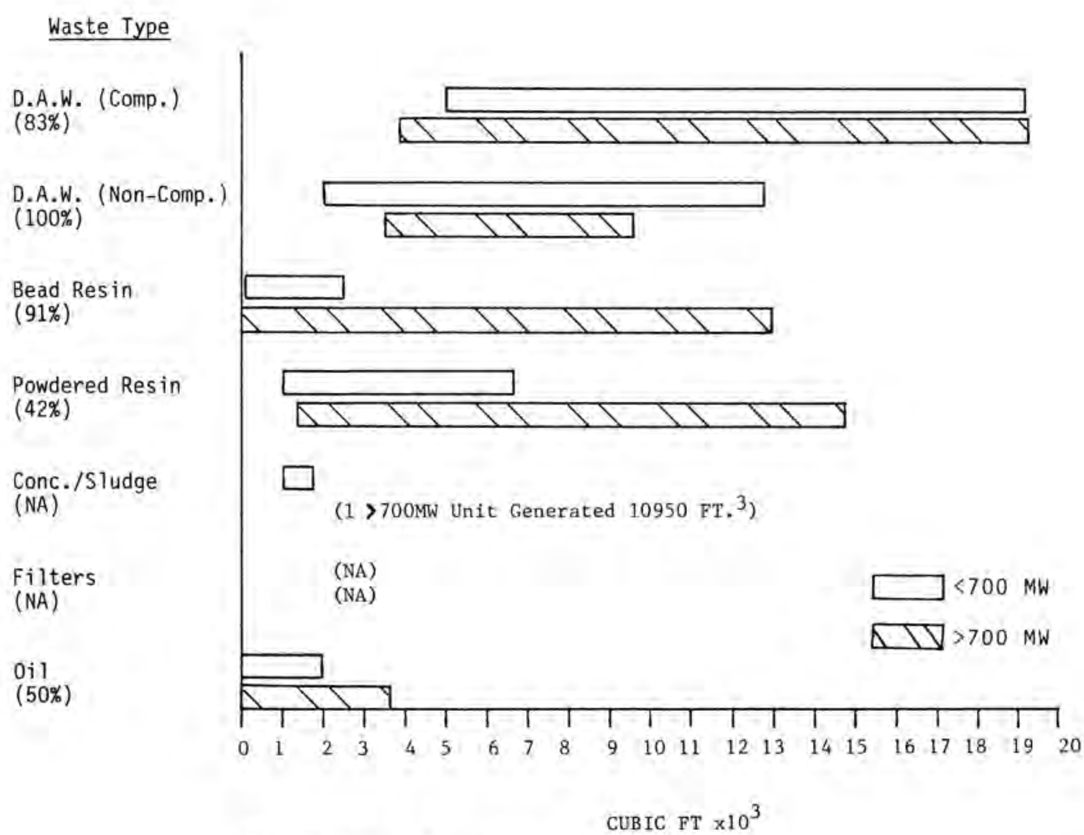

Fig. 2. Waste Range Comparison for All BWR's.

SUMMARY

Comparing the waste volumes generated by the MSU plants to the industry average waste volumes enabled the task force to pinpoint specific areas of concern. In general, the radwaste volume reduction efforts presently demonstrated at all the MSU plants are effective in reducing radwaste volumes; however, significant improvements can be made. The majority of the observations noted during the evaluation involved administrative and operational enhancements to the existing volume reduction techniques and programs. Some observations concerned the use of advanced volume reduction technology. The task force considered techniques such as supercompaction, waste shredding, liquid abrasive decontamination, and advanced filter designs as viable and proven methods of volume reduction. It was recommended, however, that emphasis be placed on improving administrative control and operational implementation of existing programs. If further waste reduction is required, consideration can then be given to the advanced technologies.

The task force concluded that implementation of the recommendations contained in the evaluation report will contribute significantly to the overall efficiency of the MSU radwaste volume reduction programs. Although the effectiveness of the recommended improvements cannot yet be quantified, it is the opinion of the task force that waste volumes can be reduced to within or below the industry waste generation averages for each waste type. To achieve this reduction in waste volumes, a strong management commitment and active involvement by concerned departments such as Operations, Maintenance, Health Physics, Chemistry, and Radwaste are needed. The task force will perform a followup volume reduction evaluation, allowing for an appropriate implementation period, to determine the effectiveness of the improvements to the programs.