SOLID WASTE MINIMIZATION

AT DUKE POWER COMPANY

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ABSTRACT

As more nuclear stations come on line, Duke is faced with the fact of increasing solid waste volumes and increasing burial site rates. In an attempt to reduce these volumes, studies were conducted to quantify and qualify "solid waste". As each component waste type was identified, a volume reduction scheme was developed to address specific waste forms. The schemes used include administrative controls, equipment purchase and building modification, and requests for regulatory exemptions.

INTRODUCTION

"Solid" radioactive waste can generally be broken down into three categories: 1) waste products from liquid processing (e.g., filters, demineralizers, solidified evaporator concentrates), 2) miscellaneous waste (e.g., DAW, contaminated tools and components), or 3) unusual sources. This paper details Duke Power's attempts to minimize the volume of miscellaneous waste and unusual source waste to be buried at low level disposal sites.

BACKGROUND

Duke Power Company's experience at Oconee and McGuire has shown that low level waste volumes increase rapidly in early plant life. The rate of increase levels off after about five to eight years. For example, the McGuire miscellaneous waste volume has increased an average of 175% per year for its first four years (Fig. 1).

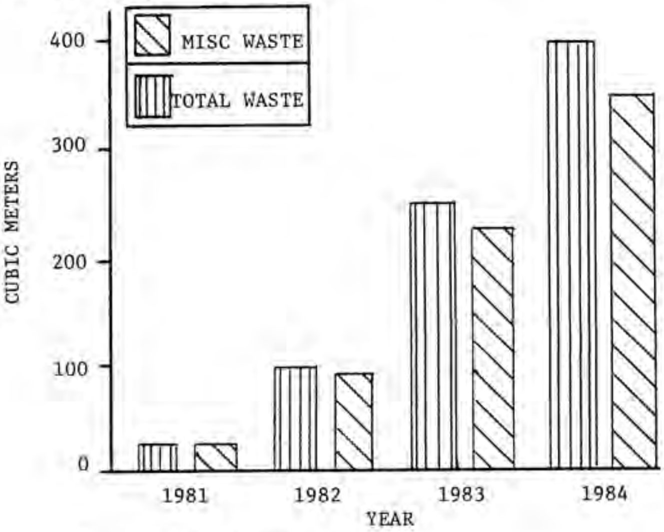

Fig. 1. MNS Waste Volumes.

After six years of operation, Oconee's rate of increase had slowed down to about 25% per year. Annual miscellaneous waste volumes had increased to 2000 cubic meters (71,000 cubic feet) in 1982 (Fig. 2).

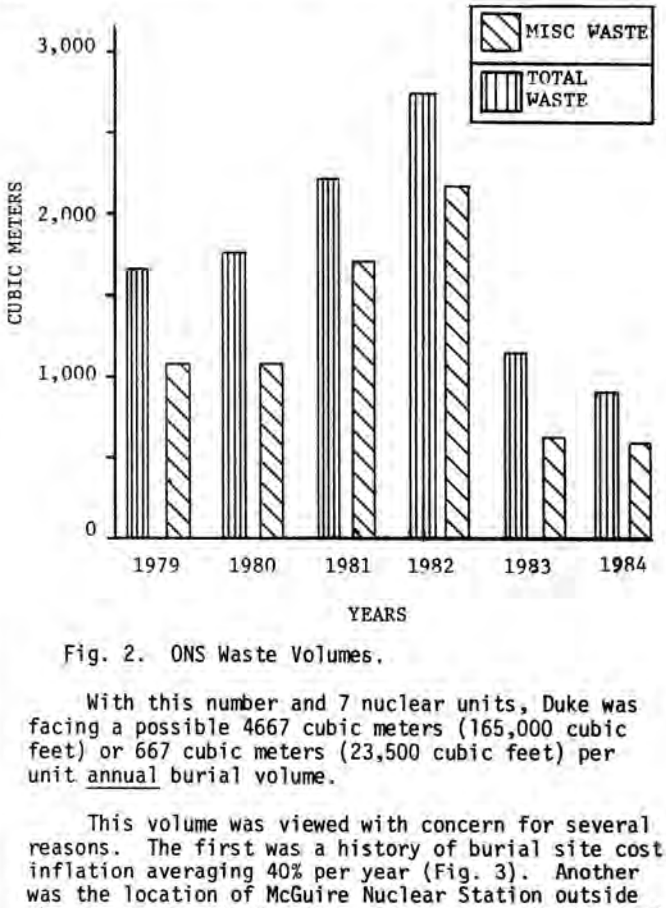

Fig. 2. ONS Waste Volumes.

With this number and 7 nuclear units, Duke was facing a possible 4667 cubic meters (165,000 cubic feet) or 667 cubic meters (23,500 cubic feet) per unit annual burial volume.

This volume was viewed with concern for several reasons. The first was a history of burial site cost inflation averaging 40% per year (Fig. 3). Another was the location of McGuire Nuclear Station outside the state of South Carolina with no guaranteed burial allotment. The third was the uncertainty of future availability of burial space due to state compact uncertainty. These factors combined to make the prospect of an annual miscellaneous waste volume of 4667 cubic meters (165,000 cubic feet) a major liability.

WASTE CLASSIFICATION STUDY

The first task undertaken to control solid waste volumes was to define exactly what "solid waste" was and which areas could be minimized.

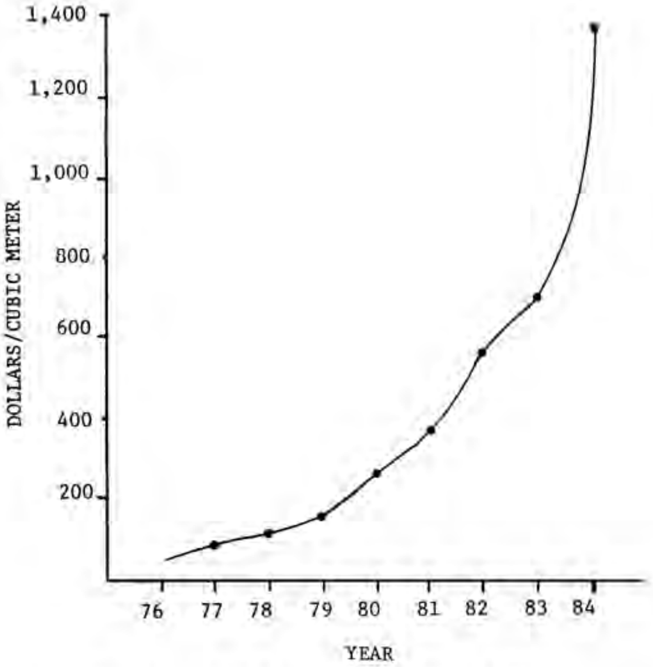

Fig. 3. CNSI Transport and Burial Prices.

During a three month period, extensive records were maintained to document types and volumes of solid waste generated. The results of this survey showed that 80% of all solid waste shipped could be categorized as "miscellaneous waste". Of this category, 73% is DAW and 27% is "non-compactible waste". Table I gives the estimated waste volumes for Duke Power (Oconee, McGuire and Catawba Nuclear Stations combined).

TABLE I

Annual Waste Volume

Total Solid Waste	=	5,850 cubic meters 206,000 cubic feet
Total "Miscellaneous Waste"	=	4,667 cubic meters 165,000 cubic feet
Total DAW	=	3,400 cubic meters 120,300 cubic feet
Total Non-Compactables	=	1,260 cubic meters 44,500 cubic feet

A volume for "unusual source" waste is difficult to generate. These materials are usually high volume, low activity wastes generated under non-routine conditions. Estimated volumes of this waste category are impossible to develop before the fact. This classification study made no attempt to project any waste volumes for this category. It simply recognized it as a possible contributor to the total waste volume.

The study determined three major areas where volume reduction possibilities existed: 1) controls on DAW generation, 2) tool and equipment contamination up-grades, and 3) "unusual" source disposal.

DRY ACTIVE WASTE (DAW)

Duke Power Company has taken a middle of the road approach to the DAW problem--a minimization program has been instituted but due to regulatory difficulties a true "sorting" program is not used. Duke's program consists of: 1) worker education and goals, 2) administrative controls prior to the RCA, and 3) administrative controls inside the RCA.

As part of the general "Radiation Worker" annual training, a segment on radioactive waste minimization is presented. Each worker is instructed in methods the individual can use to minimize wastes. Work planning is stressed to avoid taking more material into the work area than actually needed. Waste reduction is the responsibility of the individual worker and his immediate supervisor. Any vendor working at a Duke Power site is also given instructions on radwaste minimization.

Company and station-specific goals are generated every year for the amount of radwaste buried. Since station management shares the responsibility of generating these goals, their importance is better understood and all station groups are more willing to work toward meeting them.

Administrative controls are used prior to the Radiation Control Area to reduce DAW volumes. The major station group responsible for these controls is Supply. As part of this program, packing material is not allowed into the RCA. Supply personnel remove materials from boxes in the warehouse and place them in plastic bags for distribution. Thus, all these boxes and packing material can be disposed of as regular sanitary waste. Another aspect of the program is material usage tracking. Supply follows the amounts of protective clothing, poly, lab supplies, etc., that are being checked out of the warehouse. Unusual volumes are noted and reported to Health Physics for investigation. This practice allows poor materials use to be quickly discovered and corrected.

Once into the Radiation Control Area, another set of administrative controls is used to help reduce volumes. Part of this system is to designate certain areas inside the RCA as "clean", i.e., non-contaminated. These areas include laboratories, office space, and break areas. Trash from this area is marked as "clean" and stored in a designated area. Another feature of this system is to color code all trash barrels within the RCA. Red and yellow barrels are for contaminated or potentially contaminated DAW. Blue and white barrels are for clean trash. The "clean" trash is monitored prior to leaving the Auxiliary Building to insure it is non-contaminated. The acceptable radiation limits are background readings. This trash is again monitored prior to leaving the site as sanitary waste. Levels must not exceed 0.5 micro Sievert/hr (0.5 mrem/hr). This practice is estimated to save Duke approximately 1416 cubic meters (50,000 cubic feet) of burial space per year.

This program is not a "sorting" program as conveniently defined. Duke Power does not check "potentially" contaminated material (i.e., red and yellow barrels) and remove any clean trash. Duke chooses not to sort contaminated DAW for two reasons. The first is the regulatory uncertainty as to what is or is not "radioactive". Since Duke has not applied for a "de minimis" ruling on this waste form, no such cutoff level can be set. The other reason is economic-in order to be cost effective at least 10% of the "contaminated" material must be found to be "clean". Due to the success of its administrative controls, Duke does not believe this number is achievable under current conditions.

Another aspect of administrative controls is to make individuals responsible for certain types of material taken into the RCA. For example, all tools are signed out by a specific individual. This individual is held accountable for that tool. This method insures tools are returned after use and not thrown into the trash. Respirators are handled the same way. These controls make trash sorting to recover reuseable items unnecessary.

TOOL DECON

Another major contributor to the solid waste burial volume is "non-compacted" material. This group includes tools, equipment, metal, wood, cable, etc. These materials contribute about 1,260 cubic meters (44,500 cubic feet) per year to radwaste volumes.

In 1981-1982, the dates for the original study, the only decontamination methods available were hand wiping or water baths. Water baths used small ultrasonics or larger turbulators. Due to liquid radwaste system design, no cleaning chemicals could be used with the water baths. This type of decon proved to be ineffective on all fixed contamination and on high levels of loose contamination. Any tools or equipment that could not be placed in water (e.g., electronics) or were too large for the tanks could not be deconned.

Review of published reports, especially some EPRI work, and industry experience lead Duke to conclude that with properly selected decon equipment, this volume could at least be cut in half. By assuming a required three year payback, each station could spend approximately $270,000 on new decontamination equipment and any required modifications.

The first step in the decon upgrade was to identify which decontamination options were available to Duke. The possibilities included:

1) Upgrade the liquid waste system such that aggressive decon chemicals could be used in the existing tanks.

2) Switch to alternate technologies which could include electropolishing, sand blasting, liquid abrasive blasting, freon high pressure spray, or freon ultrasonic.

The upgrade of the liquid system was eliminated since that would cost more than the $270,000 available.

At this point, Duke decided to undertake a two part study. The first objective was to qualify and quantify exactly what "non-compacted waste" was at Duke's stations. The second study objective was to actually field test each possible decon technology to get some realistic numbers of their effectiveness, etc. This study was set up to bring different vendors into the station to provide decontamination services during outages. Vendors were selected such that each identified technology was actually tried at a Duke station. This study was continued for four outages at Oconee and McGuire.

In order to evaluate each technology, a log was developed to record decon data. Information available included:

1) Decon process (i.e., electropolisher, freon ultrasonic, etc.)

2) Material type (i.e., metal, tool, cable, etc.)

3) Decon time

4) Initial contamination/radiation level

5) Residual contamination/radiation level

This study revealed the following about the types of material that needed to be deconned:

1) 90% covered with oils or grease

2) 75% painted

3) 60% metal

4) 23% electrical or pneumatic

5) 12% miscellaneous material (hoses, slings, extension cords, etc.)

The average radiation levels on this material ranged from .5 to 90 micro Sieverts/hr (.05 to 9 mrem/hr) and the average contamination level ranged from 2,000 to 10,000 dpm/100 square centimeters.

This data was invaluable in developing equipment selection criteria. The first requirement was for a method to remove oils-only hand wiping or freon technologies could accomplish this. The second requirement was for a method to decontaminate electrical equipment-only freon technologies could accomplish this. A third requirement was that any new equipment had to be simple and straight-forward to operate.

The station logs were reviewed to determine how individual technologies compared. The following table illustrates the results:

TABLE II

Decon Equipment Comparison

Equipment	% Material	Time	% Releasable
Freon Ultrasonic	43%	30 Min	50%
Freon Spray	38%	19 Min	42%
Grit Blaster	26%	12 Min	46%
Electropolish	7%	30 Min	73%
Hand Wipe	11%	15 Min	21%

After comparing the list of required features with the list of equipment operation results Duke decided that the best results could be obtained using liquid abrasive blasting and some type of freon equipment. Electropolishing was rejected due to its low applicability, byproduct disposal difficulties, and level of operator skill required for proper operation.

Each station is implementing modifications to its decontamination area to remove all existing equipment. A liquid abrasive blaster and a freon decon unit will be added. McGuire and Catawba Stations chose to use a combined ultrasonic/high pressure spray freon unit. Oconee chose a high pressure spray freon unit. These modifications should be completed in 1986.

"DE MINIMIS"

The third area identified for possible volume reduction was "unusual sources". These usually are not "routinely" produced. The Nuclear Regulatory Commission has established a review system for these types of waste. Generators are asked to make evaluations for disposal options and total exposure and apply to the NRC for a "de minimis" ruling. This data will be evaluated to possibly establish a generic "BRC" (Below Regulatory Concern) level. With this number in hand, the generator will be able to "sort" potentially contaminated materials.

Duke Power is routinely seeking "de minimis" exemptions for unusual sources. In 1984, five applications were made to the NRC. The types of material involved included: 1) sand from sand blasting contaminated material, 2) slightly internally contaminated feedwater heaters, 3) sludge from a sanitary treatment pond, 4) wood scrap, and 5) powdex resin. These applications cover approximately 651 cubic meters (23,000 cubic feet) of material.

As an example of the potential savings from this program, consider the feedwater heaters. Five feedwater heaters were replaced at Oconee Nuclear Station. As a result of small primary to secondary leaks, the internals of the heaters were slightly contaminated. The total activity within all 5 heaters is estimated at 2.4E08 becquerels (6.5 mCi). If these heaters were buried as low level radioactive waste at Barnwell, the total cost is estimated to be $300,000. Duke Power has applied to bury this material on site. The total exposure after burial is estimated to be less than 1.3 micro Sievert/yr (0.13 mrem/yr).

The major difficulty with this type of application is the time involved. The utility study to determine and document disposal options and possible exposures can easily take several weeks. After the request is received by the NRC it must undergo both a technical and legal review. This process is very slow. Duke's experience has shown that "emergency" cases take at least three months for NRC approval. "Routine" applications have been pending for over one year to date.

SUMMARY

A review of the operating history at Oconee and McGuire showed a trend of increasing solid radioactive waste volumes with station age. Based on Oconee figures, total system volumes were estimated to top 667 cubic meters (23,500 cubic feet) per unit annually. After combining this with the ever increasing burial prices and the possibility of burial site closure, Duke decided to investigate methods to reduce this volume. A study of solid waste determined that approximately 80% of this material was DAW and "non-compactible" solids. Each of these waste forms was further categorized to discover ways to decrease their volumes.

Dry active waste volumes were reduced by a combination of worker training and administrative controls. With this system, Duke is able to release approximately 1416 cubic meters (50,000 cubic feet) of "clean" trash from the Radiation Control Area every year. Without this system much of this material would have to be buried as a radioactive material.

Non-compactible material includes contaminated tools and equipment, scrap metal, wood, etc. Due to limitations in the decon room equipment, this material could not be cleaned. A study indicated that at least 50% of this material could be cleaned with the proper decon equipment. By evaluating each type of equipment at Duke station, Duke was able to match equipment to its specific needs. Modifications to the decon rooms at each of Duke's stations are scheduled to be completed by 1986.

The third category of "unusual sources" is addressed through regulatory exemption. The Nuclear Regulatory Commission is approached to approve alternate disposal options for the high volume, low activity sources. Thus far, this system has proven to be slow but cost effective.