DRY ACTIVE WASTE PROCESSING AT RIVER BEND STATION UTILIZING THE HYDRO NUCLEAR DRY ACTIVE WASTE VOLUME REDUCTION SYSTEM

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ABSTRACT

The cost of disposing of radioactive waste is continuing to climb. This, combined with other factors, is generating increasing interest in volume reduction systems. In October 1986, Gulf States Utilities Company installed a self-contained Hydro Nuclear Dry Active Waste Volume Reduction System at River Bend Station. This paper discusses procurement justification, operational characteristics, operational history for the first year of service, cost savings, problems, and down time.

INTRODUCTION

Because of the immediate priorities of plant start-up, secondary considerations such as Dry Active Waste (DAW) Volume Reduction were deferred. From initial criticality on October 31, 1985 and continuing for the first year of operation, River Bend Station had no formal DAW program. Segregation consisted of frisking with a GM probe within the Radwaste Building. By the early Spring of 1986, the volume of DAW stored in barrels and Low Specific Activity (LSA) boxes was in excess of 226 cubic metres and was rapidly filling all available space in the Radwaste Building. Complicating matters further was that a lengthy outage was scheduled for October, 1986. Gulf States Utilities Company was aware that a DAW Volume Reduction Program would have to be functional prior to the outage. A DAW task force was formed and charged with the following tasks.

- Make final recommendations to senior management in May, 1986
- Have a system operational by October 10, 1986, the first day of the outage.
- Verify that the system selected is technically acceptable to the Nuclear Regulatory Commission.
- Prove the system is economically justifiable.

PROCUREMENT

Preliminary Investigation

The first consideration was the approach River Bend Station would take toward DAW processing. Due to several factors, including a hostile regulatory environment and lack of reliability, it was decided that relying only on a GM Probe for frisking and segregating would be unacceptable. We knew that D.C. Cook and Peach Bottom were using various configurations of the Hydro Nuclear DAW Volume Reduction System. The task force decided to visit Peach Bottom because their DAW equipment was installed in a trailer inside their protected area which was one option we were considering. Based upon our visit, the task force concluded that Peach Bottom was satisfied with the system. It proved to be an effective means of segregating DAW and removed human error from the counting process. Because the sorting table was located in the Radwaste Building rather than in the trailer, counting times (see the operation section of this paper) increased significantly due to high background radiation levels. It should be noted, however, that this problem was resolved when Peach Bottom relocated the sorting table to the trailer. Other important benefits to the Hydro Nuclear System at Peach Bottom were that since installing the system, they had no NRC violations and no unfavorable audits from INPO.

Three areas were considered for equipment location. They were as follows:

(1) In the Radwaste Building

(2) In an existing warehouse the task force designated as the Dry Active Waste Storage Facility (DAWSF). This building is located outside of the Protected Area but inside of the Owner Controlled Area.

(3) In a mobile trailer provided by the vendor, located inside the protected area.

Location and Configuration

Processing DAW in the Radwaste Building was eliminated from consideration for three reasons.

(1) High background radiation levels would lengthen count times thus reducing productivity.

(2) Space for equipment installation was severely limited. We had already taken up valuable space with the addition of solidification and oil separation equipment.

(3) The cost of permanent modifications to the Radwaste Building electrical, HVAC, and fire protection systems was prohibitive, at least for the first few years of operation.

Likewise, processing DAW in the DAWSF was ruled out for three reasons.

(1) Processing radwaste outside the Protected Area would have created potential licensing problems.

(2) Operations and Radiation Protection personnel would be working beyond RP and security controls established at the Protected Area boundary.

(3) Modifications to the DAWSF were as cost prohibitive as they were for the Radwaste Building.

The decision to process DAW in a trailer inside the Protected Area proved to be the best choice for the following reasons.

(1) Processing waste inside the Protected Area allowed RP and security to maintain control over the operation.

(2) The HVAC and HEPA equipped trailer could be connected to existing construction power and fire protection could be minimized to reduce modification costs.

(3) The trailer could be located in a low background radiation area.

(4) The choice of processing equipment would not be subject to space limitations.

Rental verses Purchase

A major consideration for Gulf States Utilities was financing the DAW processing equipment. Renting the equipment on an hourly basis is the least expensive option in the early years but builds no equity and the rental charges continue as long as the system is used . Purchasing the equipment has the best long term financial benefit but requires a long term commitment to the equipment.

Final Recommendations

The mix of various combinations of processing locations and equipment configurations translated into five options for upper management to consider. The following matrix identifies the variables considered in each of the five cases . "WHERE PROCESSED" refers to the location where DAW is sorted, and segregated. These locations are the Radwaste Building, the DAWSF, and a completely equipped, custom-made, vendor-supplied, double-wide trailer positioned inside the Protected Area.

It was the recommendation of the Radwaste Task Force that Case 4 was the most beneficial to GSU for the following reasons:

(1) Required the least cash flow expenditure in early years

(2) Rapidly developing technology in the area of DAW volume reduction could render this equipment obsolete. Until these new options are available for evaluation, rental of segregation equipment and trailer would eliminate the requirement to purchase potentially obsolete equipment.

(3) With a single source of supply for *the segregation* equipment, procurement time would be shortened by eliminating the need to write specifications and operating procedures for each piece of equipment.

(4) The segregation equipment vendor, as a part of the mobilization charge, would assist GSU in writing all operating procedures. (1)

(5) Mobilization and installation time for a trailer mounted system would be minimized.

A contract to rent a DAW Volume Reduction System was initiated between GSU and Hydro Nuclear in July of 1986, with a firm operational date of October 10, 1986. The complete system was delivered on October 3, 1986 and was fully operational on the promised date. (2)

OPERATION

Preliminary Segregation

Figure 1 is an operational flow chart for Preliminary Segregation taking place in the Radwaste Building. All bags of trash coming from the Radiologically Controlled Area (RCA) are frisked with a GM Probe and tagged. Any bags greater than 10 mr/hr are treated as Low Specific Activity (LSA) waste, and compacted. Bags greater than 2 but less than or equal to 10 mr/hr are opened and surveyed on a sorting table located in a Permacon enclosure in the Radwaste Building. Wet items are removed, dried, and frisked. Dry items are frisked immediately. All items greater than 2 mr/hr are treated as LSA waste and compacted. Items less than or equal to 2 mr/hr are sent to the volume reduction system for processing.

Segregation/Volume Reduction, Phase I

Figure 2 is a sketch of the major pieces of equipment located in the Dry Active Waste Processing Trailer. Figure 3 is an operational flow chart for segregation activities taking place in the DAW Trailer. All bags entering the trailer are weighed and opened on the presort table. Wet items are removed and returned to the Radwaste Building for drying. Radiological symbols (tags, tape, etc.) are treated as LSA. Non-shreddable and recoverable items are removed and returned to GSU. All other items, are cut up, if necessary, and moved to the sorting monitor table where they are scanned by one of four gas flow proportional detectors.

When in the background updating mode, the Sorting Monitor System controller, located in the control console, constantly updates its measurement of background radiation levels. To initiate counting, the operator steps on a mat switch which directs the controller to change from background updating to the counting mode, as indicated by a

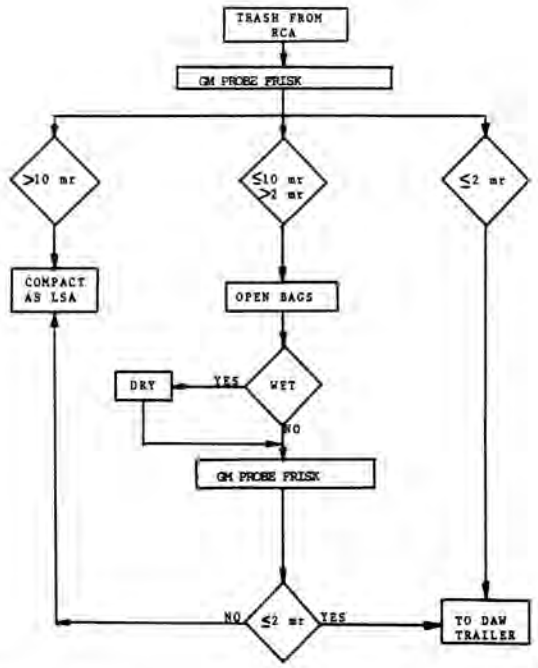

Fig. 1. Operational Flow Chart (Radwaste Building).

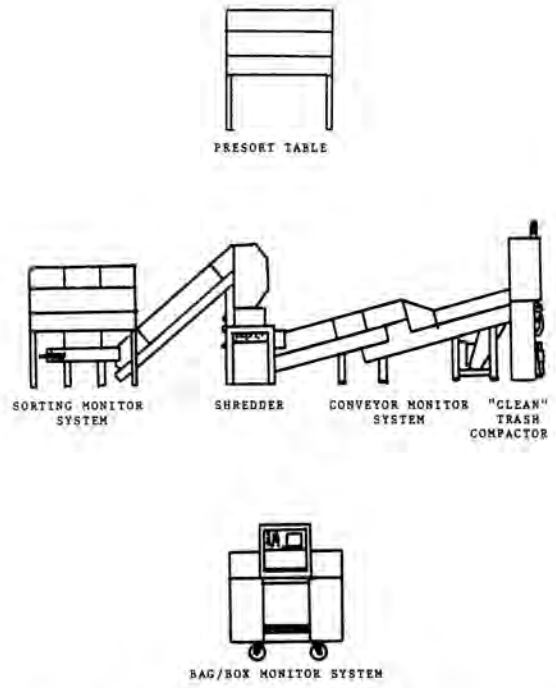

Fig. 2. DAW Segregation/Volume Reduction Process Equipment.

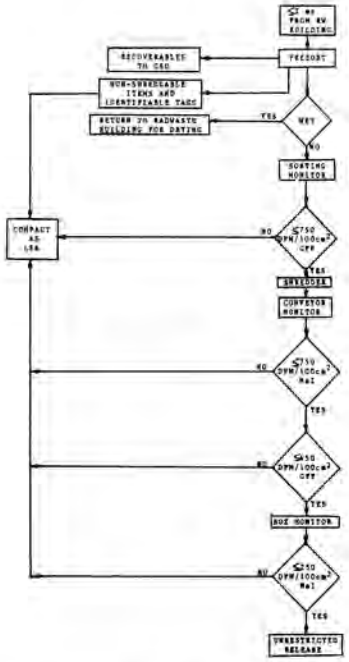

Fig. 3. Operational Flow Chart (DAW Trailer).

white counting light. At the end of the counting interval, the counting light blinks, and the waste material is considered "CLEAN" and is processed further. However, if an alarm setting is expected during a counting interval, a red alarm light and audible tone are activated. Any material that causes an alarm is considered "CONTAMINATED" and disposed of as LSA waste. All information concerning total bags of waste received, segregated, and returned for LSA disposal is documented.

NOTE: All waste that does not cause an alarm at the sorting table is considered clean waste and the remaining monitoring phases of the DAW System serve as redundant checks of the Sorting Monitor System.

Segregation/Volume Reduction, Phase II

Phase II of DAW segregation/volume reduction occurs as waste material is processed from the sorting table to the shredding unit via a conveyor belt. The shredder reduces the volume of remaining waste material and converts it to an unrecognizable form. When a sufficient amount of material has accumulated in the shredder bin, the shredder is started by the conveyor logic controller. This energizes all other automated waste processing components in a timed sequence. An auger mechanism located beneath the shredder uniformly deposits the shredded waste material on to the conveyor belt. The conveyor is separated into two segments, one mounted above the other. In traveling the first conveyor segment, waste material is evenly spread out and flattened by a leveling roller, then surveyed by a sodium iodide and gas-flow proportional detector. Upon reaching the end of the first conveyor segment, the material is dropped onto the second conveyor segment and redistributed in the process, then again leveled by a roller before being surveyed by an additional gas-flow proportional detector.

The Conveyor Monitor System Controller, also located in the control console, displays the same signals as the Sorting Monitor System for waiting, counting, and alarming. Yet, unlike the Sorting Monitor System, the Conveyor Monitor System will switch from the background updating to counting mode automatically once the automated processing has begun. If an alarm is activated by any one of the three conveyor belt detectors, the belt will halt, automatically reverse its direction, and remove the contaminated waste material beneath the detector in alarm by a vacuum system. If no alarm occurs, processing continues and the material is deposited into a compactor, compressed into a box weighing approximately thirty-five to fifty pounds.

Segregation/Volume Reduction, Phase III

Phase III of DAW segregation/volume reduction occurs as each box is surveyed by the Bag/Box Monitor System. The Bag/Box Monitor System utilizes a sodium iodide detector vertically mounted within a lead shielded/collimated enclosure. The box is placed inside the enclosure on top of a variable speed turntable. The counting time, in conjunction with the turntable speed, paces the box through one complete rotation per counting interval. The automatic counting cycle is initiated by an operator actuating a mat switch that shifts the Bag/Box Monitor System controller from the background update mode to the count mode. The operator then enters appropriate data concerning the box

to be counted and initiates a precount background check. When the check is complete, the controller signals the operator to place the box into the enclosure and to begin the count. When the count is complete, the controller signals the operator to remove the box and to begin the postcount background check. Upon completion of this check, the controller compares the pre- and post-background checks and determines if they differ statistically from the average value determined in the background update mode. This comparison is made to ensure that background radiation levels have not interfered with counting of the box. If no statistical variation in background interference is detected, and if the box count is acceptable, the controller generates a report and signals the operator that the box is "clean waste". If a high count alarm occurs, the controller generates a report and signals the operator that the box is "contaminated waste". The box that causes an alarm is treated as dry active waste material and returned to the Conveyor Monitor System for processing. (3)

OPERATIONAL HISTORY

The Hydro Nuclear Dry Active Waste Volume Reduction System has operated successfully for the past twelve months with only one day of down time due to a conveyor belt problem. A summary of operating statistics for the first twelve months is as follows:

TOTAL VOLUME PROCESS	855 cu. metres
TOTAL VOLUME "CLEAN"	354 cu. metres
TOTAL VOLUME LSA	382 cu. metres
TOTAL VOLUME WET, NON-SHREDDABLE AND /OR RECOVERABLE	119 cu. metres
TOTAL WEIGHT PROCESSED	70,537 kg.
TOTAL VALUE OF RECOVERABLE ITEMS	$70,987
TOTAL MANHOURS	27,581 manhours
TOTAL SYSTEM HOURS	2, 812hours

The system is under direction of a Gulf States Utilities Radwaste Specialist and under supervision of a Hydro Nuclear Operation Manager. Normally, a total of seven Hydro Nuclear Employees operate the system on a single shift operation with overtime as required. The original intention was to have the backlog, which by October 10, 1986 had grown to 400 cubic metres worked off by August, 1987. To our delight, the backlog was completely worked off by March 1, 1987.

With the reduction in workload, three operators were transferred inside the Radwaste Building to begin segregating a backlog of 140 cubic metres of wet waste. At this point, River Bend Station was not accumulating any backlog and was in good shape for the first refueling outage which began September 15, 1987. Figures 4 and 5 are graphic representations of the cumulative volume of waste processed, manhours, and system operating hours for the first twelve months of operation. Note the drop in productivity in March when three operators were transferred to wet waste segregation. The system was operated with four personnel, however, the manhour line reflects all seven operators' time. With the beginning of the refueling outage, two crews working 60 hours per week each were needed to keep up with the DAW generation rate.

COST SAVINGS

The cost savings to Gulf States Utilities in the first twelve months is calculated as the dollars saved by not having to process "clean" waste as LSA, the avoided depreciation by renting equipment, and the savings using lower cost labor available under the contracted service arrangement. The total net cost savings using the Hydro Nuclear DAW Volume Reduction System was approximately $130,000 for the first twelve months of operation. The following table shows percentage each category contributed to the savings.

	PERCENT OF TOTAL COST SAVINGS
Consumables	3
Super Compaction Service	9
Recovered Items	28
Shipping	1
Burial	14
Labor	35
Equipment Repair & Depreciation	10

In October 1987, the decision was made to purchase the complete DAW Volume Reduction System including the trailer. After looking at the system utilization, purchase of the system would save approximately $44,000 per year over rental for each of the three years of the lease/purchase agreement. At the same time a three-year continuing services agreement was signed for Hydro Nuclear Inc. to provide operating personnel.

SUMMARY

Employing the Hydro Nuclear Dry Active Waste Volume Reduction System has proven to be an effective and economical means of reducing DAW at River Bend Station with an overall proven volume reduction of approximately

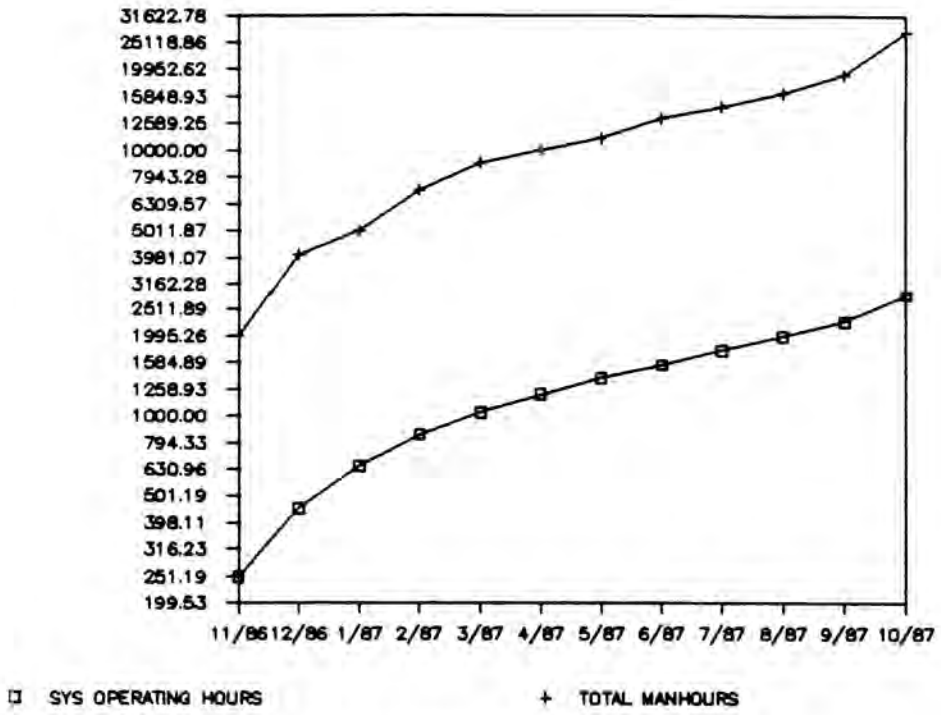

Fig. 4. Total System Operating Hours & Manhours.

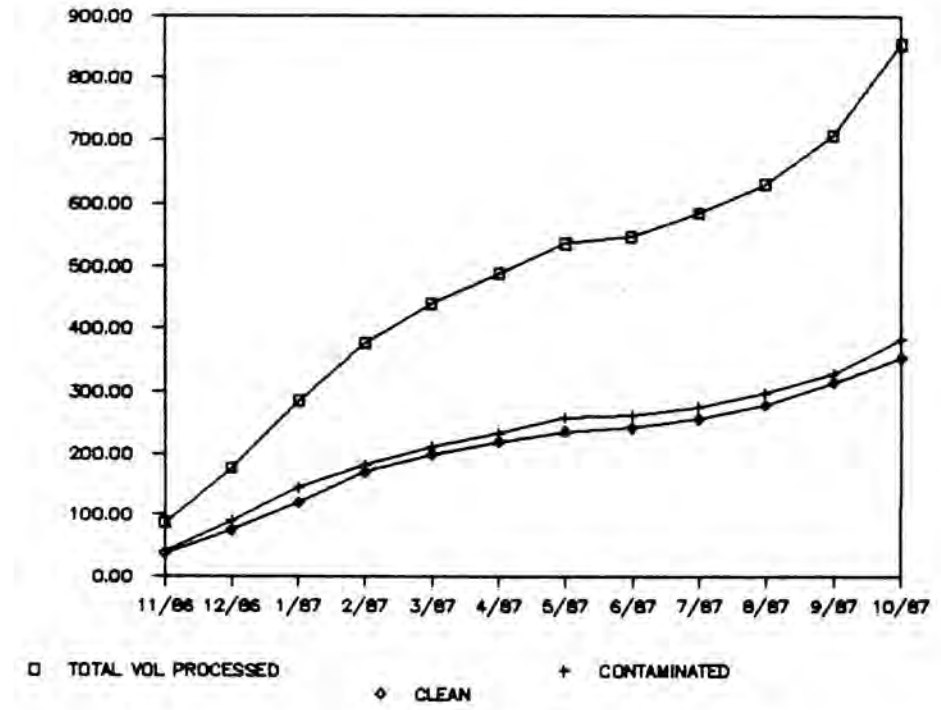

Fig. 5. Waste Processed in Cubic Meters.

42%. Gulf States Utilities Company is continuing to monitor volume reduction system performance and compare it against any new technologies in an effort to improve DAW volume reduction for the greatest cost savings.

REFERENCES

1. River Bend Radwaste Task Force, "Dry Active Waste Processing", Report to Management, T.P. Anthony, Chairman, May 25, 1986.
2. T.P. Anthony, "Hydro Nuclear Dry Active Waste Volume Reduction System at River Bend Station", 1987 EPRI Radwaste Workshop, Boulder Colorado, July 21, 1987.
3. Hydro Nuclear Services, "DAW Volume Reduction Process, Technical Description", October, 1985.