STARTUP EXPERIENCE AND OPERATIONS OF A CENTRAL FACILITY WITH AN INCINERATOR AND SUPER-COMPACTOR

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ABSTRACT

The Babcock & Wilcox Company has constructed and is starting up a commercial facility with both an incinerator and a super-compactor for reducing the volume of low-level radioactive wastes. This paper describes the activities completed to date associated with constructing, licensing, and testing at the facility and the planned activities leading up to commercial operations. In addition, the impact that B&W's commitment to processing institutional/ industrial waste has had on designing the facility, selecting the volume reduction technology, and licensing the facility operations will be highlighted.

INTRODUCTION

The Babcock & Wilcox Waste Reduction Center (WRC), located in Parks Township, PA, will be one of the first commercial facility in the United States for reducing the volume of low-level radioactive waste (LLRW) through incineration and super-compaction. The facility is designed to handle dry solids, lubricating and hydraulic oils, liquid scintillation vials, and biological wastes from nuclear plants and institutional/industrial facilities. The decision to accept LLRW from institutional/industrial generators had a significant impact on both the design and licensing of the facility as-well-as the choice of volume reduction technologies.

This paper discusses the facility's construction and the regulatory activities associated with startup of B&W's WRC. In addition, a brief summary of the incinerator and super-compactor startup testing is provided. More detailed information on the incinerator and super-compactor performance testing will be made available in later presentations.

FACILITY CONSTRUCTION

The WRC is housed in a building that has been renovated to allow it to accommodate the functions of the Waste Reduction Center. The portion of that building that now houses the majority of the process equipment and the feed conveyors had been a warehouse. The physical transformation from warehouse to Volume Reduction Facility took only eleven months, (however, the pre-requisite engineering work effectively extended the schedule by an additional eleven months). A siginificant amount of the engineering effort was taking place coincident with equipment manufacture and building construction. The WRC facility construction was "fast-tracked" in anticipation of timely issuance of an NRC operating license. The following paragraphs give a chronological review of the steps taken in bringing the WRC facility to a condition to support startup and operation.

January and February of 1984 were devoted to selecting the correct volume reduction technology. The selection criteria for the volume reduction technology where based on the following requirements:

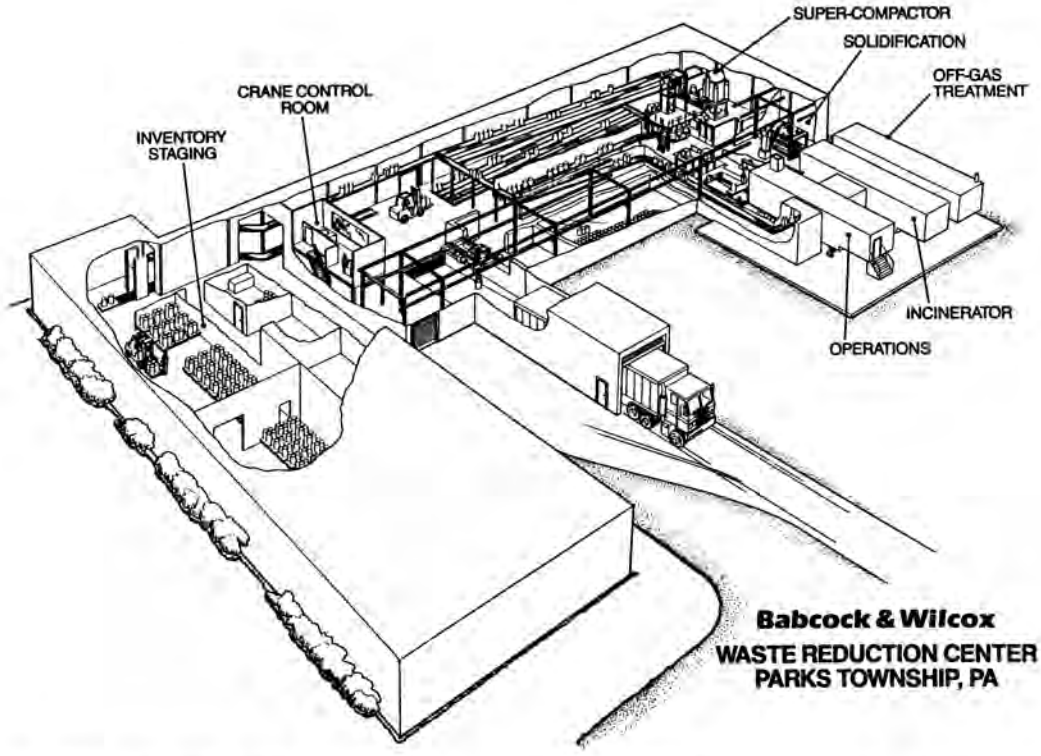
- it must be previously developed and commercially available,
- it must provide a commercially acceptable volume reduction ratio,
- it must be able to be integrated into an automated facility.

Using the above selection process, it was determined that no one technology would fully serve the needs of both utility and institutional customers. Therefore, two volume reduction technologies were selected -- super-compaction and incineration.

The WRC conceptual design effort was completed in three months, March through June, 1984. Conceptual designs utilizing three separate existing buildings on two sites were developed. These designs took into consideration the following:

- Radiological protection for public and site personnel
- Auxiliary equipment
- Licensing basis
- Operational basis
- Site and facilities

In June, 1984 the Parks Township, PA facility was selected as the WRC site. Having made the final site selection, the final design work began, and purchase orders were placed for the four major pieces of equipment to be installed in the WRC. These purchase orders covered the incinerator, the super-compactor, the remotely controlled, automated overhead bridge crane, and a liquid waste solidification system. Final design of the WRC facility stretched from June, 1984 through February, 1985. Construction of the facility was in a "fast-track" mode, therefore construction was on-going while final design efforts were being performed. The design for the modifications to the building structure, mechanical systems, electrical



systems, and site work were performed by a consulting engineering firm, as was the design of the "Skyshine" radiological shielding. B&W engineers designed the radiological shielding for personnel within the facility and defined the interface conditions between equipment and building structure. Referring to Figure 1, the following major building modifications were made:

- o added the covered truck ramp and depressed loading dock
- o added a concrete pad to the outside of the building for the three trailer incinerator system
- o installed a 10-ton overhead bridge crane
- o added a mezzanine crane control room
- o installed structural steel to support the bridge crane and mezzanine control room
- o installed shield walls around the inside perimeter of the building
- o built shield walls throughout the facility

In November, 1984, outside construction was begun. This construction included:

- o site rough grading
- o installing underground utilities, i.e., natural gas, fire protection and service water, heat tracing, and electrical power supply
- o placing concrete incinerator slab (60' x 60' x 1' thick)
- o installing track ramp and loading dock

The outside construction was completed in early February, 1985. Completing the truck ramp and loading dock were critical because these items were essential to installing the facility equipment and facilitating structural modifications to the existing building. Otherwise, the building's roof would have had to have been temporarily removed during the installation of the super-compactor press.

Inside construction started in March, 1985 and was originally scheduled to be completed in mid-August. However, construction continued through the end of October, 1985, due to unscheduled work stoppages that were necessary to allow larger pieces of equipment to be installed. The WRC facility construction was completed on November 1, 1985. Super-Compactor startup testing and other equipment testing have been ongoing since October 1, 1985. The WRC currently features a super-compactor; a liquid waste solidification system; a closed- circuit television system; a remotely operated, automatic crane for placing and retrieving incinerator ash containers; a HEPA-filtered facility ventilation system; an environmental air sampling system; and an automated inventory and control system built around an IBM PC AT Network.

REGULATORY ACTIVITIES

Many different factors have influenced the licensing process for the WRC. Most of these are attributable to the fact that this is the first facility of its type in the USA. These factors, coupled with the public concern about nuclear waste and the limited data available for institutional/

industrial waste streams, have contributed to protracted regulatory activities.

During initial meetings with regulatory personnel it was determined that necessary licensing would consist of (1) an amendment to the existing NRC special nuclear materials license (SNM-414) for the proposed WRC and (2) an air quality permit (AQP) from the Pennsylvania Department of Environmental Resources (PADER) to control non-radioactive air releases from the incinerator. The NRC license amendment request was submitted in October, 1984; the PADER incinerator AQP application, in November, 1984. Both submittals contained an environmental analysis prepared for the WRC and the incinerator vendor's NRC approved Topical Report AECC-4-NP-A. The following sections discuss the regulatory activities subsequent to these initial submittals.

Super-Compactor Regulatory Activities

The environmental analysis provided radioactive material release estimates for operation of the super-compactor, brief descriptions of the super-compactor system and its operation, and a completed occupational radiation exposure estimate for the WRC. In December, 1984, the NRC requested additional information on WRC occupational radiation exposure and on the super-compactor design and operation. A detailed occupational radiation exposure analysis prepared for the WRC was forwarded to the NRC in February, 1985; a complete facility description manual was forwarded in March, 1985.

In June, 1984, PADER indicated that an AQP for the super-compactor was required due to the public controversy surrounding the WRC. Following correspondence over the need for this requirement, B&W submitted two additional AQP applications in December, 1985, for the super-compactor. One would allow for compaction of B&W-generated waste; the other, compaction of non-B&W generated waste.

Commercial operation of the super-compactor will commence following the issuance of the NRC license amendments for the WRC and issuance of the PADER AQP's. The NRC SER/EA reports are scheduled to be issued by March 1, 1986. The PADER AQP's will be issued approximately sixty days after the license amendements.

Incinerator Regulatory Activities

Incinerator operation and the associated release of radioactive materials have generated the greatest amount of public controversy and concern. The following paragraphs summarize actions the various governmental agencies have taken as a result of that concern.

Petitions for hearings were filed with the NRC in February, 1985. The petitions primarily dealt with releases from the operation of the incinerator and health effects due to those releases. The NRC staff attorneys recommended that an informal hearing be granted and the NRC agreed. The informal hearing order was released in July, 1985, with one Commissioner dissenting. An administrative judge was appointed for the hearing and subsequently granted standing to one petitioner in October, 1985. The judge also ruled that the petitioner would have an opportunity to file further contentions on the NRC staff reports when they are issued. Resolution of the informal hearing is awaiting issuance of the NRC staff reports.

The time required for the NRC staff review has been protracted by two problems. First, in August, 1985, an error in the consultant carbon-14 food pathway dose estimate was discovered. The error was introduced to the computer code DOSG when the code was modified to calculate off-site dose due to iodine-125. Corrections were made to the environmental analysis and throughput restrictions were added by B&W to limit the release of radioactive materials that contributed to off-site exposure. All these throughput restrictions apply to the institutional/industrial waste streams and are designed to ensure that the off-site dose will not exceed ten percent of the 40 CFR 190 limits. The ten percent value was chosen by B&W to ensure that the off-site exposure is as low as reasonably achievable (ALARA).

Second, in November, 1985, the incinerator vendor, Aerojet Energy Conversion Company (AECC), discovered during testing that the incinerator off-gas scrubber would not perform as predicted and experienced premature clogging of the HEPA filters. AECC decided to add a secondary venturi scrubber in series with the primary venturi scrubber. But, this added component could not be placed within the existing trailer confines. As a result, the Topical Report AECC-4-NP-A had to be revised and submitted to the NRC for review. The WRC license amendment application referenced the AECC Topical Report and therefore, it's review was delayed by the incinerator Topical Report resubmittal. A secondary scrubber skid was designed and constructed and the incinerator is undergoing final testing.

PADER decided to add radiological conditions to the incinerator AQP and requested detailed waste characterization information in March, 1985. PADER also questioned whether incineration was the best available technology for wastes containing tritium and carbon-14. In August, 1985, B&W supplied detailed waste characterization data and best available technology justification for using incineration to process wastes containing tritium and carbon-14.

Commerical operation of the incinerator is awaiting several items. First, the NRC staff reports on the WRC must be issued. These reports are scheduled to be released on by March 1, 1986. Second, PADER must approve B&W's plan for incinerator non-radioactive testing. Third, the NRC must issue the WRC license amendment. Finally, PADER will hold a public hearing and then issue the incinerator AQP. The items are currently scheduled to be completed by September, 1986.

SUPER-COMPACTOR SYSTEM TESTING

The super-compactor system has undergone two rounds of testing. The first testing was performed at the manufacturer's location (in Holland) prior to shipment. Objectives of these first test were as follows:

- Determine compactability of specific materials.
- Determine springback of specific materials.

The test results, in most instances, confirmed pre-test assumptions regarding post-compaction final form and material compactability. Also, it was found that for the short-term (1 day to 1 year), spring back was not a problem. Detailed information on the density of the compacted material will be available in other papers.

Results of these first test were used as a basis to set up the next round of tests that were to be run after the equipment was installed in the WRC facility. The second round of compactor testing was done at B&W's WRC. The objectives of the second round testing were:

1. Startup equipment, i.e., fine tune controls and adjustments.
2. Train and qualify operators.
3. Increase data base beyond that knowledge gained in first test in Holland relative to material compactabilty and springback.
4. Gain operating experience to improve system efficiency.
5. Uncover any communication problems between the Stock process controller and the B&W computer network system.

To date approximately 400 drums have been compacted and placed into overpack drums. Super-compactor operators have been trained and qualified. The super-compactor process controller has been successfully interfaced with the B&W computer network which characterizes, tracks, and classifies all waste processed at the WRC as well as preparing shipment manifests for processed waste and reports on current and historic waste activities. The B&W system provides data to the super-compactor process controller on the identity, weight, curie content, and radiation level of each 55 gallon processed. The super-compactor system in turn provides to the B&W system the identification number of the overpack, its totalized weight, and the identification numbers of the individual compacted 55 gallon drums placed inside the overpack.

INCINERATOR STARTUP TESTING

B&W contracted with AECC for the lease of a mobile volume reduction system (MVRS) in June, 1984. The MVRS consists of a two-stage controlled air incinerator and a liquid off-gas cleanup system. The unit is contained in three mobile trailers and is designed to process dry solid waste, biological waste, scintillation fluids, and lubricating/hydraulic oils. The B&W decision to include incineration technology at the WRC was primarily influenced by B&W's commitment to handle all LLRW, including the wastes generated by institutional/industrial facilities (i.e., biological wastes).

The MVRS purchased by B&W is the second of its kind, the first unit is committed to Commonwealth Edision Company's Dresden Nuclear Station. The *Dresden* and the B&W MVRS units are essentially the same except that the B&W unit will use natural gas versus propane and the B&W unit will include a charcoal bed to filter I-125 in the institutional/industrial waste stream. The similarity of the two units and the close construction and delivery schedules have allowed B&W to take advantage of the Dresden MVRS startup testing. Much of the first-of-a- kind testing performed on the Dresden unit is abbreviated or deleted for the B&W unit.

The agglomerator (ash handling and densifier) testing was completed in late 1984 on a full scale system prior to being installed in the MVRS. The tests were designed for initial checkout and calibration, and for benchmarking the system performance. The performance tests were performed on three ash/salt mixtures with salt contents (weight %) of 0%, 30%, and 60%.

The Dresden MVRS has completed the assembly, functional checkout, calibration, incinerator performance, and off-gas system performance testing. The performance tests conducted on paper and cardboard showed an average feed rate of 358 #/hr. The feedrate for varying mixtures of polyethylene and Kraft paper averaged 130 #/hr. Prior to testing, a volume reduction factor of approximately 30:1 was expected; however, performance testing showed that the average volume reduction was approximately 80:1.

The B&W MVRS has completed the assembly, functional checkout and calibration testing. Future plans call for performance testing of the B&W MVRS after setup at the WRC. The primary purpose of this testing is to benchmark the performance of the B&W MVRS. The test plan calls for incinerating solid waste (with varying amounts of PVC, sulfur, and polyethylene), hydraulic and lubricating oils, scintillation fluids diluted with varying quantities of oils and animal carcasses. This is an important part of the MVRS testing as institutional/industrial type waste hasn't been processed in the Dresden testing.

SUMMARY

The WRC facility is complete and operational except for the incinerator and some material handling equipment. The facility was completed in only 18 months as result of a "fast-track" mode of construction, equipment procurement, and facility design. The reason for the "fast-track" construction was to complete the facility in conjunction with licensing it for operation. The licensing process has been delayed by the actions of a local special interest group, an incinerator performance problem, and an error in the original environmental analysis. All of these licensing delays are directly related to the incinerator and the B&W commitment to processing institutional/industrial waste, specifically, biological waste and waste containing C-14, H-3, and I-125 radioisotopes.

Upon receipt of the necessary licenses and permits, the WRC will begin super-compaction operations. Prior to commencing incineration operations, the incinerator must be delivered to B&W facility and acceptance testing on the institutional/industrial waste forms completed. Also, the last of the material handling equipment must be installed before the WRC is fully operational. Current plans call for the WRC to be in commercial operation with the super- compactor by mid-1986; with the incinerator a few months later; and fully operational by the end of this year.