PROGRESS AT THE ADVANCED MIXED WASTE TREATMENT PROJECT

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ABSTRACT

The contract for the Advanced Mixed Waste Treatment Project (AMWTP) was let in December of 1996 and was followed by a period of design and construction. In March of 2003, the first shipment of waste to the Waste Isolation Pilot Plant (WIPP) was made under the auspices of AMWTP. Since then the project has commenced retrieval of waste from the earthen berm in the Transuranic Storage Area – Retrieval Enclosure (TSA-RE), has characterized a body of waste, prepared waste for shipment to WIPP and continued commissioning of the main facility in which waste will be supercompacted.

This paper details the progress of the project in removing transuranic (TRU) waste from Idaho and outlines the lessons learned during the project.

INTRODUCTION

In 1996 a contract was let to BNFL Inc. as a privatization (*ie* payment on the volume of waste processed) to remove 65,000 m^3 of TRU waste from the Idaho National Engineering and Environmental Laboratory (INEEL) to WIPP. This waste was and is located at the Radioactive Waste Management Complex (RWMC) at the INEEL. It is located in two areas, the Type II Storage Modules that contain *ca* 11,000 m^3 with the residue located under an earthen berm in the TSA-RE. The waste in the Type II Storage Modules is the waste from which the 3,100 m^3 of waste was drawn and subsequently shipped to WIPP by Bechtel B&W Idaho, LLC (BBWI) prior to the end of 2002.

The AMWTP contract covers retrieval of waste from the TSA-RE together with the waste from the Type II Storage Modules, to be prepared for shipment to WIPP. The contract originally called for a 65% volume reduction of the waste and for the waste to be removed prior to 2018 with a target completion date of 2015. Since the contract is a 'privatization' arrangement with BNFL Inc. being paid against the volume of waste processed, BNFL Inc. is motivated to complete this contract as soon as possible to reduce operational costs.
This privatization contract is structured such that BNFL Inc. are remunerated for the first 25,000 m^3 to cover the fixed cost of processing the waste plus amortizing the capital cost of the project and the facility. Thereafter, payment is based on the fixed processing price (subject to appropriate price redetermination based on experienced gleaned over the first 25,000 m^3).

The contract itself is such that in addition to the 65,000 m^3 of waste specifically identified, AMWTP is called on to process a further 20,000 m^3 of waste, subject to US Department of Energy (DOE) taking up a contract option, without compromising the completion date of 2018. The DOE also has the option to have a further 100,000 m^3 of waste to be processed through the plant.

THE WASTE

The waste that is stored at the RWMC came from various sites around the DOE complex, although it predominantly came from Rocky Flats (*ca* 96%). When the waste was originally shipped to the INEEL it was purported to be TRU (*ie* > 10 nCi/g). Subsequent changes in the regulatory definition of TRU waste (*ie* > 100 nCi/g) has resulted in an estimate that *ca* 40% of the waste lies in the 10 nCi/g – 100 nCi/g

region, however, inspection of historic data suggests that on average all the 65,000 m^3 will contain > 100 nCi/g.

The waste itself consists of debris, contained in boxes and drums and 'solidified' process wastes contained in drums. The drums are standard 55-gallon drums whilst the boxes are a miscellany of sizes and materials of construction (*eg* metal, fiberglass reinforced plywood (FRP), wood *etc*). The sludge waste that is supposedly solidified, represents a wide variety of conditions, monolithic grouted wastes, pastes, drums with free liquids in or on top of the waste *etc.* The waste is made up of *ca* 30% sludge with the remainder being debris of various kinds. The records suggest that the larger proportion of this waste, *ca* 98% is considered to be mixed *ie* with Resource Conservation and Recovery Act (RCRA) components.

SOME HISTORY

At the time the contract was let, WIPP was not open and there was every possibility that the wastes from AMWTP would require storage for an extended time period at the INEEL. Although WIPP is exempt from RCRA due to the WIPP Land Withdrawal Act initially it was necessary for AMWTP to produce a waste form that was RCRA compliant against the possibility of long-term storage on-site. In early flowsheets, therefore, the plan was to grout the debris and processed sludges to meet RCRA.

When WIPP opened and it became evident it would continue receipt of waste, the need to grout the waste was removed. As a consequence, the process was modified to ship processed debris and sludge without grouting, thereby avoiding the disposal of a considerable mass of uncontaminated encapsulant.

The initial plan was to supercompact all debris and to incinerate all sludge (see flowsheet in Figure 1). A litigation challenge to DOE by Keep Yellowstone Nuclear Free (KYNF) in 1999-2000, resulted in BNFL Inc. being requested to delete the incinerator from the flowsheet but continue to ship as much waste as possible to WIPP. This resulted in a revised flowsheet (Figure 2). The main features of this were:

- Decouple characterization from processing
- Load manage sludge drums in Ten Drum Overpacks (TDOPs) to ensure all the waste shipped to WIPP was > 100 nCi/g
- Ship sludge to WIPP without treatment
- Retain unshippable sludges and select a treatment process at a later stage

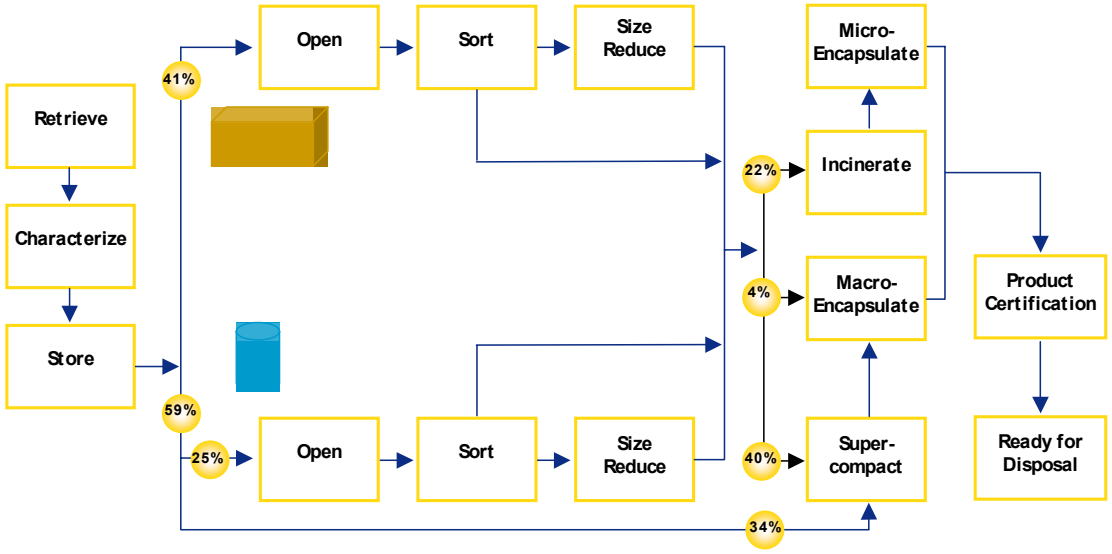

Fig. 1 AMWTP Baseline Flowsheet

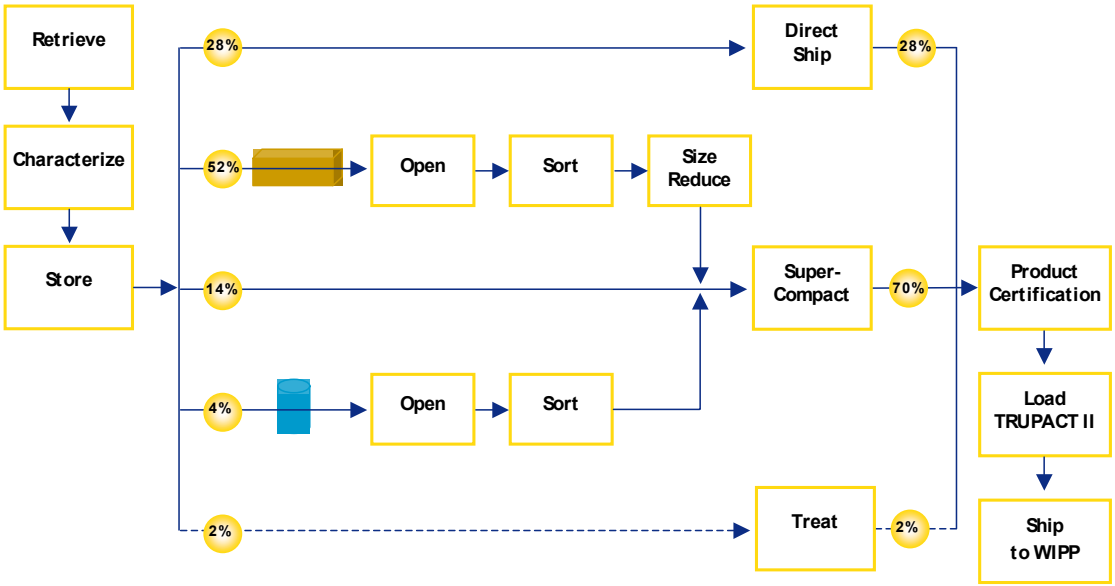

Fig. 2 AMWTP Revised Flowsheet

The volume of waste adjudged to be unshippable was small compared to the original volume to be fed to the incinerator. Furthermore, as WIPP gained more experience, there was evidence that some excluded wastes might be accommodated, independent of any specific needs of AMWTP (*eg* the possibility of shipping poly chlorinated biphenyl (PCB) containing waste of relatively high concentration to WIPP). The small volume had two consequences: namely an ability to defer treatment decisions for this body of waste and the possibility of not having to default to incineration as the treatment process.

TIMELINE

The timeline for AMWTP is shown in Figure 3. The main features are that following the contract award in Dec 1996, construction of the facility completed in December 2002, and the project shipped waste by April 2003, although the waste from the initial shipments were drawn from a body of waste characterized by BBWI during their successful 3,100 m^3 program. The Operational Readiness Review (ORR) for

retrieval and characterization was completed in March 2003 and the WIPP audit satisfied in November 2003. Soil removal from the TSA-RE berm started in March 2003, with retrieval of waste containers beginning in July 2003. At the time of writing (November 2003), 545 m^3 of waste has been retrieved. In addition, 149 m^3 of waste had been shipped to WIPP.

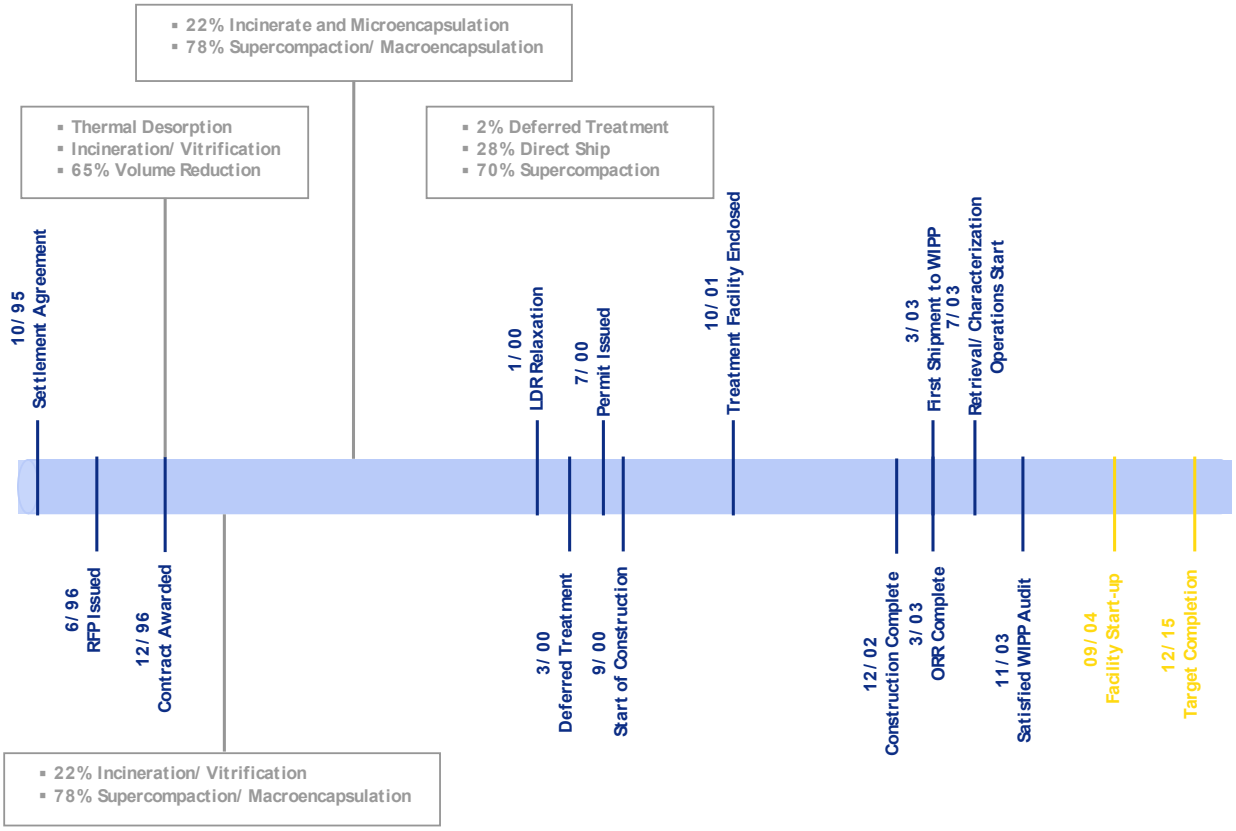

Fig. 3 AMWTP Timeline

It is envisaged that the facility will be operational by September 2004 and waste will be shipped to WIPP, following processing through the facility, starting in early 2005. The process for treating the remaining sludges will be selected around 2004, with an anticipated operational start date of 2007 for treatment of this body of waste. It is projected that the entire 65,000 m^3 will be processed by 2013.

RETRIEVAL

Drums and boxes are removed from the stack in the TSA-RE by first removing the soil overburden with a vacuum system fitted with a cyclone separator. Next the covering plywood and tarpaulin is removed. Drums and boxes are inspected for breaches and the area surveyed. Containers are then removed and where necessary either repaired or overpacked.

Bulged drums *ie* those suspected of pressurization, are vented using a remote device. In 2003, the gases from one such drum ignited during this process. Since the operations were situated at a distance and behind a shield there was no danger to operations. No spread of contamination or ignition of waste was noted. A local inquiry suggested some minor improvements to ameliorate possible sources of ignition *eg* grounding both drum and equipment, but no major shortcomings of the process were noted.

CHARACTERIZATION

Characterization consists of Real-Time Radiography (RTR) to confirm drum or box contents, to derive additional information for process choice and to detect prohibited items (free liquids, containers with liquids, shielded containers *etc.*). Drums are then head gas sampled to confirm or detect volatile species or radiolytically generated species. Containers (drums and boxes) are then assayed to determine their activity content and finally selected drums are opened and their contents sampled for chemical analysis.

The body of waste contains both radioactive and hazardous contaminants. A procedure has been devised where absence of any radioactive material is taken as an indication of the absence of hazardous material. This reduces the need for extensive sampling and chemical analysis.

On the basis of the above characterization process, the containers are consigned to the facility treatment processes or are sludge drums combined into TDOPs for shipment. Wastes that do not meet US Department of Transportation Regulations or the WIPP Waste Acceptance Criteria (WIPP-WAC) are put aside for future treatment.

At the time of writing (November 2003), there were indications that most containers were above 100 nCi/g and a large percentage of sludges, particularly the cementitious waste, exhibited free liquids.

THE FACILITY

At the time of writing, the facility has not begun active operations. The function of the facility is to:

- Open boxes of debris
- Repack the debris into 55-gallon drums
- Assay these drums
- Compact the drums
- Load manage collections of pucks into puck drums of TRU waste
- Size reduction of low-level waste (LLW)
- Visual inspection of waste in boxes and selected drums
- Removal of 'special case waste' from drums and boxes for processing

The center of the facility is the supercompactor, which provides size reduction of the debris. Waste drums will be compacted to reduce the waste volume by 75% or more. In addition, the supercompactor will, by achieving sufficiently high forces disrupt layers of confinement by bursting, tearing or plastic flow of bags and liners. The process of supercompaction will also remove any voidage in the waste to limit free volume in the final waste form.

SHIPPING

The wastes are to be sent to WIPP in conventional Transuranic Package Transporter-II (TRUPACT IIs). Waste will either be in the supercompacted form with 3 or more pucks in a 100-gallon puck drum or in

the case of sludges placed in TDOPs. Load management is carried out to ensure all wastes are TRU within the primary container (Puck Drum, see above, or TDOP) and the shipping efficiency is managed.

RESIDUAL WASTE

With the removal of the incinerator, there remains a body of waste that cannot be shipped to WIPP. Despite changes in the WIPP Waste Acceptance Criteria to accommodate, for example PCBs, the need to treat all of these wastes has not been removed. Shipment and disposal is precluded for certain wastes by factors such as high Volatile Organic Compounds (VOCs) content, potential to produce hydrogen by radiolysis, reactives, free liquids *etc.* The volumes are relatively small and without the need to treat PCBs may not require the most aggressive type of thermal treatment (*eg* incineration, plasma treatment). As more detail of the waste is assembled within characterization, a downselect of treatment technologies will be carried out in early 2004. To date, front running technologies include sorption (for free liquids) and some form of thermal desorption with oxidation for the remainder of the wastes.

LESSONS LEARNED

There have been a number of lessons to be learned from AMWTP. The first is associated with privatization. AMWTP is suited to this type of contract because it is very similar to processes in the United Kingdom *eg* Waste Treatment Complex (WTC) so the risks are well understood. The changeable nature of the environment in which the contract has been enacted places considerable risk on the concept (*eg* the litigation that resulted in deletion of the incinerator from the AMWTP permit). Privatization represents increased risk if the plant or process is 'first of a kind'.

The execution of such a contract also requires clarity of defunction and understanding between the parties. Any ambiguity results in prolonged discussion and potential loss of flexibility on the part of both parties.

For BNFL Inc., understanding the risk is of paramount importance to maximize the project. Risk includes formal risk to the project as well as commercial risks to the project's schedule. Within this framework, the use of an Operational Research (OR) model to define the throughput and its sensitivities was a vital part of framing these risks.

The need to be innovative has been demonstrated in this project where DOE and BNFL Inc. worked together to understand the implications of the incinerator deletion and the available options to proceed successfully.

CONCLUSION

AMWTP has successfully moved into its operational phase.