MOBILE INCINERATION SERVICES AT COMMONWEALTH EDISON'S NUCLEAR STATIONS

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ABSTRACT

As the costs for low-level waste disposal escalate, and as the January 1, 1986 date draws nearer, utilities throughout the United States are formulating and implementing plans to reduce the volumes of the low-level radioactive waste being generated at their nuclear power stations. Techniques being used to accomplish this goal range from sorting of dry active waste to complete volume reduction systems, like the Aerojet VR Systems being installed at Commonwealth Edison's Byron and Braidwood Stations. In between these extremes are partial solutions to the problem, including compaction, shredding and compaction, super-compaction, resin dewatering, liquid drying, and now, mobile incineration.

In June, 1983, Commonwealth Edison Company (CECO) of Chicago, Illinois, contracted Aerojet Energy Conversion Company (AECC) of Sacramento, California, to supply mobile VR services to the Dresden, La Salle, Quad Cities, and Zion Nuclear Stations. Per the contract, AECC is responsible for the design, fabrication, delivery, operation, and maintenance of a Mobile Volume Reduction System (MVRS) capable of processing combustible dry active waste and contaminated oil generated at these Com-Ed facilities. Initial commercial operation of the MVRS is planned for the Dresden Nuclear Power Station in May, 1985.

This paper is intended to summarize some of the key elements resulting from the design, fabrication, and testing of the MVRS. In addition, it is intended to identify the tasks a potential user of the MVRS service must complete in order to receive permission from the Nuclear Regulatory Commission to operate the MVRS at their site.

BACKGROUND

At the outset of the program in June 1983, the MVRS was barely more than a concept. AECC had decided that due to size, height, and throughput restrictions, a controlled-air incinerator would be utilized in lieu of the technology more familiar to AECC, the fluidized-bed technology. It was also predetermined that because of the composition of the waste (polyvinyl chloride and sulfur containing materials), a liquid off-gas cleanup system would be included to attain the desired off-gas control levels.

In the early stages of the program and up to a Preliminary Design Review in October, 1983, work proceeded, in parallel, on P&IDs, General Arrangements, and the design of the incinerator. Many different layouts were evaluated, with emphasis placed on the formulation of a design totally independent of any site structures or buildings other than the parking pad for the MVRS.

Detailed design began in late 1983, and continued through an Intermediate Design Review in January, 1984, and up to a Final Design Review in April, 1984. In late April, 1984, AECC initiated the procurement activities on the program, and also completed the Topical Report for Submittal to the U. S. Nuclear Regulatory Commission. Per the contract with CECO, AECC was responsible for providing a Topical Report on the MVRS that is accepted by the NRC for referencing in site specific permit applications. CECO was responsible for obtaining specific NRC approval to operate the MVRS on the Dresden, LaSalle, Zion, and Quad Cities sites.

DESIGN

The AECC MVRS consists of three trailers, labeled: the Operations Trailer, the Incinerator Trailer, and the Off-Gas Trailer. No other trailers, buildings, or structures are required to house the MVRS equipment.

All operations take place in the Operations Trailer. Combustible waste packages are delivered to the trailer by the utility. A hoist is utilized to transfer the waste packages from the utility's transfer vehicle to the Operations Trailer. There the packages are weighed and checked with a radiation monitor. Waste packages not meeting the defined requirements ($\leq$ 25 mrem surface dose rate; $\leq$ 250 pounds in weight) are returned to the utility for alternate processing.

The Operations Trailer also houses the main control panel and the ash packaging system, consisting of an ash hopper, an agglomerator, a shielded cart, container cappers, and container hoists. All ash packaging operations are performed remotely, including the transfer of the ash containers to the utility's transfer vehicle.

The Incinerator Trailer houses the trash ram assembly, the primary and secondary incinerator chambers, the quench pipe, and the venturi scrubber system. The incinerator is designed for a total heat release of 3.0×10^6 BTU/Hr, which is equivalent to about 350-375 pounds of DAW per hour. When processing contaminated oil, the incinerator heat release rate is reduced to 2.0×10^6 BTU/Hr.

The off-gas quench pipe is designed to reduce the temperature of the off-gas from approximately 2300°F (leaving the secondary chamber of the incinerator) to 1000°F at the inlet to the venturi scrubber. The venturi scrubber, operating as a caustic scrubbing system, removes the flyash and acidic gases produced during the combustion process. Scrub solutions generated in the venturi scrubber are concentrated to 20 wt.% prior to being transferred to a surge tank. The scrub solutions are injected via a syringe assemble into the waste packages prior to insertion of the packages in the incinerator. As the waste packages are burned the water is evaporated, leaving an ash/salt composite in the primary chamber of the incinerator. This ash/salt material is transferred from the Incinerator Trailer to the Operations Trailer via a screw conveyor located under the primary chamber of the incinerator.

Gases leaving the venturi scrubber system are drawn to the Off-Gas Trailer by an induction fan. These process gases then pass through a HEPA filtration system prior to being exhausted to the atmosphere. The overall decontamination factor for particulate material is 4×10^6.

NRC APPROVAL FOR OPERATION

Commonwealth Edison and AECC have approached the licensing of the MVRS from two fronts. AECC accepted the responsibility to submit a Topical Report describing the technical details of the MVRS to the NRC. CECO prepared the site specific application for NRC approval to operate the MVRS at licensed reactor sites.

AECC submitted the Topical Report to the NRC on May 1, 1984, and received notice of its acceptance on October 26, 1984. In accepting the Topical Report, the NRC listed a series of items that should be included in any future applications or amendments which reference the MVRS Topical Report. This list included the following:

- Any exceptions or deviations from the Topical Report.
- Interfaces between the plant and the MVRS.
- A Process Control Plan which assures that the solid waste product meets the guidelines of ETSB 11-3, Rev. 2, July 1981, Design Guidance for Solid Radioactive Waste Management Systems Installed in Light-Water-Cooled Nuclear Power Reactor Plants.
- A waste classification program to demonstrate that the solid waste product is Class A and meets the minimum waste characteristic requirments set forth in 10CFR61, Section 61.56(a).
- A description of the solid waste product container to be used for ultimate disposal of the MVRS product.
- An evaluation of off-site doses from effluent releases and direct radiation due to normal operation of the MVRS, including anticipated operational occurrences.

TESTING

Since the MVRS is a new and unique product of AECC, a substantial number of tests were planned during the MVRS program to demonstrate the capabilities of the design. These tests ranged from compaction and incineration tests on subscale fiberboard combustible drums to final, full-scale incineration tests with the deliverable MVRS unit. Throughout these tests, results indicated that the MVRS would operate as designed, producing a substantial VR factor (up to 33:1 for compacted DAW) and a final product acceptable for shallow land disposal or storage at the station site.

PRESENT SCHEDULE

AECC is currently scheduled to complete the full-scale incineration tests with the deliverable MVRS unit by March, 1985. Commercial operation of the MVRS is expected to begin at the Dresden Nuclear Power Station by May, 1985.