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TECHNICAL EVALUATION OF THE BARTLETT NUCLEAR
PORTABLE SOLIDIFICATION STATION TOPICAL REPORT

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ABSTRACT

This report summarizes EG&G Idaho's review of the Bartlett Nuclear, Inc. topical report on their Portable Solidification Station. The review evaluated compliance with pertinent codes, standards and regulations. The initial review was discussed with Bartlett Nuclear, and all outstanding issues resolved before this final evaluation was made.

FOREWORD

This report is supplied as part of the "Radwaste Volume Reduction and Solidification System Topical Report Review" being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, by EG&G Idaho, Inc., Physics Division.

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TECHNICAL EVALUATION OF THE BARTLETT NUCLEAR
PORTABLE SOLIDIFICATION STATION TOPICAL REPORT

1 SUMMARY

The topical report on the Bartlett Nuclear, Inc., Portable Solidification Station* describes the design and operational characteristics of a very small and simple system for solidifying low-activity, low-volume, hard-to-solidify liquid wastes using Modified Portland Cement (MPC-1).

The technical evaluation is based on review of this report and on Bartlett Nuclear's responses to questions on it.

The report addresses (1) the ability of the Bartlett Nuclear System to safely convert certain types of low-activity radwastes from commercial nuclear power plants to a solid form meeting current requirements for shipping and disposal, and (2) a system design including radiation protection measures which help assure that personnel radiation exposures are maintained ALARA.

The report describes the process flow, types of waste to be processed, equipment components and arrangement, postulated radiological accidents, a quality assurance plan, applicable federal regulations and standards, and anticipated radiation exposures. The report does not provide any details on the Modified Portland Cement (MPC-1) used as the solidification agent; however, it does contain two special sections on the testing of solidified samples for compliance with 10 CFR 61 waste form criteria.

*The complete title of the topical report is "Bartlett Nuclear, Inc. Modified Portland Cement (MPC-1) and Portable Mixing Station" (March 1986). This completely revised version of an earlier report is in response to NRC and EG&G Idaho questions and comments during the initial review.

In reviewing the Bartlett Nuclear System topical report, particular attention was given to the following:

1. Description of system design and equipment components including piping and instrumentation diagrams.
2. The method of operation.
3. The quality assurance program for the design, procurement, and acceptance of system components.
4. The process parameters and system design features that provide the solidification capabilities advertised for the system.
5. The design capacity in comparison with design-basis input volumes.
6. Required interfaces with the reactor plant and environment.
7. Radiation protection design features.

The EG&G Idaho reviewers observed an actual (although somewhat modified) Bartlett Nuclear Solidification Station at the Crystal River Nuclear Plant in Florida. While there the reviewers held additional discussions with Bartlett Nuclear personnel which helped resolve some of the final questions on the topical report.

The reviewers conclude that the topical report recognizes essentially all of the areas where federal regulations and guides apply, but that the report hands off responsibility for addressing and resolving many of these issues to the client utility.

Additional plant-specific information that would need to be provided by a license applicant to operate the Bartlett Nuclear System includes the following:

1. Specific characteristics and volumes of radwaste to be processed.
2. Description of the radwaste containers to be used and assurance that they meet 10 CFR 71 requirements.
3. A radiation monitoring plan for the safety of personnel in the vicinity of the solidification station.

4. A further evaluation of the airborne effluent expected from the solidification station (based on Item 1 above), and a description of the method for handling such effluent.
5. A description of the procedures used to identify and quantify the radionuclides in the solid waste product.
6. Assurance that any inadvertent spill of radioactive material can be contained using appropriate barriers and drains.
7. Any exceptions to or deviations from the Bartlett Nuclear System topical report.

Much of the foregoing information would be provided in a plant-specific process control program (PCP) prepared by the utility.

2 SYSTEM DESCRIPTION

The Bartlett Nuclear Portable Solidification Station consists of:

- a. A 55-gal drum for radwaste and cement.
- b. A hydraulic-powered mixer mounted on a movable frame from which the mixer is lowered into the drum.
- c. A small control console typically located about 25 ft from the mixer.

Liquid radwaste intended for solidification is initially sampled to perform test solidification using the Process Control Program (PCP). The appropriate proportions of radwaste, cement, and additives are then added manually to the 55-gal drum. The mixer blade is lowered into the drum where the contents are thoroughly mixed. The blade is then withdrawn as the mixture hardens. Finally, after checking the contents for hardness and free-standing water, the drum is manually capped and moved to a waste storage area.

The system is intended to process small amounts of hard-to-solidify wastes such as contaminated oils and decontamination fluids with radiation levels below 500 mR/hr at contact (system design basis). therefore no specific shielding or offgas ventilation are usually provided. Higher

activity wastes or wastes with measurable airborne activity could be processed; however, additional shielding, a filtered offgas system, and modified operating procedures would be required that are not described in the subject topical report.

All radiation monitoring equipment would be provided by the utility. Procurement and handling of the 55-gal drums is also a responsibility of the utility including radioactive contamination monitoring, decontamination, and labeling of the filled and capped drums.

Since operation of this system is intended to be largely manual, there are no special storage tanks or transfer lines for the radwaste, cement, or additives unless the client utility provides them.

The only required equipment interfaces between the reactor plant and the solidification station are electric power and water. The system must be operated in an area which can contain any leakage or spillage and return it to the utility radwaste system.

3 PROCESS PARAMETERS

The Bartlett Nuclear System is designed to process small batches of liquid radwaste that are usually difficult to solidify in large-scale, installed systems. The system is designed to handle up to twenty 55-gal drums per eight-hour shift, which is considerably more than the amount of special liquid waste expected in a month from a typical power plant.

The topical report includes a Process Control Program (PCP) for sampling and test solidifications "to establish processing parameters to insure a safe and effective solidification of low-level radwaste liquids, slurries and solids." Additionally, the presence of free-standing water and hardness of the solidified product are checked using a spatula or similar tool. The report states that "process control program constraints and full-scale testing done to date indicate the probability of occurrence for an unsatisfactory produce to be extremely low."

Compliance with the requirements of 10 CFR 61 is stated to be the utility's responsibility. However, BNI has had tests performed which demonstrate that the MPC-1 solidification medium meets the testing criteria for Class B and C wastes; (i.e. compressibility, resistance to fungi, thermal cycling, and immersion), even though Class A wastes are what is normally expected to be solidified.

The report stipulates that measuring or otherwise identifying and quantifying the radioactivity in the solidified product is the responsibility of the utility. Labeling the drum contents per 10 CFR 71 and 49 CFR 173 requirements is also a utility responsibility.

4 RADIATION SAFETY

The primary design feature intended to keep occupational radiation exposures ALARA is locating the operating console about 25 ft from the mixing station. Additionally, the small size and simplicity of the system allows for easy operation, maintenance and decontamination. Radiation exposure to a system operator based on the design-basis radiation level at the drum (before dilution and solidification) of 500 mR/hr was analyzed to be 50 mR per drum of solidified waste. Additional radiation shielding could be added by the client utility to further lower these exposures.

The topical report explicitly specifies "use [of the Bartlett Nuclear Solidification Station] in areas of a plant with adequate installed ventilation to prevent release to the environment."

The topical report contains a special section on postulated accident analyses in which it is concluded that "no credible accidents are postulated which could result in offsite release of radioactive material."

5 QUALITY ASSURANCE

Bartlett Nuclear does not have a documented quality assurance program established for this portable system. The topical report states that:

"All parts are first quality new equipment specifically selected for long life and low maintenance....Following installation the entire system is fully tested....The final testing of the station following construction prior to use is documented and maintained at the Bartlett Nuclear, Inc., offices."

The report also cites a number of examples of successful operation of the Bartlett Nuclear System.

6 REGULATORY POSITION

Based on the information provided by Bartlett Nuclear in the topical report (including responses to review questions) and the limited areas of responsibility accepted by Bartlett Nuclear, the topical report is deemed acceptable. It is recommended, however that responses* to the review questions be incorporated as an appendix to the report. Although the report hands off considerable responsibility for compliance with applicable regulations to the client utility, it demonstrates that the Bartlett Nuclear System has been designed and can be operated in compliance with the following regulatory documents cited in the report:

*Letter from W. H. Barley (BNI) to L. G. Hulman (USNRC),
Subject: Responses to Review Questions, August 7, 1986.

10 CFR 20 Standard for Protection Against Radiation

10 CFR 50 Licensing of Production and Utilization Facilities

10 CFR 71 Packaging and Transportation of Radioactive Waste

Reg. Guide 1.143 Design Guidance for Radioactive Waste Management
Systems in Light-Water-Cooled Nuclear Power Plants

Reg. Guide 8.8 Information Relative to Ensuring That Occupational
Radiation Exposures at Nuclear power Stations Will Be ALARA

ETSB 11-3 Branch Technical Position on Design Guidance for Solid
Radioactive Waste Management Systems Installed in
Light-Water-Cooled Nuclear Power Reactor Plants

ANSI/ANS-55.1 American National Standards for Solid Radioactive Waste
Processing System for Light Water Cooled Reactor Plants.