UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

July 14, 1988

Docket Nos.: 50-265

Mr. Henry E. Bliss
Director of Nuclear Licensing
Commonwealth Edison Company
Post Office Box 767
Chicago, Illinois 60690

Dear Mr. Bliss:

SUBJECT: SOLIDIFIED DECONTAMINATION RADWASTE SAMPLE AT QUAD CITIES

On April 26, 1988, Idaho National Engineering Laboratory (INEL) collected eight cement samples containing decontamination radwaste and one sample of ion-exchange resin during a Low Oxidation State Metal Ion (LOMI) decontamination operation at Quad Cities Nuclear Power Station (QCNPS), Unit 2. The samples were expected to remain at QCNPS for about two weeks before being shipped to INEL for analysis and testing.

At this time, the samples have not been shipped to INEL and remain at QCNPS because of uncertainties involving the solidification of the radioactive ion-exchange resins in cement. The cement set-up too quickly after being mixed with the ion-exchange resins containing the decontaminated radwaste and chelating agent. Technical and management concerns about the entire cement solidification process and resolution of these issues to the satisfaction of NRC, the licensee, and solidification vendor appears to have resulted in delays in shipping the samples from QCNPS to INEL.

At a meeting with the NRC staff on May 24, 1988, representatives of Commonwealth Edison Company, QCNPS, and Chem-Nuclear Systems, Inc. discussed the LOMI decontamination operation at QCNPS, Unit 2, and potential causes for the premature cement solidification. During the meeting, we stated that INEL had not yet received the cement, ion-exchange resin, and Process Control Procedure (PCP) samples and inquired as to when the samples would be sent. QCNPS personnel indicated they wanted more information about the analysis and testing that would be conducted on the samples before the samples would be sent to INEL.

Enclosure 1 provides the required information. Detailed information about the NRC/RES research program, "Characteristics of Low-Level Radwaste: Decontamination Radwaste" is included in Enclosure 2. The content of these enclosures should address those questions expressed by QCNPS personnel about analysis and

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testing of the solidified decontamination radwaste samples, and the INEL research program. However, if additional information is needed, please contact me. In any case, we request that the aforementioned samples, collected by INEL [illegible] 1 26, be shipped to INEL for analysis and examination.

Thierry Ross, Project Manager
Project Directorate III-2
Division of Reactor Projects - III,
IV, V and Special Projects

cc: J. Lee
P. Reed
D. Muller

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Mr. Henry E. Bliss
Commonwealth Edison Company

Quad Cities Nuclear Power Station
Units 1 and 2

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EXAMINATION OF DECONTAMINATION RADWASTE SAMPLES COLLECTED FROM QUAD CITIES 2

1. BACKGROUND

The samples were collected at Quad Cities 2 by Idaho National Engineering Laboratory(INEL) for the ongoing Office of Nuclear Regulatory Research program, "Characteristics of Low-Level Radwaste: Decontamination Waste." The objectives of the research program are to collect and characterize actual solidified decontamination radwaste samples from operating nuclear power stations for the purpose of obtaining data and information on the stability of solidified low-level radwaste forms and determining radionuclide and chelating agent release rates for use as source terms in modeling releases and environmental transport from low-level radioactive waste disposal sites. Quad Cities 2 is one of three operating nuclear stations INEL plans to sample during FY88. In recent years, INEL has collected samples from and performed leaching tests on cement solidified decontamination samples from five operating nuclear power stations.

II. SAMPLE ANALYSES AND TESTS

The ion-exchange resins and cement solidified decontamination and PCP samples will be analyzed and tested as follows:

A. Ion-exchange Resins:

1. Radionuclide and chemical, including chelating agent, analysis

B. Solidified Cement and PCP Samples:

1. Leaching of radionuclides and chelating agents using the procedures in ANSI/ANS-16.1
2. Radionuclide and chemical analysis
3. Immersion testing
4. Compression testing
5. Additional analyses and testing as may be needed to provide insights on the mechanism of premature solidification

ENCLOSURE 2

U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REGULATORY RESEARCH

RESEARCH PROJECT MANAGEMENT INFORMATION

TITLE: CHAR OF LL RAD DECON WASTE FIN: A6359

DIVISION: Engineering
BRANCH: Waste Management
SECTION:

PROGRAM: Nuclear Waste Disposal
ELEMENT: Low Level Waste
ACTIVITY: Materials & Engineering

TECHNICAL MONITOR: REED P

CONTRACTOR: Idaho National Engineering Laboratory

USER REFERENCE:
User need statement for the Waste Management Program (RR-NMSS-84-3). Memo from John G. Davis to Robert B. Minogue dated July 23, 1984.

OBJECTIVE:
To collect solidified decontamination radwaste from operating nuclear power stations for the purpose of obtaining data and information to provide NRC guidance on LLW form stability and determine realistic source term data for u in modeling radionuclides and chelates from LLW disposal sites. To character ize the radionuclide and chemical content of decontamination resins and solid fied wastes from operating nuclear power stations. To conduct experiments on

leaching behavior of radionuclides and chelating agents from solidified decon tamination wastes. To establish a database for radionuclides and chemicals leached from solidified waste forms collected from actual nuclear power sta- tions. To perform conpression tests on solidified decontamination LLW forms. To study the structural stability of waste forms solidified during decontamin ation process by evaluating the test method in NRC Branch Technical Positions and a draft regulatory guide on LLW forms to ensure solidification into stabl waste forms.

MAJOR CONSIDERATIONS:
10 CFR Part 61 requires radionuclide releases, chelating agent concerns, and the structural stability of solidified waste forms to be addressed in assessi the performance of LLW facilities. Leaching of radionuclides and chelating agents from solidified waste forms and the results of compression tests of so lidified LLW forms are factors in determining LLW form stability and in evalu ting source terms from LLW facilities. Leaching data and information for radionuclides, chemicals, and chelates released from actual reactor solidifie decontamination wastes are not available. Chelating agents have been shown to enhance migration of radionuclides from LLW sites. Current leach rate dat are based on laboratory samples using simulated waste streams and may not be realistic. Deterioration of cement solidified LLW forms containing ion- exchange resins upon immersion in water is of great concern. Characterizatio of waste stream ion-exchange resins and determination of mechanisms for the decomposition of cement solidified samples are being examined in this researc

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STATUS:

3/88 Project Initiated: 1984 Expected Completion: FY 1990

Project continues to provide realistic leach rate data from solidified waste forms collected from operating research. Current work emphasizes completion NUREG/CR report describing results of leaching studies from 4 BWR and 1 PWR using 4 different types of radioactive decontamination wastes (LOMI, CITROX, CA N-DECON, and DOW NS-1) solidified in cement and all leached with demineralized water. Present research has emphasized the development of sampling and analysis plan to collect ion-exchange resins and solidified cement samples from 3 operating reactors, characterizing the collected samples for radionuclide, chemical, and chelate content; leach the solidified waste forms with sea water and water of varying pH levels; and compression testing of the ceme waste forms. Preparations are being made to sample 2 operating reactors. Long-term leaching of samples collected in FY85 is continuing. Analysis of data and interpretation of results is ongoing.

RESEARCH COMPLETED:

1. Published NUREG/CR-4181, "Leachability of Radionuclides from Cement Solidified Waste Forms Produced at Operating Nuclear Power Plants" (Task 1).
2. Completed studies on leaching of radionuclides and chelates from cement solidified decontamination wastes samples collected from 4 BWRs and 1 PWR.
3. Prepared report describing sample collection, radionuclide characterizatio of solidified waste, and chelating analysis method for characterizing low-level radioactive decontamination wastes from operating nuclear reactors.
4. Collected solidified cement samples from an operating BWR using CITROX decontamination process in December 1987.
5. Shipped cement samples collected from BWR to INEL in February 1988.
6. Developed gas chromatography method for determining chelating agents in leachates.
7. Prepared numerous monthly and quarterly progress reports.

PLANNED RESEARCH FY:

1. Complete analysis of leachates for radionuclides and chelate concentration and prepare final NUREG/CR report on leaching studies from cement samples collected from 5 operating nuclear stations.
2. Collect cement solidified decontamination waste and ion-exchange resin samples using CITROX and LOMI processes from 3 operating nuclear stations.
3. Characterize collected ion-exchange resins and solidified decontamination wastes for radionuclide, chemical, and chelate content.
4. Begin leaching of cement waste samples for radionuclides and chelates usin demineralized water, sea water, and water at 3 pH levels.
5. Evaluate degradation of solidified waste forms immersed in water.
6. Propose mechanisms for degradation of cement waste forms if deterioration occurs during leaching process.

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PLANNED FUTURE RESEARCH:

- o Collect decontamination wastes (LOMI process) solidified in cement from operating nuclear stations.
- o Characterize solidified radwaste for radionuclides and chelates content.
- o Perform leaching studies on small- and large-scale sized samples including full-scale solidified samples.
- o Determine chemical form of radionuclide and chelate in leached solution.
- o Study leaching mechanism for radionuclides and chelates from solidified waste forms immersed in ground water at various pH levels.
- o Perform compression tests prior to and after leaching.
- o Perform lysimeter studies in arid and humid climates with decontamination radwaste solidified in cement.
- o Perform complete testing of cement solidified decontamination waste samples using methods specified in draft regulatory guide on LLW form stability.

DELIVERABLES FY:

1. Report on leachability of radionuclides and chelates form cement solidified waste forms of decontamination wastes collected from 5 operating nuclear stations 6/
2. Annual Report for FY88 9/
3. Prepare article for peer-reviewed scientific journal 9/

SIGNIFICANT FINDINGS:

- o Primary radionuclides solidified and leached include Co-60, Fe-59, Mn-54, Ni-63, Pu-241, Cs-137, Sr-90, and Sb-125.
- o Chelating agents leached include EDTA, DTPA, Citric Acid, Oxalic Acid, and Picolonic Acid.
- o Solidified cement waste form containing CITROX decontamination agent disintegrated during leaching.
- o Leachability index for Cs-137 is much lower (near 6) than other radionuclides.
- o Leaching results for radionuclide releases from actual reactor solidified waste forms differ from leaching dates determined from laboratory studies.

REGULATORY APPLICATIONS:

Results from this project will be used in NRC licensing and regulatory proces including:

- o Support development of regulatory criteria for determining stability of cement solidified low-level radwaste.
- o Provide criteria on leachability of radionuclides and chelating agents for leach rate assessments compression testing, and immersion testing as proposed in draft regulatory guide on low-level waste form stability.
- o Provide licensing decision on radionuclides and chelating agents released

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from solid waste forms and burial facilities of low-level radioactive wast as specified in 10 CFR Part 61.

- o Provide database for making licensing decisions and providing guidance on radionuclides and chelates released from solid waste forms for low-level radioactive wastes.
- o Provide source term data for radionuclides and chelating agents for use in modeling transport of radionuclides from low-level waste burial sites.
- o Provide independent basis for evaluating licensee decontamination and solidification data and analyses. Compare results with licensee data obtained in process control program for solidified waste forms.
- o Provide information on behavior of actual solidified wastes immersed in water and handling of decontamination waste.

SOURCE SELECT:
N/A

NRC OFFICE/REGION:
1. Endorsed by NMSS
2. Reviewed by NMSS