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DRESDEN UNIT TWO

DILUTE CHEMICAL DECONTAMINATION

AND

ALTERNATE WATER CHEMISTRY

Progress Report
for Period July 1-31, 1978

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The Dilute Chemical Decontamination Program highlights for July, 1978, on a task by task basis, are as follows.

TASK 1

Solvent Development and Filtration

No major highlights.

VNC Test Loop

The first VNC test loop run to simulate the chemical conditions of a dilute chemical decontamination of a BWR was conducted using a 2½-ft section of contaminated piping from Nine Mile Point. Generally, the loop, including the instrumentation, performed as designed.

NTA and ascorbic acid were both successfully injected into the loop to concentrations of 0.007M. During the run, the pH was controlled at 3.5 ± 0.5 by utilizing H^+ -form cation-exchange resin. The dissolved oxygen concentration was reduced from approximately 4ppm to less than 0.2ppm by the initial injection of ascorbic acid and remained below 0.2ppm throughout the run. The loop temperature was 83°C for the first 25 hours and 88°C for the remainder of the test.

The reagents were circulated for 77 hours. During the run, the solution was periodically passed through ion-exchange columns containing cation resin in the H^+ form, cation resin in NH_4^+ form and anion resin presaturated with NTA. Each of the three resin systems appears to have been successful in regenerating the NTA since the dissolved iron and Co-60 concentrations could be reduced by passing the solution through the columns.

Analyses of the millipore filters of the samples collected periodically during the run indicated there was virtually no particulate released during the run. Because of the low particulate release, virtually no particulates or Co-60 activity were collected in high gradient magnetic filters during the run.

After 77 hours the water purification process was initiated by valving in a mixed-bed ion-exchange column. The conductivity dropped from approximately 1000µmhos to 22µmhos in about 2 hours. However, the main loop pump failed and the test was terminated. Subsequently, the loop water was passed through a mixed-bed ion-exchange column in the laboratory and the conductivity was reduced to less than 1µmho.

The Co-60 dissolution curve had a traditional "S" shape, with 80% of the activity being removed in 60 hours; the dissolution rate was effectively zero after 60 hours. Injection of additional NTA to a level of 0.013M, reduction of the pH to 3.0, regeneration of the reagents (and hence removal of iron), and increasing the temperature all appeared to have little or no effect on the dissolution rate. The rate of dissolution was considerably

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slower than that observed (80% in 6 hrs) in kettle tests with similar initial conditions. Subsequent reduction of the data from the loop run should provide insight into the slower dissolution rate. Examination of the pipe after the run indicated the residual activity was primarily loosely adherent, that is, it could be removed by rubbing gently with cotton. However, the red iron oxide could not be removed with a stream of water from a squeeze bottle, which is usually effective for the removal of the residual activity in kettle tests.

In summary, the first loop run was considered highly successful. The run demonstrated that the chemical conditions of a BWR could be simulated and that the VNC loop was a versatile tool for evaluating integrated dilute chemical decontamination technology. In addition, the run provided confirmation that with a NTA system, the NTA could be regenerated, the pH could be controlled with ion-exchange resin, the dissolved oxygen concentration could be maintained below 0.2ppm with ascorbic acid; and the reagents and dissolved corrosion products could be removed and the water returned to BWR conditions.

TASK 2

Corrosion Product Characterization

No major highlights.

TASK 3

Corrosion Testing

Additional beaker-scale tests with corrosion inhibitors have been conducted to evaluate the possibility of reducing the corrosion rate of A508 in NTA. Only non-sulfur bearing compounds are being considered.

TASK 4

Pilot Loop

No major highlights.

Administrative

A presentation on the progress of the program was given at the DOE-EPRI-ESEERCO Contractor's Meeting in Palo Alto, California, on August 1, 1978.

TECHNICAL HIGHLIGHTS
ALTERNATE WATER CHEMISTRY PROGRAM

JULY 1978

Task A (Additive Requirements)

Previously calculated mass balance flowsheets for hydrogen, ammonia, and hydrazine remain unchanged. New information on the effects of these additives in suppressing oxygen concentration in the reactor water is being evaluated as it becomes available.

Task B-1 (N-16 Dose Rate)

Calculations for dose rates at four selected locations on the Dresden-2 operating floor and calculations for dose rates outside the turbine building caused by N¹⁶ and C¹⁵ sources in the D-2 turbine building have been completed. These calculations were done on the basis of 1.0 microcurie of either N¹⁶ or C¹⁵ per gram of steam at pressure vessel nozzle, so that the calculated dose rates can be scaled up by a simple multiplying factor to match whatever concentrations result from a selected alternate water chemistry.

Calculations for dose rates outside the turbine building due to N¹⁶ and C¹⁵ for a BWR/6 turbine building arrangement have also been completed.

Currently underway are the calculations for dose rates on a BWR/6 turbine operating floor. All calculations will be completed by the end of August.

Reduction of the data obtained from Dresden 2/3 during June continued throughout the month. The site was revisited to remove the equipment and cabling installed for the test.

Task B-2 (Offgas System)

The instruments and equipment required for the offgas baseline impurity test have been shipped to Nine Mile Point-1. The set-up of these instruments at the test facility has been completed and testing to measure the impurity concentrations downstream of NMP-1 offgas recombiner has started.

Task B-3 (Cooling Water Leakage Monitoring)

The Orion sodium monitor arrived. The entire system (recorder, filter, pressure regulator, rotometer, diffusion chamber, and electrode chamber) is mounted within a 12"x48"x6" cabinet which has been mounted on a metal frame. The vendor representative as well as a low-level chloride monitor will arrive in early August. Testing will begin at that time.

B-4 (Materials)

Constant extension rate tests continued in 20 ppm ammonia and neutral-no-additive solutions. Tests with hydrogen have not been started, pending qualification of a dissolved hydrogen analytical procedure.

At Vallecitos, the hydrogen-nitrogen mixture necessary to give proper

liquid phase hydrogen concentrations has been received. The remaining straining-electrode EMF tests can now proceed.

Fabrication of corrosion specimens to be inserted into the constant-load test facility at San Jose continued.

B-5 (Condensate Treatment)

Demineralizer performance has been recalculated for deep bed and powdered resin in the condensate and clean-up systems. With reactor water concentrations limited to 170 and 200 ppb Na and Cl respectively, regenerant chemical usage remains high, and bed life and capacity low and less than 10 percent of that available in current neutral no-additive systems.

B-6 (Radwaste System)

The radwaste system flowsheets for the ammonia additive have been completed for both current standard plant and for Dresden 2/3. Currently, the new line and equipment sizes are being calculated.

B-7 (Additive Addition)

Detailed calculations on addition of hydrogen to the feedwater in a bubble column or packed column were begun. The required contact time required to effect total gas dissolution dictated that the gas-liquid contactor be a large and heavy pressure vessel. An alternative method using a series of static mixing sections is currently being considered. Preliminary calculations show that contact is vastly improved and an 8 to 12-inch diameter mixing section may be adequate.

B-8 (Operational Considerations)

A literature search on the safety and toxicity hazards associated with the use of the proposed additives has been completed. A preliminary report on this subject has been prepared and is being reviewed.

Task G (Program Management)

Meetings were held with the CRC program management in Chicago on July 24 and 25 to review program status and plans.

A program status and review was presented to the EPRI/DOE subcontractors meeting in Palo Alto on July 31 and August 1.

ALTERNATE WATER CHEMISTRY & DILUTE CHEMICAL DECONTAMINATION PROJECTS

DOE Contract #EY-76-C-02-2985

Financial Data for the Month of July, 1978

Total Project Expenses This Month	141,181
Alternate Water Chemistry Expenses	90,878
Dilute Chemical Decontamination Expenses	50,303
Total Project Expenses 1978 Fiscal Year (Including This Month)	1,189,809
Cumulative Project Expenses from Inception	1,371,000