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HEDL CONTRIBUTION TO
OFFICE OF NUCLEAR WASTE ISOLATION
MAY MONTHLY REPORT

Hanford Engineering Development Laboratory

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 MAY MONTHLY REPORT

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Enclosure: May Monthly Report

HEDL CONTRIBUTION TO
ONWI MAY MONTHLY REPORT

1.0 SPENT FUEL CHARACTERIZATION EQUIPMENT

Progress During Reporting Period - Calorimetry of Turkey Point Assembly D04 subsequently emplaced in the Climax-Spent Fuel Test (C-SFT) was completed. A nominal assembly decay heat value of 1580 watts was measured. The measured value is within 2% of the 1540 watts predicted by the ORIGEN code.

Work continued on preparing a project report summarizing the development of the calorimeter and the initial test results obtained. The documentation is approximately 50% complete.

Problems and Corrective Action - None.

Planned Work - Complete calorimetry on available fuel assemblies. Complete calorimetry documentation.

2.0 SPENT FUEL CHARACTERIZATION

Progress During Reporting Period - All data from the destructive examination of five fuel rods pulled from the Climax-Spent Fuel Test (C-SFT) assemblies have been received from Battelle Columbus Laboratories (BCL). The data are currently being reduced and analyzed to provide a description of the pre-test condition for the C-SFT.

Efforts by EPRI and Northeast Utilities to provide stainless steel clad fuel rods for characterization continued. Two fuel assemblies were shipped from Connecticut Yankee (CY) to BCL. The top tie plates have been removed to provide access to the rods. Several of the damaged rods have been removed and placed in protective tubes. Basic nondestructive examination is planned on these defective rods. The exact number of rods nondestructively examined and the extent of the destructive examination will be decided after preliminary NDE data on the failed rods are reviewed.

Contact was made with Oak Ridge concerning the availability of BWR fuel rods from a Browns Ferry fuel assembly. One fuel assembly, discharged January, 1980, will be shipped the week of June 23 to BCL where only four rods will be examined for fission gas data. The remaining rods will be available for our use, provided the proper agreements can be made.

Problems and Corrective Action - None.

Planned Work - Continue analysis of DE data for the C-SFT pre-test characterization. Follow EPRI examinations of Connecticut Yankee Fuel. Arrange a meeting with Oak Ridge personnel to discuss Browns Ferry fuel rod availability.

3.0 SPENT FUEL/PACKAGE PERFORMANCE

Progress During Reporting Period - Work continued on the development of a one-dimensional fuel assembly structural analyses code. Sensitivity studies of fuel assembly response to grid spacer moment shear coupling terms, and guide tube locations and quantity were completed. Mass matrices were added to the models in preparation for response spectra analyses. A fracture mechanics code available from the Electrical Power Research Institute (EPRI) was reviewed for application in assessing the consequences of dynamic fuel response results.

Verification of STAFF-5, the two-dimensional heat transfer-fluid flow-stress model of a spent fuel assembly in a canister, continued. One comparative case was completed with STAFF and data obtained from the Fuel Temperature Test (FTT) conducted at the Engine Maintenance Assembly and Disassembly (EMAD) facility. STAFF was in good agreement with the measured FTT data.

Whole Rod Tests 1 at 950°F and 2b at 1060°F continue to operate without cladding breach. Destructive examination and fission gas analyses on the two rods removed from Test 2b were completed. Preliminary electron optics investigation of the cladding from the 900°F test rods was initiated. A letter requesting utility and vendor aid in establishing a fuel rod data base was drafted and sent to ONWI for transmittal. A paper entitled "Spent Fuel Resistance to Internally Produced Cladding Degradation" was presented at the Workshop on Alternate Fuel Forms in Gatlinburg, Tennessee on June 13, 1980.

Electric furnace checkout and calibration was completed for the Climax-Materials Interaction Test (C-MIT) thermal control furnaces. Arrangements were made to receive canister temperature data on a weekly basis from the C-SFT to provide information to adjust the thermal control furnaces for tracking fuel temperatures.

A new ORIGEN2 code obtained from Oak Ridge National Laboratory was converted for use on the Richland UNIVAC computer, and a sample test was successfully run. Decay heat values obtained with the new ORIGEN code and its nuclear data library are about 8% below values obtained with the old code. The new values are in excellent agreement (~2%) with two recent calorimetric measurements. The largest contributor to the

difference between the two calculations was traced to the capture cross section of ^{133}Cs which leads to ^{134}Cs . This cross section was previously identified as the largest source of uncertainty in decay heat calculations attributable to nuclear data uncertainties, at least for decay times near 2-1/2 years.

Attribute compilation for potential spent fuel filler materials continued and is now 95% complete. Nuclear criticality calculations were continued to evaluate the effect of the filler materials on the K_{eff} of the spent fuel canister system. An evaluation of the spent fuel filler materials thermal performance was completed. The thermal conductivity of the filler materials was related to the resulting temperature differential between the cladding and the canister wall. Comparison of the temperature differentials produced by the various filler materials provided insight into the heat transfer effectiveness of these materials. The metal alloys and graphite offered the most favorable heat transfer characteristics. Mechanical interaction evaluations were also initiated. Both thermal gradient and differential thermal expansion effects on the mechanical behavior of the spent fuel filler system are being evaluated. Detailed planning was initiated for spent fuel filler system materials compatibility testing under conditions prior to canister breach. Temperature limit tests are planned to determine the maximum allowable temperature for fuel rod cladding during the short term fill process. A furnace was identified and specimen fabrication was initiated for the temperature limit tests. Fill process tests will be conducted to establish cladding-filler-canister interactions for fill processes requiring melting or fusion of the filler material. Disposal condition tests are being planned to establish material interactions as a function of time and temperature in unbreached canisters.

An assessment of the impact to the repository isolation system from the potential release of spent fuel fission gas was initiated at the special request of ONWI. This new FY80 task is a study that includes: compilation of the quantities and characteristics of potentially released materials; release scenarios; consequences of release to the waste form, waste package, and repository; and identification of areas where additional work needs to be done. An outline and introduction were completed and reviewed by ONWI.

Problems and Corrective Action - Difficulties with the Hanford computer printer and slow turnaround times in obtaining results have affected verification activities for STAFF-5. The Hanford computer services contractor, Boeing Computer Services-Richland, is attempting to restore full printer service.

Planned Work - Complete fuel assembly dynamic load cases and compile design curves. Assess response results in terms of fatigue fracture consequences. Support transportation arrival condition task through PNL/TTC working group. Complete verification of STAFF-5. Develop a program plan to define the scope of the whole rod tests necessary to confirm conservative estimations of the degradation mechanisms. Test conditions for the next set of whole rod tests will be established and destructive examination of the two rods removed from the 1060°F whole rod test will be completed. Initiate C-MIT thermal control tests to track temperatures in the C-SFT. Complete criticality studies and continue work on calculated versus measured decay heat studies. Continue to compile spent fuel filler material attributes. Continue criticality, thermal, and mechanical interaction evaluations for the filler program. Continue temperature limit test preparations and conduct tests. Initiate fill process and disposal condition filler tests. Continue to compile documents and data to provide information for the fission gas release study.