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NOTES OF MONTHLY COMPONENT TEST PROGRAM REVIEW
MEETING HELD WITH SNPO AT WANL ON JANUARY 7, 1965

(Title Unclassified)

Westinghouse Astronuclear Laboratory
Astronuclear Laboratory
P. O. Box 10864
Pittsburgh, Pennsylvania 15236

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H. S. McCreary, Manager
Experimental Engineering

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Notes of Monthly Component Test Program Review Meeting
held with SNPO at WANL on January 7, 1965

Attendees:

DeZubay, E. A.	WANL	Miller, A. I.	WANL
Guzek, J. C.	WANL	Pouchot, W. D.	WANL
Helms, I.	SNPO-W	Rowan, W. J.	WANL
Kalvin, G.	SNPO-C	Tauch, F. G.	WANL
Kees, F. R.	WANL	Tushar, H.	SNPO-C
Larson, L.	AGC	Warner, P. C.	WANL
Lowe, J.	SNPO, Pgh. Res.	Wilke, R.	SNPO-C
McCreary, H. S.	WANL	Ziurys, E. A.	SNPO-C

Summaries of the present status of each Experimental Engineering Component Test were presented at the January 7, 1965 Monthly Component Test Review Meeting.

E. A. DeZubay described the Fluid Flow Program as follows:

HHT-2 Single Element Process and Evaluation Test

Work in this area for the past month was conducted primarily on coated elements. An emissivity comparison was made between adjacent coated and uncoated element surfaces. Tests were made on coated elements which had small areas of coating removed and radiating cavities drilled into their web. Emissivities ranging from .3 at 3,000° R to .6 at 5,000° R were obtained using Wiens law at a wavelength of approximately 0.66 μ . A comparison between a pyrometer sighted on an uncoated surface and a two color pyrometer sighted on the coated surface was in very good agreement. The difference was only 10 to 20° at a temperature of 4500° R. Comparison of the maximum internal temperature, as

measured on these tests with similar measurements made on uncoated elements, indicates a reduction in the maximum internal temperature of approximately 200° R. This was expected and is due to the lower energy radiating from the surface of the coated element due to its lower emissivity. Methods of upgrading element tests in general were also discussed. The concepts of the guard heater were explained as well as the fact that long duration testing may require a modification in the chuck. The various possibilities of upgrading electrical tests will be discussed with SNPO early in March.

HHT-4 Single Cluster Development Test

A cluster containing all reactor hardware components was successfully tested in the A-10 furnace. The cluster, having all fuel orifices plugged but with the four tie rod center bushing orifices open, was heated to a maximum surface temperature of 3900° R. The test was operated for a total of 39 minutes at various power levels and shut down without any signs of arcing. Components are presently available to test one fueled and two unfueled clusters. A cluster using 30 mil orifices and unfueled elements is being prepared and will be ready for testing at the earliest possible time when the furnace and cell again becomes available for cluster testing.

HHT-6 Interstitial Corrosion Tests

Final specifications for the 24-inch length pressure vessel were written, the test section design completed, and the preheater test completed. The preheater is being designed and wiring of the

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control console has been started. To obtain data on corrosion at an earlier date, the pressure vessel from the seal model (HHT-11) is being prepared with an interstitial internal model. Copies of drawings of this rig were supplied to Mr. Tushar of SNPO and Mr. Larson of AGC. Rig fabrication should be completed by May, 1965.

HHT-7 Filler Strip Corrosion Tests

Filler strips are to be delivered on January 13, 1965. A machining error in materials is responsible for this two-week delay. Loop piping modifications are presently in process and bus bar installation in the test cell housing the A-10 furnace is scheduled for the 14, 15, and 16 of January, 1965. Mr. Tushar asked whether this test will predict NRX-A3 filler strip corrosion. WANL'S answer was that if the results of the initial test agree with the NRX-A2 power test results, NRX-A3 geometry can be simulated and a corrosion prediction made.

HHT-11 Small Scale Seal Test

HHT-11 testing has been indefinitely postponed so that the effort may be reapplied to corrosion testing in HHT-6, Interstitial Corrosion Tests and HHT-7, Filler Strip Corrosion Testing. This will result in the removal of a milestone from Project 8080 defined as .01 and scheduled for September, 1965.

HHT-14 Short Section Filler Strip Corrosion Tests

Several hydrogen corrosion tests were performed on a simulated filler strip assembly to evaluate the ability of round graphite pins to retain the pyrotils on the last ridge of the filler strip at reactor operating

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conditions. Three types of pyrolytic pins were tested. The configuration presently being used on the NRX-A3 reactor best survived the test and retained the tiles under the test conditions. A report is presently being written, and no further work is contemplated. It is virtually impossible to ventilate the area covered by the simulated three section filler strip sufficiently to obtain a corrosion effect comparable to the unexposed parts of the element.

FFL-6 Orifice Calibration and Testing

The Diecraft orifice and their behavior was discussed. The coefficient of the Diecraft orifice was determined to be approximately 30 per cent lower than the coefficient of the equivalent tube type orifice now in use. The variation in the coefficient between so-called identical orifices is in the range of 30 per cent compared to 3 per cent for the present orifices. Additional Diecraft orifices will be tested from pre-production lots. The test equipment for the heat addition orifices flow test has been completed and testing is about to start. Cleanliness tests in which dust, shaving clippings, hair and similar material will be passed through the orifice will be performed in the near future.

FFL-15 Inner Element Pressure Distribution

The original design of the spacer gasket could not be fabricated. The design has been revised and released for quotation.

FFL-17 Plugged Core Tracer Gas Test

The initial status of the test has slipped from January 4 to January 20, 1965. This, in part, is due to slippage in delivery of required items

and, in part, to the fact that many of the piping connections are taking longer than originally anticipated. Fabrication of the sampling system was completed. The three-mil sonic orifices and filters were installed and checked with dry nitrogen. Design sampling rates were obtained with no apparent clogging of the orifice or sample lines.

FFL-21 Tie Rod Hardware Flow Test

The leakage rate of tie rod hardware seals was discussed in detail. The three most promising seals are the spread foil annular seal, the cone shaped annular seal and the O-ring seal. Some discussion followed concerning the damage which would be suffered by an O-ring seal in a radiation environment. It was agreed that on the following day at the design meeting final decisions in this area would be discussed. The tests to be performed by the Fluid Flow Laboratory are to determine seal effectiveness. Coefficients of friction on promising candidates are being determined by Engineering Mechanics as discussed under EML-76.

W. J. Rowan described the Engineering Mechanics Test Program as follows:

EML-60 Core Effective Gap Tests

All hardware and components for the test fixture are expected to be delivered during the month of January. Rig assembly will start approximately January 25, and experimental work will take place during the month of February. Mr. L. Larson voiced concern over the gap changes which had occurred as a result of core handling in similar previous testing. This previous testing is fully described in

WANL-TME-983. WANL representatives indicated that they have not neglected the potential problems that could be associated with flow impedance of the core due to different assemblies. That is, even though all the elements are the same, the flow impedance could differ between cores due to the fact that the relative position between elements could be different. WANL also agreed to attempt methods of measuring various builds of core diameters provided it would not add excessive cost or delay to testing.

EML-61 Tie Rod Fatigue Properties

During the month of December, a tie rod fatigue testing apparatus was assembled and calibrated. Tests to evaluate the fatigue properties of tie rods will begin during the month of January. Rejected Inconel 718 tie rods will be used in this test as acceptable NRX-A3 tie rods are not available. These tie rods were rejected due to imperfect head material structure. If there is any indication of fatigue failures being due to the imperfect heads, the use of these rejected tie rods will be dropped and testing delayed until specification grade tie rods are available.

EML-62 Lateral Support System Test

No test work is scheduled in this effort until the end of March or the beginning of April. However, the graphite barrel for use in this test is on order and is being fabricated from a section of an A-5 barrel which was rejected for hairline cracks. An acceptable test piece can be fabricated as these cracks were confined to a limited area. Only the acceptable portion of the barrel will be used in this test.

EML-63 Mechanical Effect of Strain Gage Coatings

EML-64 Mechanical Effect of Weldable Strain Gages

No testing has been performed or is anticipated for several months. The investigations being conducted by other groups have not been carried to a stage where the work planned by Engineering Mechanics would be applicable.

EML-65 Mechanical Test of Instrumented NRX-A Reactor Components

The last of the NRX-A3 instrument calibrations were completed during the month of December. No significant work of this type is planned for the next several months. Calibration work will again commence when NRX-A4 components become available. The only work planned for January is a strain gage calibration on a piece of core band material to provide cryogenic correction factors for the reduction of NRX-A3 data.

EML-66 Fuel Element Static and Fatigue Test

A test was performed to evaluate fixturing for compressive tests of fuel elements. These tests indicated that some of the strength information used in fixture design should be modified. New parts have been made to improve the equipment. Strength of A2 slotted and unslotted fuel element tests were conducted on elements which had slots of the same size and shape as those used in the NRX-A2 instrumented elements. The tests were conducted to establish the strength capability of a slotted element as compared to an unslotted element. The test results indicated an approximate 25 per cent reduction in element strength due to the inclusion of the slot. (A3 elements do not have an instrumentation slot.)

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EML-67 Fuel Element Cluster High Temperature Testing

Fabrication and assembly of cluster fixturing was completed during December, 1964. Cluster testing is scheduled to be conducted in January, 1965. This will include testing of a 10-inch long cluster under operating compressive loads at 5,000° R. A delay in delivery of enriched fuel elements may necessitate the use of coated but unfueled elements in this test.

EML-68 Core Insulation Development Testing

Hardware and fixturing components should be delivered during the month of January, and testing is expected to be conducted during February, 1965.

EML-69 Support Block Mechanical and Thermal Test

All the furnace equipment and fixturing for support block compressive testing was assembled and checked out in the 6 inch x 10 inch high temperature furnace. A coated support block, without coolant flowing through the center of the block and fixture components, was tested to evaluate the fixture. Load was applied through the fixturing to the support block at a constant rate, i.e., constant travel of the loading fixture vs. time. The load was increased at a steady rate up to 5,000 lbs. with no deviation from the expected pattern. In previous ambient temperature tests, brittle fracture of support blocks had occurred at loads of approximately 5,000 lbs. The test continued with the load being increased to 7,500 lb. The test was then stopped because of an unpredicted increase of load with time. Inspection of the test specimen revealed that brittle fracture had not occurred; instead, the support block had plastically deformed in the seat area. Additional support block testing will be

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performed in the coming months. As presently planned, it will follow the previously outlined program. However, methods for evaluation of this component will be re-assessed in view of the results of this experiment.

EML-70 Strip Supported Cluster Test

Fatigue testing of elements with strip supported attachments is scheduled for January, 1965. The elements and strip assemblies are of the same type which were used in the strip supported cluster compression test conducted in November, 1965. This configuration still holds promise even though it is not being actively pursued at this time due to more pressing design and development work on NRX-A3 type clusters.

EML-72 Test of Fuel Elements in their Transportation Container

An instrumented element was shipped from Cheswick, Pa. to Large, Pa. in an instrumented case, on the same truck, and over the same route which is used for normal transportation. The maximum strains found in an element during the test were about 150 micro inches per inch. Therefore, it appears that there was essentially no stress of any consequence applied to the element during the test. Accelerometers on the case showed about 1 1/2 G single amplitude for the maximum shock and/or vibration load. This would indicate no problem with the present transportation container. However, the conditions which exist when fuel elements are slipped into and out of the container appear to be extremely dangerous with regard to scraping the coating from the edges of the element. A new shipping container design should provide great improvement in this area.

EML-75 Friction Test of Reactor Components

Specimens of element material with NbC coating, ZrC and ZrO₂ coating were tested against pyrotils to establish friction coefficients. Friction coefficients were established, however, the more significant results of these tests were in relation to the wear capability of the various coatings. The ZrC tests were conducted at both ambient and operating temperatures. The NbC and ZrO₂ tests were conducted at ambient temperature only. A test was also performed to establish the frictional force developed when NbC coated, uncoated, fueled and unfueled elements were loaded against a filler strip lined with pyrotils. This was done to evaluate the effect of full length element action on a series of pyrotils and to determine the effect of fuel addition. The coefficient of friction for the full length element without coating was approximately .2 whereas single specimen tests resulted in a coefficient of friction of approximately .15. Fuel addition increased the coefficient of friction for both the coated and uncoated elements 50 per cent (from .2 to .3). Additional tests will be conducted during January and February. Filler strip axial load tests were conducted to provide data on the strength of the filler strip and its supporting ledge. Six filler strips were assembled on a 9-inch long core and loaded in compression against the seal segment. Loading was increased until fracture of the components. The recorded loads were above the point which is considered marginal for the present design.

EML-76 Reactor Hardware Static and Dynamic Tests

The central element liner seal tests conducted by Engineering Mechanics were limited to the designs which survived the flow sealing evaluation

made by the Fluid Flow Laboratory. The sharp wedged design which penetrates the graphite foil was the most promising. A number of assemblies with varying tapers and penetrations were tested. The frictional loads varied from approximately 40 lbs. to 140 lbs. This information, along with information on friction of O-rings and the sealing capability of O-rings, was supplied to WANL design sections for their use. Testing of a threaded instrumentation tube and nuts will be performed during January, 1965.

EML-77 Evaluation of Protective Screen Designs

Drafting work on test fixtures will be completed during January, 1965. Test evaluation of the most promising protective screen design will be made, even though these assemblies are not being produced for a specific reactor.

EML-85 Control Drum Bearing Test

All scheduled testing will be completed during the week ending January 9. The initial survey of the vibration response at low g level input establish 6 resonant points. Vibration dwells of one hour were run at approximately 10 g's at the highest 5 of these frequencies and at .7 g at the lowest frequency. Dwells at 20 g's are currently being run at the 4 highest frequency resonances. Primary interpretation of the resulting data indicates that bearing capability is sufficient for NRX work, however, additional designs may be considered for flight design.

EML-88 Insulating Control Drum Bow Test

A control drum design which includes insulation between the boron plate and beryllium drum is currently being considered. A test will

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be performed to show the effectiveness of this insulation in preventing control drum distortion during thermal conditions similar to startup patterns. Testing has been delayed until the completion of EML-85, Control Drum Bearing Test.

EML-89 Sector Spigot Compressive Load Test

The spigot on the beryllium sector was compressed with a plate in a manner similar to the arrangement which exists in a reactor. The assembly was then thermally shocked by exposing it to liquid nitrogen. The spigot cracked in a pattern similar to the cracks which were seen earlier this year in the NRX-A1.

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