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SNPO-6
Astronuclear
WANL-TME-1166

NOTES OF MONTHLY COMPONENT TEST PROGRAM REVIEW

MEETING HELD WITH SNPO AT WANL ON

MAY 6, 1965

Title Unclassified)

9

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by H. F. C. TIC, date SEP 11 1973

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H. S. McCreary, Manager
Experimental Engineering

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SNPO

MAY 21 1965

Mr. J. L. Dooling
NERVA Subcontract Manager
Rocket Engine Operations - Nuclear
Department 7140
Aerojet-General Corporation
Post Office Box 1947
Sacramento, California

Subject: WANL-TME-1166, Notes of Monthly Component Test Program
Review Meeting held with SNPO at WANL on May 6, 1965

Dear Mr. Dooling:

Transmitted herewith are five (5) copies of the subject report. This report is transmitted for your information.

Respectfully,

Original Signed By
H. F. Faught
H. F. Faught
Program Manager
NERVA Nuclear Subsystem

:ss

Enclosures -3

cc: Mr. W. Schroeder, SNPO-C, w/enclosures (3)
SNPO-C/WANL Resident Office, w/o enclosures
AGC/WANL Resident Office Attention: D. Sheppard, w/enclosure - 1
G. Mader, w/enclosure - 1
K. Kasschau, Spec. Ass't to Nerva Project Mgr., at AGC/Sacto, w/o enclosure
L. Larson, AGC, w/enclosures - 1
G. Kalvin, SNPO-C, w/enclosures - 1

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WANL-TME-1166

Notes of Monthly Component Test Program Review Meeting

held with SNPO at WANL on May 6, 1965

Attendees:

DeZubay, E. A.	WANL	McCreary, H. S.	WANL
Fix, H. J.	WANL	Miller, A. I.	WANL
Kalvin, G.	SNPO-C	Rowan, W. J.	WANL
Kees, F. R.	WANL	Selz, A.	WANL
Larson, L.	AGC	Sheppard, D.	AGC
Mader, G.	AGC	Wisniewski, E.	WANL

Summaries of the present status of each Experimental Engineering Component Test were presented at the May 6, 1965, Monthly Component Test Review Meeting. The following material was presented by Engineering Mechanics.

EML-60 Core Effective Gap Test

The diameter of the core for various bundling pressures was measured, and the data correlates with previous diameter vs. bundling pressures obtained on the nine-inch core. Porosity checks were made on 100 of the elements being used in the core assembly. Values of porosity obtained indicate that the porosity effect, which may occur in this test, will be less than 10 per cent of the total interstitial flow expected. The interstitial pressure and effective gap measurements will begin in the month of May. A series of friction measurements were made on elements of the nine-inch core with shim material used to increase the dimensions of the peripheral elements. Current results indicate that the increased peripheral element dimensions reduces the central element frictional forces approximately 15 per cent. The friction required to displace the peripheral elements increased about two to three times when the shim material was placed around these elements.

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EML-66 Fuel Element High Temperature Static and Fatigue Testing

Compression tests on two-inch fueled element specimens were conducted during the past month. The temperature range for these experiments was between 4000 and 5000°R. The fixturing used in this test maintains a compressive loading with less than ten per cent of the strain being produced by bending effects. The compression strength of the elements in the 5000°R range was found to be considerably lower than the values in the neighborhood of 4000°R. Additional tests will be run during the month of May.

EML-68 Core Insulation Development Testing

A checkout run was performed on the rig and fixtures with the tile bow test assembly. A temperature gradient of 2500°R across the tile was achieved. In future testing, reactor conditions will be simulated with a temperature gradient of approximately 3000°R on the pyro tile.

EML-69 Support Block Mechanical and Thermal Testing

The remaining NRX-A2 power test support blocks were compression tested to failure at either room temperature or 4500°R. The failure loads were in the same range as in previously reported testing. The average failure load at room temperature was 4100 lb and 7800 lb at high temperature.

A trial run was made using water as a coolant to obtain a thermal gradient in a support block. Extreme high temperature gradients were produced (in the neighborhood of 1000°R). No adverse affects were noted in a visual examination of the block.

EML-73 Inner Reflector Testing

Three graphite (6 in. x 6 in.) barrels were tested to failure. The specimens included a solid barrel, a cemented stave barrel, and an uncemented stave

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EML-73 Inner Reflector Testing (cont'd)

barrel. These assemblies withstood external hydraulic pressures of 575 psi, 525 psi and 505 psi, respectively. Radial deflections of approximately 100 mils were produced before the failures occurred. These model tests indicate that all three design configurations are valid barrel design approaches. Additional tests are planned for the month of May and include arrangements which limit the barrel deflection during pressurization cycle.

EML-75 Friction Tests of Reactor Components

A ten-minute bonding test of NbC coated fuel element and support block specimens was performed in hydrogen at 4500°R with a contact pressure of 250 psi. These specimens were bonded when removed from the furnace. Previous tests conducted under similar conditions did not show bonding; however, it is felt that the weak bond which was developed in these previous tests was broken during the removal of the test assembly. Additional tests of element tile and element-element combinations will be conducted in May.

EML-82 Outer Reflector Sector Testing

Tension and compression testing was conducted on beryllium specimens. These specimens were obtained from billets which were used to fabricate NRX reactor outer reflectors. The load cycle used in these tests applies the tension at approximately 200°R and the compression at approximately 575°R. These temperature stress combinations were selected to simulate the conditions expected during reactor operation.

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EML-88 Insulated Control Drum Bow Tests

During the month of April, equipment was being prepared for drum bow tests which were planned for May. Recent additions of instrumentation on the control drum have just been included and will delay the test to some extent. However, the test may be conducted late in May. These tests will be conducted on insulated and uninsulated control drums.

Mr. Kalvin asked if argon had been considered as a potential test gas. WANL representatives answered that hydrogen, helium, argon and nitrogen have all been considered as gases to be used in these tests. Helium is being used in tests conducted in Building 8 since hazards eliminate hydrogen. The heat transfer characteristics, as well as Reynolds number relationships, eliminate the use of argon and/or nitrogen.

EML-92 Thermal Contact Resistance Test

Additional tests were conducted on graphite-beryllium and graphite-aluminum interfaces. Preliminary data with helium and hydrogen indicate significant changes in the value of thermal contact resistance due to interface pressure and interface temperature.

EML-93 Pyrolytic Foil Wrapper Tests

Heat treated and degassed pyrofoil was tested and gave ultimate strength values of 1400 psi and .7 per cent elongation. Corresponding values for the pyrofoil previously used which was not heat treated and degassed were approximately 600 psi and .6 per cent. The blisters which occurred in the pyrofoil during the previous test did not occur with this new material.

EML-93 Pyrolytic Foil Wrapper Tests (cont'd)

First runs were made on the test assembly which includes pyrofoil in a configuration similar to a reactor application. This assembly involves a continuous strip of pyrofoil approximately 0.01-inch thick wrapped around an aluminum ring ten times. This assembly is then placed in the lateral support system which was previously used for the partial length core vibration testing. A test was conducted in which the aluminum ring was heated to a temperature which would produce approximately 1/2 per cent elongation in the foil. Examination of the wrapper after cooldown, revealed areas of buckling and some indications of damage; however, the foil was in good shape even though it had plastically deformed.

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E. A. DeZubay presented the Fluid Flow Laboratory Program as follows:

HHT-1 Single Element Process Evaluation Test

and
HHT-2

During the month of April, 125 corrosion tests were performed at the Large Site and 41 at the Waltz Mills Site. Of those performed at Large, 114 were quality control runs and 11 were developmental tests. The new pin hot end chuck was used successfully without arcing in 6 of the developmental tests. This type chuck will be used for all future developmental testing. Standard chucks will be used for only quality control testing. Mr. Kalvin asked what time limitations have been placed on parameters for A5 quality control testing. WANL representatives answered that present fixtures will run for 30 minutes without arcing. Mr. Larson also asked for information on the progress of achieving axial temperature profiles identical to reactor operation. WANL representatives stated that more work is necessary on chuck development before this can be achieved. The chuck must be moved 10 inches downstream to more nearly duplicate reactor operating temperature profiles.

HHT-4 Single Cluster Development Test

A standard cluster with 30-mil orifices was corrosion tested for 2 1/2 minutes. The test data was as follows:

Power Input	2.13 MW
Cluster Surface Temperature	2800°R
Exhaust Gas Temperature	2780°R

The radiation loss of 125 btu/sec or 6.1 per cent was estimated from the difference of the power input and the enthalpy rise of the gas. The furnace is now being fitted with a cluster for filler strip corrosion testing.

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HHT-6 Interstitial Corrosion Tests

A new configuration, better simulating the reactor length, has been devised.

The 6-mil gap test previously scheduled has been delayed, and the new configuration will be corrosion tested in its place. Testing will commence as soon as fabrication is complete.

HHT-7 Filler Strip Corrosion Testing

Testing is approximately one week behind schedule. Build 1, Test 2 has been assembled and placed in the furnace. The delay was due to additional modifications being made—a fueled sample being located in the thermally hot region of the assembly, more thermocouples to measure gas temperature, and thermal sensitive paint on the outside surface of the specimen. Testing is now scheduled to begin May 10, 1965.

FFL-6 Orifice Calibration Test

Leak tests were performed on orifice to element gaskets at 150 psi and 540°R. The results were as follows:

	<u>lb/sec</u>
1. neoprene gasket	1.1×10^{-5}
2. no gasket	134×10^{-5}
3. individual graphite foil gasket	46×10^{-5}
4. no gasket	182×10^{-5}
5. single graphite foil gasket	148×10^{-5}

FFL-17 Plugged Core Tracer Gas Test

The 45° azimuth mapping test at 300 psi has been completed. Reduction of the resulting data is now in progress. Pressure profile data for 13 of the 22 runs has been played back and reduced. The reduced data was computer processed and indicates that sampling does not affect pressure distribution within the core.