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DEVELOPMENT TEST NO. IP-558-T
GAS SAMPLING FACILITY CORRELATED WITH
FRONT TO REAR THERMOCOUPLE STRINGER - KW REACTOR

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DEVELOPMENT TEST NO. IP-558-T
GAS SAMPLING FACILITY CORRELATED WITH
FRONT TO REAR THERMOCOUPLE STRINGER - KW REACTOR

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DEVELOPMENT TEST NO. IP-558-T
GAS SAMPLING FACILITY CORRELATED WITH
FRONT TO REAR THERMOCOUPLE STRINGER - KW REACTOR

I. OBJECTIVE

This test authorizes the installation of sampling tubes in the vacant positions in one of the two front-to-rear graphite stringers to be installed in KW Reactor in January 1963. These lines will permit withdrawal of a gas sample from the active zone at a point where the graphite temperature is being measured. Analysis of this gas sample on the gas chromatograph and on a new catalytic oxygen-hydrogen instrument is expected to yield valuable information on graphite burnout versus temperature and gas quality.

II. BASIS AND JUSTIFICATION

PITA IP-20-I establishes a temperature limit of 850°C in the 0.130 coring zone extending across the front of the K Reactors. One problem associated with these high temperatures is the possibility of sufficiently high water-vapor graphite reaction rates to significantly weaken the graphite moderator. As a result of the extensive channel reconditioning planned for zirconium retubing, the central portions of the stack may also be subjected to temperatures of the order quoted above. Thus, a definite resolution of the potential water-vapor graphite reaction becomes yet more important.

Useful information on this subject may be obtained by sampling and analyzing the reactor atmosphere at various points in-reactor. This Development Test proposes the inclusion of two 1/8" diameter, 410 stainless steel tubes with one of the two front-to-rear stringers to be installed shortly in KW (under the authorization of the aforementioned PITA. One of these will be used to sample reactor gas at a point just within the front of the stack and one to sample reactor gas at the downstream end of the 0.130 coring zone. Analysis of the gas samples for O₂ and water-vapor concentration will provide specific information on the depletion of each across the 0.130 coring zone, and thus, on the proportion of each which reacts in the 0.130 zone. Analysis for the reaction products (CO, H₂ and CO₂) from a zone of known temperature within the reactor is also expected to yield significant information on the extent of reactions between graphite and gas impurities. If this approach proves feasible, an additional important technique will be available for assessing the mechanism and importance of the various potential oxidation reactions.

III. GENERAL PROCEDURE

Two sections of Series 410, stainless steel (12% chromium and without nickel content) will be included with the bundle of thermocouple wires. The tubing is the same size (1/8" O.D.) as the thermocouples. One section will terminate at the same point as thermocouple L-1 (two feet into the stack) and the other at the same point as thermocouple L-4 (eight feet into the stack). The tubing

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will be brought out of the pile in the same fashion as the thermocouples and will terminate in two of the three vacant spots of the flange. The gas seal around the tube will be made in the same fashion as the thermocouples. The outer end of each tube will be provided with a Hoke valve. Copper tubing (3/16" O.D.) will be installed from the Hoke valves across the face of the reactor (behind the gunbarrel flanges) to the X level where connections to the moisture analyzer will be located. Tygon tubing will be used from the X level to conduct gas to the chromatograph to analyze for other components. Analysis of the gas will also be made with a semiportable sensitive hydrogen and oxygen analyzer which is being placed in service by FEO.

Figure 1 shows a sketch of the tubing installation in the stringer; Figure 2 shows the hookup to be used at the moisture analyzer. Reactor gas which has passed through the moisture analyzer will be exhausted to the building exhaust duct on the X level.

Because the reactor gas includes activated atoms, some increase in dose rates will be experienced on the front face when gas is being withdrawn through the tubes. It is estimated that a maximum dose rate of the order of 6 mr/hr. at one foot will be seen from each tube through which gas is being withdrawn.

IV. DETAILED PROCEDURE

- 1) In preparation of the thermocouple stringer, the tubing will pass through vacant holes in the shielding plugs and seal in exactly the same way as the thermocouples. (There are 10 thermocouples and 13 holes available.)
- 2) Exterior ends of tubing will be provided with a needle valve (Hoke type) and will also be capped. These termination fittings will project about six inches from the thermocouple junction box on the front nozzle flange. Samples will be handled through copper lines from this point to the X level. From the X level, samples will be handled by tygon lines. (It is anticipated that the copper lines can be installed during operation and thus require no outage time.)
- 3) When the TC Stringer eventually has to be removed for disposal, the tubing will go with it.

V. HAZARDS

The stainless steel will be activated to approximately the same radiation level as the metal portion of the thermocouples on a weight for weight basis. Both are relatively short lines. While they will increase the level of activity, the increase will not be such as to appreciably affect removal procedures for the stringer.

All valves in the sampling lines will be kept closed when the gas is not being sampled to insure against air in-leakage. The extreme sensitivity of the instruments will insure against leaks in valves and copper lines thus providing a continuous leak test during use to insure against inadvertent leaks.

VI. PROCESS STANDARDS

All provisions of the Process Standards and PITA IP-20-I remain in full force. Deviations from Design Change No. 654 as required to accomplish the inclusion

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of the two sampling lines on the one stringer, are authorized by this Development Test.

VII. Costs

The materials required to accomplish this test will be supplied by FEO. The costs of installing the tubing in the stringer will be borne by KW Processing Operation. The costs of installing the other appurtenances and of performing analysis will be borne by FEO. No outage time will be incurred as a result of this test.

VIII. RESPONSIBILITIES

KW Processing will be responsible for installing the 400 series stainless tubing and valves, and for operating continuity and safety of the reactor. Facilities Engineering Operation will supply the tubing and obtain analyses of gas samples withdrawn. Research and Engineering will be responsible for interpreting the results of the experiment and for recommendations as warranted.

Engineer
Mechanical Development

Engineer
Process Technology

JP Cooke:RE Baars:hr

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December 20, 1962

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FRONT TO REAR THERMOCOUPLE STRINGER - KW REACTOR

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Figure 1

Over-all Assembly of Tubing in
Thermocouple Stringer

Figure 2

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