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[redacted]

Richland, Washington
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This document consists of 4 Pages No. [redacted]

and 4 medium

HORIZONTAL CONTROL RODS FOR "C" REACTOR

A meeting was held on May 17 to review possible alternate designs of horizontal rods for 105-C. This meeting was attended by:

W. K. Alexander
W. R. Lewis
T. P. Hackman — Pile Technology Division

P. R. McMurray — H. I. Division

R. T. Perkins
E. H. Kolts — "F" Division

G. M. Roy
E. L. Reed
R. F. Klein
H. L. Hollister
H. E. Grantz — Reactor Division

Problem

The system used on "C" must operate satisfactorily at an anticipated graphite temperature of 380°C (760°F) with the possibility expressed by the Technical Division that this temperature limitation may be raised if satisfactory new pile atmospheres can be developed. The design will be based on a maximum graphite growth of 3 inches at a distance of 3 feet from the edge of the graphite block. This value ignores the anticipated favorable results from graphite coring, and is greater than the growth expected in "C" based on experience with present reactors.

A satisfactory rod end seal configuration is required for these conditions.

GH

[redacted]

Decision

It was decided that a round control rod with external seal would be recommended to the Working Committee for this application.

Discussion

The following factors were considered and resulted in the decision that was made:

Thimble Temperatures

The expected thimble temperature is 380°C (716°F), which is the same as the maximum graphite temperature with a CO_2 atmosphere. The Technical Division stated that there is a good possibility that these temperatures may be raised if new atmospheres can be developed.

The use of aluminum thimbles at these temperatures is considered to be marginal despite successful operation during the past six months in existing areas at 380°C. At this temperature aluminum becomes extremely ductile, suffers a marked decrease in physical properties and, therefore, is liable to fail due to the forces that may be applied to it by the rods under conditions of marked graphite growth.

It was agreed that thimbles should not be included around the horizontal rods. Therefore, external seals would be required.

Rod Shape

The Reactor Division representatives stated that use of a rubbing type seal necessitates the use of a round rod to obtain satisfactory sealing. A packing seal applied to a rectangular shape rod would bear principally on the rod corners and very little on the flat portions of the rod, with resulting gas leakage. This point was agreed upon in the meeting.

Seal Maintenance

Although the seal is designed for relatively long life, it is to be expected that maintenance and/or seal replacement will occasionally be required. By removal of a single snap ring, the seal housing assembly may be pulled out (using long hooked tools, if necessary) and replaced with a new seal assembly. Estimated replacement time is not more than 30 min. The probable SWP allowance is 3-4 hours. Maintenance is therefore considered to be without undue complication.

Rod Flexibility

Calculations indicate that the proposed round rod is as flexible as the "H" type rectangular rod in that the force required for a given deflection is approximately the same for each configuration. However, for an equal deflection, the stress is higher in the round rod, which means that yielding of the rod tube and a permanent set would occur at a smaller deflection in the round rod.

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Rod Flexibility (continued)

Neglecting the expected effect of coring on graphite growth, the maximum deviation from a straight line expected in the rod hole is 3 inches at a point 36 inches inside the graphite block. The rectangular rod could bend this amount without exceeding its yield strength, whereas the round rod would be stressed beyond its yield point.

By tapering the graphite track on which the rod travels, the maximum deflection of the rod under the above conditions of graphite growth can be reduced to 2 inches. This deflection can be tolerated within safe stresses.

Rod Scratching

Concern was expressed regarding the effect of possible scratches on the rod surface resulting in undue damage to the external seal.

The "P" Division representatives stated that an examination of the horizontal rods in the "H" Area indicates that the scratches in the rod are a result of contact of the rod with the thermal shielding and kick plate. By proper design of the thermal shield and step plug, scratching from these sources will be eliminated. This same inspection revealed that the bottom of existing rods which contacts the graphite becomes scuffed to a minor degree rather than scratched. The Reactor Division stated that a seal can be designed that will operate satisfactorily with the scuffing condition.

Additional Factors to be Considered

The following questions or comments were offered by those present during review of the assembly and arrangement drawings of the proposed round horizontal rod:

1. The corrosion resistance of 61ST material of the outer rod tube should be checked. (This has been checked since the meeting and found to be satisfactory.)

2. The possibility of galvanic corrosion should be reviewed again at the following points:

   a. The steel joint between the rod tip and the rack drive assembly.

   b. Between the seal holder and the rod 61ST tube.

3. The shielding requirements of the rod tip should be reviewed.

4. The rod removal procedures should be confirmed by the "P" Division.

5. The H. I. representative raised the additional point after the meeting regarding the possibility of the deposition of long life elements on the outside of the rod from the water used for seal lubrication.

6. The Technical Division stated that it will be permissible from a shielding standpoint to flare the inside diameter of the step plug to reduce the deflection slope of the controls under conditions of maximum graphite growth.

The above points will be reviewed and comments submitted to the Working Committee by the Reactor Division.

H E Grantz

H. E. Grantz
Reactor Division

HE Grantz:hr