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HDC-1593

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RECORD CENTER FILE

1. PE Lowe
2. HE Grantz
3. HS Ishin
4. RT Jaske
5. RM McCugh
6. AT Strand
7. GH Syrovoy
8. RR Wall
9. D&C File

Richland, Washington
 January 17, 1950

COPY 1

This document consists of

Page 1

TO: H. S. Ishin

FROM: R. T. Jaske

Subject: PILE TEMPERATURE STUDY

SP-10912

SP-10913

SP-10914 incorporated 4/17/57

Our discussion of December 5, 1949 perhaps left something to be desired in the way of outline and background. This memo is an attempt to set a definite goal and supplement G. H. Syrovoy's letter of October 17, 1949.

Regarding heat transfer studies of annular spaces around the process tube, there is general agreement among all concerned, that high graphite temperatures are essential at the initial startup. Pile Technology, in studying graphite damage, has developed information that shows little or no expansion occurring when temperatures are maintained at 275° C. Stored energy levels are less than 5% and K/Ko has saturated in the region of 3.5 to 4. Badly expanded samples (1% increase in length) have recovered 75%. This, of course, is in the pile, since nuclear annealing is necessary, temperature alone not being sufficient. You may refer to HW-14522, HW-14310 and HW-13117 for further discussion of these points. Based on this assumption we should select some minimum startup temperature, for the edge of the active zone, say 200° C as a starting point.

Conversely, there is an upper limit determined by the gas atmosphere used, the maximum allowable temperature of control rods, the additional heat load of high gamma radiation from controls, and mechanical limitations such as horsepower requirements for gas circulation. In HW-14376, the danger of graphite oxidation in oxidizing atmospheres at the temperatures of 500° C or higher is sufficient indication that such an upper limit exists. Oxidation of control rod materials in CO₂ atmospheres above 500° C is also serious enough to be a problem. An alternative which the author considers attractive is the use of sufficient coring around the process tube to permit the use of helium, and still obtain an expanded zone of heat flux. By judicious selection of annulus pattern the graphite cooling loads may be redistributed toward the fringe tubes.

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JUL 27 1955

300 AREA

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H. S. Isbin

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Jan. 17, 1950

Reactivity losses, while never unimportant, will not be the major determining factor in this problem, perhaps being overcompensated by increases due to increased moderator temperature. P. F. Gast has stated that there is no reason to believe that the positive graphite coefficient should reverse although it may drop to a value as low as $0.2 \text{ ih}^\circ\text{C}$ at moderator temperatures of 400 to 500°C . Kindly refer to HW-8305 for a detailed treatment of the reactivity loss situation, which paper was used as a basis for a curve of losses as a function of core size which will be transmitted separately. It is apparent that undercutting and coring can be treated as decreases in moderator density, less undercutting being required as temperature increases are obtained by coring.

A necessary part of this investigation is inclusion of the effect of heating of the reflector caused by conduction from an uncooled thermal shield. This is expected to be a minor effect, if of any significance at all, first estimates showing total heating of 1 megawatt @ 800 MW power level. It will be necessary to determine the metal temperature in the binder surrounding the reflector in order to determine if cooling will be necessary. Temperatures in the binder can be allowed to reach a maximum of 650°F without any special precautions. More detailed information will be supplied by the writer when required.

In view of the discussion above, please furnish an estimate of graphite temperature and binder temperatures both in the green condition and after suitable increments of exposure ending at some saturation condition. Temperature adjustment can be made by changing the core diameter around the tube. Helium is to be considered as the atmosphere. The minimum startup temperature on the edge of the active zone to be 200°C as a goal, maximum startup temperature to be as little over 350°C in the central zone as possible. It is assumed that two methods supporting the tube will be considered for the present:

1. Tube laying on two graphite tracks of a minimum area, with tube concentric to hole.
2. Tube supported concentrically at intervals by a splined constriction (essentially an interrupted track).

Effects of local cooling and resultant expansion must be weighed against general gains.

Changes in core diameter should be fixed to three or four finite steps in size. Larger annulus openings at the edges of the unit do not contribute as much reactivity loss as openings in the center allowing more freedom at such locations.

Sketches enclosed show approximate geometry and indicate variables to be studied. The Design Group will follow the work closely and assist wherever possible. For instance, the amount of undercutting is a variable dependent on the position in the stack and the annulus size selected for that area.

RTJ:cf

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Jan. 17, 1950

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- HW-14310 "Radiation Damage to Graphite"
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- HE-14352 Interim Report No. 1 Production Test 105-85-P
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P. F. Gast to File, December 16, 1947

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GENERAL ELECTRIC CO. HANFORD WORKS		TUES BLOCK		TUES 5011 P. 10.11		NO. 1	
SCALE		APPROVED		DATE 1-11-50		DRAWN BY J. S. MAYES	
				CHECKED <i>R. M. G. G.</i>		PROJ. NO. 1300	
				E. R. NO.		BLDG. NO. 105 G	
				DWG. NO. 5P-10912		NO.	

PERMIT NO. 1211-A
NOT APPLICABLE FOR CONSTRUCTION

1-20-50
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NOTE: RIBS ARE $\frac{1}{2}$ " WIDE & TAPPED FROM EACH END.

SECTION 2-A-2.

WAZX

END PAGE

JOE BLOCK
OUTLINE OF TUBE BLOCK
JOE BLOCK IS FULL WIDTH
UNDERCUT IN HEIGHT
TUBE BLOCK UNDERCUT
IN HEIGHT & WIDTH TO BE SQUARE

HDH-1593

-4-

-5-

HDC-1593

TUBE BLOCK

JOE BLOCK

JOE BLOCK IS FULL WIDTH
& UNDERCUT IN HEIGHT.
TUBE BLOCK IS TO BE SQUARE
& UNDERCUT IN WIDTH & HEIGHT

END VIEW

1/2" DIM.

SECTION "A-A"

JOE BLOCK RIBBED

TUBE BLOCK NOT RIBBED

SECTION THRU E

RIS IN JOE BLOCK AREA WIDE
& TAPERED FROM EACH END

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GENERAL ELECTRIC CO.
HANFORD WORKS

SCALE
APPROVED

TUBE BLOCK

DATE 1-1-51 DRAWN BY L. M. S. P.

CHECKED L. M. S. PROJ. NO. C-500

E. R. NO. BLDG. NO. C-500

DWG. NO. SP-10913

-6-✓

HDC-1593

END VIEW

TUBE BLOCK
JOE BLOCK

TUBE BLOCK IS TO BE SQUARE
UNDERCUT IN WIDTH & HEIGHT
JOE BLOCK IS FULL WIDTH
UNDERCUT IN HEIGHT

OUTLINE OF PROCESS TUBE
OUTLINE OF HOLE IN JOE BLOCK
OUTLINE OF HOLE IN TUBE BLOCK

SECTION "A-A"

SECTION THROUGH

PROCESS TUBE TO REST ON
BOTTOM OF OFFSET HOLE IN
JOE BLOCK WHICH CENTER THE
TUBE IN THE TUBE BLOCK.

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DATE 1-20-50 BY 103~~

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1-20-50
1-12-50

GENERAL ELECTRIC CO. HANFORD WORKS	SCALE APPROVED	DATE 1-11-50 DRAWN BY JIM STEVENSON
TUBE BLOCK		CHECKED P. MOORE PROJ. NO. C-300
TUBE SUPPORT		E. R. NO. BLDG. NO. 1056
10.3		DWG. NO. 5P. 10914

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