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TECHNICAL BASES FOR K REACTOR DICHROMATE AND pH CONTROL

A. P. Larrick

~~Classification reviewed for declassification but left unchanged by [illegible] Date [illegible]-73~~

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TO A. H. Hardin

FROM A. P. Larrick *APL*

SUBJECT TECHNICAL BASES FOR K REACTOR DICHROMATE AND pH CONTROL

References: (1) Letter, RW Reid to AR Maguire, "pH - Dichromate Specifications," November 10, 1970.

(2) DUN-7253, "Half-Plant Low Dichromate Evaluation at KW Reactor - Final Report, Production Test-176," AP Larrick, September 3,1970.

(3) Letter, PA Carlson to RW Reid, "Dichromate Evaluation," November 4, 1969.

As we agreed in our meeting of November 9, 1970, this letter is being written to provide you with additional technical basis for preparing the Process Standards as outlined in Reference 1. We are also enclosing fuel surface-tube outlet temperature data which supplements the information provided in Reference 2. These data will help establish dichromate concentration and coolant pH based on the outlet coolant temperatures of the hottest reactor process tubes.

The Standards should be based on the interrelationship given below between fuel cladding surface temperature and exposure time. The fuel cladding surface temperature may be related to tube outlet coolant temperature by considering fuel type and the number of fuel elements in a process tube.

The specific recommendations are as follows:

1. A sodium dichromate concentration of 1.0 ppm should be employed for all operations which result in 10 or more fuel columns with fuel cladding surface temperatures exceeding 120 C and exposure periods exceeding 70 operating days. Note that the exposure period is specified in days rather than MWD/T, and as such is independent of power level. This independence of power level is valid for reactor power levels 4400 MW or below.

2. A sodium dichromate concentration of 0.5 ppm may be employed for all operations which result in 10 or more fuel columns with cladding temperatures exceeding 120 C and exposure periods less than 70 operating days.

3. A sodium dichromate concentration of 0.5 ppm may be employed for all operations which result in less than ten tubes operating with cladding temperatures exceeding 120 C, regardless of the exposure period.

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4. The pH should be controlled at 6.6 ± 0.1 for all operations which result in ten or more fuel columns with fuel cladding surface temperatures exceeding 120 C and at 6.7 ± 0.1 for all remaining less severe conditions.

The fuel cladding surface temperatures are related to tube outlet coolant temperatures as shown in the following table:

SURFACE TO OUTLET COOLANT TEMPERATURE RELATIONSHIP

Fuel Type	Loading, Elements/Column	Cladding Surface Temperature, C	Tube Outlet Coolant Temperature, C
K5E	46	120	105.0
K5E	51	120	107.5
K5N	38	120	110.0
C2N	38	120	115.0
K4N	38	120	115.0

The ten columns with cladding surface temperatures exceeding limiting temperatures should be determined as the sum of any combination shown in the above table. For example, the limit may be exceeded by 10 columns of 46 elements of K5E fuel operating at 105 C outlet temperature or by a combination such as seven columns of 46 elements of K5E fuel at 105 C plus three columns of 38 elements of K5N fuel at 110 C outlet temperature.

In order to smooth minor fluctuations in operating conditions, we suggest that the above water chemistry changes not be made until the cladding temperature change has persisted for 24 hours at equilibrium operating conditions.

If you have any further questions, please do not hesitate to call me.

END

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