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**DIPOXATE EVALUATION**

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<th>TITLE</th>
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<tbody>
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<td>APR 18, 1963</td>
<td>P.A. Carlson</td>
<td>DEC 5, 1969</td>
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**DATE**

November 4, 1969

**DATE**

April 18, 1963

**ISSUING FILE**

DEC 5, 1969

**PAYROLL NO.**

57029

**LOCATION**

711 B. R. 1

**FILES ROUTE DATE**

12-1-70

**SIGNATURE AND DATE**

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DICHROMATE EVALUATION

P. A. Carlson

November 4, 1969

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Fuel failure statistics coupled with preliminary results from the half-plant dichromate test recently completed at KW Reactor show that process water with 0.5 ppm dichromate is significantly more corrosive than process water containing 1.0 ppm dichromate with respect to localized aluminum cladding corrosion. Enough information is available, however, to indicate that the differences in terms of fuel and aluminum tube failure rates may only be operationally significant during the months of highest outlet coolant temperature operation. At lower tube outlet coolant temperatures, little difference in localized aluminum corrosion has occurred on fuels exposed to either dichromate concentration. We will be able to pin this down in better detail after the data from 36 fuel columns recently discharged from KW Reactor have been obtained and analyzed. The experience and preliminary data suggest, however, that the water chemistry variables of pH and dichromate addition should be tied to outlet coolant temperature to achieve operating economies without undue risk of fuel and/or aluminum tube failure. The following table provides interim water chemistry specifications subject to revision when the test data analysis is complete early in CY-1970.

**Recommended Interim Water Chemistry Specifications - K Reactors**

<table>
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<tr>
<th>Bulk Outlet Coolant Temperature</th>
<th>Maximum pH</th>
<th>Minimum Dichromate, ppm</th>
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<tr>
<td>90-95</td>
<td>6.6</td>
<td>1.0</td>
</tr>
<tr>
<td>&lt; 90</td>
<td>6.7</td>
<td>0.5</td>
</tr>
<tr>
<td>&lt; 85</td>
<td>6.8</td>
<td>0.5</td>
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</table>
If an operating margin is desired, these values represent the upper (pH) and lower (dichromate) limits. They should not be exceeded except for short periods of time; i.e., one to four hours.

It should be noted that it would be preferable to tie the specification to tube outlet temperature, say to the average temperature of the 20 hottest tubes. Data from PTA-176 spans tube outlet coolant temperatures of 90-115°C and we expect to be able to narrow the requirement for 1.0 ppm dichromate water when the data analyses are complete.

The examination of the fuel columns irradiated under PTA-176 and data analysis are scheduled to be completed by January 30, 1970 at which time these specifications will be reviewed and a formal technical basis prepared for Process Standards. It should be recognized, however, that interim operation at 0.5 ppm dichromate does increase the risk of fuel failure, and that the degree of risk compared to operation with 1.0 ppm cannot be accurately assessed with available information. Fuel and Target Irradiation Technology is establishing a program of fuel examination to monitor fuel cladding corrosion behavior. Some information on the amount of corrosion as a function of fuel exposure will also be obtained from the PTA-176 data. Higher corrosion rates can be tolerated on low-exposure fuels, thus lower inhibitor concentrations can be used during periods when exposures are low.

Other uncertainties are aluminum tube and hot die size fuel behavior. We will have probolog data from KW Reactor to compare with data from KE tubes in the near future; however, this will not be indicative of localized tube corrosion. Examination of KE tubes which suffered Van Stone failures at mid-year showed no pitting of the tube walls. At this time we suggest a wait-and-see attitude and have no immediate plans to recommend aluminum tube removals for examination. With respect to hot die size fuel, we expect similar aluminum cladding localized corrosion behavior. Whether this results in equivalent failure rates remains to be shown. There could be a difference in susceptibility to pitting corrosion because the bond materials are different.

We will be working with Fuel and Target Irradiations to determine whether further testing to evaluate the effects of pH and dichromate on the behavior of hot die size fuel are warranted. In any case, these tests would not be scheduled before May 1970.

P. A. Carlson, Manager
Reactor Materials Technology