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REACTOR PRIMARY COOLANT SYSTEM PIPE RUPTURE STUDY
METHOD FOR DETECTION OF SENSITIZATION IN STAINLESS STEEL

MONTHLY PROGRESS LETTER

March 1979

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NRC Research and Technical
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NUCLEAR TECHNOLOGY DEPARTMENT • GENERAL ELECTRIC COMPANY

SAN JOSE, CALIFORNIA 95125

GENERAL  ELECTRIC

Progress Report for March 1979

Total funds expended during March are estimated to be \$18K including G&A, IR&D and fee.

PTL Pipe Measurements

Efforts this period were directed towards obtaining EPR measurements on weld heat affected zones of Type-304 stainless steel pipes which were tested for intergranular stress corrosion cracking resistance in the Pipe Test Laboratory (PTL). All of the pipe weldments EPR tested exhibited IGSCC in the PTL, but, due to extensive cracking, the actual heat affected zone areas measured were those in which no cracks were present; i.e., adjacent to, or directly opposite the cracked regions. The EPR measurements were obtained using the field technique. This technique consists of the following steps:

1. A spot about 1-in. in diameter is lightly ground and then polished using a hand-held moto-tool with diamond paste abrasive.
2. Stop-off lacquer is then painted over the spot leaving an exposed area 1/4-in. square where the measurement is to be taken (weld heat affected zone). The masked-off area is necessary to prevent a "crevice effect" around the O-ring seal used on the bottom of the miniaturized electrochemical cell.
3. The miniaturized cell is attached to the pipe using stainless steel hose clamps around the pipe. The cell is centered over the area to be measured.
4. Electrical connections are made to the portable polarization system, and to the pipe (working electrode) by clamping a wire between the hose clamp and pipe.
5. A small amount (about 2 cc) of deaerated electrolyte ($0.5M \text{H}_2\text{SO}_4 + 0.01M \text{KSCN}$) is injected into the cell, and the open circuit potential measured.
6. The EPR test is then conducted, after which, a one-step replica is taken from the etched surface so that the structure can be evaluated and photographed.

Measurements were obtained from 24 pipe weldments representing 9 different pipe samples. These results, all from the outside of the pipe weldments, are given in Table 1. These data reveal the weld variability between degrees of sensitization at different locations of the various heat affected zones. For example, the Pa values for heat 497816 (7.2 and 42.3 C/cm²) are real (not test or equipment irregularities), and are corroborated by the resultant etched microstructures. The structure for the 42.3 value

is comparable to the furnace sensitized condition of most Type-304 samples evaluated earlier.

Work is continuing to obtain EPR values on the inside of the above weldments for comparative purposes. The pipe samples were split longitudinally and the inside weld heat affected zones will be tested using the same procedures outlined for field testing. These data will be reported next period.

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TABLE 1

EPR RESULTS FOR OUTSIDE WELD HEAT
AFFECTED ZONES OF PTL SAMPLES
(0.5M H₂SO₄ + 0.01M KSCN, 30°C, 6V/h)

<u>Heat</u>	<u>Pa (C/cm²)</u>
M7616	5.7
M7616	15.3
M7616	4.9
M7616	12.2
M0063	1.4
M0063	1.0
M0063	4.1
M0063	4.7
454970	6.8
454970	14.4
454970	8.8
454970	6.8
TV002-002	20.8
TV002-002	26.1
497816	7.2
497816	42.3
181190	4.1
181190	5.3
435496	7.5
435496	6.1
51416	4.7
51416	2.8
51416*	27.4
51416*	21.8

* As-welded plus LTS (500°C/24h).

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