INTERIM REPORT

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Author(s): Daniel van Rooyen
Corrosion Science Group
Department of Nuclear Energy
Brookhaven National Laboratory

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Responsible NRC Individual and NRC Office or Division:
Dr. Joseph Muscara
Metallurgy & Materials Branch
Division of Reactor Safety Research
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Brookhaven National Laboratory
Upton, NY 11973
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MONTHLY HIGHLIGHTS

for

February 1979

Program: Stress Corrosion Cracking of PWR Steam Generator Tubing

Principal Investigator: D. van Rooyen

Reactor Safety Programs
Department of Nuclear Energy
Brookhaven National Laboratory
Upton, New York 11973

*Work carried out under the auspices of the U.S. Nuclear Regulatory Commission.

MONTHLY HIGHLIGHTS

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RSR Program - Stress Corrosion Cracking of PWR Steam Generator Tubing

Daniel van Rooyen

Laboratory and Apparatus

The one slow strain apparatus that has been operating provided some very useful information for material which may be experiencing conditions similar to active denting. This testing, especially at the lower temperature where very low strain rates are needed to induce cracking, requires a fairly long exposure time. Therefore, to examine a sufficient number of materials and test conditions, it has become necessary to build additional slow straining equipment. The second unit will be completed before March and components for the third unit have been ordered.

There has been some concern regarding the amount of cold working the specimens received as a result of flattening the tube sections before cutting into plate tensile pieces. Tensile specimens have been prepared from the tube sections without any rolling and special grips have been designed to hold the semicircular ends. These specimens will be tested and compared to the plate type which have been used to date, to ensure that the slight degree of cold work did not influence the conclusions drawn.

Capsules (Fig. 1) have been designed and fabricated to provide a specimen with a stress pattern similar to that of a dented tube. These capsules will be placed in an autoclave and the stress in the gauge section will be controlled by the difference of the vapor pressure of the solution and the gas pressure in the tube. The gas pressure inside the tubes will be held constant to simulate a condition where denting has stopped or the pressure will be slowly increased to

provide the continuously increasing strain a tube would experience in an active denting condition. Time to failure will also be recorded by a contacting pressure gauge monitoring the internal pressure. This test is being done to conform to the "different stress types" item in the proposed schedule of the research.

Results

Five heats of production type material have cracked both at 365°C and 345°C. The exposure time of the U-bend specimens at 325°C is now 20 weeks and we are expecting to see some results from that test very shortly, since this is close to the time indicated by extrapolation from the higher temperature results.

In slow strain rate tests, the crack propagation rate diminishes with temperature to the extent that very little intergranular SCC occurs at 325°C with a strain rate of 10^{-7} sec^{-1}. The 325°C test was repeated with a strain rate of 10^{-8} sec^{-1}, with more rapid cracking. The test at 290°C with a strain rate of 10^{-8} sec^{-1} is still in progress, so far having shown 26% strain without drop in load.

Controlled potential studies are continuing with heat #5 in 365°C simulated primary water. Improvements are being made in our method of measuring the time-potential changes during the test.

Constant stress tests on a series of 5 C-ring specimens are in progress. The specimens are stressed to 130% y.s. and exposed to 365°C D.I. water. There has been no indication of failure after 6 weeks.

Cyclic load tests also continue, with no new data this month.

February 12, 1979

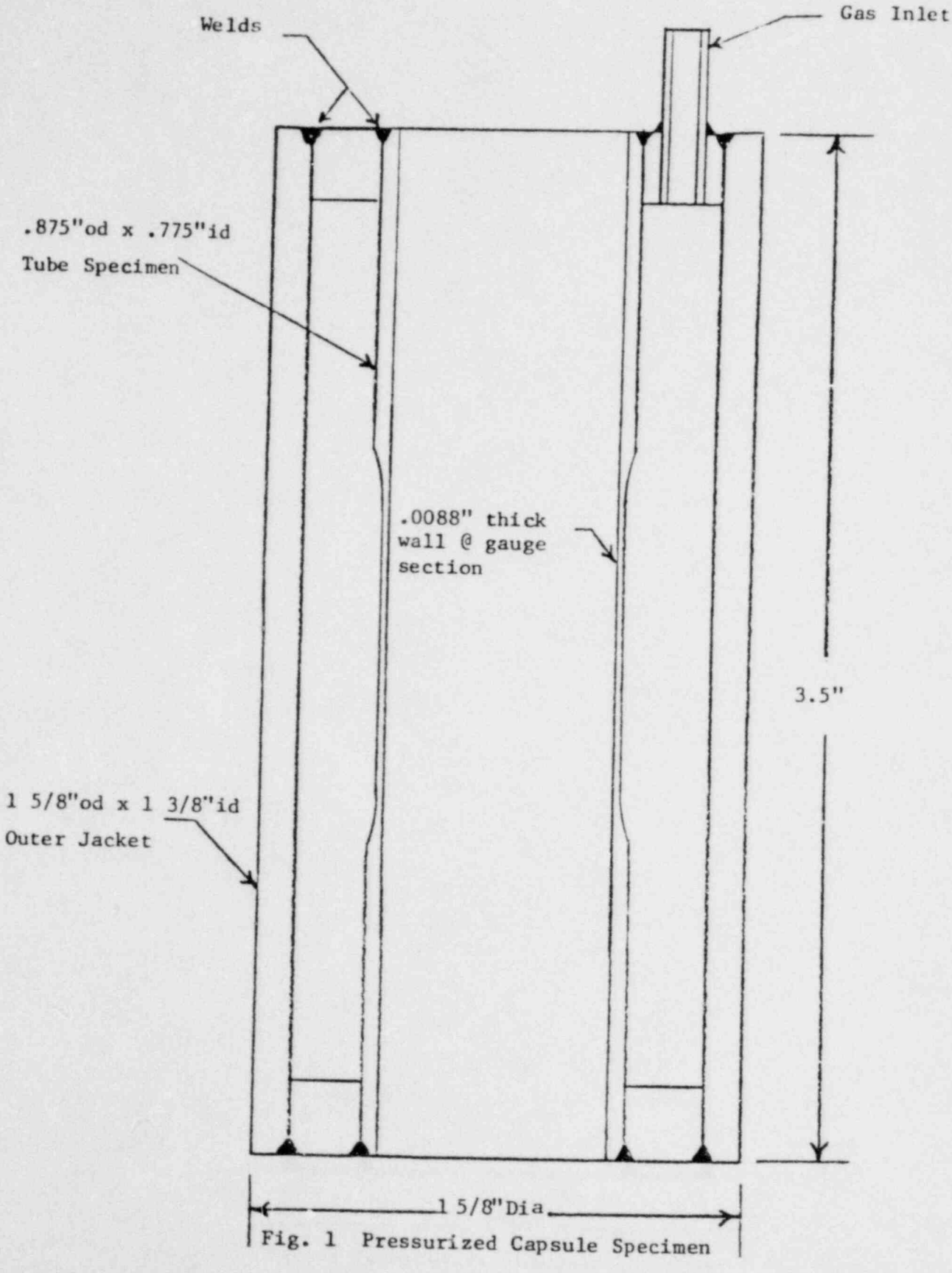

Fig. 1 Pressurized Capsule Specimen

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