

INTERIM REPORT

Accession No. _____

Contract Program or Project Title:
Application of the Internal Friction Nondestructive Evaluation Technique for
Detecting Incipient Cracking of Bypass Lines and Pipes in Boiling Water Reactor
Subject of this Document: Piping Systems

Same as above

Type of Document:

Monthly Progress Report

Author(s):

L. L. Yeager

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Responsible NRC Individual and NRC Office or Division:

J. Muscara

Division of Reactor Safety Research

This document was prepared primarily for preliminary or internal use. It has not received full review and approval. Since there may be substantive changes, this document should not be considered final.

Prepared for
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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INTERIM REPORT

NRC Research and Technical
Assistance Report

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DAEDALEAN ASSOCIATES, INC.

ENGINEERING, DESIGN AND ANALYSIS SERVICES

31 May 1979

Dr. Joseph Muscara
Nuclear Regulatory Commission
Division of Reactor Safety Research
Mail Station 1130 SS
Washington, D. C. 20555

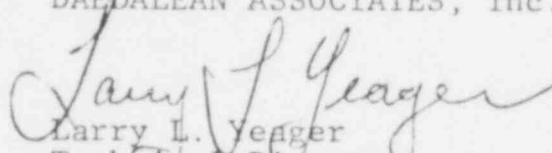
Dear Dr. Muscara:

Enclosed are two copies of the eleventh progress report for Contract No. NRC-04-78-242 covering the reporting period from 30 April 1979 to 25 May 1979.

If you have any questions concerning the enclosed information, please do not hesitate to contact us.

Sincerely,

DAEDALEAN ASSOCIATES, Inc.


Larry L. Yeager
Technical Director
Material Systems

Enclosures

cc: Accessions Unit

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DAEDALEAN ASSOCIATES, Incorporated

PROGRESS REPORT NO. 11

THE APPLICATION OF THE INTERNAL
FRICTION NONDESTRUCTIVE EVALUATION
TECHNIQUE FOR DETECTING INCIPIENT
CRACKING OF BYPASS LINES AND PIPES
IN BOILING WATER REACTOR PIPING SYSTEMS

Submitted to:

Nuclear Regulatory Commission
Division of Reactor Safety Research
Washington, D. C. 20555

NRC Research and Technical Assistance Report

Contract Number
NRC-04-78-242

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Report of Progress During the Period
30 April 1979 to 25 May 1979

June 1979

THE APPLICATION OF THE INTERNAL
FRICTION NONDESTRUCTIVE EVALUATION
TECHNIQUE FOR DETECTING INCIPIENT
CRACKING OF BYPASS LINES AND PIPES
IN BOILING WATER REACTOR PIPING SYSTEMS

OBJECTIVES

The objective of this program is to determine the feasibility of applying the internal friction NDE technique as developed by DAEDALEAN ASSOCIATES, Inc., to the in-service inspection of BWR primary piping systems. Laboratory and field parameters that correlate to changes in the specific damping capacity are included in the scope of this program.

PROGRESS DURING THE REPORTING PERIOD

During this reporting period operation of the Project Demonstration Loop (PDL) at Battelle Northwest Laboratory was continued with pipe specimen No. 1. Battelle personnel have continued to apply the internal friction damping technique. After approximately 700 load cycles, the pipe specimen is still intact. Indications of crack growth were detected through 700 cycles, at which time it was decided to conduct radiographic inspection of the pipe specimen. Graphs and tables of the data will accompany the next progress report as the latest data has not yet been received at DAI.

Radiographic and ultrasonic inspections were conducted on the pipe specimen during the week of 21 May 1979. According to Mr. Robert Clark of Battelle, the radiographic inspection did not show any evidence of crack formation, but the ultrasonic inspection gave some indications of cracking. The pipe specimen will be removed from the loop and sectioned for visual inspection.

The longevity of pipe specimen No. 1 is believed to be due to a conscientious welder who welded at the specified voltage, but welded slower than specified to make the best weld he could.

A new specimen (No. 2) will be prepared under supervision to ensure the time specification is adhered to. Specimen No. 2 should be in the loop and ready for operation around 1 June 1979.

A trip was made by DAI personnel to the Dresden Nuclear Station during this reporting period. Work done and results of this trip are discussed in the following section.

SUMMARY OF IMPORTANT TRIPS, CONFERENCES,
MEETINGS AND BRIEFINGS

On 14 May 1979, DAI engineers David Fresch, Patrick Harrigan and Bruce Jachowski visited the Dresden power plant for the purpose of receiving radiation training and investigating the previously installed instrumentation. May 14 was spent in the training sessions.

On Tuesday, 15 May 1979, the DAI personnel set up the electronic equipment in the test shack and confirmed the wires connected to the transducers on Unit 2 feedwater lines C and D. It was found that when no input signal was applied to the mini-shakers, pipe system noise was detected and transmitted by the accelerometers. However, when the mini-shakers were energized with an AC signal from the oscillator, the output response, as seen by the frequency analyzer and oscilloscope, looked quite similar to that of a frequency controlled voltage amplifier. As the frequency was increased from 20 Hz to several thousand Hz, the output voltage also increased with no resonant peaks being observed. It was hypothesized that cross-talk between the cables leading to the containment wall might be responsible for this behavior. In order to test this hypothesis, the electronic equipment was moved to the containment wall and attached directly to the BNC connectors there, eliminating from the circuit the ~200 feet of cable between the wall and the test shack. The same phenomenon was observed with the additional facet of an amplification factor of approximately 8x; that is, the output voltage was 8 times the input voltage. Several possible options exist for solution methods:

1. Any and all other active electronics connections, using the same containment penetration as the DAI test instrumentation should be turned off to determine if interaction with the signal path of the DAI electronics is taking place.

2. If this solution is not possible, or yields no results, a second option is to employ DAI's frequency spectrum analyzer to monitor the inherent or transient noise as transmitted by the accelerometers. This would allow DAI engineers to isolate major frequency responses from the inherent, pipe generated, noise. Data acquisition would then be attempted employing these peak operationally generated outputs.
3. Negotiations are currently underway with Mr. Joseph Reese, Technical Staff, of the Zion Nuclear Facility in Zion, Illinois to determine the availability of the Zion installation for instrumentation by DAI engineers. A further possibility is the modification of the containment penetration at Dresden, during the next maintenance period.

UNANTICIPATED TECHNICAL OR MANAGEMENT PROBLEMS

None

ANTICIPATED PROBLEMS

None

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REQUIREMENTS FOR CHANGES IN KEY PERSONNEL

None

ANTICIPATED COST AND COMPLETION SCHEDULE

Because of the delay incurred in SCC testing at Battelle Northwest and instrumentation problems at the Dresden nuclear facility, it is anticipated that the collection of laboratory and field data will proceed beyond the estimated termination date of the present phase of the program. For this reason, it is anticipated that a request for extending the contract through September will be submitted during the next reporting period.

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GANTT CHART FOR PHASE I FOR THE APPLICATION OF THE INTERNAL FRICTION NDE TECHNIQUE FOR
 DETECTING INCIPIENT CRACKING OF BYPASS LINES AND PIPES IN BOILING WATER REACTOR PIPING SYSTEMS

PHASE I		PERIOD OF PERFORMANCE (MONTHS)											
TASK NUMBER - DESCRIPTION	UBTASK LETTER	1	2	3	4	5	6	7	8	9	10	11	12
I - GENERATION OF BASE LINE DATA													
I-A - PLANNING AND COORDINATION OF SCC LOOP EXPERIMENTS		△	—	—	—	—	—	—	—	—	—	—	△
I-B - COLLECT $\frac{\Delta W}{W}$ DATA IN DAI LABORATORY ON SCC PIPE		△	—	—	—	—	—	—	—	—	—	—	△
I-C - MONITOR SCC EXPERIMENTS IN SCC LOOP TEST FACILITY			△	—	—	—	—	—	—	—	—	—	△
II - MONITOR BYPASS LINES UNDER FIELD CONDITIONS IN AN ACTUAL PWR PLANT												▲	-----
II-A - COORDINATION BETWEEN THE CONTRACTOR AND PLANT OPERATOR		△	—	—	—	—	—	—	—	—	—	—	△
II-B - COLLECTION OF FIELD DATA (IMPLIES REACTOR SCHEDULE)									△	—	—	—	△
II-C - DATA ANALYSIS AND PRESENTATION OF RESULTS IN THE FINAL FORM MONTHLY REPORTS		⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
II-D - SEMI-ANNUAL REPORT	446							⊙					
II-D - ANNUAL TOPICAL REPORT													△
II-D - PLANNING DOCUMENT FOR TASKS I AND II	224		▲	▲									

▲----- Work in Progress
 ▲————▲ Completed Work