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July 18, 1980

Mr. Charles Z. Serpan, Jr., Chief  
Metallurgy & Materials Research Division  
Office of Nuclear Regulatory Research  
Nuclear Regulatory Commission  
Washington, D.C. 20555

APRIL-MAY BI-MONTHLY STATUS LETTER: LWR PRESSURE VESSEL IRRADIATION  
SURVEILLANCE DOSIMETRY PROGRAM

The objective of this program is to make measurements in neutron fields ["Benchmark" and reactor "Test and Surveillance Regions"] for the subsequent validation/calibration of available state-of-the-art data and dosimetry, damage correlation, and the associated reactor analysis procedures used for predicting the integrated effect of neutron exposure for light-water reactor [LWR] pressure vessel [PV] steel test irradiation and surveillance programs. The task includes selection of the neutron fields, the validation/calibration of dosimetry and damage exposure and correlation procedures in these fields, and the establishment of a set of seventeen ASTM recommended standard practices, guides, and methods.

PROGRAM REVIEW AND DEFINITION

W. N. McElroy, G. L. Guthrie, R. Gold, and E. P. Lippincott attended the LWR Pressure Vessel Surveillance Dosimetry Program "Activities, Status, and Scheduling Meetings" and "PCA Blind Test Meeting" in Washington, D.C., May 19-23, 1980. R. Gold presented results of neutron and gamma spectrometry measurements in the LWR-PV mockup at the PCA, assisted in planning the FY-1981 schedule for LWR-PV mockup (4/12 + SSC configuration) at the PCA and formulating the requirements for a Power Reactor Benchmark field for Physics Calculations. In a similar fashion, G. Guthrie and E. Lippincott presented information on damage correlation and neutron field characterization studies and plans for PSF and test and power reactors. The meeting results have been documented and were distributed to all participants the week of June 23, 1980.

LWR PRESSURE VESSEL IRRADIATION SURVEILLANCE

DOSIMETRY PROGRAM BI-MONTHLY STATUS LETTER

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INTERIM REPORT

Accession No. \_\_\_\_\_  
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**Contract Program or Project Title:**

LWR Pressure Vessel Irradiation Surveillance Dosimetry Program

**Subject of this Document:**

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**Type of Document:**

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CC Preston, WN McElroy

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C. Z. Serpan, Jr., Chief  
Metallurgy & Materials Research Branch  
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4. AUTHORS (If more than three, name first author followed by "and others.")  
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## TASK A - NEUTRON FIELDS

### ORNL-PSF Dosimetry PV Mockup Validation/Calibration Studies

Preliminary data were received from five of the six utility/vendor/service laboratories performing comparison analysis of the samples from PSF-Surveillance Capsule Perturbation Experiment. Laboratory-to-laboratory variations in reported reaction rates of a few up to about 50% were noted for some important reactions such as  $\text{Fe}^{54}(n,p)$ . Correlation between HEDL and participants analysis of the same dosimeter were made by L. S. Kellogg and A. I. Davis and tables were prepared containing all absolute reported values as well as the correlations. The results were reviewed and discussed by W. N. McElroy and E. P. Lippincott with participants at the May 19-23, 1980 NRC-Program Review and June 2-5, 1980 ASTM Meetings.

### McGuire I (PWR)

Sample selection and sizing is complete. Assembly of the bare and Cd covered dosimetry sets and shipment to IRT are anticipated prior to the end of June 1980.

### PCA-PSF

Absolute reaction rate results were reported for In, Al, and Ni dosimeters irradiated in PCA, PSF startup and NBS calibration runs.

### Brown's Ferry 3 (BWR)

SSTR dosimetry capsules from the Brown's Ferry irradiation have still not been returned to HEDL for analysis and re-use of the deposits. These capsules contain sixteen fission deposits valued at about \$1000 per deposit. This unwarranted holdup has lasted for many months and continues to impact negatively on completing old and new SSTR LWR-PV neutron dosimetry work in a cost-effective manner.

## TASK B - RECOMMENDED ASTM STANDARDS

The "0" Master Matrix Guide, ASTM Standard E706-80 of Figures 1 and 2, was extensively revised in mid-April, 1980 by W. N. McElroy, was successfully balloted within ASTM Subcommittees E10.05 (Nuclear Radiation Metrology)\* and E10.02 (Behavior and Use of Nuclear Metallic Materials in Nuclear Systems) in May-June 1980, and was approved for subsequent ASTM Committee E10 and Society ballot at the June 1980 ASTM Savannah, Georgia, Meeting.

S. Anderson of Westinghouse prepared a first draft of the "IA" ASTM Standard, "Analysis and Interpretation of Nuclear Reactor Surveillance Results," Figures 1 and 2. This standard was reviewed and discussed at the Savannah, Georgia ASTM-E10.05 meeting and is now being revised and prepared for E10.05 Subcommittee ballot.

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\*New approved subcommittee name, formerly E10.05 on Dosimetry.

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G. Martin of General Electric prepared a revised draft of the "II C" ASTM Standard, "Sensor Set Design and Irradiation for Reactor Vessel Surveillance," Figures 1 and 2, which was discussed at the May, 1980 NRC LWR Program Review and the June, 1980 ASTM E10.05 meetings. After further revisions, this draft will also be submitted for E10.05 Subcommittee ballot.

G. Guthrie distributed copies of a revised draft of the "IE" ASTM Standard "Damage Correlation" Standard at both the May NRC-LWR Program Review and the June ASTM meetings for comment.

H. Farrar, IV and B. Oliver of Rockwell International distributed copies at the NRC LWR Program Review meeting of a first draft of the "III C" ASTM Standard "Analysis of Helium Accumulation Fluence (HAFM) Monitors for Reactor Vessel Surveillance" for comment. The distribution was limited to the NRC-Steering Committee members.

#### TASK C - DAMAGE ANALYSIS AND CORRELATION

The 44-day full power irradiation of the PSF-SSC capsule was successfully completed by ORNL on June 23, 1980. Plans are now being formulated for hot cell disassembly and post-irradiation shipment of activated specimens (metallurgy and dosimetry) to participants in the July-September 1980 time period.

Interim results are now available for the re-evaluation of the neutron exposures reported in the dosimetry sections of 19 surveillance reports of LWR's built by Westinghouse. The new calculations indicate that errors of up to a factor of two exist in the fluence values given in the original surveillance reports. In general the errors are in such a direction that the re-calculated fluence values are higher.

D. Pachur, Jülich, West Germany, visited HEDL June 12-13, 1980 to review cooperative TEM experimental program work related to damage analysis and correlation studies being accomplished in support of the NRC Task C and Jülich programs. The visit was quite beneficial. It gave L. Thomas and G. Guthrie a convenient opportunity to question Dieter Pachur about the logic employed in selecting the testing order for examination of TEM specimens, and also allowed them to ask detailed questions concerning some of Pachur's published work. During the visit HEDL received copies of Pachur's ASTM Savannah paper on "Apparent Embrittlement Saturation and Radiation Mechanisms of Reactor Pressure Vessel Steels."

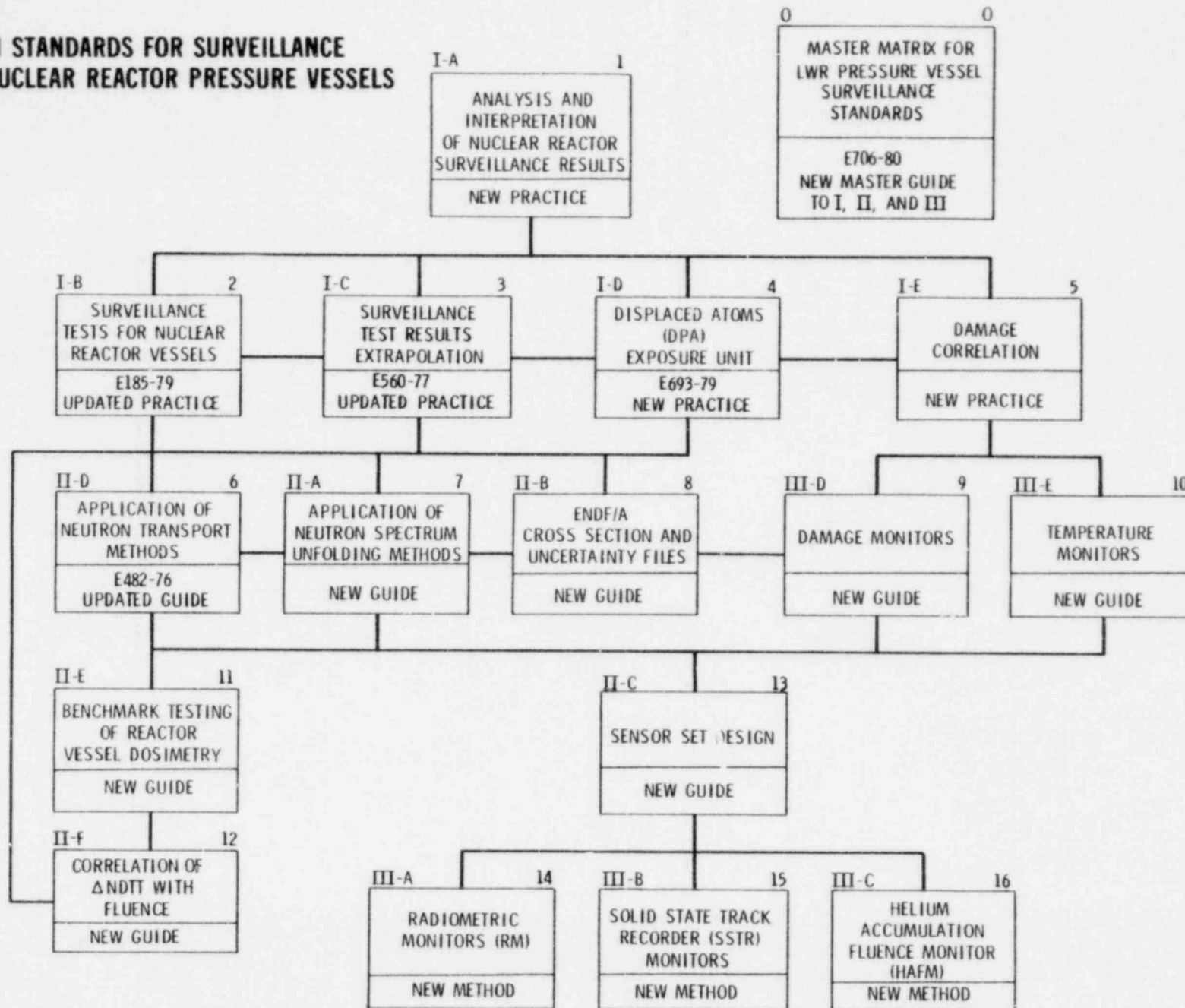
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Enclosures

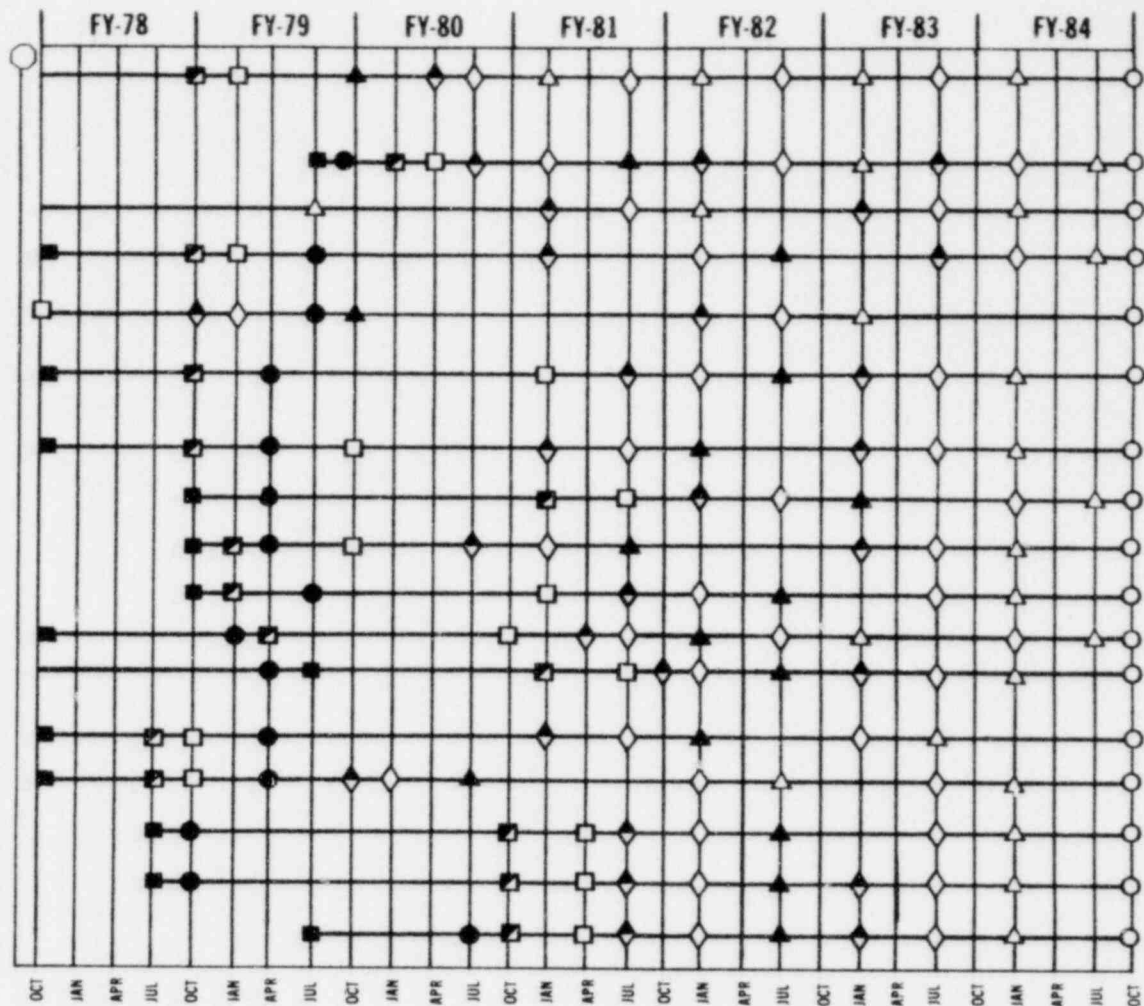
# ASTM STANDARDS FOR SURVEILLANCE OF NUCLEAR REACTOR PRESSURE VESSELS





RECOMMENDED E10 ASTM STANDARDS

- 0. MASTER MATRIX GUIDE TO I, II, III
- I. METHODS OF SURVEILLANCE AND CORRELATION PRACTICES
  - A. ANALYSIS AND INTERPRETATION OF NUCLEAR REACTOR SURVEILLANCE RESULTS
  - B. SURVEILLANCE TESTS FOR NUCLEAR REACTOR VESSELS (+)
  - C. EXTRAPOLATING REACTOR VESSEL SURVEILLANCE RESULTS
  - D. CHARACTERIZING NEUTRON EXPOSURES IN FERRITIC STEELS IN TERMS OF DISPLACEMENTS PER ATOM, INCLUDING ASTM ENDF/A DPA FILE
  - E. DAMAGE CORRELATION FOR REACTOR VESSEL SURVEILLANCE
- II. SUPPORTING METHODOLOGY GUIDES
  - A. APPLICATION OF MULTIPLE SENSOR FLUX FLUENCE SPECTRAL DETERMINATION CODES
  - B. APPLICATION OF ASTM/ENDF/A CROSS SECTION AND ERROR FILE
  - C. SENSOR SENSITIVITY DESIGN AND IRRADIATION FOR REACTOR VESSEL SURVEILLANCE
  - D. APPLICATION OF NEUTRON TRANSPORT METHODS FOR REACTOR VESSEL SURVEILLANCE
  - E. BENCHMARK TESTING OF REACTOR NEUTRON DOSIMETRY
  - F. CORRELATION OF  $\Delta$ NDTT WITH FLUENCE (+)
- III. SENSOR MEASUREMENTS METHODS
  - A. ANALYSIS OF RADIOMETRIC MONITORS FOR REACTOR VESSEL SURVEILLANCE
  - B. ANALYSIS OF SOLID STATE TRACK RECORDER (SSTR) MONITORS FOR REACTOR VESSEL SURVEILLANCE
  - C. ANALYSIS OF HELIUM ACCUMULATION FLUX/FLUENCE (HAFM) MONITORS FOR REACTOR VESSEL SURVEILLANCE
  - D. ANALYSIS OF DAMAGE MONITORS FOR REACTOR VESSEL SURVEILLANCE
  - E. ANALYSIS OF TEMPERATURE MONITORS FOR REACTOR VESSEL SURVEILLANCE



\* AN ASTERISK INDICATES THAT THE LEAD RESPONSIBILITY IS WITH SUBCOMMITTEE E10.02 INSTEAD OF WITH SUBCOMMITTEE E10.05.

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