INTERIM REPORT

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Contract Program or Project Title: Light Water Reactor Pressure Vessel Irradiation Program

Subject of this Document: Summary of Conferences on "Accuracies in Correlation Between Property Change and Exposure Data from Reactor Pressure Vessel Steel Irradiations" at Jülich, September 24-27, 1979 and the Third ASTM-Euratom Symposium on Reactor Dosimetry at Ispra, October 1-5, 1979.

Type of Document: Foreign Trip Report

Author: R. E. Maerker

Date of Document: October 12, 1979

Responsible NRC Individual and NRC Office or Division: C. Z. Serpan, Chief, Metallurgy and Materials Research Branch, Division of Reactor Safety Research

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INTERIM REPORT

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ORNL

FOREIGN TRIP REPORT

ORNL/FTR-726

DATE: October 12, 1979

SUBJECT: Report of Foreign Travel of R. E. Maerker, Project Leader for Development of an Advanced Methodology for LWR Dosimetry Applications, Engineering Physics Division

TO: Herman Postma

FROM: R. E. Maerker

PURPOSE: To participate in a specialists' meeting on accuracies in correlation between property change and exposure data from reactor pressure vessel steel irradiation at KFA, Jülich, West Germany and in the Third ASTM-Euratom symposium on reactor dosimetry at Ispra, Italy.

SITES VISITED:			
9/24/79	Conference	Jülich, FRG	W. Schneider
10/1-5/79	Conference	Ispra, Italy	W. McElroy

ABSTRACT: The traveler presented an invited paper at each meeting on the general subject of covariance estimations. Most of the Jülich meeting was devoted to papers on the dosimetry-metallurgy interface and correlations of steel embrittlement with various parameters — i.e., temperature, fluence, chemical content, etc. The meeting at Ispra involved mostly unfolding, surveillance techniques, benchmark referencing, covariance calculations, and dosimetry applications to fuel elements and fusion as well as pressure vessel monitoring. The most significant conclusion derived from the Jülich meeting was the large uncertainty in predicting failure of the pressure vessel through metallurgical analysis. The most pleasing conclusion from the Ispra meeting was the apparent interest on the part of the Europeans in adopting least squares techniques including the use of correlations in unfolding.

SUMMARY

The purpose for attending the two conferences was twofold. First, the presentation of two invited papers on the general subject of uncertainties in calculations and measurements as applied to the few channel spectral unfolding problem, and second, the acquisition of knowledge concerning the general problems involved in the complete picture of LWR pressure vessel surveillance, dosimetry, and damage predictions. In addition, the interaction of each of the areas with the others and the interplay of all the uncertainties was discussed, both from the American standpoint as well as the European one. The phase of the subject matter most interesting to me was the one involving estimation of covariances, since this subject is of primary importance in the project ORNL has with EPRI on developing an advanced methodology for LWR dosimetry applications.

The activities of KFA Jülich on steel radiation embrittlement studies include a new non-destructive testing method involving cold-neutron scattering. The French have developed a method of measuring damage by the use of tungsten and graphite damage detectors which can be correlated with steel damage. The US, under EPRI funding, have undertaken a re-evaluation of the data base obtained from test and power reactors of the damage-fluence relationships. Euratom has undertaken the comparison of various unfolding obtained by different codes – primarily STAYSL and SAND-II. In my opinion, the comparisons are meaningless because the input is not identical (i.e., SAND-II ignores correlations). Perhaps the most significant conclusions to be derived from the Jülich conference are the difficulty in accurately predicting damage in the pressure vessel, and the adoption of d.p.a. as the most significant fluence unit (instead of fluence greater than 1 MeV or 0.1 MeV).

The Ispra meeting was far more general in its subject matter than the Jülich one. Sessions involved application of dosimetry to the fusion and fuel areas, the metallurgy and dosimetry interface, LWR pressure vessel surveillance in power and test reactor experiments, fast reactor and research reactor characterization, adjustment codes, uncertainties and input needs, benchmarks, and dosimetry techniques. In addition there were several review papers describing the status of various aspects of the technology, for example, by G. Nagel of Germany, H. Till of EPRI, T. Marston of EPRI, A. Capgras of France, W. Schneider of Germany, R. Lewis of B&W, W. McElroy of HEDL, M. Austin of Great Britain, and R. Dierckx of Ispra. There were at least five papers on the use of covariances in unfolding or development of covariances from measurements, ours being one. The paper presented by Mannhart of Germany will be very useful to our project because it involves the covariances of many foil experiments performed at PTB which are necessary for us in our adjustment procedure. The most significant conclusion which I drew from this meeting was the increasing importance that is being placed on adjustment codes and covariances, primarily by the European community, due to the tireless efforts of F. G. Perey of ORNL. In this country, only ORNL has adopted this methodology.

The two papers presented by the traveler were, "Uncertainties and Biases Arising from Methods Approximations: The Calculation of Reaction Rates in the PCA 8/7 Configuration," by R. E. Maerker and J. J. Wagschal for the Jülich meeting, and "Covariances of Fission-Integral Measurements at the NBS ^{252}Cf and ISNF facilities and at the ORNL-PCA Facility," by J. J. Wagschal and R. E. Maerker of ORNL and D. M. Gilliam of NBS, for the ASTM-Ispra meeting. In addition, the traveler attended and participated in a meeting of Subcommittee E10.05.01 in Ispra, which was held in an attempt to encourage the future participate of the Europeans. Many informal discussions were also held concerning the PCA calculations, and the traveler participated greatly in these since he is responsible for the "definitive" calculation of the PCA blind test funded by NRC.

APPENDIX

FULL ITINERARY:

9/24/79	Knoxville-Atlanta
9/21-22/79	Atlanta-Frankfurt-Cologne-Aachen
9/22-27/79	Aachen-Jülich-Aachen
9/27-28/79	Jülich-Oberwesel
9/28-29/79	Oberwesel-Lindau
9/30/79	St. Moritz-Varese
9/30/79-10/5/79	Varese-Ispra-Varese
10/5-6/79	Varese-Milan
10/6/79	Milan-Frankfurt-Atlanta-Knoxville

PERSONS CONTACTED:

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BIBLIOGRAPHY OF LITERATURE ACQUIRED

Many, but not all, of the papers presented at the two meetings were made available to the attendees. I managed to acquire most of the papers which were of some interest to me – some fifty or so different papers. Rather than list all of them, I will be glad to make them available to anyone interested. Their subject matter ranges over the entire gamut of subjects addressed in the two conferences and have been alluded to in the text of this report.

DISTRIBUTION

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