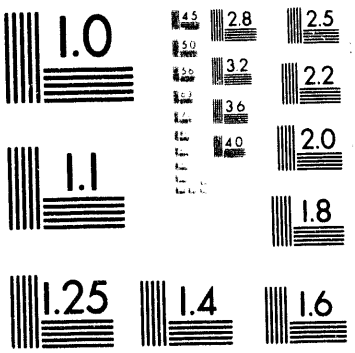
1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6

1 of 1

DOE/ER/54137-T1

NEUTRONICS AND NUCLEAR DATA REQUIREMENT FOR FUSION REACTORS

PERFORMACE REPORT
(July 1992 - August 1993)

by

E.T. Cheng

TSI Research, Inc.
225 Stevens Avenue, Suite 203
Solana Beach, California 92075

Report of a Research Project
Sponsored by
the U.S Department of Energy, Office of Fusion Energy,
under Contract No. DE-FG03-92ER54137

August 1993

Performance Report (July 1992 - August 1993)

Research Project: Neutronics and Nuclear Data Requirements for Fusion Reactors
U.S. DOE Contract No. DE-FG03-92ER54137

Prepared by: E.T. Cheng, TSI Research, Inc, August 1993

This report summarizes following activities and accomplishments for the project from the period of July 1992 through August 1993: (A) Fusion Nuclear data coordination activities and (B) Neutronics and activation analysis.

A. Fusion Nuclear Data Coordination Activities

1. An IAEA Research Coordination Meeting on Measurement and Evaluation of Long-lived Activation Cross Sections of Importance to Fusion Reactor Technology was fruitfully participated by over 30 scientists worldwide in Del Mar, CA, April 29-30, 1993. The RCM was hosted by TSI Research on behalf of the US Government. Dr. E.T. Cheng of TSI and Dr. Anatoly Pashchenko of the IAEA Nuclear Data Section served as coordinators of the RCM.

2. The International Workshop on Nuclear Data for Fusion Reactor Technology was successfully held in Del Mar, CA, May 3-6, 1993. It was attended by 66 scientists representing the international nuclear data and fusion users communities. Dr. E.T. Cheng of TSI and Dr. Fred Mann of WHC-Hanford served as Conference Chairman and Technical Program Chairman, respectively. A report summarizing the conclusions and recommendations from the participants will appear soon.

3. There are two new activities being initiated by the IAEA. TSI Research was requested to coordinate these activities: (a) IAEA Specialists' Meeting on Activation Cross Section Measurements and Techniques. This meeting, to be hosted by JAERI, Japan, will be held in November 1993. The participants will include scientists

from US (Don Smith, ANL, and Cheng, TSI), Japan (Maekawa and Ikeda), Russia (KRI, St. Petersburg), and other countries; (b) IAEA Coordinated Research Program on "Establishment of an International Reference Data Library of Nuclear Activation Cross Sections." The performance period of this new CRP will be from 1994 to 1997. It is expected to be participated by Csikai (Debrecen, Hungary), Perlado (Madrid, Spain), Forrest (Harwell, UK), Herring (INEL, US), Ignatyuk (Obninsk, RF), Kopecky (ECN, Holland), and Cheng (TSI, US). The reference library will include sets of coefficients to convert the activation products into application quantities such the prompt dose release during a reactor accident (per Herring's participation). Cheng will keep the ITER Project informed about the progress of this CRP.

4. Cheng visited Southwest Institute of Nuclear Physics and Chemistry (SWINPC), Mianyang, China, April 15-16, 1993. He discussed with Professors Wenmian Jiang and Yuan Chen of SWINPC the Chinese integral experiments activities. The perspective of the SWINPC activities for the next few years (1993-1997) looks like the following:

a. Lead sphere experiments - In progress and to be completed in 1995. Research contract with the IAEA (through the coordination of TSI Research) is expected to be awarded to SWINPC.

b. Beryllium sphere experiments - Being planned. The large sphere including US, China, and Russia beryllium shells is needed. The procedure to ship the US and Russian shells to Mianyang has to be initiated and completed as soon as possible. The total thickness of the combined US/China/Russia sphere will be 19.85 cm. Experimental duration will be from 1993 to 1994.

c. Data testing integral measurements for ITER related materials - A unique experimental geometry will be established to conduct transmission measurements with a 14 MeV neutron source for ITER related materials such as Fe, Cr, V, and Cu. The experimental period will be from 1994 to 1996.

d. High precision Tritium Breeding Measurements - A proposal from TSI Research to perform tritium breeding measurements to high accuracy (<3%) is under investigation by SWINPC.

B. Neutronics and Activation Analysis

1. TSI Research has been providing neutronics support to the ITER project since the establishment of the ITER-JCT in San Diego. Meetings were held with the JCT members, Drs. Saji, Holland, and Piet, to provide expert's opinions on activation issues. Neutronics and activation calculations were performed and presentations on results for a candidate V-alloy/Li blanket and Inconel vacuum vessel were made to the ITER Nuclear Integration group. A snapshot ITER blanket design was established timely based on these interactive discussions and calculations.

2. ITER related activation calculations were performed and results provided to the INEL group for the detailed safety analysis.

3. Due to the urgency of the ITER needs, ENDF/B-V and REAC2 based cross section data libraries were used in all calculations. The new libraries, which include ENDF/B-VI (FENDL equivalent), and REAC3 are already available and will need to be integrated into our capability of neutronics analysis.

4. Multidimensional analysis for the ITER blanket streaming effect is requested by the ITER-JCT San Diego. Cross section and other sensitivity analysis are also expected as the ITER design progresses. TSI Research will prepare to provide more timely support for the ITER-JCT if requested.

Publications:

1. E.T. Cheng, G. Saji, "Activation and Waste Management Considerations of Fusion Materials," to be presented at the 6th ICFRM, Stresa, Italy, September 27 - October 1, 1993.

2. E.T. Cheng, et al., "Waste Recycling Considerations for D-T

Fusion Reactors," Fusion Technology, 21 (1992) 2001.

3. E.T. Cheng, "Nuclear Data for Fusion Blanket Nucleonics and Shielding," Proc. ANS Topical Mtg. on New Horizons in Radiation Protection and Shielding, Pasco, Washington, April 26 - May 1, 1992.

4. E.T. Cheng, "Implications of the IAEA CRP on Long-lived Activation Cross Sections Important to Waste Disposal and Materials Recycling for Fusion Reactor Materials," Paper presented at the IAEA First Research Coordiantion Meeting on Activation Cross Sections for the Generation of Long-lived Radionuclides of Importance in Fusion Reactor Technology, Vienna, Austria, 11 - 12 November 1991.

5. E.T. Cheng, "Assessment of Low Activation Materials," Proc. 14th IEEE/NPSS Symp. Fusion Engineering, San Diego, CA, September 30 - October 3, 1991, 91CH3035 - 3, P. 621.

DATE FILMED

4/7/94

END