ACTION **SHEET 1**

between

The Office of Atomic Energy for Pence of Thailand
and
The United States Department of Energy
for

PRELIMINARY SAFETY ANALYSIS REPORT REVIEW

1. Introduction

As allowed for under Article I (Objective) of the "Arrangement for the Exchange of Technical Information and for Cooperation in the Field of Peaceful Uses of Nuclear Energy between the Office of Atomic Energy for Peace (OAEP) and the United States Department of Energy (DOE) dated 20 March, 1997, Argonne National Laboratory (ANL) and the Thailand Office of Atomic Energy for Peace undertake to carry out consultation and cooperation in the review of the **Preliminary Safety Analysis** Report.

2. Background

On June 26, 1997, the OAEP contracted with General Atomics (GA) for the construction of a new research reactor using TRIGA LEU fuel at the Ongkharak Nuclear Research Facility site near Bangkok, Thailand. Before conswction can begin, the Thai Atomic Energy Commission (AEC) must issue a construction permit.

The Sub-committee on Nuclear Facility Safety (NFSS) – an arm of the Thai AEC – was set up as an ad-hoc licensing board to assess and to recommend to the Thai AEC on safety measures of research reactors. The responsibilities of the NFSS include recommending the issuance of a construction permit and an operating license. The OAEP has madc its licensing branch available to provide technical and administrative assistance to the NFSS.

The NFSS guidelines for the licensing process specifics, among other things, that the safety of the proposed reactor **should** be reviewcd and evaluated by the regulatory body in the vendor's country. However, the U.S. NRC, the regulatory body in the United Stares, does not perform safety reviews of either power or research reactors to be sized outside of the United States'. Consequently, in 1998 the NFSS endorsed the substitution of a credible independent reviewer, Oak Ridge National Laboratory (ORNL), to perform the required country-of-origin review.

In 1999, DOE transferred this work to Argonne National Laboratory (ANL). The Reduced Enrichment for Research and Test Reactor (RERTR) program at ANL was established by DOE in 1978 to provide the technical means for converting research and test reactors from hi&-

[1] See letter from Shirley Jackson, U.S., NRC. to Mr. Kriengsak Bhadrakom, Secretary General, OAEP, dated September 11, 1998.

enriched uranium (HEU) to low-enriched uranium (LEU) fuels. As part of this program, extensive studies on the performance, safety, and economic characteristics of research reactors have been conducted, including joint studies with 32 research reactors in 2 1 countries. The TRIGA LEU fuel to be used in the ONRC reactor was developed by GA and tested in cooperation with DOE under the auspices of the RERTR Program, On the basis of this extensive experience and ongoing work, DOE has provided indemnification to the RERTR Program to provide assistance in the redesign of research and test reactors outside the U.S., so that the reactors can USC low rather than high-enriched uranium and thus reduce the potential for loss or diversion of high-enriched uranium.

It is common practice in the U.S. to submit a Safety Analysis Report (SAR) to the NRC as part of the application to operate a research reactor. NUREG 1537[2] specifies the scope and content of the SAR, and therefore provides the basis for the country-of-origin review. In addition, IAEA expert and team missions have reviewed several revisions of the Preliminary Safety Analysis Report for the 10 MW ONRC TRIGA Reactor (PSAR), and ANL will make use of this work.

The IAEA has provided two individual expert missions and two team missions to the operating organization of the ONRC to review aspects of several revisions of the PSAR. ANL will consider the conclusions provided by these IAEA missions and the disposition of the recommendations and suggestions.

The first expert reviewed the information on the reactor neutronics in Revision B of the PSAR in February 1998 and issued a report[3] entitled "Review of the Preliminary Safety Analysis Report of the ONRC Reactor from the Aspect of Nuclear Design and Safety,"

A second expert reviewed the information in Revision C of the PSAK on reactor thermal hydraulics and prepared a report[4] entitled "Assessment Report for Thermal-Hydraulic Review of the ONRC Draft PSAR."

An IAEA team mission with five members reviewed the conclusions and the status of recommendations of the two previous missions and reviewed Revision D of the PSAR in June 1998, in addition to resolving the issues from the two previous expert missions, this team mission provided recommendations and suggestions in its report' entitled "Report of a TC Mission to Review the Preliminary Safety Analysis Report of the ONRC Reactor."

A second team mission reviewed Revision D (amended) in June.1999 'to determine the status of its previous recommendations and suggestions. The official report of this mission is expected to be issued in November 1999. Based on preliminary information, this mission report is expected to contain three remaining issues: the classification of systems, structures, and components, the maximum hypothetical accident, and the confinement system. The country-of-origin review will examine these issues.

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[2] U.S. Nuclear Regulatory Commission, Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors, Part 1 (Format and Content), February 1996 and Part 2 (Standard Review Plan and Acceptance Criteria), February 1996.
[3] IAEA Expert Mission Report. THA/4/013-11, 6-17 April 1998.
[4] IAEA Export Mission Report, THA/4/013-12, 1-28 March 1998.
[5] IAEA Team Mission Report, IAEA-RU-7715, 22 June – 3 July 1998.

3. **Scope of Work**

At DOE's **request, ANL** will **examine** specific aspects of the **PSAR,** Revision E, as specified in the scope of work **below,** to **fulfill** the requirement for the country-of-origin review. The work identified in this Action Sheet shall be performed at **ANL** facilities. These **ANL** Tasks include the following:

1. Review Revision E for consistency **with** the guidelines of NUREG 1537.
2. Review remaining issues identified in **the** reports of the IAEA **Missions,** and **examine** the treatment of those issues in Revision **E.**
3. Perform analyses listed in Attachment **A.** Investigate **significant** discrepancies with GA's results.

4. **Project Management**

The tasks planned by **ANL** and OAEP related to programmatic and technical questions encompass the **Project** Management milestones required to complete the project and appear as Attachment A to the **Action** Sheet.

5. Fiscal Management

As specified in the **Arrangement,** except where otherwise agreed in writing, **all** costs resulting from this collaboration **shall** be borne by the parry **that** incurs them. ANL shall **be** responsible for budget **planning** and financial management upon receiving designated funding and authorization from DOE.

6. Schedule of Work

Completion of country-of-origin review, consisting of the specific tasks identified in Attachment A – Analyses, **three** months **after** commencement of work.

7. **Deliverables**

report

8. Duration and Termination

This Action Sheet shall enter into force upon **the later** date of **signature** and shall be completed when the deliverable is provided **to** DOE.

Attachment A – Analyses

The analyses to be performed are specified below. All references to figures and page numbers refer to Revision E (September 1999) of the PSAR.

NUCLEAR DESIGN

1. Perform a Monte Carlo calculation for the fresh core shown in Fig. 5-25 on p. 5-87 and compare flux results with those shown in that figure.
2. Verify results shown in Fig. 5-22 on p. 5-8 1 for reactivity versus burnup for initial core.
3. Perform burnup calculation for the Fuel Reload Plan shown in Fig. 5-23 on p. S-82. Compare results with those shown in Table 5-11 on p. 5-84 and Fig. S-24 on p. 5-85.
4. Calculate Beginning of Life power peaking factors shown in Table 5-12 on p. 5-89 for all rods out and for maximum power peaking factor (2.42).
5. Calculate prompt neutron lifetime on p. 5-96 and effective delayed neutron fraction on p. 5-99 for transient analyses.
6. In Table 5-l 5 on p. 5-l 00, calculate excess reactivity at BOL and control rod system reactivity worth with all rods inserted and with the maximum-worth rod stuck out to verify shutdown margin at BOL.
7. Verify prompt negative temperature ***coefficient*** as a fiction of temperature at BOL shown in Fig. 5-32 on p. 5-106.

THERMAL AND HYDRAULIC DESIGN

8. Verify selected fuel and cladding temperature profiles shown in Fig. 5-34 on p. 5-124 for the hottest fuel rod in the ONRC core.
9. Verify selected values of CHFR vs Total Flow shown in Fig. S-47 on p. 5-155.
10. Verify selected values of Safety Limits for the ONRC reactor in Fig. 17-1 on p. 17-4.

ENGINEERED SAFETY FEATURES

11. Review IAEA comments and GA ***response on*** design of emergency core cooling system in Section 7.2 on p. 7-2.

SAFETY **ANLAYSES**

12. Review IAEA comments and GA response on Maximum Hypothetical Accident (MHA) discussed in Section 16.4.1 on p. 16-8.
13. Verify results of one transient analysis discussed in Section 16.4.3.2 on p. 16-22.

9. **Key Personnel**

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For the Office of Atomic Energy for Peace

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Signature

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Printed **Signature**

Secretary-General
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Date

For the United States Department: of Energy

Kenneth Sanders
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