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Department of State

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ACTION 55-25

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FM AIT TAIPEI

TO AIT VASHQDC

SECRET SECTION 01 OF 05 TAIPEI 80372

EXDIS

E.O. 12958; GDS 5 MAY 1995 (GROSS, WILLIAM)

TAGS: TECH, ENG, PARL, TV

SUBJECT: U.S. NUCLEAR TECHNICAL TEAM VISIT

REFS: AJ AIT/V 6955, BI AIT/T 8118

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1. ALL TEXT SECRET.

2. SUMMARY: U.S. NUCLEAR TECHNICAL TEAM VISITED TAIWAN 1-5 MAY 1973 FOR DISCUSSIONS WITH AEC AND INER OFFICIALS ON ASSIGNMENT OF U.S. SCIENTISTS TO INER, CONVERSION OF TRR TO 28 PERCENT-ENRICHED FUEL, TRANSFER OF SPENT TRR FUEL TO U.S., AND STATUS OF INER CHEMICAL PROCESSING PROJECTS INCLUDING AHODE-SLIME AND URANIUM EXTRATION.

3. U.S. NUCLEAR TEAM IMPRESSED WITH INER'S PROGRESS AND WELCOMED THE CHANCE TO VISIT OTHER INER FACILITIES. THE TEAM CONCLUDED THAT INER WAS READY TO ACCEPT US HELP IN IMPROVING ITS NUCLEAR MATERIALS HANDLING AND PROCESSING ABILITIES.

4. CHECKOUT PERIOD: THE U.S. TEAM CHECKED OUT ON THE FOLLOWING TOPICS:

- A. FUEL TECHNOLOGY;
- B. REACTOR SYSTEMS ENGINEERING;
- C. INSTRUMENTATION;
- D. DECONTAMINATION, DOSE REDUCTION, AND ACCIDENT RECOVERY;
- E. REACTOR PHYSICS AND SAFETY.

5. U.S. NUCLEAR TEAM VISITED TAIWAN FOR A SERIES OF DISCUSSIONS WITH INER PERSONNEL ON THE FOLLOWING THEMES:

- A. FUEL TECHNOLOGY;
- B. REACTOR SYSTEMS ENGINEERING;
- C. INSTRUMENTATION;
- D. DECONTAMINATION, DOSE REDUCTION, AND ACCIDENT RECOVERY;
- E. REACTOR PHYSICS AND SAFETY.

6. THE U.S. WILL EXPEDITE PREPARATION OF A DETAILED PROPOSAL FOR IMPLEMENTATION OF ASSIGNMENTS BASED ON THIS AGREEMENT FOR EARLY SUBMISSION TO INER FOR FURTHER DISCUSSIONS.

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RXR 7-PIN U-AL FUEL. INER FORMAL POSITION IS THAT
CONVERSION TO HALF 25 PERCENT-ENRICHED RXR FUEL AND
HALF CURRENT NATURAL URANIUM FUEL IS ALSO TECHNICALLY
FEASIBLE BUT SUPERIOR TO FULL CORE CONVERSION FROM A
COST-EFFECTIVENESS POINT OF VIEW BECAUSE IT GIVES
NEEDED HIGHER FLUX LEVELS AND DOES NOT MAKE OBSOLETE
THEIR TTR FUEL FABRICATION FACILITY AND URANIUM-PHOSPHATE
EXTRACTION PROGRAM. U.S. FORMAL POSITION IS THAT HALF
CORE CONVERSION IS TECHNICALLY FEASIBLE BUT INFERIOR
TO FULL CORE CONVERSION BECAUSE FULL CONVERSION GIVES
HIGHER FLUX LEVELS, HIGHER EXPERIMENTAL REACTIVITY
LOAD CAPACITY, AND LOWER PLUTONIUM PRODUCTION. INER
PERSONNEL, INCLUDING DIRECTOR CHEN, TOLD U.S. TEAM
INFORMALLY THAT THEY NOW BELIEVE THAT TTR IN ITS
CURRENT CONFIGURATION DOES NOT GIVE HIGH ENOUGH FLUX
TO MEET REQUIREMENTS FOR LWR FUEL TESTING ASSIGNMENTS
THEY EXPECT WILL BE MADE TO INER FROM TAIPower THROUGH AEC;
I.E., INER NEEDS AT LEAST PARTIAL CONVERSION OF TTR TO
HIGHER ENRICHMENT FUEL TO ACHIEVE HIGHER FLUX LEVELS.
DURING PRIVATE CHEN/LEWIS DISCUSSIONS FOLLOWING UP ON
THESE POINTS, CHEN CONCEDED THAT HIS RESISTANCE TO
PHASING OUT THE USE OF NATURAL URANIUM FUEL WOULD BE
MUCH LESS IF TIME, AND U.S. ASSISTANCE, WERE AVAILABLE
TO FIND REPLACEMENT PROJECTS SUCH AS RXR-TYPE U-AL
FUEL FABRICATION PLANT. THIS LED TO DISCUSSION OF A POSSIBLE BASIS FOR
A U.S./TAINAN COMPROMISE ON THE TTR CONVERSION ISSUE AS
OUTLINED IN PARA 2. U.S. FINAL POSITION IN TTR TALKS
WAS THAT THE CONVERSION FEASIBILITY STUDY WAS COMPLETED,
THAT NEXT STEP WOULD BE A FORMAL U.S. PROPOSAL FOR
DISPOSITION OF THE TTR CONVERSION ISSUE, AND THAT, AFTER
A DECISION IS MADE ON CONVERSION GOALS, INITIATION OF
AN IMPLEMENTATION PROGRAM WOULD BE APPROPRIATE. PARA 6
DOCUMENTS THE JOINTLY AGREED U.S./TAINAN STATEMENT ON
CONVERSION DECISION ISSUES AND SUBSEQUENT IMPLEMENTATION
STEPS.

6. SUMMARY OF RESULTS OF TTR CONVERSION DISCUSSIONS AT
INESS MAY 2-4, 1979: AT THE MEETING AT INER, MAY 2-4,
1979, THE STUDY TEAM FOR TTR CONVERSION FROM INER AND
FROM THE U.S. DISCUSSED ALTERNATIVE OPTIONS FOR POSSIBLE
CONVERSION OF TTR. AMONG THE ITEMS DISCUSSED WERE THE
IMPORTANT ISSUES TO BE CONSIDERED IN THE FINAL DECISION
ON WHETHER OR NOT, OR IN WHAT WAY, TO CONVERT THE REACTOR.
ALSO DISCUSSED WERE SOME OF THE MAJOR STEPS THAT WOULD
HAVE TO BE TAKEN TO IMPLEMENT THE CONVERSION IF
AND WHEN A DECISION TO CONVERT WERE MADE. THESE DECISION
ISSUES AND IMPLEMENTATION STEPS ARE SUMMARIZED BELOW.

- (A) IMPORTANT ISSUES FOR FINAL DECISION ON TTR
CONVERSION

- (i) A FURTHER STUDY TO SEARCH FOR AN OPTIMUM
CORE UNDER THE FOLLOWING GUIDELINES:

- HIGHER FLUX AND REASONABLE CYCLE LENGTH
ENOUGH TO PERFORM REACTOR FUEL DEVELOPMENT;

- CONTINUOUS UTILIZATION OF INER EXISTING
FACILITIES AND MATERIALS;

- MINIMUM MODIFICATIONS TO THE PRESENT TTR
SYSTEM;

- COMPREHENSIVE SAFETY ASSURANCE.

- (2) A TOTAL COST-BENEFIT ANALYSIS OF THE
OPTIMUM CONVERSION.

- (3) TTR CONVERSION IMPLEMENTATION STEPS

- (1) FINANCIAL ARRANGEMENTS AND SCHEDULE

- PROVISIONS SHOULD BE MADE FOR THE MODE IN
WHICH FUNDS ARE MADE AVAILABLE FOR FUEL AND COMPONENT
PROCUREMENT, SHIPMENTS, ETC. A DETAILED SCHEDULE FOR
EVERY ACTIVITY OF THE CONVERSION SHOULD BE DEVELOPED.

- (2) SELECTION OF CORE CONFIGURATION

- A SERIES OF CALCULATIONS SHOULD BE PERFORMED
WITH CONSISTENT METHODOLOGY TO ANALYZE TRADEOFFS IN
EXPERIMENTAL LOAD, NEUTRON FLUX, CYCLE LENGTH, PLUTONIUM
PRODUCTION, AND FUEL REQUIREMENTS FOR VARIOUS FEASIBLE
CONFIGURATIONS OF THE CONVERTED TTR. THESE CALCULATIONS
WILL PROVIDE THE BASIS FOR CHOOSING THE INITIAL CORE
LOADING, THE REQUIRED FUEL INVENTORIES, THE REQUIREMENTS
FOR ADDITIONAL SHUTOFF AND ADJUSTER RODS, AND THE NEEDS
FOR REACTOR MODIFICATIONS (E.G., MODIFICATIONS OF THE
MODERATOR COOLING SYSTEM, TO THE CONTROL PANEL, AND
TO THE ADJUSTER ROD HEADGEAR).

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- (3) PREPARATION OF AN AMENDED FSAR
  A set of amendments to the TRR FSAR should be prepared. This activity will include a definition of the limiting fuel conditions based on final reactor configurations; an evaluation of the protection system for a range of postulated ramp rates characteristic of the converted TRR; analysis of the effects of a variety of postulated loss of loop coolant accidents; and a hazard analysis (safety evaluation) in which the fission product inventory should be calculated, and potential radiological exposure should be determined as related to exposure limits and based on postulated reactor accidents.

- (4) CONTROL SYSTEM
  The adequacy of the present TRR control system in the converted core should be evaluated, and modifications should be determined, if needed.

- (5) FUEL AND CONTROL ROOD PROCUREMENT
  Based on the number of fuel rods, safety rods, and adjuster rods to be procured, on the selection of the payment mode and on the detailed conversion schedule, the procurement activity should include selection of quality level criteria and of testing and acceptance criteria; determination of contract guarantee clauses and auditing procedures; preparation of detailed cost estimates; signing of contracts; early procurement of fuel samples for metallurgical, mechanical, and thermal-hydraulics testing; and, finally, shipment and delivery of finished products.

- (6) PROCUREMENT OF REACTOR COMPONENTS
  Depending on the features of the selected reactor configuration, some modified reactor components may need to be procured. These components may include additional moderator heat exchangers, and modifications to the control panel and to the adjuster rod reaggear.

- (1) OPERATING PROCEDURES
  A new set of operating procedures should be developed. In particular, reactivity considerations related to operational safety (see pp. A-13 to A-12 of ANL Report, April 1979) should be developed. Start-up procedures should also be developed, along with the procedures to be followed in achieving the first loading. The latter procedures should consider gradual insertion of the new fuel rods in the core, to test their performance and the accuracy of the calculations on which the conversion is based.

1. TRR SPENT FUEL TRANSFER: A joint DOE/INER program to develop a plan for the transfer of TRR spent fuel to the U.S. was discussed. Areas of U.S. and Taiwan planning responsibility were identified as were the steps required to implement the transfer. Participating in the spent fuel discussions were: Dr. Wu Chaw-Chin, Deputy Director
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Uranium projects wind down, Iker plans to place emphasis on further development of an inert solvent extraction process for separating rare earth elements from monazite heavy sand found on the coast of Taiwan. They said they were not interested in thorium extraction in this project.

Dr. Chen asked if the U.S. would support Iker restarting the uranium/thorium conversion project, which was discontinued at U.S. request, in the form of development work on the dematured fuel cycle. He said he thought the U.S. strongly supported this type of work.

11. Visit to hot laboratory (Z-20): A tour of the hot laboratory facility was taken on May 4, 1979. This facility appeared to be well designed and all of the equipment used for the examinations of spent fuel was in place and operating. The facility contains heavily shielded 10-foot halls composed of high density concrete and are segmented based on the metallurgical examinations required for spent fuel structural studies. During the visit, an irradiated TRR rod was being gamma-scanned to determine fuel-column integrity. Segmenting equipment was in place and operating. Space has been allocated for creep-test devices in one of the larger cells. Fuel rods may be moved from the TRR to the facility in a new stainless-steel end-loading transfer cask. The containment of the various areas was in accordance with U.S. practices; zonning is practiced and adequate off gas and waste systems have been provided to serve the facility. Closed circuit TV is employed for personnel surveillance.

12. Computer capability: The computer system shared by Iker and Chungsan Institute is a Cyber 70 model.

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73-28. THIS CDC SYSTEM HAS A CORE MEMORY OF 121672
60-BIT WORDS AND A DUAL CPU. THE EFFECTIVE CPU SPEED
IS 1.2 MIPS, LESS THAN A OF CDC 6600. THE
OPERATING SYSTEM IS NOSB WITHOUT ANY LOCAL MODIFICATIONS
AND THE SYSTEM SOFTWARE IS STANDARD CDC PRODUCT LINE.
I/O CAPABILITY INCLUDES SIX SINGLE DENSITY MODEL 244
DISK PACKS AND FOUR TAPE DRIVES. THE SYSTEM IS OPERATED
ALMOST EXCLUSIVELY IN BATCH MODE WITH MOST ACCESS THROUGH
CARD INPUT OVER THE COUNTER. REMOTE ACCESS IS LIMITED
BUT AVAILABLE BOTH ON-SITE AND AT VARIOUS LOCATIONS ON
THE ISLAND; E.G., WEATHER RESEARCH AT TAIPEI. THE
COMPUTER SYSTEM IS PRESUMABLY THE LARGEST FACILITY
ON THE ISLAND. A STAFF OF 28 IS RESPONSIBLE FOR
COMPUTER OPERATIONS, INCLUDING SYSTEM AND SOFTWARE
MAINTENANCE. THERE APPEARS TO BE TOTAL RELIANCE ON
CDC PERSONNEL FOR DETAILED HARDWARE AND SOFTWARE
TROUBLE-SHOOTING -- 2 CUSTOMER ENGINEERS ON-SITE.
THEN PERSONNEL IN TAIPEI, JAPAN, AND U.S. THE COMPUTER
IS SAID TO RUN 24 HOURS PER DAY, BUT THIS IS MISLEADING
IN THAT NO ACCESS TO THE MACHINE IS PERMITTED OTHER
THAN STANDARD WORK DAY AND VERY SMALL, IF ANY, STAFF
ARE AVAILABLE ON O/S-HIFTS. THEY SAY THAT ONE RECENT
MONTH SHOVED 500 CPU-HOURS. THIS STATISTIC IS USED
TO SUPPORT A CLAIM OF SATURATION AND THE NEED FOR NEW
HARDWARE. ALTHOUGH THERE IS A SUGGESTION THAT THEY
WOULD RETAIN A CDC SYSTEM IF A NEW MACHINE WERE LEASED
OR PURCHASED (MENTION WAS MADE OF A CYBER 75), IT SEEMS
CLEAR THAT THEY DO NOT HAVE A MAJOR SOFTWARE INVESTMENT
WHICH WOULD PRECLUDE SWITCHING TO ANOTHER U.S. OR
JAPANESE COMPUTER SYSTEM.

13. VISIT TO TRT FUEL FABRICATION PLANT: THIS PLANT IS
NEW AND MODERN WITH ABOUT 60,000 SQUARE FEET OF FLOOR
SPACE. EQUIPMENT IS TOP QUALITY FRENCH-BUILT (CERCA).
VALUE IS PERHAPS U.S. DOLLAR 7-9 MILLION FOR THE BUILDING
AND U.S. DOLLAR 6-10 MILLION FOR EQUIPMENT. ONE METAL-
LURGIST, MR. KUNG, HEADS THE FACILITY; HE CLAIMS TO
HAVE 40 STAFF PERSONNEL. TRT NATURAL URANIUM FUEL
PRODUCTION CAPABILITY IS ABOUT 200 RODS PER YEAR, AND
THEY CLAIM TO BE OPERATING AT THIS LEVEL. THE FACILITY
IS READILY ADAPTABLE TO VIRTUALLY ANY OTHER TYPE OF FUEL
FABRICATION OPERATIONS (U-235, UO2, ETC.) WITH INSTALLA-
TION OF A FEW KEY PIECES OF NEW EQUIPMENT.

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