(7-78)
10 CFR 110

APPLICATION FOR LICENSE TO EXPORT NUCLEAR MATERIAL AND EQUIPMENT *(See Instructions on Reverse)*

B-180225(R0362)

PDR

1. APPLICANT'S USE	a. DATE OF APPLICATION	b. APPLICANT'S REFERENCE	2. NRC USE	a. LICENSE NO.	b. DOCKET NO.
	1/7/82	MACPJ 3075KY		XSNM-1909	11002721

3. APPLICANT'S NAME AND ADDRESS — RIS

a. NAME: NISSHO IWAI AMERICAN CORPORATION

b. STREET ADDRESS: 1211 AVENUE OF THE AMERICAS

c. CITY: NEW YORK — STATE: NY — ZIP CODE: 10036

d. TELEPHONE NUMBER (Area Code – Number – Extension): 212-730-2255

4. SUPPLIER'S NAME AND ADDRESS *(Complete if applicant is not supplier of material)* — RIS

1982 JAN 11 AM 9 29

a. NAME: DEPARTMENT OF ENERGY OAK RIDGE OPERATIONS

b. STREET ADDRESS: P.O. BOX E

EXPORT/IMPORT AND INTERNAT'L SFGRDS

c. CITY: OAK RIDGE — STATE: TN — ZIP CODE: 37830

5. FIRST SHIPMENT SCHEDULED	6. FINAL SHIPMENT SCHEDULED	7. APPLICANT'S CONTRACTUAL DELIVERY DATE	8. PROPOSED LICENSE EXPIRATION DATE	9. U.S. DEPARTMENT OF ENERGY CONTRACT NO. (If Known)
OCTOBER, 1983	APRIL, 1984	SAME AS ITEMS 5 & 6	SEPTEMBER, 1985	

10. ULTIMATE CONSIGNEE — RIS

a. NAME: JAPAN ATOMIC ENERGY RESEARCH INSTITUTE

b. STREET ADDRESS: 2-2, Uchisaiwai-cho 2-chome, Chiyoda-ku

c. CITY – STATE – COUNTRY: Tokyo 100, Japan

11. ULTIMATE END USE *(Include plant or facility name)*

56.058 kg U for the fuel of the Japan Materials Testing Reactor (JMTR) in Oarai Research Establishment

11a. EST. DATE OF FIRST USE: September, 1984

12. INTERMEDIATE CONSIGNEE — RIS

a. NAME: NUCLEAR FUEL INDUSTRIES, LTD.

b. STREET ADDRESS: 23-5, Nishishinbashi 3-chome, Minato-ku

c. CITY – STATE – COUNTRY: Tokyo 105, Japan

13. INTERMEDIATE END USE

Fabrication of enriched uranium metal into fuel elements

13a. EST. DATE OF FIRST USE: December, 1983

14. INTERMEDIATE CONSIGNEE — RIS

a. NAME

b. STREET ADDRESS

c. CITY – STATE – COUNTRY

15. INTERMEDIATE END USE

15a. EST. DATE OF FIRST USE

16. NRC USE	17. DESCRIPTION (Include chemical and physical form of nuclear material; give dollar value of nuclear equipment and components)	18. MAX. ELEMENT WEIGHT	19. MAX. WT. %	20. MAX ISOTOPE WT.	21. UNIT
	Uranium Metal	56.058	93.30	52.302	kg

RECEIVED JAN 20 1982 US NUCLEAR REGULATORY COMMISSION DOCUMENT MANAGEMENT BR TIDC

22. COUNTRY OF ORIGIN–SOURCE MATERIAL	23. COUNTRY OF ORIGIN–SNM WHERE ENRICHED OR PRODUCED	24. COUNTRIES WHICH ATTACH SAFEGUARDS (If Known)
U.S.A.	U.S.A.	U.S.A.

25. ADDITIONAL INFORMATION *(Use separate sheet if necessary)*

8202020016 820107
PDR XPORT
XSNM-1909 PDR

26. The applicant certifies that this application is prepared in conformity with Title 10, Code of Federal Regulations, and that all information in this application is correct to the best of his/her knowledge.

27. AUTHORIZED OFFICIAL — a. SIGNATURE: [signature] — b. TITLE: Manager, Nuclear Energy & Equipment

Japan Atomic Energy Research Institute

2-2, Uchisaiwai-cho 2-chome, Chiyoda, Tokyo 100
Telephone: (03) 503-6111
Telex: J24596
Cable: JAERINIPPON TOKYO

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EXPORT/IMPORT AND INTERNAT'L SFGRDS

To whom it may concern :

END USE STATEMENT

The undersigners certify that a quantity of

56.058 kgs of uranium (93.30 % U-235 enriched)

in form of uranium metal containing 52.302 kgs of U-235 which will be furnished to us under the Adjustable Fixed Commitment Enrichment Contract and a metal-conversion contract with USDOE will be used by us for fuel elements of the Japan Materials Testing Reactor (JMTR) in our Oarai Research Establishment, Oarai, Ibaraki, Japan.

The enriched uranium metal shall be fabricated into fuel elements by Nuclear Fuel Industries Ltd., 23-5, Nishishinbashi 3-chome, Minato-ku, Tokyo 105, Japan.

We authorize Nissho-Iwai American Corp., 1211 Avenue of the Americas, New York, U.S.A. and/or Transnuclear, Inc., 5205 Leesburg Pike, Falls Church, Virginia, U.S.A. to apply for the export license.

JAPAN ATOMIC ENERGY RESEARCH INSTITUTE

Shoichi Takahashi
Shoichi Takahashi
Head, Division of Contracts

JMTR

CHECKLIST FOR USE IN REVIEW OF REQUESTS FOR
HIGHLY ENRICHED URANIUM TO DETERMINE
TECHNICAL AND ECONOMIC JUSTIFICATION

Date November 30, 1981

1. Name of Facility: Japan Materials Testing Reactor (JMTR)

2. Quantity of Uranium Requested (Kgs): 56.058 Kgs U in form of Uranium Metal

3. Enrichment in the Isotope U-235 (%): 93 %

4. Sale or Toll Enriching: Toll enriching

5. Current Core Loading (Kgs of U-235): Approx. 7 Kgs U-235

6. Current Power Level (MWth): 50 MWth

Criticality and Full Operating Power Dates and Power Rating (If request involves new facility): Criticality : December, 1969 50 MWth: January, 1970

8. Name of Convertor and Fabricator of Fuel: Convertor: USDOE

Fabricator: Nuclear Fuel Industries, Ltd., in Japan

9. Breakdown of Fuel Inventory (Kgs of U-235):

a. Amount of U-235 in Fabrication outside USA Including Scrap Allowances:
Approx. 40 Kgs U-235 (including the amount of U Metal on the way of transportation from U.S.A. to Japan)

b. Amount of U-235 in Storage in Completed, Unirradiated Fuel Elements:
Approx. 16.9 Kgs U-235

c. Amount of U-235 in Core: Approx. 7 Kgs U-235

d. Amount of U-235 in Spent Fuel Storage within the Community Including Chemical Reprocessing Plants, and the Reprocessing Schedule for Such Material:
Approx. 49.8 kgs U-235 in Spent Fuel Storage,
Approx. 33.9 kgs U-235 in the USDOE Savannah River Plant, and
Approx. 15.6 kgs U-235 on the way of transportation from Japan to USDOE SRP

e. Amount of U-235 Lost and/or Consumed During Operation of Above Facility:
Approx. 7 Kgs U-235/year

f. Amount of U-235 per Fuel Element: Standard Fuel Element: 0.279 Kgs U-235
Fuel Follower : 0.195 Kgs U-235

g. Average Core Life: 4 weeks

h. Average Lead Time for Conversion and Fuel Fabrication if Conversion and Fabrication is to be Done Abroad:
Approx. 2 years

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RESEARCH, TRAINING, AND TEST REACTOR DIRECTORY

1. GENERAL	
1.1 Reactor Name (Acronym)	Japan Materials Testing Reactor(JMTR)
1.2 License Number	
1.3 NRC Docket Number	
1.4 Reactor Address	Narita-cho, Oarai-machi, Higashi-Ibaraki-gun, Ibaraki-ken 311-13, Japan
1.5 Reactor Telephone	02926-7-4111
1.6 Reactor Owner	Japan Atomic Energy Research Institute
1.7 Reactor Operator	as above
1.8 Reactor Administrators	as above
1.9 Reactor Facility Staff	
a. Scientific/Technical	40
b. Operations	80
c. Support	20
d. Normal Number of Personnel in Reactor Containment/Confinement	30
1.10 Reactor Architect/Engineer	Japan Atomic Energy Research Institute, and NAIG, Hitachi, MAPI, Sumitomo and Dai-ichi groups
1.11 Reactor Constructor	NAIG, Hitachi, MAPI, Sumitomo and Dai-ichi groups
1.12 Organization/Country Supplying Nuclear Technology	Not applicable
1.13 Reactor Setting	Mar. 1965 (start of construction)
1.14 Reactor Operating Status	
a. Initial Criticality Date	Mar. 28, 1968

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b. Full Power Date	Jan. 12, 1970 (50 MW)
c. Operating Cycle	about one month/operation cycle
	5 operation cycles/year
d. Full Power Hours/Year	2800 hours
e. Pulses/Year, Average Energy	Not applicable
1.15 Reactor Facility Cost	12,000 million yen (including Hot Lab. and irradiation facilities)
1.16 Annual Operating Budget	2,000 million yen(excluding personnel expenses)

2. REACTOR

2.1 Reactor Type	Tank type, highly enriched uranium(93%), light water moderated and cooled
2.2 Reactor Vessel	
a. Configuration	See Fig.1
b. Overall Dimensions	9500 mm hight 2600 mm diameter
c. Material	stainless steel
d. Normal Operating Pressure	14 kg/cm^2-G(Inlet)
e. Normal Operating Temperature	42°C (Inlet)
2.3 Core	
a. Volume	102 l
b. Overall Dimensions	540 x 386 x 750 (mm) (Including in-core irradiation space)
c. Lattice Configuration	square pitch 77.2 mm
d. Number of Elements	
1. Standard	22
2. Control	5
e. Maximum Number of Grid Locations That can be used for Fuel	37
f. Normal Core ^{235}U Content	Approx. 6.6 kg
g. Subdivided Core	
1. Number of Subdivisions	None
2. Subdivision Differentiating Characteristics	None

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3. Number of Elements per Subdivision	None
2.4 Containment	
a. Type	Domed building
b. Volume	4×10^4 m^3
c. Material	Reinforced concrete, steel roof
2.5 Moderator	Light water
2.6 Blanket Gas	None
2.7 Reflectors	Beryllium
2.8 Thermal Shield	None
2.9 Biological Shield	Light water, concrete
a. External Radiation Levels	0.1 mR/hr
2.10 Power Level	
a. Normal Steady State	50 MW
b. Pulsing	Not applicable
2.11 Normal Average Thermal Power Density	
a. Volumetric (2.10.a/2.3.a)	490 KW/1
b. Linear (2.10.a/(Number of Plates/Pins x Plate/Pin Length))	1.46 KW/cm
2.12 Normal Specific Power (2.10.a/2.3.f)	7.58 KW/g
2.13 Reactor Control	
a. Safety Rods	
1. Number	4
2. Shape and Dimensions	63.5 mm square x 800 mm
3. Material and Loading	Hafnium, 10.7kg/element
4. Normal Withdrawal/Insertion Speed	200 mm/min. or 40 mm/min.
5. Scram Insertion Speed	800 mm/250 m·sec
6. Total Reactivity	17.3 % $\Delta k/k$

7. Average Reactivity Addition Rate	1.08 x 10^{-2} %Δk/k/mm/2rods
8. Scram Mechanism	Scram initiated by release of magnetic actuated spring actuator energized from core of driving mechanism canning
b. Regulating Rods	
1. Number	1
2. Shape and Dimensions	63.5 mm square x 800 mm
3. Material and Loading	Hafnium 10.7 kg/element
4. Normal Withdrawal/Insertion Speed	Variable 0 ~ 2000 mm/min.
5. Total Reactivity	0.5 % Δk/k (automatic control range)
6. Average Reactivity Addition Rate	5 x 10^{-3} % Δk/k/mm
c. Chemical Shim Control	
1. Chemical	Not applicable
2. Loading	Not applicable
3. Control Mechanism	Not applicable
4. Total Reactivity	Not applicable
d. Burnable Poison	
1. Isotopes Utilized	Not applicable
2. Location	Not applicable
3. Loading	Not applicable
4. Total Reactivity	Not applicable

3. FUEL

3.1 Standard Fuel Element	
a. Configuration	Modified ETR type
b. Element Dimensions	77.04 square at pad portion 1200 mm length
c. Overall Plate/Pin Dimensions	778 mm length 1.27 mm thickness

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d. Number of Plates/Pins per Element	19 plates
e. Distance Between Plate/Pin Centerlines	3.94 ~ 4.29
f. Active Portion of Fuel Plate/Pin	
1. Dimensions	750 mm length, 61.6 mm width 0.51 mm thickness
2. Composition	U-Al alloy
3. ^{235}U Enrichment	93 %
4. Fissile Material Density	0.62 g/cm^3
g. Reflector Portion of Fuel Plate/Pin	
1. Composition	None
2. Dimensions	None
h. Clad	
1. Composition	Aluminum
2. Thickness	0.38 mm
i. Structural Material	Aluminum

3.2 Control Rod Fuel Element

a. Specify Differences from Standard Fuel Elements	Element dimension: 63.64 square x 890 (mm) Number of fuel plate: 16 plates U-235 content: 12.19 g/plate

3.3. Fuel Cycle

a. Criteria for Refueling	Reactivity and burn up
b. Frequency of Refueling	2/cycle
c. Normal Element Lifetime	1 cycle
d. Burnup	
1. Average ^{235}U Burnup	20 %
2. Peak ^{235}U Burnup	34 %
3. Maximum Allowed ^{235}U Burnup	40 %
e. Number of Elements Replaced During Typical Refueling	25 elements/cycle
f. Spent Fuel	
1. Minimum Cooling Time	120 days
2. Maximum Amount in Storage	Approx. 2250 elements

g. Disposition of Spent Fuel	Spent fuel storage rack
h. Spent Fuel Shipping Cask	JMTR W5200 (cylindrical type, lead shielding dry cask)
i. Spent Fuel Handling	Double hook handling tool, under water
j. Fuel Failure Detection	During operation: 1. Detection of delayed neutron and γray included in primary coolant with BF_3 and NaI 2. Detection of γ ray included off gas with NaI Other; Wet sipping method with NaI

3.4 Fuel Inventory

a. Current Fissile Material Inventory Status	As of November 30, 1981
1. New Fuel In-Process	43.6 kgs U (NFI in Japan, and on the way transportation from USA to Japan)
2. New Fuel On Hand	62 elements
3. Fuel In-Core	27 elements
4. Spent Fuel In Storage	220 elements
5. Spent Fuel Being Reprocessed	56 kgs U (in USDOE SRP, and on the way of transportation from Japan to USDOE SRP)
6. Non-Fuel Special Nuclear Material	None
b. Fissile Material Inventory Needed to Assure Continuity of Operations	
1. New Fuel In-Process	125 elements
2. New Fuel On Hand	50 elements
3. Fuel In-Core	27 elements

3.5 Fuel Source

a. Fuel Fabricator	Nuclear Fuel Industries Ltd.(NFI). Japan
b. Fuel Supplier	USA
c. Fissile Material Origin	USA
d. Enrichment Supplier	USA
e. Method of Fabrication	1) U-Al alloy 2) Covered with Al plates by the picture flame method 3) Fuel element; the roll-swaging method

	f. Fuel Element Cost	9.500 thousand yen/element/75 elemen
4.	HEAT TRANSFER DATA	
4.1	Fuel Element Heat Transfer Area (No. of Plates/Pins x Active Plate/Pin Surface in Contact with Coolant)	1.76 m^2
4.2	Fuel Element Flow Area	3.75×10^{-3} m^2
4.3	Fuel Element Wetted Perimeter	2.63 m
4.4	Fuel Meat Thermal Resistivity	3.584 cm·sec·°C/cal
4.5	Clad-Coolant Heat Transfer Coefficient (at Hot Spot)	1.62×10^{-3} cal/cm^2·sec·°C
4.6	Heat Flux at Plate Surface	
	a. Normal Average Heat Flux	9.89×10^5 Kcal/hr·m^2
	b. Peak Heat Flux	
	1. Without Hot Channel Factors	3.78×10^6 Kcal/hr·m^2
	2. With Hot Channel Factors	4.05×10^6 Kcal/hr·m^2
	c. Axial Peaking Factor in Hot Channel (from Axial Fission Rate Distribution)	
	1. Without Hot Channel Factors	1.52
	2. With Hot Channel Factors	1.63
	d. Hot Spot Location	Lttice position ; H-8 (see Fig. 2)
4.7	Peak Operating Fuel Plate/Pin Temperature	
	a. At Plate/Pin Surface	
	1. Without Hot Channel Factors	141 °C
	2. With Hot Channel Factors	188 °C
	b. Inside Fuel Meat	
	1. Without Hot Channel Factors	150 °C
	2. With Hot Channel Factors	197 °C
4.8	Primary Coolant	Light water
4.9	Coolant Flow	
	a. Flow Direction	Down flow
	b. Flow Induced by	Centrifugal pump x 3
	c. Normal Flow Rate	6000 m^3/hr

d. Maximum Flow rate	6000 m^3/hr
e. Mean Core Flow Velocity	10 m/sec
f. Normal Core Inlet Temperature	42 °C
g. Normal Core Temperature Rise (ΔT)	7.2 °C
h. Peak Coolant Temperature Rise (ΔT) at hot Spot	
1. Without Hot Channel Factors	38 °C
2. With hot Channel factors	52 °C
i. Coolant Pressure at Core Outlet (Absolute)	11.7 kg/cm^2
j. Coolant Pressure at Hot Spot (Absolute)	
1. Without Hot Channel Factors	
2. With Hot Channel Factors	12.6kg/cm^2
4.10 Hot Channel Factors (Including Only effects Other than Nuclear Peaking; Specify Breakdowns)	
a. For Coolant Temperature Rise	1.35
b. For Film Temperature Rise	1.70
c. Others	None
4.11 Core Heat Dissipation System	Primary coolant → Heat Exchager → Secondar coolant → cooling tower (with cooling fan showering)
4.12 Shutdown Heat Removal System	Operating primary cooling system for about 5 hours
a. Worst Case Elapsed Time from Shutdown to Coolant Independence Without Fuel Distortion	
4.13 Emergency Core Cooling System	Emergency pump(500 m^3/hr) driven by Diesel generator

5. NUCLEAR DATA

5.1 Fuel Loading

a. Minimum Critical Mass	Approx. 5 kg U-235
b. Normal Core Loading (Beginning of Cycle at Rated Power)	Approx. 6.6 kg U-235
c. Maximum k_{excess} Components	
1. Temperature	0.3 % Δk/k
2. Equilibrium Xenon; 3. Equilibrium Samarium	4.1 % Δk/k
4. Xenon Override	
5. Burnup (Including Burnable Poison)	5.3 % Δk/k
6. Experimental Sample	
7. Others	0.5 % Δk/k
8. Total	10.2 % Δk/k (limit)
d. Shutdown Margin	0.81 (limit; 0.9)

5.2 Reactivity Coefficients

a. Temperature	
1. Moderator	-3.1×10^{-2} % Δk/k/ ℃
2. Doppler	
3. Fuel Expansion	
4. Burnable Poisons	
b. Void	-2×10^{-1} % Δk/k/% void

5.3 Neutron Flux Densities

a. Steady State Average Thermal	2.6×10^{14} $n/cm^2 \cdot sec$ (in fuel region)
b. Steady State Peak Thermal	3.6×10^{14} " "
c. Steady State Average Fast	1.8×10^{14} " "
d. Steady State Peak Fast	2.6×10^{14} " "
e. Peak Pulsing Power	Not applicable
f. Pulse Integrated Power	Not applicable

5.4 Pulsing Characteristics

a. Pulse Period	Not applicable

b. Full Width at Half Maximum	Not applicable
c. Maximum Frequency of Pulses	Not applicable
5.5 Fission Density	
a. Normal Average	2.0×10^{15} fission/element
b. Peak	7.8×10^{15} fission/element
c. Axial Peak/Average Ratio for Typical Element	1.52
5.6 Maximum Fission Product Inventory	3.7×10^{7} Ci/core
6. OPERATING EXPERIENCE	
6.1 Forced Outages per 100 Full Power Operating Hours Since Criticality	
a. Equipment Malfunction	0.199
b. Personnel Error	4.6×10^{-3}
c. Total	0.26
7. SAFEGUARDS	
7.1 Agency Responsible for Regulatory Jurisdiction	Nuclear Safety bureau, Science and Technology Agency
8. PAST MODIFICATIONS AND FUTURE PLANS	
8.1 Past Major Modifications	
a. Power Increase	None
b. Fuel Conversion	209 g U-235/element → 279 g - U-235/element
C. Other	None
d. Date	Oct., 1971
8.2 Future Major Modifications	
a. Power Increase	None
b. Fuel Conversion	Increasing uranium content of fuel element
c. Decommissioning	None
d. Other	None
e. Date	After
8.3 Future Reactors	
a. Type	High Flux Material Testing Reactor
b. Date	After ten years

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Irradiation Facilities	Description	Dimensions (Sample max.) (in mm)	Neutron Flux (n/cm/sec) Thermal	Neutron Flux (n/cm/sec) Fast	Gamma Flux (Rad/hr)
Beamports	None				
Convertor Blocks	None				
Irradiation Racks	None				
Pneumatic Tubes	..				
Neutron Source	None				
Reactor Core	Water Loop x 2	118ø x 750 1	$0.3 \sim 1 \times 10^{14}$	$1 \sim 2 \times 10^{13}$	
	Gas Loop	8.2ø x 750 1	"	"	
	Neutron Control Facility	32ø x 270 1	$0.1 \sim 1 \times 10^{14}$	$0.3 \sim 3 \times 10^{14}$	
	Hydraulic Rabbit x 2	26ø x 120 1	1×10^{14}	2×10^{13}	
	Irradiation Holes	36ø x 750 1	$0.1 \sim 3 \times 10^{14}$	$0.1 \times 20 \times 10^{13}$	
Reactor Pool	None				
Thermal Column	None				

9.1 REACTOR, LABORATORY, AND EXPERIMENTAL FACILITIES (Cont.d)

Laboratory Facilities	Description
Accelerator	None
Critical Assemblies	Securing the operation of JMTR and making the core configuration to perform accurate irradiations in JMTR
Gamma Sources	Not applicable
Hot Cells	The hot laboratory of JMTR consists of a concrete hot cave line and a lead cell line. They are mainly used for dismounting irradiated capsules and for post-irradiation examination of fuels and materials
Neutron Activation Analysis	None
Neutron Generator	None
Neutron Radiograph	None
Neutron Spectrometer	None
Radioisotope Laboratories	None

RESEARCH AND TECHNICAL PROGRAM AND REACTOR UTILIZATION SUMMARY

10.1 Research, Technical, and Training Program

1) Water reactor safety research
2) Research and development of the Very High Temperature Reactor
3) Fuel and material irradiation for Fast Breeder Reactor and Advanced Thermal Reactor
4) Materials irradiation for reactor materials
5) R & D on materials for fusion reactor
6) Basic research on material science

10.2 Principal Isotopes Produced

JMTR produces many kinds of Radioisotope and supplies them for industrial and medical used in Japan. The major nuclides of Radioisotope are P-32, S-35, Cd-58, Ir-192, C-14, Mo-99, Tm-170, Cr-51, etc. Antimony is also irradiated to produce neutron sources for reactor start-up in various domestic nuclear plants.

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11. COMPUTER CODES UTILIZED IN DESIGN

11.1 Neutronics — PDQ, UGMG, THERMOS

11.2 Structural Design

a. Reactor Vessel ______

b. Fuel ______

c. Containment ______

11.3 Heat Transfer ______

12 DECOMMISSIONED FACILITY DATA

12.1 Facility Structural Condition — None

12.2 Maintenance and Surveillance Program ______

12.3 Types and Quantity of Contamination Present ______

12.4 Types and Quantity of Stored Wastes Present ______

12.5 Facility Radionuclide Inventory ______

12.6 Planned Interim Disposition of Facility ______

12.7 Planned Ultimate Disposition of Facility ______

12.8 Estimate Volume of Radioactive Waste Generated by Decommissioning ______

13 FACILITY DESIGN AND OPERATION REFERENCE DOCUMENTS

JAERI 1056 ; Conceptual Design of the Japan Materials Testing Reactor

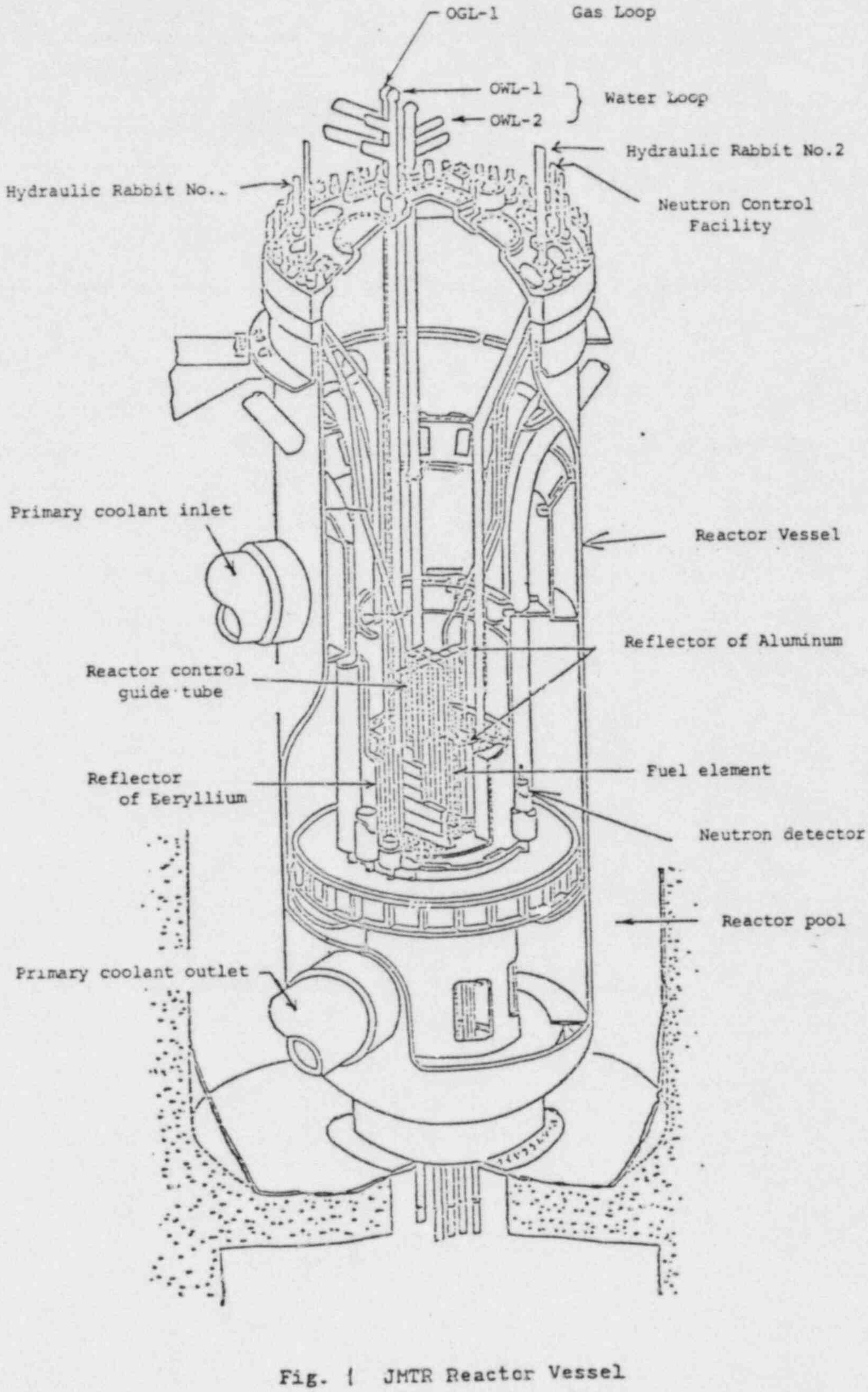

Fig. 1 JMTR Reactor Vessel

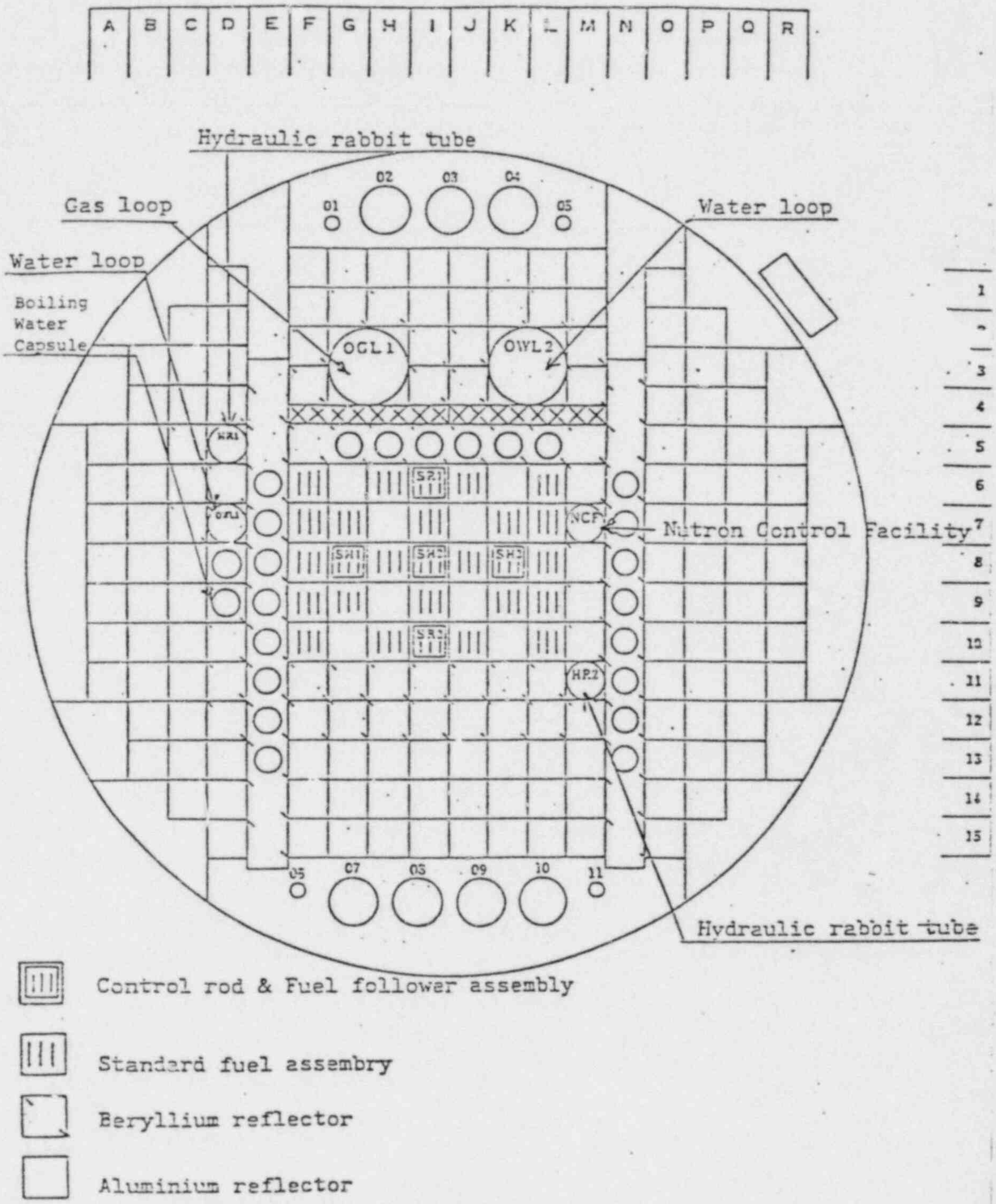

Fig. 2 JMTR Core Cross Section (Top View)