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NUCLEAR FUEL REPROCESSING AND MIXED-OXIDE FABRICATION SERVICES

Prepared for

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PNC
Tokai Mura Reprocessing Plant

1. Development and Status

The Power Reactor and Nuclear Fuel Development Corporation (PNC) was established on October 2, 1967, as the centralized national organization with responsibility for developing advanced power reactors and fuel designs in Japan. The organization, which replaced the former Atomic Fuel Corporation, was given the goal of developing Japan's fast breeder reactors and carrying out the prospecting, mining, milling, enrichment, fabrication, and reprocessing of nuclear fuel. Two of PNC's major functions, in connection with the reactor and fuel cycle development efforts, are the fuel reprocessing and fabrication of mixed-oxide fuel with facilities located at the PNC industrial complex called Tokai Works.

The initial conception of a reprocessing plant began in the mid-1960s, with Japan negotiating with the U.S. for American foreign aid to build the reprocessing plant. These negotiations were cut off in 1966 over a general concern about the spread of nuclear weapons. As a result, Japan selected the French company, Saint Gabain Techniques Nouvelles (SGN), builder of the Eurochemic reprocessing plant in Belgium, for detailed design of the reprocessing plant. The SGN contract also provided assistance from the Commissariat a l'Energie Atomique (CEA). PNC staff members were sent to CEA's La Hague reprocessing plant to coordinate the design work and participate in training programs.

In March 1969, a government committee report was published that documented the design review and gave assurance that the proposed plant was capable of safe operation. Based on the assurances of this committee, the prime minister of Japan formally approved the plant in January 1970. Initially, the complex was known as the Tokai Processing Works of the Nuclear Fuel Corporation. The Tokai plant was originally estimated to cost $36 million. Ultimate cost of the plant, including a pilot plant for cryogenic-krypton recovery from the reprocessing off-gas system, has been reported as about $350 million. The construction contract was signed between Japan Gasoline Company (JGC) and SNG in December 1970. Actual construction work on the Tokai Mura Reprocessing Plant began in June of the following year. Construction was completed in 1974.

The Tokai Mura reprocessing plant utilizes the Purex process. The plant has a capacity of about 0.7 metric tons of uranium per day or 210 metric tons per year based on operating at design capacity for 300 days per year. Nominal capacity would be approximately 120 metric tons per year based on operating at 90 percent of design capacity for 200 days per year. Hot-test operation began in 1977 with the initial commercial reprocessing campaign beginning in 1981. Through the end of 1982, a cumulative total of approximately 170 MTU of spent fuel has been reprocessed. A commercial-size domestic reprocessing plant with a 1,200 MTU per year capacity is being considered for the 1990s to meet all reprocessing demand.

The second reprocessing plant is being planned as a joint effort by government and private industry. Site selection, design, and construction of the plant is expected to be undertaken by private industry with indirect government aid in the form of low-interest loans. A company was established in 1980, Japan Nuclear Fuel Service Co., Ltd., with utility companies and manufacturers taking responsibility for the construction and operation of the proposed second plant. The government must yet negotiate a safeguards agreement with the relevant foreign government such as the United States. The broad prior consent that Japan considers necessary to the smooth operation of such a plant has not yet been attained.

Operation of the Tokai fuel reprocessing plant provides a source of plutonium that can be used, after conversion to an oxide powder, in the fuel fabrication program. The mixed-oxide fuel fabricated by PNC is restricted for research use only in accordance with the terms of a United States-Japan agreement. Accordingly, the applications for the fabricated fuel are in the reactor development programs and to furnish a source of fuel for the Fugen, Joyo, and Monju reactors.

2. Site Description

The site of the Tokai reprocessing plant encloses 220,000 square meters. The plant is bounded by the Pacific Ocean on the east and the Shinkawa River on the west. It forms a major part of the PNC Tokai Works complex.

The Tokai Works site is about 150 kilometers northeast of Tokyo. The site is adjacent to the Japan Atomic Energy Research Institute facility and the Tokai Nuclear Power Plant. The supporting facilities, docks, and access roads developed for these nuclear activities were important in selecting the site for the reprocessing plant.

In addition to the spent-fuel reprocessing facility, the Tokai Works encompasses the following major facilities:

- fuel inspection development laboratory
- fuel analysis development laboratory
- plutonium fuel development laboratory
- uranium enrichment development laboratory
- mixed-oxide fuel fabrication facility
- radioactive waste storage
- health and safety building
- supporting power station, shops, and utilities

The reprocessing site is accessible from the main Highway 6 via Connector Road 245. The nearest town and railroad is Katsuta, approximately 15 kilometers west. A dock equipped with a 125-MT capacity crane is available at the adjacent Tokai Nuclear Power Plant site. All incoming fuel shipments will arrive by oceangoing ships or by highway.

3. Facility Description

The main plant for fuel reprocessing is a large multistory building that houses the fuel receiving and fuel storage pool, cask cleaning and decontamination area, and the shielded chemical operation areas for dissolving, separating, and purifying the extracted products.

a. Fuel Reception and Storage
The truck and cask-receiving area is inside the main plant. The casks are transferred by crane to the cask unloading pit and unloaded. The fuel is then moved to the fuel storage pool.

b. The fuel processing is initiated by moving the fuel into the shielded cells for end-fitting removal and chopping the fuel rods into short segments.

c. The process tanks are stainless steel and sized to receive and hold the amount of mixed products permitted for criticality limits. The shield cells, or hot cells, in which the chemical treatments are performed are specially equipped for each operation in the process.

d. The gaseous effluents are exhausted through filters and monitors for release through the main stack.

e. A shielded storage space is provided for interim storage of high-level radioactive solid waste. A separate waste management facility is to be provided for vitrification of the high-level liquid waste from the reprocessing plant.

f. Outside the main building but adjacent to the reprocessing building are support buildings and facilities for the analytical laboratory, the decontamination shop, the water-cooling facility, the chemical tank form, low-level radioactive waste storage, uranium product storage, and machine shops.

4. Process Description

The Tokai Reprocessing Plant uses the Purex process with a mechanical chop-leach head end for the recovery operation. It has an LWR reprocessing design capacity of 0.7 metric tons of uranium per day. The plant is designed to produce uranium trioxide (UO_3) powder and plutonium nitrate ($PN(NO_3)_4$) solution, as its final products. With the co-conversion process used in plutonium fuel fabrication, the uranium may be left in the initial form ($UO_2(NO_3)_2$).

The major steps in a reprocessing process are briefly described as follows:

1. Spent Fuel Reception: The fuel is received on trucks from special ships. The casks are transferred to the receiving area and unloaded into the unloading pool. The spent fuel is then transferred to the fuel storage pool.

2. Chopping: The fuel-assembly end fittings are removed and the fuel is chopped into short segments to expose the fuel inside the cladding for chemical processing.

3. Dissolution: The fuel, including uranium, plutonium, and fission products, is dissolved in a hot nitric acid solution, leaving behind cladding hulls. The hulls are canned and stored on site. Off-gas is treated and released through the stack.

4. Separation: The fission products are separated from the uranium and plutonium by solvent extraction. The solvent is 30 percent TBP and 70 percent Dodecane. The uranium and plutonium are leached out by the solvent, while the fission products are scrubbed out by nitric acid. Mixer-settler cells are used for separation. The fission products are then stored as highly radioactive liquid waste.

5. Partition: The second extraction cycle separates the plutonium from the uranium. The plutonium is stripped out of the solvent solution by nitric acid containing uranyl nitrate plus hydrazine as a reducing agent.

6.a Uranium Purification: The uranium stream passes through further solvent extraction to remove remaining impurities.

.b Uranium Concentration and Denitration: The uranium solution is run through evaporators to concentrate the uranium and then is put through a denitrator, which converts it into the finished product, uranium trioxide. The uranium may be left as uranyl nitrate for the co-conversion process.

7.a Plutonium Purification: The plutonium stream also goes through further processing in order to remove any remaining uranium or fission products.

.b Plutonium Concentration: The plutonium solution is run through an evaporator in order to concentrate the plutonium into its finished product, plutonium nitrate. The plutonium may be left as a solution for the co-conversion process.

The main type of fuel processed is Zircaloy-clad, low-enriched uranium (up to a maximum of 4 percent enrichment) from light water reactors. Table IV.1 is a tabulation of the typical characteristics of the fuel being processed in the Tokai plant.

There are equipment variations in the fuel separation step that involve different types of continuous solvent extraction containers. The major varieties are the mixer/settler, pulse columns, and centrifugal contactors. The PNC plant, which uses French technology, employs mixer/settlers. The advantages of the mixer/settlers are their ease of design, low weight, and the fact that they maintain their concentration profiles upon shutdown. One concern in continuous solvent extraction systems in fuel reprocessing is time

to steady state. This time can be reduced, which is desired, by minimizing recycle streams and keeping as low as practicable the ratio of contactor volume to throughput rate. The necessary chemical reaction times must be provided in the contactor holdup times.

PNC has developed a process to reduce the release of krypton from the plant in the off-gas system. The process involves a cryogenic, krypton recovery system to reduce the release of the radioactive isotope to the environment.

PNC has also announced that it has started hot tests on glass solidification of high-level radioactive waste at the Chemical Process Facility at Tokai Works. This represents the first step in the development of a liquid waste disposal system for the reprocessing plant.

5. Reprocessing Operations

Construction of the Tokai Reprocessing Plant was completed in 1974. The plant then had to undergo extensive inspection and system checks and the personnel had to complete operator training. Hot tests using actual spent fuel from Japanese LWR power plants began in September 1977. Following the hot tests, several campaigns of preguarantee and guarantee testing were carried out between 1979 and 1980. On December 25, 1980, a government license for operation of the plant was received from the Minister of State for Science and Technology.

Milestones passed along the way in placing the reprocessing plant in service are described. The hot-tests of the plant were planned as four distinct campaigns. The first campaign was conducted using 3.3 tons of spent fuel from the Japan Power Demonstration Reactor of JAERI. This fuel was selected for its low average burnup (4,000 MWD/ton) and long cooldown. The second campaign was performed on BWR fuel, 4.7 tons from the Fukushima 1 reactor. The third campaign used 6.4 tons of PWR fuel from the Mihama 2 plant. Finally, the fourth campaign was to be performed as the hot-test guarantee tests (GT) and was planned to use both BWR and PWR fuel. The portions of the hot test were designated GT-BWR and GT-PWR, respectively. The GT-BWR test began in August 1978 but was interrupted after treating 4.7 tons of Fukushima 1 fuel due to the discovery of trace amounts of radioactivity from an acid recovery evaporator in the heating system.

Operation of the main plant was halted since radioactivity on the order of 10^{-3} per Ci/cm^3 was detected in the steam condensate piping, which is located outside the controlled area. Installation of a new evaporator was required and this operation under hot conditions took one year to complete.

The plant resumed operation in November 1979 after inspection and cold tests were conducted. A preguarantee test was next performed to confirm acceptable operation of the new evaporator and to reindoctrinate operator personnel. A total of 5.2 tons of fuel, both BWR-type fuel from Fukushima 1 and PWR-type fuel from Mihama 2, were processed. This test proved the performance of the plant before acceptance from the contractor. In January 1980, the GTPWR test began, using Mihama 2 fuel. A total of 6.8 tons were reprocessed to complete

the hot-test operations. These tests demonstrated the safe and successful operation of the plant with results as follows:

- The operability and safety of the equipment proved to be satisfactory.
- Design capacity of 0.7 MTU per day was demonstrated.
- Purities and yields of products (uranium and plutonium) were within predictable limits.
- The radioactivity discharged to the sea and air were less than expected.
- Accountability of nuclear material was acceptably valid, and material unaccounted for (MUF) was within a reasonable range.
- The collective dose equivalent to plant operators was 5.7 man-rem for three months. The average dose equivalent to an individual was 0.01 rem for the three-month period.

A total of 157 assemblies and 31 MTU of spent fuel were reprocessed during the hot-test operations, and about 168 kg of plutonium were recovered in liquid form. Part of the plutonium produced during the tests was transferred to the plutonium co-conversion test equipment in the plutonium fuel development facility. Although the operation of the reprocessing plant was satisfactory, several problems did arise during the hot-test operations. The problems can be summarized as follows:

1. In the JPDR campaign, large fragments of sheared channel boxes clogged the fuel distributor, which is connected to the dissolver. As a result, chopped fuels became trapped in the hopper of the distributor. Use of remotely operated facilities and reduction of the length of the chopped sections remedied the problem.
2. Crud buildup, mainly activated iron compounds, caused some trouble. The crud caused a significant increase of undissolved sludge in the dissolver solution, which placed a burden on the clarification step. Replacement of the filter cartridge and optimization of the filter mesh size were necessary.
3. Some iodine, which might vaporize in the acidic and boiling conditions of the various process steps, was detected in the plant exhaust ventilation system. This necessitated addition of silver zeolite filters to the ventilation system and frequent monitoring.

In Japan, regulations specify that this type of plant must pass a governmental licensing inspection of its performance to obtain official government approval for regular plant operation. Accordingly, the first cycle, from April to July, was conducted using 28.5 tons of BWR fuel. The fuel was from the JPDR plant and from the Fukushima 1, Hamaoka 1, and Shimane 1 reactors. The second cycle, from September to December, processed 19.5 tons of PWR fuel from the

Mihama 1 and Genkai reactors. The government license for regular operation was granted on December 25, 1980.

Regular commercial operation of the reprocessing plant was started in January 1981. During the first six months of the year, 26.8 MTU of BWR fuel was reprocessed. However, operations were suspended for three months of this time for repair of defects in the heating steam tubes of the acid recovery and distillation system. An additional 14 MTU of fuel was processed during the last half of 1981.

The second commercial campaign began in January 1982. By June a total of 30.9 MTU of fuel had been reprocessed. As of the end of December 1982, an additional 20.1 MTU of fuel was reported as processed, making a cumulative total of approximately 170 MTU that had been reprocessed at Tokai Mura between the beginning of operations in 1977 and December 1982.

Table 1

BASIC DATA

NAME:	:	Tokai Mura
ORIGINAL NOMINAL DESIGN CAPACITY	:	210 MTHM per year
EXPANDED CAPACITY/DATE	:	-
CURRENT NOMINAL CAPACITY	:	120 MTHM per year
STATUS	:	Shut down since February 1983 for repair of leaks in dissolver
OWNER	:	PNC
OPERATOR	:	PNC
MILESTONES	:	
• **ANNOUNCEMENT OF PLANS**	:	1966
• **START OF SITE CLEARANCE**	:	January 1970
• **START OF CONSTRUCTION**	:	June 1971
• **FIRST NUCLEAR MATERIAL ON SITE:**		September 1977
• **START OF OPERATION**	:	January 1982[1]

[1] A commercial plant of 1,200 MTHM per year under consideration.

Table 2

SITE DATA

LOCATION	:	Tokai Mura
NEAREST LARGE TOWN	:	Katsuta (15 km)
MAIN CONNECTIONS		
• **NEAREST HIGHWAY**	:	Highway 6 (12 km)
• **NEAREST RAILWAY STATION:**		Katsuta (15 km)
• **NEAREST PORT**	:	Tokai Nuclear Power Plant (15 km)
CASK ARRIVAL MODE	:	Truck

Table 3

FACILITY DATA

SPENT-FUEL RECEPTION

• **MODE**	:	Truck from special ships
• **MAXIMUM WEIGHT/DESCRIPTION**	:	110 MT/crane
• **CASK TYPES ACCEPTED**	:	Existing casks (Model HZ-75T and Excellox-3A)
• **CAPACITY (CASKS/DAY)**	:	NA
• **STATUS**	:	Operational

SPENT-FUEL STORAGE

• **MODE**	:	Wet (pool)
• **CAPACITY**	:	Not specified
• **U-235 LIMIT (% IN NEW FUEL)**	:	NA
• **PU-FISSILE LIMIT (% IN NEW FUEL)**	:	NA
• **BURN-UP LIMIT**	:	NA
• **STATUS**	:	In service

FUEL PROCESSING

• **CAPACITY**	:	210 MTHM per year
• **U-235 LIMIT (% IN NEW FUEL)**	:	Low-enriched mainly; up to 4% enrichment
• **PU-FISSILE LIMIT (% IN NEW FUEL)**	:	NA
• **BURN-UP LIMIT**	:	Approx. 28,000 MTU for low-enriched uranium feed; 3,900 MWD/MTU for natural uranium fuel
• **PROCESS TYPE**	:	PUREX

Table 3

FACILITY DATA
(continued)

- **SUPPLIER OF PROCESS TECHNOLOGY** : Saint Gobain Nucleaire; assistance from CEA
- **DESIGNER** : Saint Gobain Nucleaire
- **CONSTRUCTOR** : Japan Gasoline Company and Saint Gobain Nucleaire
- **STATUS** : Operational

STORAGE OF RECOVERED URANIUM

- **CAPACITY/FORM** : Capacity not known/Uranyl nitrate $UO_2(NO_3)_2$
- **STATUS** : Operational

STORAGE OF RECOVERED PLUTONIUM

- **CAPACITY/FORM** : Capacity not known/plutonium nitrate $Pu(NO_3)_4$
- **STATUS** : Operational

STORAGE OF FISSION PRODUCTS

- **CAPACITY/FORM** : Fission products from mixer-settler cells stored. Capacity not known. Vitrification of wastes planned.
- **STATUS** : Storage available; development of solidification/vitrification facilities under development.

Table 4

OVERVIEW OF THE CONTRACTUAL SITUATION FOR REPROCESSING COMMERCIAL LWR FUEL

(MTU)

Fuel-Trac®
September 1983

Country/Company	Reactor	Contracted Quantity	Fuel Shipped Through 1982	Fuel to be Shipped Through 1995	Fuel Reprocessed Through 1982	Fuel Stored by the End of 1982
JAPAN						
Chubu	Hamaoka	-	25.60	-	19.20	6.40
Chugoku	Shimane 1	-	39.60	-	30.10	11.50
Kansai	Mihama 1	-	23.00	-	13.90	9.10
	Mihama 2	-	27.20	-	25.50	1.70
Kyushu	Genkai 1	-	33.60	-	16.20	22.40
JAPC	Tokai 2	-	23.20	-	7.50	15.70
Shikoku	Ikata 1	-	19.60	-	19.60	0.00
TEPCO	Fukushima 1	-	39.10	-	23.40	15.70
	Fukushima 2	-	15.80	-	10.40	5.40

Table 5
REPROCESSING OF COMMERCIAL LWR FUEL THROUGH 1982 AND DISPOSITION OF RECOVERED PLUTONIUM

Fuel-Trac®
September 1983

Campaign Designation	Campaign Start/End Dates	Country/Company	Reactor Name	Quantity Reprocessed (MTU)	Plutonium Recovered ($kgPu_f$)	Disposition of Plutonium ($kgPu_f$)
HOT TEST						
BWR	January 1978- March 1978	JAPAN Tokyo Electric	Fukushima 1	4.7	18.3	-
PWR	March 1978- June 1978	JAPAN Kansai Electric	Mihama 2	6.4	38.0	-
GT-BWR	August 1978- August 1978	JAPAN Tokyo Electric	Fukushima 2	4.7	24.0	-
PGT	November 1979- December 1979	JAPAN Tokyo Electric	Fukushima 1	2.4	15.0	-
		Kansai Electric	Mihama 2	2.8	18.0	-
GT-PWR	January 1980- February 1980	JAPAN Kansai Electric	Mihama 2	6.8	49.0	-

Table 5
REPROCESSING OF COMMERCIAL LWR FUEL THROUGH 1982 AND DISPOSITION OF RECOVERED PLUTONIUM
(continued)

Campaign Designation	Campaign Start/End Dates	Country/Company	Reactor Name	Quantity Reprocessed (MTU)	Plutonium Recovered ($kgPu_f$)	Disposition of Plutonium ($kgPu_f$)
GURANTEE TEST						
Cycle 1	April 1980-July 1980	JAPAN				
		Tokyo Electric	Fukushima 1	11.6	34.0	-
		Chugoku	Shimane 1	13.3	88.0	-
		Chubu	Hamaoka 1	2.8	9.0	-
Cycle 2	September 1980-December 1980	JAPAN				
		Kyushu	Genkai 1	5.6	33.0	-
		Kansai	Mihama 1	13.9	66.0	-

Table 5
REPROCESSING OF COMMERCIAL LWR FUEL THROUGH 1982 AND DISPOSITION OF RECOVERED PLUTONIUM
(continued)

Campaign Designation	Campaign Start/End Dates	Country/Company	Reactor Name	Quantity Reprocessed (MTU)	Plutonium Recovered ($kgPu_f$)	Disposition of Plutonium ($kgPu_f$)
FIRST COMMERCIAL CAMPAIGN						
81-1A	January 1981- February 1981	JAPAN Tokyo Electric	Fukushima 1	4.7	140.0	-
		Chubu Electric	Hamaoka 1	1.9		-
81-1B	May 1981- June 1981	JAPAN Tokyo Electric	Fukushima 2	5.7		-
		Chubu Electric	Hamaoka 1	14.5		-
81-2	September 1981- December 1981	JAPAN Kyushu	Genkai 1	5.6	33.0	-
		Shikoku	Ikata 1	8.4	32.0	

Table 5
REPROCESSING OF COMMERCIAL LWR FUEL THROUGH 1982 AND DISPOSITION OF RECOVERED PLUTONIUM
(continued)

Campaign Designation	Campaign Start/End Dates	Country/Company	Reactor Name	Quantity Reprocessed (MTU)	Plutonium Recovered ($kgPu_f$)	Disposition of Plutonium ($kgPu_f$)
SECOND COMMERCIAL CAMPAIGN						
82-1A	January 1982-March 1982	JAPAN				
		Chugoku Elec.	Shimane 1	14.8	56.0	-
		Shikoku Elec.	Ikata 1	4.0	70.0	-
82-1B	March 1982-June 1982	JAPAN				
		JAPC	Tokai 2	4.1	15.0	-
		Shikoku Elec.	Ikata 1	7.2	32.0	-
		Kansai Electric	Mihama 2	0.8	3.0	-
82-2	September 1982-December 1982	JAPAN				
		JAPC	Tokai 2	3.4	14.0	-
		Kansai Electric	Mihama 2	8.7	56.0	-
		Kyushu Electric	Genkai 1	5.0	40.0	
		Chugoku Elec.	Shimane 1	2.0	9.0	

Table 6
REPROCESSING OF NON-COMMERCIAL REACTOR FUEL THROUGH 1982 AND DISPOSITION OF RECOVERED PLUTONIUM

Fuel-Trac®
September 1983

Campaign Designation	Campaign Start/End Dates	Country/Company	Reactor Name	Quantity Reprocessed (kgU)	Plutonium Recovered ($kgPu_f$)	Disposition of Plutonium ($kgPu_f$)
HOT TEST	September 1977-December 1977	JAPAN JAERI	JPDR	3300	4.2	-
GUARANTEE TEST						
Cycle 1	April 1980-July 1980	JAPAN JAERI	JPDR	800	NA	-

Table 7
SUMMARY OF REPROCESSING OPERATIONS THROUGH 1982

Fuel-Trac®
September 1983

	COMMERCIAL FUEL (MTU)					DEMONSTRATION AND RESEARCH REACTOR FUEL (kgU)		
Year	BWR	PWR	LWR	GCR	HWR	FBR	RR (HEU)	RR (LEU)
1977	-	-	-	-	-	-	3300	-
1978	9.40	6.40	15.80	-	-	-	-	-
1979	2.40	2.80	5.20	-	-	-	-	-
1980	27.70	26.30	54.00	-	-	-	800	-
1981	26.80	14.00	40.80	-	-	-	-	-
1982	24.30	25.70	50.00	-	-	-	-	-
Total	90.60	75.20	165.80	-	-	-	4100	

Table 8

SUMMARY OF THE DISPOSITION OF PLUTONIUM RECOVERED THROUGH 1982[1]

Fuel-Trac®
September 1983

Country/Company	Plutonium Recovered ($kgPu_f$)	Domestic Use		Sales			Loan			Stored	
		Reactor	Quantity ($kgPu_f$)	Buyer	Quantity ($kgPu_f$)	Final Use	Borrower	Quantity ($kgPu_f$)	Final Use	Location	Quantity ($kgPu_f$)
JAPAN	77330	-	-	-	-	-	-	-	-	-	-
JAERI											
Tokyo Electric											
Kansai Electric											
Chugoku Electric											
Chubu Electric											
Kyushu Electric											
Shikoku Electric											
JAPC											

ALL RECOVERED PLUTONIUM HAS BEEN USED IN FUEL FOR FUGEN, MONGU, AND JOYO WITH THE REMAINING STORED AT TOKAI WORKS

Table 9
ESTIMATES OF FUTURE REPROCESSING OF COMMERCIAL LWR FUEL THROUGH 1995
(MTU)

Fuel-Trac®
September 1983

Country	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Totals
FUTURE REPROCESSING OPERATIONS DEPEND ON REPAIRS CURRENTLY BEING DONE														

Table 10

ESTIMATES OF PLUTONIUM RECOVERED FROM FUTURE REPROCESSING OF COMMERCIAL LWR FUEL THROUGH 1995

($kgPu_f$)

Fuel-Trac®
September 1983

Country	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Totals	Potential Disposition of Plutonium
FUTURE REPROCESSING OPERATIONS DEPEND ON REPAIRS CURRENTLY BEING DONE															