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International Nuclear Fuel C
Fact Book

K. M. Harmon
L. T. Lakey
I. W. Leigh
A. G. Jeffs

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PNL-3594

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226-250	A011
251-275	A012
276-300	A013

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INTERNATIONAL NUCLEAR FUEL CYCLE FACT BOOK

K. M. Harmon
L. T. Lakey
I. W. Leigh
A. G. Jeffs

Issued November 1980
Latest Revision January 1986

Prepared for
the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest Laboratory
Richland, Washington 99352

DATE DUE

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PREFACE

As the US Department of Energy (DOE) and DOE contractors have become increasingly involved with other nations in nuclear fuel cycle and waste management cooperative activities, a need has developed for a ready source of information concerning foreign fuel cycle programs, facilities, and personnel. This Fact Book was compiled to meet that need.

The information contained herein has been obtained from many unclassified sources: nuclear trade journals and newsletters; reports of foreign visits and visitors; CEC, IAEA, and OECD/NEA activities reports; proceedings of conferences and workshops; etc.

The information in the Fact Book is subject to frequent change. If you have suggestions which would improve the usefulness of the book or if you can provide more current information, please let us know so that these changes can be included in periodic updates.

International Program Support Office
Nuclear Fuel Cycle and Waste Management Program Office
Pacific Northwest Laboratory
P.O. Box 999
Richland, WA 99352

Telephone/FTS: (509) 375-2697 or 375-2038
Telex: 15-2874

TABLE OF CONTENTS

TECHNICAL ACRONYMS

AFR	Away-from-reactor spent fuel storage facility
AGR	Advanced gas-cooled reactor, UO_2 fuel (UK)
ALONA	FRG acid digestion plant at Mol, Belgium
ATR	Advanced thermal reactor
AVH	AVM-type waste vitrification plant (La Hague, FR)
AVM	Atelier de vitrification de Marcoule (France)
BWR	Boiling water reactor
CANDU	Canada deuterium uranium reactor
D&D	Decontamination and decommissioning
ESTER	Multistage pot calcination-vitrification process for HLW (Italy)
FBR	Fast breeder reactor
FBTR	Fast breeder test reactor
FIPS	Fission product solidification process (FRG/KFA)
FRP	Fuel reprocessing plant
GCHWR	Gas-cooled, heavy water moderated reactor
GCR	Gas-cooled, graphite moderated reactor
GWd	Gigawatt days
GWe	10^9 watts of electricity (1000 MWe)
HAO	Oxide head-end
HARVEST	British waste vitrification process
HLLW	High-level liquid waste
HLW	High-level waste
HTGR	High-temperature, gas-cooled reactor
HTR	High-temperature reactor
HWLWR	Heavy water moderated, light water cooled (same as LWCHW)
HWR	Heavy water reactor
IFTF	Immobilized Fuel Test Facility (Canada)
ILW	Intermediate-level waste
KgHM	Kilograms heavy metal
KgU	Kilograms uranium
LGR	Light water cooled, graphite moderated reactor
LHGW	Low heat generating waste
LLW	Low-level waste
LLLW	Low-level liquid waste
LMFBR	Liquid metal fast breeder reactor
LWCHW	Light water cooled, heavy water moderated (same as HWLWR)
LWR	Light water reactor
MLW	Medium-level waste (same as intermediate-level)
MOX	Mixed (plutonium/uranium) oxide
Mtce	Million metric tons of coal equivalent
Mtoe	Million metric tons of oil equivalent
MTR	Materials test reactor
MW	Megawatts
MWd/t	Megawatt days per tonne
MWe	Megawatts electric
MWt	Megawatts thermal
NPT	Non-Proliferation Treaty

PAMELA	FRG vitrification pilot plant (Mol, Belgium)
PFR	Prototype Fast Reactor (UK)
PHWR	Pressurized heavy water reactor
PLWR	Pressurized light water reactor
PURR	Prototype d'usine de retraitement des rapids (FR)
PWR	Pressurized water reactor
QUAD	10^{15} Btu
t/a	Tons per annum
tHM	Tons heavy metal
tSWU/a	Tons of separative work (U enrichment) per annum
tU	Tons uranium per annum
TEKO	Nonradioactive semi-works facility (FRG)
THORP	Thermal Oxide Reprocessing Plant (UK)
THTR	Thorium high-temperature reactor
Th/U	Thorium/Uranium
TRU	Transuranic
TWh	Terawatt hour (million megawatt hours)
URL	Underground Research Laboratory
WIP	Waste Immobilization Plant (India)

INTRODUCTION AND OVERVIEW

INTRODUCTION

The International Fuel Cycle Fact Book has been compiled in an effort to provide 1) an overview of worldwide nuclear power and fuel cycle programs and 2) current data concerning fuel cycle and waste management facilities, R&D programs and key personnel. Additional information on each country's program is available in the International Source Book: Nuclear Fuel Cycle Research and Development, PNL-2478, Rev. 2.

The Fact Book is organized as follows:

- Overview section--summary tables which indicate national involvement in nuclear reactor, fuel cycle, and waste management development activities.
- National summaries--a section for each country which summarizes nuclear policy, describes organizational relationships and provides addresses, names of key personnel, and facilities information.
- International agencies--a section for each of the international agencies which has significant fuel cycle involvement.
- Energy supply and demand--summary tables, including nuclear power projections.
- Fuel cycle--summary tables.

TABLE 1. Reactor Mix

Country	Reactors Online, Ordered, or Under Construction (12-31-85) LWR	HWR	GCR	Other	Advanced Reactor Development
Argentina	--	3	--	--	--
Belgium	7	--	--	--	--
Brazil	3	--	--	--	--
Bulgaria	6	--	--	--	--
Canada	--	22	--	--	--
China (PR)	3	--	--	--	FBR, HTR
Czechoslovakia	10	--	--	--	--
Egypt	2	--	--	--	--
Finland	4	--	--	--	--
France	56	1	7	2 FBR	FBR
Germany (FRG)	21	--	--	1 FBR, 1 HTR	FBR, HTR
Germany (GDR)	7	--	--	--	--
Hungary	4	--	--	--	--
India	2	6	--	--	FBR
Italy	4	1	1	--	HWR, HTR
Japan	41	1	1	1 FBR	FBR, HWR
Korea (South)	8	1	--	--	--
Mexico	2	--	--	--	--
Netherlands	2	--	--	--	--
Pakistan	--	1	--	--	--
Philippines	1	--	--	--	--
Poland	6	--	--	--	--
Rumania	4	2	--	--	--
South Africa	2	--	--	--	--
Spain	7	--	1	--	--
Sweden	12	--	--	--	--
Switzerland	6	--	--	--	--
Taiwan	6	--	--	--	--
UK	--	1	40	1 FBR	FBR
USA	123	--	--	1 HTR, 1 LGR,	HTR, FBR
USSR	60	--	--	2 FBR, 23 LGR	--
Yugoslavia	1	--	--	--	--

TABLE 2. Fuel Production Program[a]

Country	Mining[b] & Milling	Conversion	Enrichment	Fuel Fabrication UO_2	Fuel Fabrication MOX
Argentina	X	X	X	X	R&D
Australia	X	--	R&D	--	--
Belgium	--	X	(c)	X	X
Brazil	X	X	X	X	--
Canada	X	X	--	X	--
France	X	X	X	X	X
Germany (FRG)	X	X	X	X	X
India	X	X	--	X	X
Italy	X	X	(c)	X	X
Japan	X	X	X	X	X
Korea (South)	R&D	R&D	--	R&D	--
Mexico	X	X	--	X	--
Netherlands	--	--	X	--	--
South Africa	X	X	X	--	--
Spain	X	--	--	X	--
Sweden	--	--	(c)	X	--
UK	--	X	X	X	X
USA	X	X	X	X	X
USSR	X	X	X	X	X
Yugoslavia	X	--	--	--	--

(a) Legend: X - industrial plant in operation or on order
R&D - R&D stages only

(b) Commercial mining and milling operations are also conducted in the following countries: Central African Republic, Gabon, German Democratic Republic, Namibia, Niger, Philippines and Portugal.

(c) Partnership in Eurodif enrichment plant in France.

TABLE 3. Spent Fuel Management and Waste Treatment Programs

Country	Spent Fuel Dry Storage	Fuel Reprocessing	Waste Conditioning HLW	Waste Conditioning Non-HLW
Argentina	R&D	R&D	R&D	X
Australia	--	--	R&D	--
Belgium	--	X	X	X
Brazil	--	R&D	R&D	R&D
Canada	R&D	R&D	R&D	X
Finland	R&D	--	--	X
France	X	X	X	X
Germany (FRG)	X	X	X	X
India	--	X	X	X
Italy	--	X	X	X
Japan	X	X	X	X
Mexico	--	--	--	X
Netherlands	--	--	--	X
Spain	--	--	--	X
Sweden	X	--	--	X
Switzerland	--	--	--	X
UK	X	X	X	X
USA	X	X	X	X
USSR	X	X	R&D	X

Legend: X - commercial facility planned or operating
R&D - R&D stages only

TABLE 4. Spent Fuel and Waste Disposal R&D Programs

Country	Spent Fuel Disposal	HLW Disposal	LLW/ILW Disposal
Argentina	--	X	X
Belgium	--	X	X
Brazil	--	--	X
Canada	X	X	X
Finland	X	X	X
France	--	X	X
Germany (FRG)	X	X	X
Germany (DGR)	--	--	X
India	--	X	X
Italy	--	X	X
Japan	--	X	X
Mexico	--	--	X
Netherlands	--	X	X
South Africa	X	X	X
Spain	X	X	X
Sweden	X	X	X
Switzerland	X	X	X
UK	--	X	X
USA	--	X	X
USSR	--	X	X

NATIONAL SUMMARIES

ARGENTINA


BOLIVIA
PARAGUAY
BRAZIL
Belo Horizonte
Sao Paulo
Santos
Rio de Janeiro
Salta
Resistencia
San Miguel de Tucumán
Corrientes
Posadas
Porto Alegre
Santiago del Estero
San Juan
Santa Fe
Córdoba
URUGUAY
Concordia
Mendoza
Rosario
Mercedes
Ezeiza
Buenos Aires (CNEA)
La Plata
ARGENTINA
Mar del Plata
Bahía Blanca
Arroyito
Pilcaniyeu
Chubut
Comodoro Rivadavia
Falkland Islands
Río Gallegos
Tierra del Fuego
0 400 800 km
0 500 mi
N

ARGENTINA

MAJOR PUBLIC HOLIDAYS (1986)

Jan 1	New Year	July 9	Independence Day
Jan. 6	Epiphany	Aug. 15	Assumption
Feb. 9-11	Carnival	Aug. 17	General San Martin
March 27	Holy Thursday	Oct. 12	Columbus Day
March 28	Good Friday	Nov. 1	All Saints
May 1	Labor Day	Nov. 6	Bank Holiday
May 25	Revolution Anniv.	Dec. 8	Immac. Conception
May 29	Corpus Christi	Dec. 25	Christmas
June 20	Flag Day		

TIME

Standard Time Washington D.C.: **+ 2 hours**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States; in addition, a visa is currently required for a visit to Argentina. Most travel agencies can provide up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 80.5 Peso

per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Argentina are complete as listed; dial international access code: **011 + 54 + local number.**

US EMBASSY - BUENOS AIRES

American Embassy
4300 Colombia, 1425
Buenos Aires
Argentina

Tel: 54-1-774-7611
Telex:

Science Attache — William S. Tilney

ENERGY

Population	1984	30 million
Energy Demand	1979	40 Mtoe
Electric Power Plant Capacity	1980	12 GWe
Electric Power Production	1982	27.1 TWh-- 50% oil/coal 40% hydro/geoth **10% nuclear**

NUCLEAR POWER

Policy: High priority on self-sufficient CANDU-based nuclear power industry; government ownership and operation of all nuclear power plants; develop nuclear plant and services export capability.

Nuclear Power Plant Capacity	1986	0.9 GWe
	1990	0.9 GWe
	2000	1.6 GWe
Reactor Mix	1986	HWR: 2 (1974-83) 1 (1988)

INDUSTRIAL FUEL CYCLE

Policy: Develop gaseous diffusion capability for U enrichment (Pilcaniyeu), D_2O production and all phases of the CANDU-type PHWR fuel cycle; may export Pu to breeder nations.

Waste Management Strategy: Reprocess spent fuel; vitrify HLW in pot process; dispose of HLW glass canisters in granite host-rock repository.

Cumulative Spent Fuel Arisings (HWR)	1980	416 tU
	1985	940 tU
	1990	1,900 tU
	2000	5,800 tU

Demonstration/Production Activities

- D_2O production: 1984--200 t/a D_2O enrichment plant, supplied by a Swiss firm; develop domestic technology.

- Uranium mining and milling (t/a):
  1981--260; 1985--680.
  Uranium enrichment: 500 kg/a of 20% enriched U--1985.

- Conversion of yellowcake to UO_2;
  UO_2 fuel fabrication.

ORGANIZATION

- **CNEA** (Comision Nacional de Energia Atomica)--National Atomic Energy Commission, owns and operates all facilities.

CNEA (National Atomic Energy Commission)

Comisión Nacional de Energía Atomica (CNEA)
Avenida del Libertador 8250
1429 Buenos Aires — Tel: 54-1-70-7711
Argentina — Telex: 121 388

President — Alberto Constantini

EZEIZA ATOMIC CENTRE

Location: 40 miles northwest of Buenos Aires, near airport.

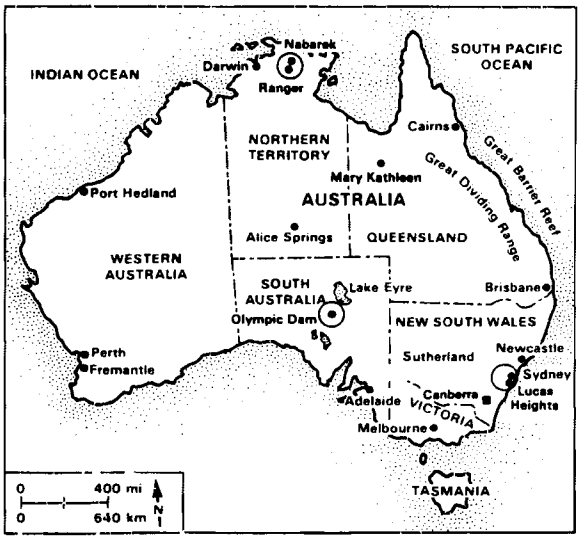
Facilities

- Conversion of yellowcake to UO_2 (150 tU/a).

- Fuel production: the first of three planned fabrication lines started up in 1982; capacity, 1-1/2 PHWR assembly per day; MOX fuel R&D.

- Fuel reprocessing: Ezeiza pilot plant, planned capacity of 20 kgU/day feed, 10-15 kgPu/a product; cold runs--1987. Potential--expansion of pilot plant to commercial facility with 160 kg/d capacity (1990s).

AUSTRALIA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SOUTH PACIFIC OCEAN
Nabarek
Darwin
Ranger
Cairns
NORTHERN TERRITORY
Great Barrier Reef
Great Dividing Range
Mary Kathleen
AUSTRALIA
Port Hedland
Alice Springs
QUEENSLAND
WESTERN AUSTRALIA
SOUTH AUSTRALIA
Lake Eyre
Brisbane
Olympic Dam
NEW SOUTH WALES
Perth
Fremantle
Sutherland
Newcastle
Sydney
Lucas Heights
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Adelaide
VICTORIA
Melbourne
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AUSTRALIA

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
January 26	Australia Day
March 28	Good Friday
March 30-31	Easter
April 25	ANZAC Day
December 25-26	Christmas

TIME

Standard Time Washington D.C.: (New S. Wales) **+ 15 hours**

Standard Time period: **03/02 - 10/25/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States. In addition, a visa is currently required for a visit to Australia. Most travel agencies can provide up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 1.4648 Australian Dollar
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Australia are complete as listed; dial international access code: **011 + 61 + local number.**

US EMBASSY - CANBERRA

American Embassy
Moonan Place, Yarralumla
Canberra Tel: 61-62-73-3711
Australian Capital Territory 2600 Telex:

ENERGY

Population	1984	15.5 million

Energy Resources: production exceeds consumption by about 20%, but Australia imports 38% of its oil.

Electric Power Production	1983	106.3 TWh-- 73% coal 13% hydro/geoth 9% gas 5% oil

NUCLEAR POWER

Policy: No nuclear power installed; none planned. Large uranium reserves; uranium currently produced for export. Government sponsors nuclear R&D.

ORGANIZATION

* Ministry of State for Resources and Energy.
* AAEC--Australian Atomic Energy Commission (expected to be replaced during 1986 by ANSTO--Australian Nuclear Science and Technology Organization).
* Lucas Heights Research Laboratory.

INTERNATIONAL RELATIONSHIPS

Member State of IAEA and OECD/NEA. Cooperative agreements with Japan, Italy and the UK for development of the SYNROC process. Bilateral safeguards agreements (control use of Australian-derived Uranium) with Japan, Republic of Korea, Philippines, USA, Canada, United Kingdom, France, Switzerland, Sweden, Finland, and Euratom (EC).

AAEC

Expected to be replaced by ANSTO (Australian Nuclear Science and Technology Organization), consisting of 7-member Executive and up to 11-member advisory council, with the principal function of R&D in nuclear science and technology.

Chairman	Prof. Max H. Brennan

AAEC (contd)

Australian Atomic Energy Commission
Lucas Heights Research Laboratory
New Illawarra Road, Lucas Heights
Private Mail Bag
Sutherland N.S.W. 2232 Tel: 61-2-543-3111
Australia Telex: 24562

Director, Research	Dr. D. G. Walker
Deputy Director, Research	Dr. P. M. Kelly
Deputy Director, Operations	Dr. R. Smith
Materials	Dr. K. U. Snowden
Environmental Science	Dr. D. R. Davy
Nuclear Technology	D. R. Ebeling

Fuel Cycle R&D: HLW immobilization (SYNROC process development and waste form properties), mill tailings treatment (actinide transport, surface hydrology, and radionuclide release).

Facilities

* **Nonradioactive SYNROC Fabrication Plant**
Mission: Engineering-scale tests of SYNROC process.
Design Basis: 10 kg/hr SYNROC (40 cm); all operations compatible with remote handling; highly instrumented and partly automated.
Milestone: Commissioning, 1986.

* **SYNROC Glove Box Line**
Mission: Produce SYNROC containing actinides/^{99}Tc.
Process Scale: Hundreds of grams.
History: Startup, 1984.

Hot-Cell Processing Line for SYNROC
History: Startup, 1984.

AUSTRALIAN NATIONAL UNIVERSITY

Australian National University
P.O. Box 4
Canberra 2600
Australia

Director, Research School of Earth Sciences	Prof. A. E. Ringwood

Waste Management R&D: HLW immobilization (SYNROC process).

GRIFFITH UNIVERSITY

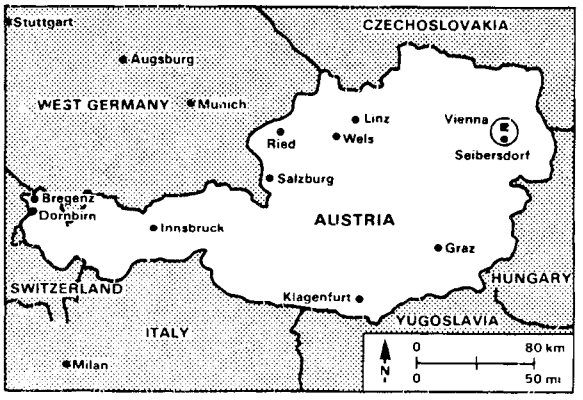
Griffith University
Nathan, Queensland
Australia 4111

Tel: 61-7-275-7111
Telex: AA40362

Chancellor — Sir Theodore Bray

Fuel Cycle/Waste Management Activities: Contract R&D.

AUSTRIA


Stuttgart
Augsburg
WEST GERMANY
Munich
CZECHOSLOVAKIA
Linz
Vienna
Ried
Wels
Seibersdorf
Salzburg
Bregenz
Dornbirn
Innsbruck
AUSTRIA
Graz
SWITZERLAND
HUNGARY
Klagenfurt
YUGOSLAVIA
ITALY
Milan
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80 km
0
50 mi

AUSTRIA

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year	June 1	Corpus Christi
January 6	Epiphany	August 15	Assumption
March 28	Good Friday	October 26	National Day
March 30-31	Easter	November 1	All Saints
May 1	Labor Day	December 8	Im. Conception
May 8	Ascension	Dec. 25-26	Christmas
May 18-19	Pentecost		

TIME

Standard Time Washington D.C.: **+ 6 hours**

Daylight Saving Time period: **03/30 - 09/27/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States. A visa is currently not required for a visit to Austria; however, it is recommended to consult a travel agency for up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 17.14 Schilling
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Austria are complete as listed; dial international access code: **011 + 43 + local number.**

US EMBASSY - VIENNA

American Embassy
Boltzmanngasse 16, District IX
A-1091 Vienna
Austria

Tel: 43-222-231-5511
Telex:

ENERGY

Population	1983	7.6 million
Energy Demand	1979	27 Mtoe (50-60% imported)
Oil Demand	1980	12.7 Mtoe (88% imported)
Electric Power Plant Capacity	1983	13 GWe
Electric Power Production	1983	42.6 TWh-- 72% hydro/geoth. 10% coal 10% gas 8% oil

NUCLEAR POWER

Policy: Government sponsors R&D on reactor safety, waste treatment and waste isolation. 0.7 GWe nuclear plant at Zwentendorf completed but not approved for operation.

INDUSTRIAL FUEL CYCLE

Policy: Initial--depend on foreign suppliers. Currently negotiating with China on long-term storage and disposal of spent fuel.

ORGANIZATION

* OEFZS--Austrian Research Center Seibersdorf - responsible for waste treatment and disposal R&D. Headquartered in Vienna with a laboratory at Seibersdorf.

GEOLOGICAL SURVEY

Geological Survey of Austria
Rasumofskygasse 23
A-1031 Wien
Austria

OEFZS (Austrian Research Center Seibersdorf)

Oesterreichisches Forschungszentrum
Seibersdorf GmbH
Lenaugasse 10
A-1082 Vienna
Austria
Tel: 43-222-42-7511
Telex: 7-5400

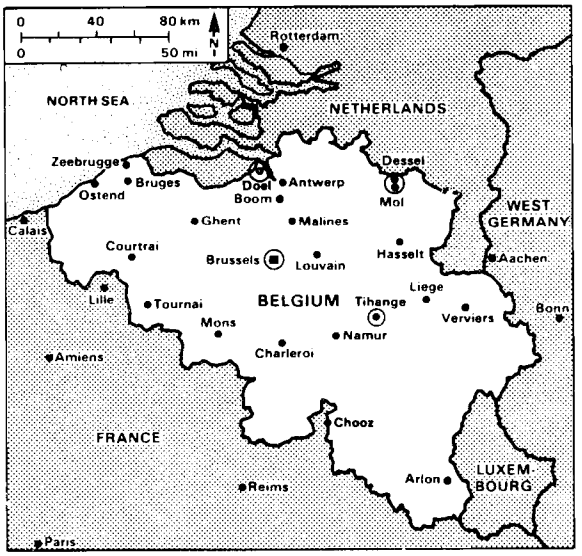
A-2444 Seibersdorf
Austria
Tel: 43-2254-80-0
Telex: 14-353

Waste Management	Dr. Peter Krejsa 43-2254-80-2541
Incineration Material Test, Cementation	Dr. Peter Patek 43-2254-80-2568
Bituminization	Dr. Karl Knotik 43-2254-80-2405

Owners: Government, industry, and utilities.

Waste Management R&D: HLW immobilization, LLW and ILW treatment, waste isolation in granite formations (geology, hydrology, heat transfer, corrosion, barrier materials, and risk analysis).

BELGIUM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Rotterdam
NORTH SEA
NETHERLANDS
Zeebrugge
Bruges
Ostend
Doel
Antwerp
Boom
Dessel
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WEST GERMANY
Calais
Ghent
Malines
Courtrai
Brussels
Louvain
Hasselt
Aachen
Liege
Lille
Tournai
BELGIUM
Tihange
Verviers
Bonn
Mons
Namur
Charleroi
Amiens
Chooz
FRANCE
LUXEM-BOURG
Arlon
Reims
Paris

BELGIUM

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year	July 21	National Day
March 30-31	Easter	August 15	Assumption
May 1	Labor Day	November 1	All Saints
May 8	Ascension	November 11	Armistice Day
May 18-19	Pentecost	December 25	Christmas

TIME

Standard Time Washington D.C.: **+ 6 hours**

Daylight Saving Time period: **03/30 - 09/27/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States. A visa is currently not required for a visit to Belgium, however, it is recommended to consult a travel agency for up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 49.82 Franc
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Belgium are complete as listed; dial international access code: **011 + 32 + local number.**

US EMBASSY - BRUSSELS

American Embassy
40 Boulevard du Regent, B3
B-1000 Brussels
Belgium

Tel: 32-2-513-3830
Telex: 84-621336

USDOE Representative, Energy and Resources Office — Dana M. Marshall

ENERGY

Population	1983	9.9 million
Energy Demand	1982	41.6 Mtoe (84% imported)
Oil Demand	1982	19.8 Mtoe (100% imported)
Electric Power Plant Capacity	1983	15.0 GWe
Electric Power Production	1983	52.7 TWh-- **46% nuclear** 32% coal 13% oil 7% gas 2% hydro/geoth.
	1985	**>60% nuclear**

NUCLEAR POWER

Policy: Complete the LWRs currently under construction; evaluate addition of an eighth (1300 MWe) unit. Produce base load electricity by nuclear and coal power plants.

Nuclear Power Plant Capacity	1986	5.4 GWe
	1995	5.4 GWe
	2000	6.7 GWe
Reactor Mix	1985	PWR: 7 (1975-85)

INDUSTRIAL FUEL CYCLE

Policy: Well-rounded capability--uranium enrichment (share in Eurodif); MOX and UO_2 fuel fabrication; purchase of foreign reprocessing services; decision on resuming operation of former Eurochemic plant pending.

Waste Management Strategy (responsibility of ONDRAF): Vitrify HLW and store [(50 years) investigation of HLW disposal in clay formation underway]; treat and immobilize other wastes; sea-dumping of LLW halted (pending LDC approval); shallow-ground disposal under investigation.

Cumulative Spent Fuel Arisings (LWR)	1980	196 tU
	1985	560 tU
	1990	1,290 tU
	2000	3,000 tU

Major Milestone

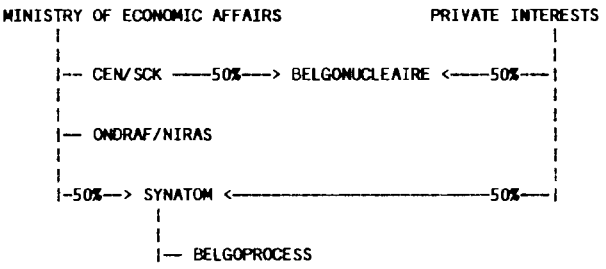
- Industrial repository (ILW, TRU) Late 1990s

INTERNATIONAL RELATIONSHIPS

US: **DOE/SCK Umbrella Agreement for Waste Management Exchange**
- Term: 1-19-81 to 1-18-89.
- Scope: Terminal storage in geologic formations; technology of retrievable storage; waste processing technology; environmental effects.
- Emphasis: General information exchange.

Member of EC, IAEA, OECD/NEA. Partnership in Eurodif uranium enrichment plant (France) and in SNR-300 LMFBR demonstration project (FRG). Belgian URL at Mol is co-sponsored by CEC.

ORGANIZATION



BELGONUCLEAIRE

Belgonucleaire S.A.
Rue du Champ de Mars 25
B-1050 Brussels
Belgium

Tel: 32-2-513-9700
Telex: 22187 nucbru b.

General Manager — J. Van Dievoet

Mission: Provide engineering services for nuclear power plants, nuclear fuel cycle facilities, and waste treatment plants; fabricate MOX fuels.
Sponsor: CEN/SCK (50%), utilities/holding companies (50%).

BELGONUCLEAIRE (contd)

Facilities

* **MOX Plant** (at Dessel, near Mol)
  Mission: Produce MOX fuels for FBRs and LWRs.
  Design Capacity: 38 t/a LWR fuel, 7 t/a FBR fuel.
  History: Startup, 1973.

BELGOPROCESS

Belgoprocess
B-2400 Mol
Belgium
Tel: 32-14-312-861
Telex: 31-924

[Brussels National Airport (Zaventem); then by rental car, (1-1/2 hours), or train to Mol.]

Managing Director	H. Meyers
Industrial Development Lab.	J. Van Geel
Plant Operations	J. Claes

Activities: Maintenance of ex-Eurochemic facilities; medium-level waste conditioning; technical support to FRG PAMELA pilot plant (Mol).

Facilities

* **Eurowetcomb** (hot pilot plant-acid digestion)
  Mission: Wet combustion of combustible TRU wastes and Pu recovery.
  Design Basis: Acid digestion with H_2SO^4-HNO^3.
  History: Startup, 1980.

* **Eurobitum** (bituminization plant)
  Mission: Immobilize ILW.
  Design Basis: Batch chemical pretreatment; screw extruder-evaporator (continuous); capacity, 650 m^3/a ILW.
  History: Startup, 1978; on-stream time, 87% through June 1983. Plant now operated batchwise.

* **Fuel Reprocessing Plant**
  Original Mission: Reprocess low- and high-enriched metal and oxide fuels from test reactors for Eurochemic partners.
  Original Design Basis: Chemical decladding; PUREX flowsheet; contact maintenance. Capacity, 350 kgU/day for natural and low-enriched uranium fuels, 250 kgU/day for 1.6-5% ^{235}U fuels, 5-10 kgU-Al/day for HEU fuels.

BELGOPROCESS (contd)

Operating History: Operated from 1966-1974, treating 180 tU in low-enriched fuels, including 100 tU in LWR/oxides, to yield 67 m^3 HLW; 30 t high-enriched fuels, to yield 806 m^3 HLW. The plant has been decontaminated and is now under Belgium ownership. Renovation and recommissioning is currently under study by SYNATOM. Contacts with potential foreign partners being pursued.
Renovation Design Basis: 1 MTHM/day (up to a nominal 150 MTHM/a); chop-leach head-end for LWR fuels.

* **ALKEM Acid Digestion Plant** (FRG facility, see KfK, GE-10).

* **PAMELA HLW Vitrification Pilot Plant** (FRG facility, see DWK, GE-8).

CEN/SCK (Nuclear Energy Research Center)

Centre d'Etude de l'Énergie Nucleaire/
Studiecentrum voor Kernenergíe
Laboratory of the CEN/SCK
Boeretang 200
B-2400 Mol
Belgium
Tel: 32-14-31-1801
Telex: 31-922 Atomol

General Manager	S. Amelinckx
Fuel Cycle	P. Dejonghe
Chemistry	L. H. Baetsle
Waste	N. L. C. Van de Voorde
Geological Disposal	A. A. Bonne

Sponsor: Government--Ministry of Economic Affairs.

Waste Management R&D: FBR fuel reprocessing (head-end and offgas treatment), incineration of TRU wastes, immobilization of cladding hulls, LLW treatment, geologic waste isolation in clay formations.

Facilities

* **HERMES Pilot Plant** (Head-End Research facility on Mockup Engineering Scale)
Mission: Develop head-end treatment technology for LWR fuels.
Design Basis: Chop-leach; silver zeolite and cryogenic treatment of offgas.

CEN/SCK (contd)

Process Components: Double-pin chopper, critically safe dissolver, centrifugal filtration for solution clarification, fuel residue dissolver, "super dissolver" for cleanup of hulls, off-gas scrubbers, treatment of hulls by high-pressure compaction, encapsulation of compacted hulls.
Throughput: 10 kg irradiated fuel (20-30% PuO_2 in UO_2) per batch.
History: Hot operation, depending on authorization and budget allocation.

* **FLK Slagging Incinerator** (radioactive)
Mission: Volume reduction of combustible, and of selected noncombustible, low-activity TRU wastes.
Design Basis: High-temperature combustion (1200-1500°C); capacity, 50-100 kg/hr; product, unsoluble granular slag.
History: First tests with Pu-bearing wastes (tens of grams Pu in several tons of waste), 1983.

* **CEN/SCK Bituminization Plant**
Mission: Immobilize Belgian LLW.
Design Basis: Stirred evaporator, batch process; capacity, 60-80 l/hr liquid LLW or 15-20 l/hr dried sludge.
History: Startup, 1964.

* **Underground Research Laboratory**
Mission: In-situ investigation in a deep clay formation to develop technology for disposal of ILW, TRU waste, and HLW.
Description: Access shaft to -230 m level, 2.65 m useful dia; laboratory gallery, 3.5 m useful dia by 30 m length; cast iron liner.
Test Program: Geomechanical behavior of clay around underground structures, water-flow measurements, in-situ heater tests, clay stability studies, liner stresses, borehole atmospheres, corrosion; test emplacement of HLW and TRU incinerator residues.
History: Laboratory operational, late 1984.

FBFC (French-Belgian Fuel Fabrication Company)

Société Franco-Belge de Fabrication de Combustibles
FBFC **(Plant)**
Europalaan 12
B-2480 Dessel
Belgium

Tel: 32-14-31-5851
Telex: 32357 Sofaco B

Plant Manager — M. Huberlant

FBFC (contd)

Function: Fabrication of fuel assemblies for LWR (capacity: 400 t/a). 50% French/50% Belgian.

FBFC Tour Manhattan-La Defense (Administrative)
6 Place de l'Iris
F-92400 Courbevoie, France

MINISTRY OF ECONOMIC AFFAIRS

Ministry of Economic Affairs
Administration of Energy
Rue de Mot, 30
B-1040 Brussels — Tel: 32-2-233-6636
Belgium — Telex: 23509 ENERGI B

ONDRAF/NIRAS (National Institute for Radioactive Wastes and Fissile Materials)

Organisme National des Dechets Radioactifs
et des Matieres Fissiles (ONDRAF/NIRAS)
Boulevard du Regent 54
B-1000 Brussels — Tel: 32-2-513-7460
Belgium — Telex: 65784 Nirond

Chairman, Board of Directors	M. Frerotte
Chairman, Perm. Tech. Committee	F. Deconinck
General Manager	E. Detilleux
Tech. Manager/Deputy General	F. Decamps

Sponsor: Government.

Function: Organize for transportation of radioactive materials, waste conditioning and interim storage, spent fuel AFR storage, waste disposal Pu storage; define waste management R&D requirements.

Organization: ONDRAF/NIRAS is governed by a Board of Directors composed of a president, vice-president, and board members representing various national ministries and local government executives. The Board is advised by a permanent Technical Committee.

SYNATOM

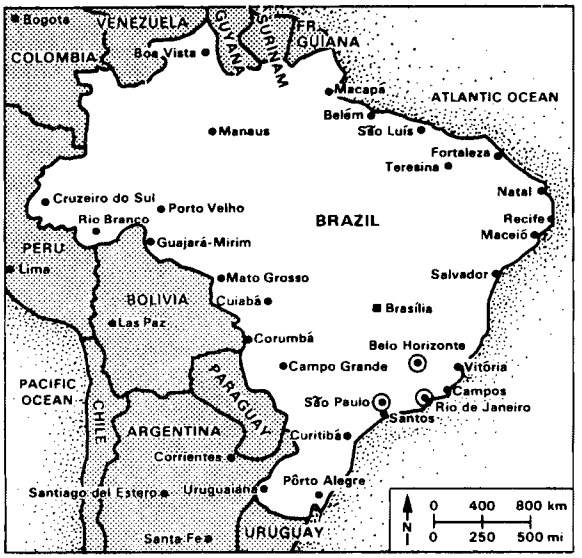
SYNATOM S.A.
Avenue Marnix, 13
B-1050, Brussels
Belgium

Tel: 32-2-518-6666
Telex: 24-152 SYNAT B

Chairman, Board of Directors	R. De Cort
Managing Director	R. Cayron
General Manager	Pierre A. Erkes
Fuel Reprocessing Service	Jean Danguy

Mission: Provide commercial fuel cycle services for the Belgian nuclear utilities.
Owners: SNI (50%), INTERCOM (20%), EBES (20%), UNERG (10%).

BRAZIL


Bogotá
VENEZUELA
COLOMBIA
Boa Vista
GUYANA
SURINAM
FR. GUIANA
Macapá
ATLANTIC OCEAN
Belém
São Luís
Manaus
Fortaleza
Teresina
Natal
Cruzeiro do Sul
Porto Velho
Rio Branco
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Maceió
Guajará-Mirim
PERU
Lima
Mato Grosso
Salvador
BOLIVIA
Cuiabá
Brasília
Las Paz
Corumbá
Belo Horizonte
Campo Grande
Vitória
PACIFIC OCEAN
CHILE
PARAGUAY
São Paulo
Campos
Rio de Janeiro
Santos
ARGENTINA
Curitibá
Corrientes
Pôrto Alegre
Santiago del Estero
Uruguaiana
Santa Fe
URUGUAY
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0 250 500 mi

BRAZIL

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year	Sept. 7	Independence
Feb. 10-11	Carnival	Oct. 12	N. S. Aparecida
March 28	Good Friday	Nov. 2	All Souls
April 21	Tiradentes Day	Nov. 15	Proclamation of the Republic
May 1	Labor Day		
June 1	Corpus Christi	Dec. 25	Christmas

TIME

Standard Time Washington D.C.. (East/all coast) **+ 2 hours**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States. In addition, a visa is currently required for a visit to Brazil and it is recommended to consult a travel agency for up-to-date information concerning all requirements.

CURRENCY EXCHANGE RATE

1 US$ = 10135.00 Cruzeiro
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Brazil are complete as listed; dial international access code: **011 + 55 + local number.**

US EMBASSY - BRASILIA

American Embassy
Avenida das Nocoes, Lote 3
Brasilia
Brazil

Tel: 55-61-223-0120
Telex:

Science Counselor — Frederick Vaznaugh

ENERGY

Population	1985	136 million
Energy Demand	1984	~143 Mtoe
Indigenous Energy Sources: limited crude oil, shale oil, natural gas, and coal. Oil:	1984	50.7% imported
Electric Power Plant Capacity	1984	42 GWe
Electric Power Production	1984	161.9 TWh-- 93.5% hydro 6.5% thermal

NUCLEAR POWER

Policy: Ambitious program to develop complete government-owned nuclear industry, based upon technology transfer from FRG and other countries.

Nuclear Power Plant Capacity	1986	0.6 GWe
	1995	1.9 GWe
	2000	3.1 GWe
Reactor Mix	1985	PWR: 1 (1984) 2 (1991-93)
Reactor Development		FBR

INDUSTRIAL FUEL CYCLE

Policy: Full commercial capability through a government-owned corporation--conversion of U_3O_8 to UF_6; enrichment; UO_2 fuel fabrication; fuel reprocessing.

Waste Management Strategy: Not yet defined.

Cumulative Spent Fuel Arisings (LWR)	1985	32 tU
	1990	180 tU
	1995	510 tU
	2000	1,000 tU

Demonstration/Production Activities

- Uranium mining and milling: 500 tU/a--in operation.
- UF_6 production: 2000 tUF_6/a (1988).

- Uranium enrichment (Becker nozzle process), at Resende (Nuclebrás):
  - First Cascade, 24 stages; to 1% U-235 at first stage (1988)
  - 200-300 tSWU/a demo plant (1990).
- Fuel fabrication: 80 t/a (1982); design capacity--400 tU/a.
- Spent fuel reprocessing: 10 kg/d pilot plant (completion date as yet unknown).

INTERNATIONAL RELATIONSHIPS

US: Joint Natural Analog Studies (Migration of Radionuclides from Ore Deposits in Brazil).

Member of IAEA (has not signed NPT); dependence on nuclear technology transfer from other nations, principally from FRG.

ORGANIZATION

- Federal Ministry of Mines and Energy--planning, execution and control of nuclear power program.
- CNEN (Nuclear Energy Commission)--regulatory and R&D.
- Nuclebrás--plant engineering, construction and operation; operates through partly-owned subsidiaries--Nucon (construction), Nuclen (design), Nuclep (heavy components), Nuclam (mining), Nuclei and Nustep (enrichment), Nuclemon (thorium production), and federal and state utilities, such as FURNAS.

CDTN (Center for the Development of Nuclear Technology)

Centro de Desenvolvimento de
Tecnologia Nuclear de Nuclebrás (CDTN)
Rua Gonçalves Dias No. 1054
Belo Horizonte, MG — Tel: 55-31-441-5422
Brazil — Telex:

Director — V. Mattos Andrade Silva

Mission: Applied research and industrial development of uses of atomic energy.

CNEN (Nuclear Energy Commission)

Comissao Nacional de Energía Nuclear (CNEN)
Rua General Severiano 90
Botafogo ZC-82
22290 Rio de Janeiro, RJ — Tel: 55-21-295-2232
Brazil — Telex: 21-21280

President — Rex Nazare Alves

Fuel Cycle and Waste Management R&D: Uranium enrichment; migration of radionuclides from thorium deposits, (joint Brazil-US study); spent fuel reprocessing. 10 kg HM/day pilot reprocessing facility being built (by the government) in the Rio de Janeiro area (completion date unknown).

IPEN (Energy and Nuclear Research Institute)

Instituto de Pesquisas Energeticas e Nucleares
Cidade Universitaria
Caixa Postal 11.049
Pinheiros - CEP 01000 — Tel: 55-11-211-6011
Sao Paulo, Brazil — Telex: 11-23592 IPEN

Superintendent — Claudio Rodrigues

Areas of Activity: Physics; nuclear physics; high energy physics. Life Sciences; nuclear medicine; radiobiology; radiation health and safety. Engineering and reactor technology; instrumentation. Chemistry; materials in the nuclear industry. Isotope and radiation applications and production. Nuclear waste disposal. Nuclear metallurgy. Radiochemistry.

NUCLEBRÀS

Nuclebràs
Avenida Presidente Wilson 231
CEP 20030, Rio de Janeiro — Tel: 55-21-292-1144
Brazil — Telex: 23128, 23830

President	Licinio Seabra
Director-Superintendent	General Jose Pinto de Araujo Rabello
Director, Mineral Production	Paulo Lima
Director, Nuclear Fuel	David Neiva Simon
Director, Nuclear Plants	Ronaldo A. Cruz Fabricio

Mission: Establish a nuclear fuel cycle industry, promote nuclear technology, transfer to private industry, design and build nuclear power plants, pursue R&D programs.
Owner: Government.

CANADA


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YUKON
NORTHWEST TERRITORIES
CANADA
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
Hudson Bay
QUEBEC
NEW BRUNSWICK
ONTARIO
Edmonton
Saskatoon
Calgary
Vancouver
Pinawa
Winnipeg
Gentilly 2
Quebec
Montreal
Pt. Lepreau
Elliot Lake
Ottawa
Tiverton
Burlington
Chalk River
Pickering
Toronto
UNITED STATES

CANADA

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
March 28	Good Friday
March 30-31	Easter
May 19	Victoria Day
July 1	Dominion Day
October 13	Thanksgiving
November 11	Remembrance Day
December 25-26	Christmas

TIME

Time zones correspond to those in the United States.

Daylight Saving Time period: **04/27 - 10/25/86**

PASSPORT/VISA

In lieu of passport, identification such as birth certificate (but not driver's license) is sufficient for a visit to Canada. Most travel agencies can provide up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 1.4025 Canadian Dollar
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual Numbers for direct dialing to Canada are complete as listed; dial long distance access code: 1
+ 3-digit area code + 7-digit local number.

US EMBASSY - OTTAWA

American Embassy
100 Wellington Street
Ottawa
Canada

Tel: 613-238-5335
Telex:

ENERGY

Population	1984	24.8 million
Energy Demand	1983	215.3 Mtoe
Oil Demand	1983	66.5 Mtoe
Electric Power Plant Capacity	1984	95.5 GWe
Electric Power Production	1983	408 TWh-- 65% hydro/geoth 19% coal **12% nuclear** 2% oil 2% gas

NUCLEAR POWER

Policy: Strong support of domestic use and export of the CANDU reactor system.

Nuclear Power Plant Capacity	1986	10.6 GWe
	1990	13.2 GWe
	2000	15.6 GWe
Reactor Mix	1985	HWR: 16 (1968-85) 6 (1986-92)

INDUSTRIAL FUEL CYCLE

Policy: Retrievable storage of spent fuel, pending decision between reprocessing and disposal of spent fuel; continue small reprocessing R&D activity.

Waste Management Strategy: Geologic disposal of "nuclear fuel waste," either spent CANDU fuel or immobilized HLW, in a crystalline rock repository; disposal of reactor wastes in engineered surface facilities.

Cumulative Spent Fuel Arisings (HWR)	1980	3,650 tU
	1985	8,800 tU
	1990	17,700 tU
	2000	38,000 tU

Major Milestones

* URL operational	1989
* Complete concept verification for a geologic repository	1990

INTERNATIONAL RELATIONSHIPS

US: DOE/AECL Umbrella Agreement for Waste Management Exchange

- Term: 9-8-76 to 8-25-87.
- Scope: Waste treatment; storage; geologic disposal; transportation requirements; operational considerations; environment and safety; public acceptance issues.
- Emphasis: Collaboration in AECL URL project near Whiteshell; intercomparison of performance assessment computer models and codes; information exchange in waste form characterization and in waste/spent fuel storage.

US: DOE/AECL Implementing Agreement for a Technical Cooperative Program

- Term: 1986-1990 (expected to be signed Feb. 86).
- Scope: Cooperative experimental program at Canada's URL; performance assessment studies; field testing investigations; URL shaft deepening and characterization. (DOE to pay for cost of shaft extension to 450 m.)

Member of IAEA and OECD/NEA. Exchange agreements with CEC, FRG/BMFT, SKB, UKAEA and Euratom.

ORGANIZATION

* AECB (Atomic Energy Control Board)--regulatory.

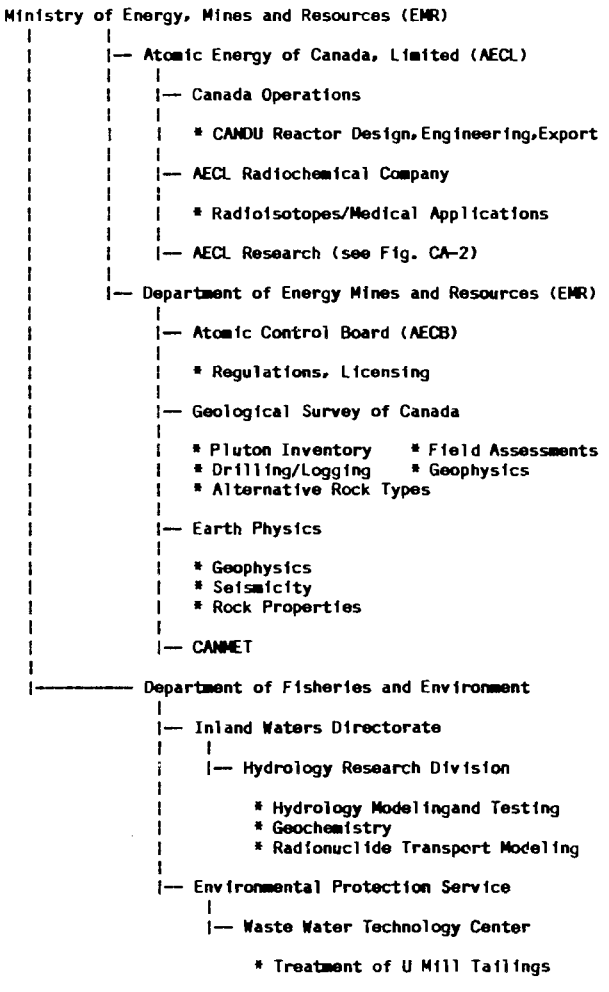
* AECL (Atomic Energy of Canada Limited)--a Crown Corporation owned by the federal government. Nuclear R&D; design, engineering and sale of CANDU reactors; Waste management R&D at Whiteshell and Chalk River.

* Ontario Hydro--provincial public utility, owns and operates most of Canada's nuclear power plants--those located in Ontario Province. Waste management R&D.

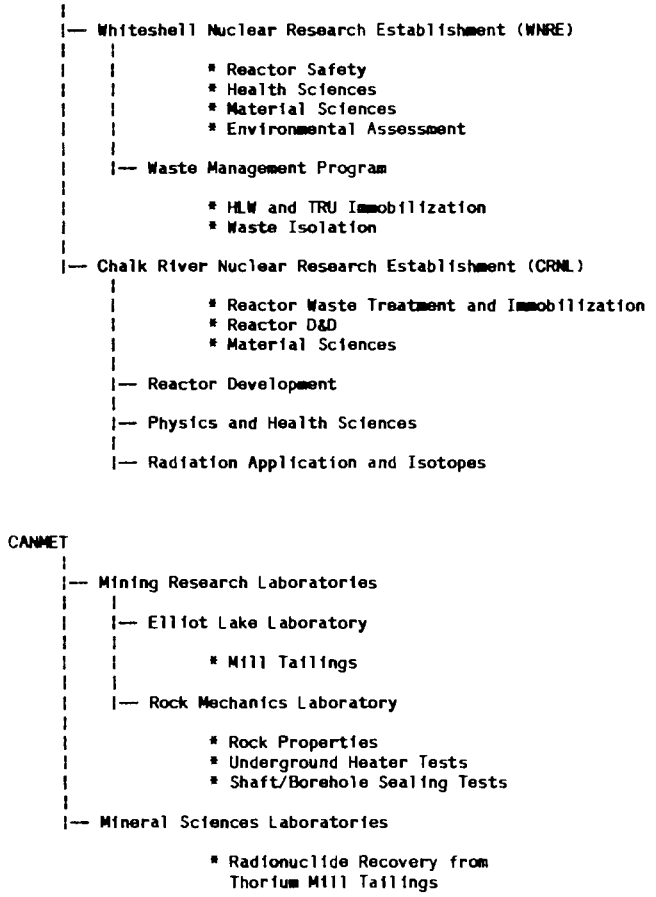
* Hydro Quebec--provincial public utility, owns and operates Gentilly 2 (600 MWe CANDU station).

* NB Power (New Brunswick Electric Power Commission)--provincial utility, owns and operates Point Lepreau Nuclear Generating Station (600 MWe CANDU).

FEDERAL GOVERNMENT RESPONSIBILITIES— FUEL CYCLE/WASTE



ENERGY, MINES AND RESOURCES CANADA - PARTIAL ORGANIZATION



AECB

Atomic Energy Control Board
P.O. Box 1046
270 Albert Street
Ottawa, Ontario K1P 5S9
Canada

Tel: 613-995-5894
Telex: 533771

President	J. H. Jennekens
Fuel Cycle/Materials Regulations	W. D. Smythe
Waste Management	G. C. Jack -3181
Fuel and Heavy Water Plant	J. P. Didyk
Regulatory Research	J. W. Bears
Safety/Safeguards	J. R. Coady

AECL

Atomic Energy of Canada Limited
275 Slater Street
Ottawa, Ontario K1A 0S4
Canada

Tel: 613-237-3270
Telex: 053 31 26

Chairman	Robert Despres
President	James Donnelly
President, AECL Research	Dr. Stanley R. Hatcher
Vice President, R&D	Dr. A. J. Mooradian

AECL-CRNL

AECL-Chalk River Nuclear Laboratories
Chalk River, Ontario K0J 1J0
Canada

Tel: 613-687-5581
Telex: 053-34555

General Manager	Dr. P. J. Harvey
V. P., Reactor Development	Dr. R. E. Green
V. P., Physics/Health Sciences	Dr. J. D. Milton
V. P., Radiation Appl./Isotopes	Dr. H. K. Rae

Facilities

Waste Treatment Center (WTC)
Mission: Develop reactor waste treatment processes.

AECL-WNRE

AECL-Whiteshell Nuclear Research Establishment
Pinawa, Manitoba R0E 1L0
Canada

Tel: 204-753-2311
Telex: 0757553

AECL-WNRE (cont'd)

General Manager	M. G. Wright
V. P., Waste Management	Dr. W. T. Hancox
Geological/Environmental	Dr. K. W. Dormuth
Geochem./Waste Immobilization	Dr. K. Nuttal
Low-Level Waste	Dr. D. J. Cameron
Waste Management Technology	Dr. D. H. Charlesworth

Facilities

- **WIPE** (cold pilot plant-vitrification)
  Mission: Develop HLW conditioning process for the CANDU-Thorium fuel cycle.
  Design Basis: 10 kg/hr glass--rotospray calciner/ceramic melter.
  History: Startup, 1983.

- **Hot Pilot Plant-Reprocessing**
  Mission: Develop CANDU-Thorium fuel cycle technology; provide HLW for waste studies.
  Design Basis: Thorex process, mixer-settlers; capacity, 0.3 kg/day.
  History: Hot operation, 1980.

- **URL** (Underground Research Laboratory)
  Mission: Provide a research facility in a virgin granite pluton characteristic of the Canadian granite formations which may be selected for waste repository construction. (USDOE participating in experimental programs)
  Design Basis: Location about 20 km from WNRE, on the Lac du Bonnet Batholith; horizontal tunnel with adjoining rooms located 240 m below the surface, with vertical shaft. Possible level at 450 m. Licensed radioactive sources and selected tracers may be used in the facility, but no radioactive wastes are to be emplaced there.
  Milestones: Site evaluation, 1980; URL construction, 1984; underground operation, 1989.

- **HTF** (Hydrostatic Test Facility)
  Mission: Test the performance of containers made of different metals under temperature/pressure conditions that could exist in an underground disposal vault.
  Design Basis: Carbon steel pressure chamber with a test cavity 1.5 m in diameter and 3 m in depth contained in a 4 m x 4m xj 4.6 m deep concrete-lined pit. Temperature/pressure can be adjusted and controlled over long periods of time.
  History: Startup, 1984.

AECL-WNRE (contd)

* IFTF (Immobilized Fuel Test Facility)
Mission: Test the effects of water, heat and pressure on waste forms, containers, buffer and backfill materials, and rock in the presence of a radiation field. spent fuels and HLW forms in a radiation field.
Design Basis: A high-level radiation source used in conrete canisters to measure corrosion of metals; warm cells for experiments involving moderate levels of radiation. **Three Laboratories:** Analytical, Low-Activity Examination, and Alpha.
History: First canister loaded, August 1984.

EMR

Energy, Mines and Resources Canada
Science and Technology
580 Booth Street
Ottawa, Ontario K1A 0E4 — Tel: 613-995-3065
Canada — Telex: 053-3117

Director, Nuc.Fuel Waste Disposal — Dr. J. S. Scott

EMR-CANMET

EMR-Canada Centre for Mineral and Energy Technology
555 Booth Street
Ottawa, Ontario K1A 0G1
Canada — Tel: 613-995-4029

Director General	Dr. W. G. Jeffery 613-995-4179
Deputy Director General	J. T. Gubb
Rock Mechanics	G. E. Larocque
Waste Management (Elliot Lake)	Gordon Ritcey

Laboratories

* **Mineral Sciences** * **Rock Mechanics**

* Mining Research Laboratories
Elliot Lake, Ontario P5A 2K2
Canada

EMR-EPB

EMR-Earth Physics Branch
1 Observatory Crescent
Ottawa, Ontario K1A DY3
Canada

Director	J. G. Tanner

EMR-GSC

EMR-Geological Survey of Canada
601 Booth Street
Ottawa, Ontario K1A OE8 — Tel: 613-995-4938
Canada — Telex: 053-3117

Director	Dr. R. A. Price

OH

Ontario Hydro
700 University Avenue
Toronto, Ontario M5G 1X6 — Tel: 416-592-5111
Canada — Telex: 06 217662

Director, Nuc. Design/Developmt.	H. S. Irvine -5210
Nuclear Materials Management	H. N. Isaac -5539
Radioactive Materials Mgmt.	T. J. Carter -6024
Radiation/Decom. Waste Disposal	P. J. Armstrong-5830
Fuel Disposal	R. A. McEachran-4066

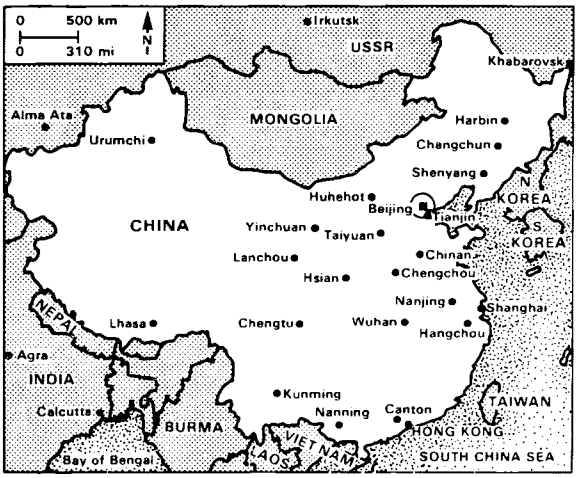
Function: Design, construction, and operation of CANDU power stations.

Facilities

- **RWVRF** (Radioactive Waste Volume Reduction Facility)
  Location: Bruce Nuclear Complex, Tiverton, Ontario.
  Components: Pyrolysis incinerator (2-chamber), solid waste compactor.
  History: Startup, 1977.

- **Intermediate-Level Waste Storage**
  Location: Bruce Nuclear Power Development Waste Management Site, Tiverton, Ontario.
  Components: In-ground concrete tile holes or trenches, above-ground concrete "Quadricell."

CHINA
(People's Republic of China)



CHINA

MAJOR PUBLIC HOLIDAYS

January/ February	Lunar New Year
May 1	Labor Day
Aug 1	Army Day
October	National Liberation Days

TIME

Standard Time Washington D.C.: **+ 13 hours**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States; in addition, a visa is currently required for a visit to the People's Republic of China. Most travel agencies can provide up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 3.1935 Yuan
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

US EMBASSY - BEIJING

American Embassy
Xiu Shui Bei Jie 3
Beijing
People's Republic of China

Science Counselor Dr. Jack Gosnell

ENERGY

Population	1984	1 billion
Energy Demand	1980	637.2 Mtoe
Electric Power Plant Capacity	1980	55-60 GWe
Electric Power Production	1983	349 TWh-- 70% coal 24% oil 3% hydro/geoth. 3% gas

NUCLEAR POWER

Policy: Develop nuclear power as one of three major sources of energy to solve problems caused by uneven distribution of resources; be self-sufficient, but introduce foreign advanced technology.

Nuclear Power Plant Capacity	1990	2 GWe
	2000	10 GWe
Reactor Mix	1985	PWR: 3 (1988-90)
Reactor Development		BWR, HTR, FBR

INDUSTRIAL-SCALE FUEL CYCLE ACTIVITIES

Uranium mining, milling and enrichment; fuel fabrication, reprocessing of defense fuels.

INTERNATIONAL RELATIONSHIPS

Member of IAEA. Cooperative agreements have been signed with Argentina, Canada, France, Germany, Italy, Japan and the US.

ORGANIZATION

* Ministry of the Nuclear Industry--fuel cycle development
* State Bureau of Nuclear Safety--responsible for standards/regulations, construction permits/operating licenses, monitoring plant operations; conducts joint safety research with other nations.

- Atomic and Nuclear Energy Research Institute of the Academy of Sciences (Peking Area and Southwest China)--nuclear R&D.
- CNEIC (China Nuclear Energy Industry Corporation) --handles import and export.
- China Zhongyuan Engineering Corporation--provides technical services and engineering work.

INSTITUTE OF ATOMIC ENERGY

Institute of Atomic Energy
Academia Sinica
Beijing
People's Republic of China

Director	Dai Cuanzheng

INSTITUTE OF NUCLEAR ENERGY TECHNOLOGY

Institute of Nuclear Energy Technology
Qinghua University
P.O. Box 1021
Beijing
People's Republic of China

Director	Prof. Lu Yingzhong
Dep. Dir., Radiochem. Technology	Prof. Zhu Yong-jun

MINISTRY OF THE NUCLEAR INDUSTRY

Ministry of the Nuclear Industry
Beijing
People's Republic of China

Minister	Jiang Xingxiong
Science/Tech.Com., V.Chairman	Wang Ganchang

STATE BUREAU OF NUCLEAR SAFETY

State Bureau of Nuclear Safety
Beijing
People's Republic of China

Director	Jian Sheng-Jie

FINLAND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N
NORWAY
SWEDEN
FINLAND
USSR
Murmansk
Ivalo
Rovaniemi
Kemi
Kuusamo
Luiea
Pitea
Oulu
Vilhelmina
Kem
Umea
Kajaani
Kokkola
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Gulf of Bothnia
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Turku
Vantaa
Espoo
Kotka
Helsinki
Mariehamn
Hanko
Leningrad
Gulf of Finland

FINLAND

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
January 6	Epiphany
March 28	Good Friday
March 30-31	Easter
May 1	May Day
May 8	Ascension Day
May 18-19	Pentecost
June 21	Midsummer
November 1	All Saints
December 6	Independence Day
December 25-26	Christmas

TIME

Standard Time Washington D.C.: **+ 7 hours**

Daylight Saving Time period: **03/30 - 09/27/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States. A visa is currently not required for a visit to Finland, however, it is recommended to consult a travel agency for up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 5.3875 Markka (FIM)
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Finland are complete as listed; dial international access code: **011 + 358 + local number.**

US EMBASSY - HELSINKI

American Embassy
Itaeinen Puistotie 14B
Helsinki 14
Finland

Tel: 358-90-17-1931
Telex:

ENERGY

Population	1985	4.9 million
Energy Demand	1984	26.2 Mtoe (73% imported)
Oil Demand	1984	8.8 Mtoe (100% imported)
Electric Power Plant Capacity	1983	11.0 GWe
Electric Power Production	1983	41.2 TWh-- 42% nuclear 32% hydro/geoth. 21% coal 3% oil 2% gas

NUCLEAR POWER

Nuclear Power Plant Capacity	1986	2.3 GWe
	1995	2.3 GWe
	2000	3.3 GWe
Reactor Mix	1985	PWR: 2 (1977/81) BWR: 2 (1979/82)

INDUSTRIAL FUEL CYCLE

Policy: Purchase fuel and fuel cycle services from other countries (spent fuel from Russian-built reactors is returned to USSR).

Waste Management Strategy: Not fully defined; spent fuel or HLW from non-Russian fuels will be stored for 40 years, then placed in a granite repository; reactor wastes are bituminized and will be stored underground.

Cumulative Spent Fuel		IVO	IVO
Arisings (LWR), tU	1980	22	46
	1985	228	183
	1990	450	330
	2000	900	700

Major Milestones

* Complete updated final disposal concept for spent fuel	1992
* Complete site selection	2000
* Complete repository	2020

INTERNATIONAL RELATIONSHIPS

Member of IAEA and OECD/NEA. Collaboration with Denmark and Norway in waste management studies. Purchases fuel cycle services, including disposal of spent fuel, from USSR for USSR-purchased PWR power stations.

ORGANIZATION

- **IVO** (state-owned power company) and **TVO** (power company, jointly owned by IVO and several industrial companies): IVO operates two Russian-built PWR reactors, while TVO operates two Swedish-built BWR plants.
- **Nuclear Waste Commission of Finnish Power Companies**--established by IVO and TVO to do joint analysis and planning for managing their nuclear wastes.
- **VTT** (Technical Research Center)--nuclear research, including waste management R&D.

ATOMIC ENERGY COMMISSION

Atomic Energy Commission	
Ministry of Trade and Industry	
Pohjoinen Makasiinikatu 6	
SF-00130 Helsinki	Tel: 358-0-160-5256
Finland	Telex: 125-452 EDEPT SF
Chairman	Prof. Pekka Jauho
	358-0-456-4100
	Telex: 122972
Secretary-General	Jussi Manninen

GEOLOGICAL SURVEY OF FINLAND

Geological Survey of Finland	
Kivimiehentie 1	
SF-02150 Espoo	Tel: 358-15-46931
Finland	Telex: 123185 geolo SF
Director	Prof. L. K. Kauranne
Research Director	Prof. K. Korpela
Nuclear Waste Disposal	Dr. M. Salmi
	358-0-803-7988

IVO

Imatra Power Company (IVO)
Malminkatu 16
P.O. Box 138
SF-00101 Helsinki — Tel: 358-0-694-4811
Finland — Telex: 124-608

INSTITUTE OF RADIATION PROTECTION

Institute of Radiation Protection
P.O. Box 268
SF-00101 Helsinki 10 — Tel: 358-0-61671
Finland — Telex: 122691 STL-SF

Chief Inspector, Reactor Safety — S. Vaisanen
Inspectors — E. Ruokola - I. Aro

IVO

Industrial Power Company Ltd. (IVO)
Fredrikinkatu 51-53
SF-00100 Helsinki — Tel: 358-0-60-5022
Finland — Telex: 122-065

VTT (Technical Research Center of Finland)

VTT Nuclear Engineering Laboratory
P.O. Box 169
SF-00181 Helsinki — Tel: 358-0-4561
Finland — Telex: 122-972 VTTHA SF

Director, Nuclear Waste — Prof. Pekka Silvennoinen
Nuclear Waste Management — Dr. Seppo Vuori

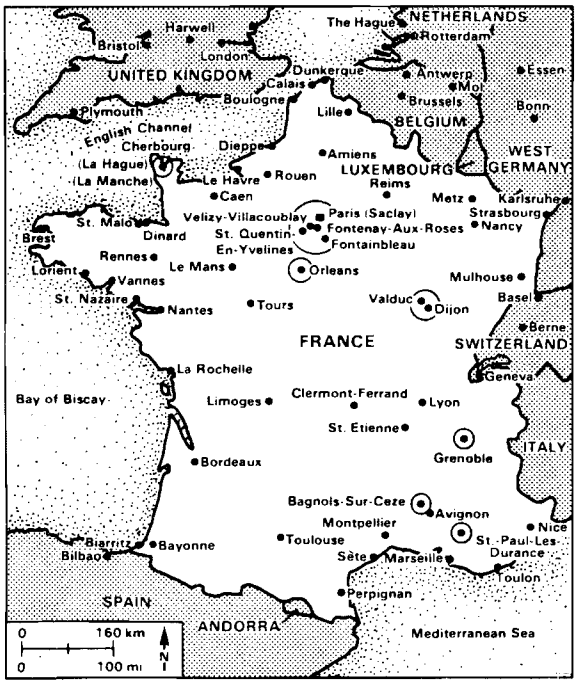
VTT Reactor Laboratory
Otakaari 3A
SF-02150 Espoo — Tel: 358-0-4561
Finland — Telex: 122-972 VTTHA SF

Director — Dr. Pekka Hiismaki
Nuclear Waste Management — Dr. Jorma Heinonen

VTT Metals Laboratory
Metallinmichenkuja 6
SF-02150 Espoo — Tel: 358-0-4561
Finland — Telex: 122-972 VTTHA SF

Director — Dr. Jarl Forsten
Nuc. Fuel Material Research — Esa Vitikainen

FRANCE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Nancy
Brest
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Montpellier
Nice
Toulouse
St.-Paul-Les-Durance
Biarritz
Bayonne
Bilbao
Sète
Marseille
Toulon
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SPAIN
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FRANCE

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
March 30-31	Easter
May 1	Labor Day
May 8	Ascension
May 18-19	Pentecost
July 14	Bastille Day
August 15	Assumption
November 1	All Saints
November 11	Remembrance Day
December 25	Christmas

TIME

Standard Time Washington D.C.: **+ 6 hours**

Daylight Saving Time period: **03/30 - 09/27/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States. A visa is currently not required for a visit to France, however, it is recommended to consult a travel agency for up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 7.4435 Franc
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to France are complete as listed; dial international access code: **011 + 33 + local number.**

US EMBASSY - PARIS

American Embassy
2 Avenue Gabriel
75382 Paris
France

Tel: 33-14-296-1202
33-14-261-8075
Telex: 65-0221

Science Counselor J. Boright

ENERGY

Population	1984	54.61 million
Energy Demand	1980	198 Mtoe (74% imported)
Oil Demand	1980	115 Mtoe (98% imported)
Electric Power Plant Capacity	1983	78.4 GWe
Electric Power Production	1983	296.9 TWh-- **48% nuclear** 24% hydro/geoth. 21% coal 5% oil 2% gas

NUCLEAR POWER

Policy: Aggressive nuclear power program, scaled down recently to construction of one new reactor per year; commercialization of the breeder reactor; export of nuclear plants and services.

Nuclear Power Plant Capacity	1986	39.1 GWe
	1990	52.3 GWe
	2000	61.6 GWe
Reactor Mix	1985	GCR: 8 (1959-72) PWR: 38 (1967-85) 18 (1985-92) LMFBR: 2 (1973/86)
Reactor Development		LMFBR commercialization; SuperPhenix--1985; follow-on work still under debate.

INDUSTRIAL FUEL CYCLE

Policy: Maintain full domestic fuel cycle capability; aggressive export of fuel cycle plants, equipment and services (including uranium enrichment and spent fuel reprocessing).

Waste Management Strategy: HLW--vitrify and store in engineered storage facility for indefinite period, then emplace in geologic repository (granite, salt, clay or seabed). LLW--immobilize in bitumen, concrete or resin and store in engineered surface facility.

Cumulative Spent Fuel Arisings, tU	1980	1985	1990	2000
	248	2,700	7,700	22,000

Cumulative Waste Arisings, m^3	1983	1990	2000
vitrified HLW	400	750	3,000
packaged TRU waste	10,000	15,000	45,000
packaged LLW/ILW	210,000	410,000	800,000

Industrial-Scale Activities

* Uranium mining and milling (tU): 1981--2,000; 1985--3,900.

* Uranium enrichment (tSWU/a)
  - Pierrelatte, gaseous diffusion: 400-600
  - Eurodif, gaseous diffusion: 1982--10,800.

* Fuel fabrication (tHM/a)
  - UO_2: 1983--600; current--400; 1986--1,100
  - MOX: for FBR fuels--5; for LWR fuels--15.

* Spent fuel reprocessing
  - Marcoule: 700 t/a, U metal fuels,
  - La Hague: 800 t/a, U metal fuels; 400 t/a, UO_2 (to be expanded to 1,600 t/a).

Major Milestones

* TOR demonstration reprocessing plant for FBR fuels (Marcoule)	1986
* UP3 reprocessing plant (La Hague) including T7 vitrification plant	1988-9
* UP2-800 reprocessing plant (La Hague) including R7 vitrification plant (complete progressive UP2 to UP2-800 conversion)	1991
* New LLW disposal site	1986-7
* Underground Research Laboratory	1989

INTERNATIONAL RELATIONSHIPS

US: DOE/CEA Umbrella Agreement for Waste Management Exchange
- Term: 7-26-83 to 7-26-88.
- Scope: Preparation and packaging of radioactive wastes; D&D; waste and spent fuel storage; geologic disposal; transportation requirements.
- Emphasis: Technical workshops in the areas of LLW and TRU waste management; exchange of waste repository site characterization technology and data for granite and salt host rocks.

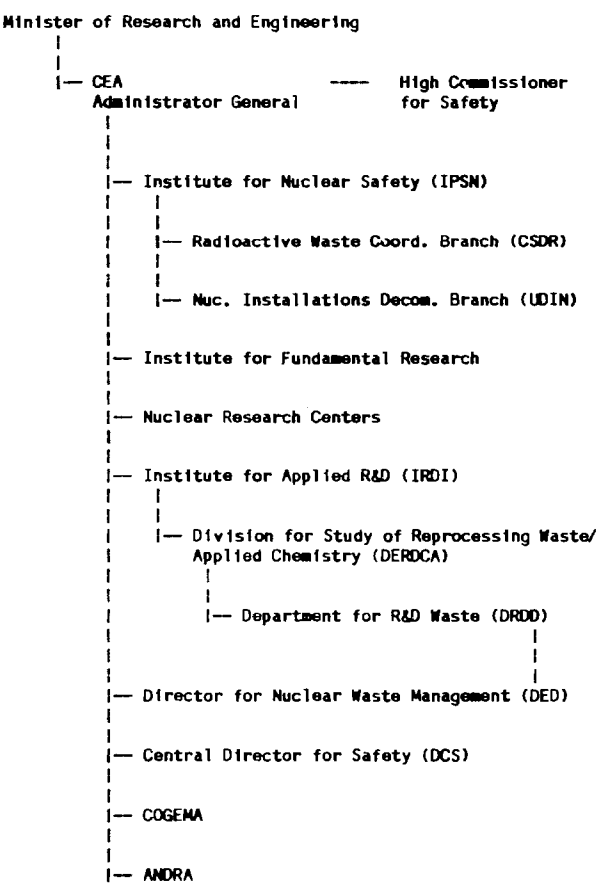
Member of EC, IAEA and OECD/NEA. Major role in Eurodif uranium enrichment consortium (Cogema). Partnership with German and British companies in United Reprocessors GmbH (Cogema) and in Nuclear Transport, Ltd. (Transnucleaire).

ORGANIZATION

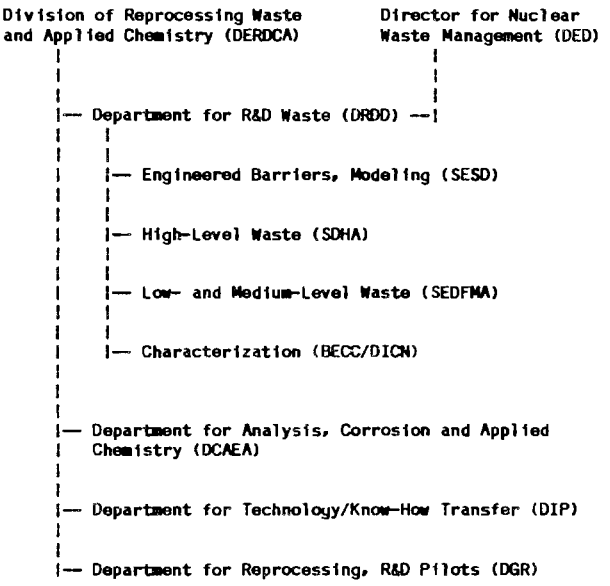
* **EdF** (Electricite de France, 100% government)--public power generation; owns and operates all nuclear plants except Phenix (50% EdF, 50% CEA) and SuperPhenix (NERSA: 51% EdF, 33% ENEL, 16% RWE)

* **CEA** (Atomic Energy Commission)--controls all nuclear R&D and industrial fuel cycle activities:
  R&D: Nuclear research centers at Cadarache, Fontenay-aux-Roses, Grenoble, Marcoule, Saclay; Institute for Nuclear Protection and Safety
  Commercial fuel cycle: COGEMA (mining, uranium conversion, enrichment, reprocessing); SGN, a COGEMA subsidiary (design, construction and marketing of fuel cycle facilities)
  Commercial waste disposal: ANDRA.

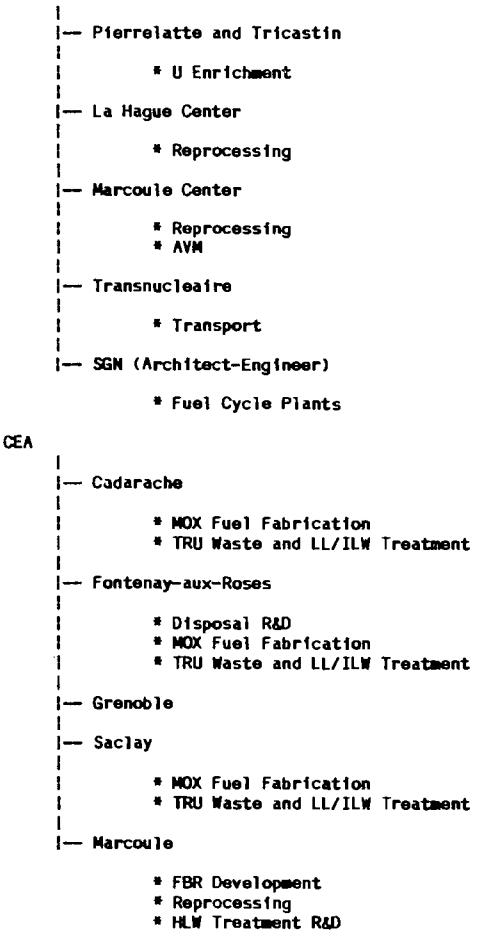
NUCLEAR FUEL CYCLE RESPONSIBILITIES



DERDCA RESPONSIBILITIES



RESEARCH CENTERS



ANDRA (National Agency for Radioactive Waste Management)

Agence Nationale pour la Gestion
des Déchets Radioactifs
Commissariat a l'Energie Atomique
31, Rue de la Federation
F-75752 Paris CEDEX 15
France

Tel: 33-14-273-6000
Telex: 20-5433 ANDRAGE F

Director	Jean Chatoux
Deputy Directors	Alain Barthoux
	Armand Faussat
Operations	Emile Roussel
Projects	Yves Marque
Quality Assurance	Hubert Nouguier
Safety	Francis Van Kote
Sites	Raymonde Andre-Jehan

Mission: Design, construct and manage long-term waste disposal centers; establish radioactive waste packaging/disposal specifications; contribute to R&D programs related to long-term waste disposal.

Facilities

* Centre de la Manche
  B.P. 71
  F-50140 Beaumont-Hague
  Michel Noraz

  Mission: Disposal of ILW and LLW; capacity: 460,000 m^3 (1985: 265,000 m^3 in place).

* Two new centers; sites to be determined 1985/86.

BRGM (Bureau of Geological and Mineral Research)

Bureau de Recherches Géologiques
et Minières
B.P. 6009
F-45060 Orleans
France

Tel: 33-13-863-8001
Telex: 780258 F

Managing Director	H. Astie
Waste Storage	P. F. R. Peaudecerf
Hydrogeology	J. J. Collin
Geotechnology	Ph. Masure

CEA (Atomic Energy Commission)

Commissariat à l'Énergie Atomique (CEA)
Centre d'Etudes Nucleaires (CEN)
29-33, Rue de la Federation
F-75752 Paris — Tel: 33-14-273-6000
France — Telex: 200671 Energat

Administrator General	Gerard Renon
High Commissioner for Safety	Jean Teillac
Director, Nuc. Safety (FaR)	Pierre Tanguy
Director, Nuc. Waste Mgmt. (FaR)	Jean Lefevre 33-14-654-7471
Asst. Director, Interntl.	Pierre Jourde
Asst. Director, R&D	Annie Sugier
Director, Safety	Jacques Bellot
Director, Applied R&D	Michel Rapin

CEA-IPSN (Institute of Protection and Nuclear Safety)

Institut de Protection et de Sûreté Nucléaires (IPSN)
B.P. 6
F-92260 Fontenay-aux-Roses — Tel: 33-14-654-7080
France — Telex: 204841 Energat Fnayr

Safety Analysis	D. Queniart
Waste Safety	J. Lewi
Technical Protection	J. Pradel
Waste Protection Research	A. M. Chapuis
Safety Studies/Research (CEN-C)	M. Bailly
Instrumentation/Methodology Undergrd. Disp. (Fanay-Augeres)	J. Lewi

CEA-IRDI (Institute for Applied Research and Development)

Institut de Recherche Technologique et de Developpement Industriel (IRDI)

President	Michel Rapin
Division, Reprocessing Waste/ Applied Chemistry	J. Megy
Department, Technology/ Know-How Transfers	M. Courouble
Department, Reprocessing/ R&D Pilot Plants	J. Sauteron
Department, Analysis-Corrosion/ Applied Chemistry	M. Leveque
Department, R&D Waste (FaR)	Guy Baudin 33-14-654-8222

CEA-IRDI (contd)

Characterization (Cadarache)	A. Saas
LL/ILW (Cadarache)	D. Alexandre
HLW (Marcoulé)	M. Bonniaud
Engineered Barriers, Modeling (FaR)	M. Jorda 33-14-654-8129

CEN-CA (Cadarache Nuclear Research Center)

Centre d'Études Nucléaires de Cadarache
B.P. 1
F-13115 Saint-Paul-lez Durance — Tel: 33-42-25-7000
France — Telex: CEACA 440678 F

(Marseille-Marignane Airport; 65 km to Cadarache by car provided by Center, or rental car.)

Bureau for Evaluation and Control of Waste Confinement (BECC/CIDN)	A. Saas 33-42-25-7364
Information Center for Waste	Mrs. Rocca-Serra 33-42-25-7882
Studies of LLW/ILW	D. Alexandre 33-42-25-7123

Waste Management R&D: Treatment of TRU waste, LLW, and ILW; properties of non-HLW waste forms and waste isolation (radionuclide migration).

Facilities

* **Solid Waste Treatment Pilot Plant**
  Mission: TRU solid waste reduction by cryogenic crushing and Pu recovery by acid leaching.
  Design Capacity: Eight 100-l drums per batch, one batch every 24 - 48 hrs.
  History: Startup, 1985.

* **Bituminization Plant**
  Design Basis: Immobilize reactor wastes; twin-screw extruder; capacity, 260 m^3/a.
  History: Startup, 1977.

* **MOX Fuel Fabrication**

* **LLW Incinerator**

* **Resin Embedding Pilot Facility**

* **Solvent Incinerator**

CEN-FaR (Fontenay-Aux-Roses Nuclear Research Center)

Centre d'Études Nucléaires
de Fontenay-aux-Roses
B.P. 6
F-92260 Fontenay-aux-Roses — Tel: 33-14-654-8000
France — Telex: FaR 20481

(See CEA-IRDI, Institute for Applied R&D)

Waste Management R&D: Safety-related research; airborne waste treatment; solvent extraction processes for waste partitioning; OKLO studies; engineered barriers, modeling.

CEN-G (Grenoble Nuclear Research Center)

Centre d'Études Nucléaires
de Grenoble
Avenue des Martyrs 85X — Tel: 33-76-97-4111
F-38041 Grenoble — Telex: 320323 Energat
France — Greno

Director — Michel Suscillon

* **Waste Resin Embedding Facility**

CEN-M (Marcoule Nuclear Research Center)

Centre d'Études Nucléaires de la Vallee du Rhone
B.P. 171
F-30203 Bagnols-sur-Ceze — Tel: 33-16-689-5390
Marcoule, France — Telex: 480232F

Manager, High-Level Waste — M. Bonniaud
Deputy Manager — Claude G. Sombret
Ext. 2767
Laboratory Studies — N. Jacquet-Francillon
Confinement Processing — A. Jouan
Ext. 2768
Hot Technology — F. Laude

Facilities

* **TOR** (Reprocessing Head-End Pilot Plant)
  Mission: Develop technology for LWR, FBR and MOX fuels.
  Design Basis: PUREX flowsheet, mixer-settlers and pulsed columns; 5 tHM/a.

CEN-M (contd)

* **PIVER** (Hot Pilot Plant-Vitrification)
  Mission: Test batch vitrification processes (1969-1973); produce samples for characterization and advanced (high-temperature) waste forms.
  Design Basis: Pot calciner/melter; capacity, 90 kg glass/batch or 25-30 m^3 HLLW/a; product, borosilicate glass blocks, 25 cm dia by 2.5 m high.

* **Hull Fusion Non-Radioactive Prototype** (84 startup)

* **PEV Prototype** (full-scale, non-radioactive R7/T7 vitrification process). Startup, 1984

CEN-S (Saclay Nuclear Research Center)

Centre d'Études Nucléaires
de Saclay
F-91191 Gif-sur-Yvette
France

Tel: 33-16-908-6000
Telex: 690641 F Energat Saclay

Director	Paul Mirat
Nuclear Wastes	Henri Vialettes

Facilities

* **Bituminization Plant** (radioactive)

* **Metal Waste Melter** (startup, 1985)

COGEMA (Compagnie Générale des Matières Nucléaires)

COGEMA, Inc.
Direction Generale
B.P. 4
F-78141 Velizy Villacoublay Cedex
France

Tel: 33-13-946-9641
Telex: 69-7833 COGEM

Vice President, Reprocessing	Claude Aycoberry
Ind. Director, Reprocessing	Maurice Delange
La Hague Expansion Proj./Reproc.	Francois Chenevier
Marcoule Expansion Proj./Reproc.	Andre Bekiarian

COGEMA-LA HAGUE CENTER

COGEMA, Centre de La Hague
B.P. 270
F-50107 Cherbourg
France

Tel: 33-13-303-6000
Telex: 170030 Energat

Director — Jean Parmentier
Reprocessing — Jean-Louis Ricaud
Waste Management — Jean-Pierre Laurent

Fuel Cycle Program: Spent fuel reprocessing and HLW vitrification. The La Hague plant was originally designed to handle magnesium-clad U metal fuels from gas/graphite power reactors. Current plans are to transfer all reprocessing of gas/graphite fuels to Marcoule UP1 and devote La Hague to treating LWR fuels with occasional FBR fuel campaigns through UP2.

Facilities

- **UP2** (Fuel Reprocessing Plant)
  Mission: Reprocess magnesium-clad, natural uranium metal fuels from gas/graphite reactors and oxide fuels from LWRs and Phenix FBR (Phenix fuel has been reprocessed from 1979 to 1984, diluted with natural uranium fuel for criticality control).
  Design Basis: Metal fuels: chemical decladding; PUREX flowsheet; capacity, 800 t/a and 1.6 tPu/a; contact maintenance. Oxide fuels: shear-leach HAO head-end; remote maintenance; capacity, 400 t/a of LWR fuels.
  History: Startup: UP2, 1967; HAO, 1976. From startup (6/76) through 11/85 total HAO throughput was 1,337 t fuel from LWRs and 10 t from Phenix.

- **UP2 800** (Fuel Reprocessing Plant)
  Mission: Reprocess U oxide and MOX fuels from French LWRs.
  Design Basis: Progressive expansion of UP2 plant from 400 to 800 t/a of LWR fuel started in 1984, to be completed in early 1990s. Chop leach head-end, PUREX flowsheet, AVM vitrification process [R7 vitrification plant: rotary calciner, metallic or ceramic melter; capacity, 600 m^3/a HLLW (three lines - 50 l/hr HLLW, 25 kg/hr glass); canister dimensions: 42 cm dia x 1.3 m high (400 kg glass)].
  Capacity: 800 t/a.
  Milestone: 1991.

COGEMA-LA HAGUE CENTER (contd)

* **UP3** (Fuel Reprocessing Plant)
  Mission: Reprocess LWR fuels.
  Design Basis: Chop-leach head-end; PUREX flowsheet; AVM vitrification process (T7 plant: identical to R7 vitrification plant).
  Milestones: Startup, UP2 800--1990/91.

COGEMA-MARCOULE CENTER

COGEMA, Centre de Marcoule
B.P. 170
F-30200 Bagnols-sur-Ceze — Tel: 33-16-689-5390
Marcoule, France — Telex: 480232F MARCOGEMA

(Marseille-Marignane Airport, then by train to Avignon and by car to the Center.)

Director — Maurice Alles
Reprocessing Plant — Maurice Chotin

Facilities

* **UP1** (Reprocessing Plant)
  Mission: Reprocess magnesium-clad natural uranium metal fuels from military or gas/graphite power reactors.
  Design Basis: Mechanical declad; PUREX flowsheet; contact maintenance; capacity 400-450 tHM/a of gas/graphite reactor fuel, in addition to military fuel load.
  History: Startup, 1958; total gas/graphite power reactor fuels processed up to 11/85: 2,000 t.

* **AVM** (Ateliers de Vitrification de Marcoule)
  Mission: Demonstrate AVM process: vitrify Marcoule UP1 wastes.
  Design Basis: Rotary calciner feeding an induction-heated metallic melter; capacity, 30 l/hr HLLW feed and 360 kg/day (1 canister) borosilicate glass product; waste form, glass blocks 0.5 m dia x 1.0 m high.
  History: Hot startup, 6/78; as of 7/15/85, 956 m^3 of HLLW had been vitrified (1,233 canisters).

* **Incinerator** * **Bituminization Facility**

DAM (Directorate of Military Applications)

Direction des Applications Militaires
Commissariat a l'Energie Atomique
31-33 Rue de la Federation
F-75752 Paris, Cedex 15
France

FBFC (Franco-Belge Company for Fuel Fabrication)

Société Franco-Belge de Fabrication de Combustibles
Avenue Bertie Albrecht
F-75008 Paris — Tel: 33-14-766-5200
France — Telex: 290503

Facilities

* **Fuel Fabrication Plant** (Romans, France)
  Mission: Fabricate UO_2 fuels for power reactors.
  Design Capacity: 400 t/a (to be increased to 600 t/a).

* **Fuel Fabrication Plant** (Dessel, Belgium)
  Mission: Fabricate UO_2 fuels.
  Design Capacity: 400 t/a.

PARIS SCHOOL OF MINES

Ecole Nationale Superieure des Mines de Paris
Centre d'Informatique Geologique
35 Rue Saint-Honore
F-77305 Fontainebleau — Tel: 33-16-422-4821
France — Telex: 600736 MINEFON

Director, Math. Geol. Center — Dr. Ghislain de Marsily
Deputy Director — Dr. G. E. Ledoux

Waste Management R&D: Geologic waste isolation (fluid flow, heat transport and mass transport studies--theoretical, laboratory and field tests).

SGN

Société Générale pour les
Techniques Nouvelles
1 Rue des Herons,
Montigny le Bretonneux
F-78184 St.-Quentin-en-Yvelines
Cedex, France

Tel: 33-14-058-6000
Telex: 698316 F

President	Louis Pradere
Managing Director	Pierre B. de la Combe
Technical Director	Claude Bernard

IN

Transnucléaire
11 Rue Christophe-Colomb
F-75008 Paris
France

Tel: 33-14-723-7850
Telex: 280992

General Manager	Bernard Savornin
Technical Manager	Paul Blum

GERMANY
(Federal Republic of Germany)

GERMANY (FRG)

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
March 28	Good Friday
March 30-31	Easter
May 1	Labor Day
May 8	Ascension
May 18-19	Pentecost
June 17	Day of Unity
December 25-26	Christmas

TIME

Standard Time Washington D.C.: **+ 6 hours**

Daylight Saving Time period: **03/30 - 09/27/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States. A visa is currently not required for a visit to Germany, however, it is recommended to consult a travel agency for up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 2.4235 Mark (DM)
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Germany are complete as listed; dial international access code: **011 + 32 + local number.**

US EMBASSY - BONN

American Embassy
Deichmannsaue
D-5300 Bonn 2
Federal Republic of Germany

Tel: 49-228-339-3390
Telex: 885452

Science Counselor — Dr. Robert G. Morris

ENERGY

Population	1983	61.4 million
Energy Demand	1980	272 Mtoe (55% imported)
	1982	257 Mtoe
Oil Demand	1980	133 Mtoe (96% imported)
Electric Power Plant Capacity	1983	87 GWe
Electric Power Production	1983	373.8 TWh--
		18% nuclear
		64% coal
		10% gas
		5% hydro/geoth.
		3% oil
	1985	**33% nuclear**
	1990	**~40% nuclear**

NUCLEAR POWER

Policy: Strong federal support for nuclear industry; emphasis on LWR; LMFBR and HTGR demonstration projects.

Nuclear Power Plant Capacity	1986	17.6 GWe
	1990	22.9 GWe
	2000	25.6 GWe
Reactor Mix	1985	PWR: 9 (1972-85)
		5 (1986-92)
		BWR: 7 (1972-85)
		FBR: 1 (1987)
		HTR: 1 (1985)

INDUSTRIAL FUEL CYCLE

Policy: Full commercial capability --enrichment; fuel fabrication; domestic reprocessing of standard LWR fuels; plutonium recycle to FBRs and LWRs. Immediate reprocessing load is to be handled by foreign plants.

Waste Management Strategy: Vitrification of HLW and interim storage of HLW glass for at least 10 years; disposal of reprocessing wastes in salt-dome repository; disposal of reactor and decommissioning wastes in salt repository or abandoned iron mine.

Cumulative Spent Fuel Arisings (LWR)		1980	960 tU
		1985	2,250 tU
		1990	4,550 tU
		2000	11,000 tU
Cumulative Waste Arisings	2000	LLW	250-500,000 drums
		ILW	70-100,000 drums
		HLW	4,600 blocks glass

Industrial-Scale Activities

* Uranium mining and milling (tU/a): 100.

* Uranium enrichment (tSWU/a): 1985--100, 1986--400.

* Fuel fabrication
  - UO_2 fuel: 950 tU/a
  - MOX fuel: either 40 tHM/a for LWR fuels or 10 tHM/a for FBR fuel elements (ALKEM).

* AFR spent fuel storage
  - 1,500 t, dry storage (Gorleben), startup 1986.
  - 1,500 t, dry storage (Ahaus), stopped by court order.

* Fuel reprocessing plant (350 to 500 t/a)--to be constructed near Wackersdorf, Bavaria. Approval process started 1985.

Major Milestones

* Spent fuel AFR at Gorleben	1986
* First fuel reprocessing plant at Wackersdorf	1995
* Konrad iron mine repository	1989
* Gorleben repository, LLW/HLW	1995/2003
* Be ready to accept HLW canisters from Cogema/La Hague	1990

INTERNATIONAL RELATIONSHIPS

US: DOE/BMFT Umbrella Agreement for Waste Management Exchange
- Term: 12-20-74 to 12-31-89.
- Scope: Geologic disposal in salt deposits; retrievable surface storage; R&D; D&D; operational aspects of LL/ILW storage and disposal; transportation.
- Emphasis: Detailed technical exchange of waste treatment technology (design/operation of US and FRG HLW vitrification pilot plants, conditioning of LLW/TRU wastes, waste form characterization) and waste package development;

collaboration in in-situ tests in FRG's Asse salt mine; US observation of shaft drilling at the Gorleben repository site; cooperation in tests of transport/storage casks and in waste transportation studies.

DOE/BMFT Implementing Agreement for Asse Mine Studies

- Term: 10-1-81 to 10-1-86.
- Scope: In-situ studies of brine migration, test equipment, performance of materials, thermal effects.

DOE/BMFT Implementing Agreement for HLW Immobilization Studies

- Term: 11-28-84 to 11-28-90.
- Scope: Plant design, construction and operation; fabrication by DOE of heat-and-radiation sources that simulate HLW glass canisters, for FRG tests at Asse.

SNL/BAM Implementing Agreement for Transportation Research

- Term: 1-1-85 to 12-1-87.
- Scope: Cask development and design; transportation packaging; risk analysis.

Member of EC, IAEA and OECD/NEA. Partnership with the Netherlands and the UK in URENCO uranium enrichment consortium, with France and the UK in United Reprocessors GmbH (UWK) and Nuclear Transport, Ltd. (Transnuklear), with Belgium and The Netherlands in FRG SNR-300 LMFBR demonstration project. Small interest in SuperPhenix project (France).

ORGANIZATION

* Federal Government
  - Coordinates FRG nuclear program
  - Sponsors R&D
  - Builds and operates radioactive waste disposal facilities (through PTB)
  - Sets licensing rules

* States (Laender)
  - License nuclear plants
  - Provide LLW interim storage area

* Utilities
  - Provide spent fuel storage, reprocessing and waste treatment
  - Pay for waste disposal

GOVERNMENT RESPONSIBILITIES—NUCLEAR FUEL CYCLE/W MANAGEMENT

BMFT (Federal Ministry for Research and Technology)
- * Government Fuel Cycle/Waste Management Program Administration
- GSF/IfT
  - * FRG Lead Geologic Waste Disposal R&D
  - * Supporting Lab Work - Salt Properties
  - * Asse II Studies
  - * Konrad R&D
- KfK
  - * LWR/FBR Spent Fuel Reprocessing
  - * LWR Fuel Cycle Waste Treatment/Packaging
  - * LWR Spent Fuel Management Alternatives
  - * HLW Vitrification R&D - PAMELA Support
- KFA
  - * HTGR Fuel Cycle
  - * Waste Treatment
- HMI
  - * Waste Form Characterization Techniques/ Properties

BMW (Federal Ministry for Economics)
- BGR
  - * Geologic Survey
  - * Salt Dome Repository R&D (Salt Properties, Rock Mechanics)
- PTB
  - * Fuel Storage Licensing
  - DBE
    - * Construction/Operation

BMI (Federal Ministry of Interior)
- * State Licensing Procedures
- * Nuclear Safety/Radiation Protection
- RSK (Reactor Safety Commission)
- SSK (Radiation Protection Commission)

LAENDER (State Governments)

* Licensing

INDUSTRIAL/UNIVERSITY RESPONSIBILITIES

DWK (Owned by FRG Nuclear Utilities)

* Fuel Reprocessing/Waste Conditioning Services
* Funding of Waste Disposal Services Provided by Federal Government
* Construction/Operation of PAMELA Pilot Plant

— WAK (DWK Subsidiary)

* Reprocessing Pilot Plant
* DWK R&D Program Management

— BLG (DWK Subsidiary)

* Gorleben Spent Fuel/LLW Storage Facilities Operation

NUKEM (Owned by Degussa, 45%; RWE, 25%, RTZ, 18%; MG, 12%)

* LLW/TRU Waste Treatment R&D Facility Design
* R&D—Spent Fuel Packaging for Disposal

ALKEM (Owned by NUKEM, 40%; KWU, 60%)

* MOX Fuel Fabrication R&D/Production
* TRU Waste Treatment

TRANSNUKLEAR (Owned by NUKEM, 67%; Transnucleaire SA, 33%)

* Shipping Cask Development/Production
* Portable LLW Solidification
* Transportation of Radioactive Materials

TUM (Technical University Munich)

* Actinide Chemistry R&D

ALKEM

ALKEM GmbH
Postfach 110069
D-6450 Hanau 11 (Wolfgang) — Tel: 49-6181-58-0
Federal Republic of Germany — Telex: 418-4124 rbu d

Directors	Horst Roepenack 49-6181-58-4600
	Dr. Wolfgang Stoll 49-6181-58-4666
Plutonium Waste Treatment	Dr. Volker Schneider 49-6181-58-4590
	Dr. F.-W. Ledebrink 49-6181-58-4155

Facilities

* **MOX Fuel Fabrication Plant**
  Capacity: 40 t/a, LWR fuel; 10 t/a, FBR fuel.

BAM (Federal Institute for Material Testing)

Bundesanstalt fuer Material Pruefung (BAM)
Unter den Eichen 87
D-1000 Berlin 45 — Tel: 49-30-8104-1
Federal Republic of Germany — Telex: 18-3261 BAMB D

BGR (Federal Institute for Geosciences and Natural Resources)

Bundesanstalt fuer Geowissenschaften
und Rohstoffe
Stilleweg 2
D-3000 Hannover 51 — Tel: 49-511-6468-1
Federal Republic of Germany — Telex: 92-3730 bfb

Director, Division 2, General/Technical Geology	Prof. Helmut Venzlaff
Director, Subdivision, Engineering Geology	Prof. Michael Langer
Rock Mechanics	Prof. A. Pahl
Soil Mechanics	Dr. R. Luedeling
Salt Mechanics	Dr. H. Albrecht
Rock Mech. in Mining/Tech. Res.	Dr. D. Meister
Rad. Waste Disposal	Dr. W. Jaritz
Underground Storage	Dr. H. Reum
Hydrogeology	Dr. H. Vierhuff
Groundwater Geophysics	Dr. W. Giesel

BMFT (Federal Ministry for Science and Technology)

Bundesministerium fuer Forschung und Technologie	
Heinemannstrasse 2	
Postfach 200706	Tel: 49-228-591
D-5300 Bonn 2	Telex: 88-5674 BMFT
Federal Republic of Germany	Fax: 49-593-105
Minister, Science/Technology	Dr. Heinz Riesenhuber
Director General, Energy/ Environment/Raw Materials	Dr. Guenter Lehr
Director, Energy Sci. Tech.	Dr. Manfred Popp
Reprocessing/Recycling	Dr. Rolf-Peter Randl 49-228-59-3275
Waste Disposal	Dr. Hamacher 49-228-59-3282
Spent Fuel	Helmut H. Geipel
Waste Treatment	Dr. Karlheinz Huebenthal
Repository Programs	Reinhard Ollig

BMI (Federal Ministry of the Interior)

Bundesministerium des Innern	
Graurheindorfer Strasse 198	
D-5300 Bonn 1	Tel: 49-228-6811
Federal Republic of Germany	Telex: 88-6664 bmid 88-6896
Chairman, Advisory Committee on Reactor Safeguards (RSK)	Dr. Schenk
Chairman, Advis. Committee on Radiological Protection (SSK)	A. Kaul

DBE (German Company for Construction and Operation of Waste Disposal Facilities)

Deutsche Gesellschaft zum Bau und Betrieb von Endlagern fuer Abfallstoffe mbH (DBE)	
Woltorfer Strasse 74	
D-3150 Peine 1	Tel: 49-5171-43-100
Federal Republic of Germany	Telex: 92-646 dbe d
Managing Director	Wolfgang Pitz
Director, Mining	Gernot Gruebler
Director, Licensing	G. Holtz
Director, Project-Related R&D	Dr. H. Jezierski

DHI (German Hydrographic Institute)

Deutsches Hydrographisches Institut
Isotopenlaboratorium
Bernhard-Nacht-Str. 78
P.O. Box 220
D-2000 Hamburg 4 — Tel: 49-40-3190-1
Federal Republiof Germany — Telex: 21-1138 bmvhh d

President — Prof. Gerhard Zickwolff

DWK (German Fuel Reprocessing Company)

Deutsche Gesellschaft fuer Wiederaufarbeitung
von Kernbrennstoffen mbH
Hamburger Allee 4, Postfach 1407
D-3000 Hannover 1 — Tel: 49-511-3390-0
Federal Republic of Germany — Telex: 92-20202 dwk

Board Member for Engineering/ Technical Director	Joachim Mischke
Waste Management	Dr. Klaus Einfeld
Project Direction	Dr. Storck
Board Member for Research	Dr. Mueller von Blumencron

Facilities

* **AFR Spent Fuel Storage Facilities** (Gorleben and Ahaus sites)
  Design Basis: Dry storage in CASTOR casks - 400 casks in a building which has dimensions of 600 ft x 125 ft x 62 ft high; capacity, 1500 t.
  Milestone: Startup of Gorleben AFR, 1986.

* **Fuel Reprocessing Plant** (Wackersdorf, Bavaria)
  Mission: Demonstrate operability and safety of small commercial plant; reprocess spent LWR fuels commercially.
  Design Basis: Shear-leach head-end; PUREX process; capacity, 350 t/a.
  Milestone: Startup, 1995.

* **PAMELA Pilot Plant** (Mol, Belgium)
  Mission: Demonstrate ceramic melter and VITROMET production with stored Eurochemic LEWC.
  Design Basis: liquid-fed ceramic melter, 0.72 m^2 surface area; capacity, 36 l/hr feed, 25 kg/hr glass (3 canisters/day @ 150 kg glass/canister); product, either borosilicate glass blocks or VITROMET, 0.3 m dia by 1.2 m high.
  History: Hot operation, startup 1985.

GSF/IfT (Company for Radiation and Environmental Research, Institute for Underground Storage)

Gesellschaft fuer Strahlen- und
Umweltforschung mbH Muenchen,
Institut fuer Tieflagerung
Theodor-Heuss-Strasse 4 Tel: 49-531-8012-1
D-3300 Braunschweig Telex: 95-2865 iftta d
Federal Republic of Germany Fax: 49-531-8012-200

Waste Management R&D: Development and testing of safe, final geological storage for radioactive wastes, and of data for planning, constructing and operating repositories.

Director, Disposal Techniques	Dr. Klaus Kuehn 49-531-8012-231
Eng. Techniques	(Vacant)
Geotechnology	Manfred W. Schmidt
Test Fields	Tilman Rothfuchs 49-5336-89232
Geophysics	Dr. D. Flach
Director, Safety Tech.	Dr. Werner Hild
Safety Analysis	Dr. Storck
Geology	Dr. T. Brasser
Geochemics	Dr. H. Gies
Director, Proj. Mgmt.	Dr. Wernt Brewitz
ILW/HLW Projects	Dr. Rolf Stippler
Gorleben Site	Kunze
Licensing	O. Opp

Schachtanlage Asse
D-3345 Remlingen
Kreis Wolfenbuettel
Federal Republic of Germany Tel: 49-5336-891

Director, Operational Devel.	Klaus Duerr
Mine Manager	Kurt Thieleman
Tech. Planning	Helmut Kolditz
Rad. Protection	Dr. Mueller-Lyda

Facilities

- **Asse II Salt Mine** (12 km SE of Wolfenbuettel)
  Mission: In situ testing and disposal technology development for a salt dome repository; through 1978, disposal of LLW and ILW.
  History: Startup, 1967.
- **Chemical and Hydrology Laboratories** (Braunschweig)
- **Rock Mechanics Laboratory** (Braunschweig)

HMI

Hahn-Meitner Institut fuer Kernforschung, GmbH
Postfach 390128
Glienicker Strasse 100
D-1000 Berlin 39
Federal Republic of Germany

Tel: 49-30-8009-1
Telex: 18-5763

Scientific Technical Director — Prof.-Dr. H. Lindenberger
Managing Director — Dr. M. Nettesheim
Reactor Chemistry Section (HMI Waste Program) — Dr. Werner Lutze

KFA (Juelich Nuclear Research Center)

Kernforschungsanlage Juelich GmbH
Postfach 1913
D-5170 Juelich
Federal Republic of Germany

Tel: 49-2461-610
Telex: 83-3556

Director, Institute of Chemical Technology — Prof. Erich Merz 49-2461-61-5299
Reprocr./Final Storage — Dr. Erich Zimmer
HTGR Fuel Cycle Project — G. Kaiser
Director, Decon. Inst. — Dr. Manfred Laser
Director, Reactor Mtls. Inst. — Prof. H. Nickel

Facilities

* **FIPS II** (radioactive)
  Mission: Develop HLW vitrification technology.
  Design Basis: Denitration to form sludge, drum dryer, in-can melter. Capacity, 1 kg/hr glass; product, phosphate or borosilicate glass.
  Milestone: Hot operation, 1986 (FBR work by KfK).

KfK (Karlsruhe Nuclear Research Center)

Kernforschungszentrum Karlsruhe GmbH
Postfach 3640
D-7500 Karlsruhe 1
Federal Republic of Germany

Tel: 49-7247-821
Telex: 78-26484
Fax: 49-7247-82-5503

(Convenient route from US is by plane to Frankfurt and by train or car to Karlsruhe.)

KfK (contd)

Manager, Fuel Reproc./Waste Mgmt. Project (PWA)	Dr. Reinhard Kroebel 49-7247-82-2032
Director, Waste Treatmt. (HDB)	Dr. Guenter Hoehlein
Director, Institute for Hot Chemistry	Prof. Klaus Ebert
Deputy Director	Dr. Gunter Koch
Director, Institute for Nuc. Waste Tech. (INE)	Dr. Helmut Krause 49-7247-82-2230
Final Disposal	Dr. R. Koester 49-7247-82-2302
Chemistry (WMRD)	Dr. Horst Pentinghaus
Process Engineering	Dr. S. Weisenburger
Director, Institute for Radiochemistry (IRCh)	Prof. Ache
Director, Ctrl. Eng. Dept. (IT)	W. P. Schmidt
Remote Handling	G. Boehme
Director, Lab. for Aerosol Phys./Filter Tech. (LAF II)	J. Wilhelm

Facilities

- **MILLI Hot Cell Facility** (fuel reprocessing)
  Mission: LWR and FBR fuel reprocessing R&D.

- **MINKA Hot Glove Boxes** (U and Pu)
  Mission: Extraction code verification for pulsed columns and maloperation experiments.
  Design: Small scale pulse columns first extraction cycle.
  Milestone: Startup: U - 1985, Pu - 1986.

- **PUTE Hot Facility** (fuel reprocessing)
  Mission: U/Pu Separation.
  Design Basis: Pulsed Columns, Electr. Chem. Reduction.
  History: Startup 1982.

- **PUSTA Facility** (fuel reprocessing)
  Mission: Development of Pulsed Plate Columns Design Data, Correlation Equations.
  Design Basis: Columns of 100 mm, 210 mm, and 350 mm diameter.
  History: Startup, 1984.

- **KRETA**
  Mission: Develop ^{85}Kr recovery technology. (Project completed August/1985).
  Design Basis: Cryogenic distillation; capacity, 50 m^3/hr.

KfK (contd)

* **PASSAT Facility**
  Mission: Development and testing of DOG filters.
  Design Basis: Packed fiber mist eliminators, HEPA-filter, iodine-filter.
  History: Startup, 1978 (prog. completion, 1987).

* **BEATE Facility**
  Mission: Aerosol source term destination and VOG-behavior.
  Design Basis: Stirring and transport of liquids by air and steam.
  History: Startup, 1983 (prog. completion 1987).

* **Ceramic Melter** (nonradioactive)
  Mission: HLW vitrification process development with ceramic melter for the PAMELA pilot plant and for the WA-350.
  Design Basis: Liquid-fed joule heated melter; PAMELA capacity: 30 l/hr HLLW or 30 kg/hr glass; WA-350 capacity: 80 l/hr HAWC evaporation.
  History: Startup, 1981; WA-350 melter, 1985/86.

* **ALONA** (radioactive acid digestion pilot plant built and operated by KfK at Mol, Belgium)
  Mission: Demonstrate acid digestion of combustible TRU wastes.
  Design Basis: Treatment with H_2SO_4-HNO_3 in thermal loop system. Capacity, 1,000 m^3/a.
  History: Startup, 1982; terminated 1985.

* **Waste Concreting Plant** (radioactive)
  Mission: Immobilize KfK ILW.
  Design Capacity: 2.5 t/day waste.
  History: Startup, 1977.

NUKEM

NUKEM GmbH
Postfach 110080
D-6450 Hanau 11
Federal Republic of Germany

Tel: 49-6181-58-0
Telex: 41-84113 nuk d

Managing Directors	M. Stephany P. Jelinek-Fink Dr. K. G. Hackstein
Division Managers, Process Engineering	H. Pirk H. Dyroff
Department Manager, R&D TRU Waste	Dr. H. Huschka Dr. Volker Schneider

PTB (Federal Science/Engineering Laboratory)

Physikalisch-Technische Bundesantalt
Bundesallee 100
D-3300 Braunschweig
Federal Republic of Germany

Tel: 49-531-5921
Telex: 95-2822 ptb d

Director	Prof. Dr. H. Roethemeyer
Director, Division Storage/ Radwaste Disposal	Dr. Horst Schneider 49-531-592-7620
Waste Product	Dr. Ernst Warnecke
Radiation Safety	Dr. Ehrlich
R&D, Accident Analysis	Dr. Illi
Explorations/Mine Construction	G. Wosnick
Director, Subd. Fuel Matls.	Dr. W. Collin
Transport Licensing	M. Blechschmidt (acting)
Interim Stor. Fac. Licensing	M. Blechschmidt

Facilities

* **Gorleben Disposal Site** (20 km NE of Braunschweig)
  Mission: Dispose of high-level and TRU wastes.
  Repository Concept: 65 m deep boreholes in tunnel floors at depths of 800-1000 m in the Gorleben salt dome.
  Milestone: Startup, 1995.

* **Konrad Iron Mine** (10 km SW of Braunschweig)
  Mission: Disposal of low-level and decommissioning wastes. Hard-rock disposal R&D.
  Milestone: Startup as disposal site, 1989

  Mine Manager — M. Kubetzy 49-534-127-3588

TRANSNUKLEAR

Transnuklear GmbH
Postfach 110030
D-6450 Hanau 11
Federal Republic of Germany

Tel: 49-6181-580
Telex: 41-84123 tnf d

Executive — Dr. Peter Vygen

TUM (Technical University Munich)

Technische Universitaet Muenchen
Walther-Meissner-Strasse
D-8046 Garching (Muenchen) Tel: 49-89-21051
Federal Republic of Germany Telex: 52-2854 tumue d

Director, Radiochem. Institute Prof. Franz Baumgaertner

WAK (Fuel Reprocessing Company)

Wiederaufarbeitungsanlage Karlsruhe
Betriebsgesellschaft mbH
Postfach 220
D-7514 Eggenstein-Leopoldshafen 2 Tel: 49-7247-881
Federal Republic of Germany Telex: 78-26893 wak d

(WAK and the WAK plant are located next to Karlsruhe Nuclear Research Center. WAK is a subsidiary of DWK.)

Chief Executive Dr. Walter Schueller
49-7247-88204
R&D Division Dr. Karl-Dieter Kuhn
49-7247-88506

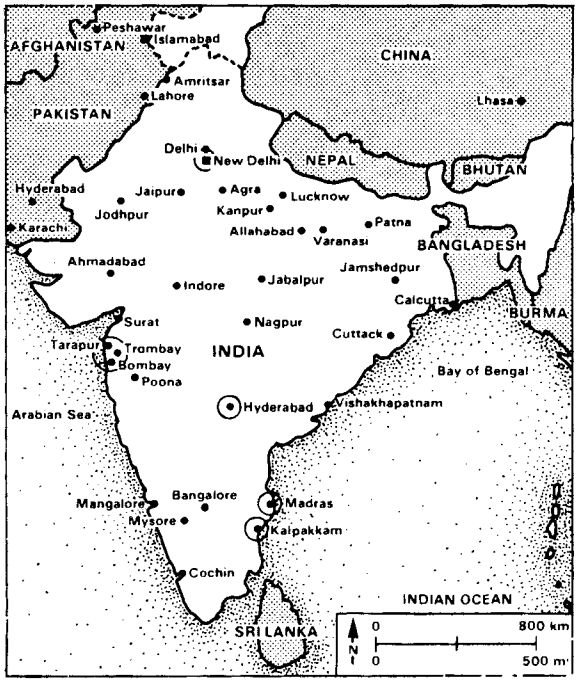
Facilities

* **WAK Reprocessing Plant** (owned by KfK)
Mission: Reprocess UO_2 fuels; recover plutonium for recycle; test advanced technology.
Design Basis: Chop-leach head-end; PUREX process; capacity, 175 kg HM/day.
History: On-line from 9/71 to early 1980, when it was shutdown for dissolver replacement. Total throughput to 1980, 115 tHM (43 tHM from LWR fuel). Operation resumed, October 1982.

* **TEKO Hall** (cold semi-works, owned by KfK)
Mission: Test fuel cycle components and unit operations; currently being equipped for fuel reprocessing studies.
Design Basis: Shear, dissolver, centrifuge, solvent extraction battery; head-end capacity, 4 tHM/day.

Manager Dr. Eiben
49-7247-88450

INDIA


Peshawar
Islamabad
AFGHANISTAN
CHINA
Amritsar
Lahore
Lhasa
PAKISTAN
Delhi
New Delhi
NEPAL
BHUTAN
Hyderabad
Jaipur
Agra
Lucknow
Jodhpur
Kanpur
Karachi
Allahabad
Patna
Varanasi
BANGLADESH
Ahmadabad
Jamshedpur
Indore
Jabalpur
Calcutta
BURMA
Surat
Nagpur
Cuttack
Tarapur
Trombay
INDIA
Bombay
Poona
Bay of Bengal
Hyderabad
Vishakhapatnam
Arabian Sea
Mangalore
Bangalore
Madras
Mysore
Kalpakkam
Cochin
INDIAN OCEAN
SRI LANKA
N
0
800 km
0
500 m

INDIA

HOLIDAYS

Jan. 1	New Year	Aug. 15	Independence
January	Id-ul-Fitr	August	Janmashtami
Jan. 26	Republic Day	Sept.	Anant Choudas
February	Vasanta	October	Dusehra
February	Maha Sivarati	October	Diwali
March	Holi	Oct. 2	Gandhi's Birth
March	Dulhendi	October	Bhaiya Dooj
April	Durga Ashtmi	November	Guru Nanak's Birthday
April	Muharram		
April	Mahavir Jayanti	December	Singh's Birth
Apr. 13	Baisakhi	Dec. 31	Bank Holiday
August	Raksha Bandhan		

TIME

Standard Time Washington D.C.: **+ 10.5 hours**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States; in addition, a visa is currently required for a visit to India. Most travel agencies can provide up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 12.03 Rupee

per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

US EMBASSY - NEW DELHI

American Embassy
Shanti Path, Chanakyapuri
110021 New Delhi
India

Tel:
Telex:

Science Counselor — S. Ahmed Meer

ENERGY

Population	1984	731 million
Energy Demand	1979	94 Mtoe
Oil Demand	1980	28 Mtoe (65% imported)
Electric Power Plant Capacity	1982	35 GWe
	1985	50 GWe
Electric Power Production	1982	107 TWh-- 50% coal 42% hydro 6% oil **2.7% nuclear**

NUCLEAR POWER

Policy: Heavy dependence on nuclear power to augment the nation's electric power generating capacity. A three-phase program--first phase, reactors fueled with natural uranium; second phase, FBRs fueled with Pu produced by first-phase reactors; third phase, self-sustaining thorium-uranium cycle reactors.

Nuclear Power Plant Capacity	1986	1.3 GWe
	1990	1.7 GWe
	2000	5.9 GWe
Reactor Mix	1985	BWR: 2 (1969) HWR: 4 (1973-85) 2 (1986-89)

Reactor Development	1985	FBR	12-15 MWe test unit
	1990	FBR	500 MWe commercial

INDUSTRIAL FUEL CYCLE

Policy: Achieve self-sufficiency in CANDU-type fuel cycle--uranium milling, conversion to UO_2, fuel fabrication, reprocessing (in small plants adjacent to power stations); if enriched UF_6 supply for India's BWRs is cut off, they may fuel with UO_2-PuO_2.

Waste Management Strategy: Vitrification of HLW, interim storage for at least 20 years and disposal in a granite or gneiss formation.

Cumulative Spent Fuel Arisings (LWR and HWR)	1980	370 tU
	1985	780 tU
	1990	1,580 tU
	2000	5,000 tU

Cumulative Waste Arisings	1982	2000
Primary solid wastes	1,700 m^3	107,000 m^3
LLW concentrates	2,500 m^3	77,000 m^3
ILW	650 m^3	20,000 m^3
HLW	350 m^3	8,000 m^3

Industrial-Scale Activities

* Heavy-water production (t/a): 1981--300; additional capacity is planned, sufficient to yield a 13,000 t inventory by the year 2000.

* Uranium mining and milling (t/a): 200.

* UO_2 fuel fabrication (t/a): 1981--100; 1984--210.

* Fuel reprocessing:
  Trombay pilot plant, 30 t/a (1962--)
  Tarapur plant, 100 t/a (1982--)
  Kalpakkam plant, 100 t/a.

* HLW vitrification: Tarapur (1986--).

ORGANIZATION

Prime Minister
- Department of Atomic Energy
  - Atomic Energy Commission
    - Atomic Minerals
    - Nuclear Fuels
    - Power Project Engineering
    - Research and Development
      - Reactor Research Center (Kalpakkam)
        - * Fuel Cycle R&D
        - * Waste Management
      - Bhabha Atomic Research Center
        - * Fuel cycle R&D
        - * Waste management

BARC

Bhabha Atomic Research Centre
Trombay, Bombay 400 085
India

Director, Nuclear Safety Group	V. N. Mackoni
Waste Management Division	N. S. Sunder Rajan
Central. WM Facil., Kalpakkam	R. V. Amalraj
Radiol. Protection Division	K. G. Vohra
Director, Chem. Engineering Group	B. K. Garg
Fuel Reproc. Div. PreFre	A. N. Prasad

Activities: BARC has five test reactors; radiochemistry and isotope laboratories; an isotope production and processing unit; pilot plants for production of heavy water, zirconium, titanium, etc.; a thorium plant; a uranium metal plant; a fuel reprocessing plant; the Fuel Irradiation and Processing Laboratory; and supporting facilities. Fuel cycle R&D includes fuel reprocessing, HLW solidification, treatment of alpha-emitting wastes (incineration, wet oxidation, decontamination, and immobilization of cladding hulls), D&D, and waste isolation in geologic formations.

Facilities

- **Trombay Fuel Reprocessing Plant**
  Mission: Reprocess natural uranium metal fuels.
  Design Basis: Chemical declad, PUREX flowsheet; contact maintenance; capacity, 0.1-0.15 tHM/day.
  History: On-line, 1965-1974; modified and being readied to operate again.

- **HLW Vitrification Plant**
  History: Construction start, 1981.

DAE

Department of Atomic Energy
Chhatrapati Shivaji Marharaj Marg
Bombay 400 039
India

DAE (contd)

Atomic Energy Commission (AEC)
Chairman — Dr. Raja Ramanna

Atomic Energy Regulation Board (AERB)
Chairman — A. K. De (Inst. of Tech.)
Function: Regulation and licensing of nuclear facilities.

Nuclear Power Board
Chairman — Dr. M. R. Srinivasan
Function: Design, construction, and operation/maintenance of nuclear power stations.

KOLAR WASTE DISPOSAL RESEARCH STATION

Located in the Kolar gold mine area of the Karnataka State.

Mission: Assess the suitability of peninsular gneisses for location of a repository (in situ studies).
Description: Tunnel extended from abandoned section of one of the Kolar gold mines into a neighboring gneissic formation.
History: Startup, late 1979.

MADRAS ATOMIC POWER PROJECT

Madras Atomic Power Project
Kalpakkam, India

Mission: Nuclear power production, FBR development, fuel reprocessing and waste treatment, plutonium fuel fabrication for FBRs.
Fuel Cycle R&D: FBR technology, reprocessing of FBR fuels.

Facilities

* **Kalpakkam Fuel Reprocessing Plant**
  Mission: Reprocess spent fuel from the Kalpakkam reactors and from the 15-MW FBTR commissioned 1985.
  Design Basis: PUREX process, with a separate line for FBTR mixed-carbide fuels; capacity, 0.5 tHM/day for PHWR fuels.

* **Kalpakkam Fuel Reprocessing Laboratory**
  Mission: Develop and test equipment and unit operations for FBR fuel reprocessing.

* **Kalpakkam HLW Vitrification Plant**
  History: Construction start, 1983.

TARAPUR ATOMIC POWER STATION

Tarapur Atomic Power Station
Tarapur, Maharashtra
India

Mission: Provide electric power, reprocess spent fuel from Tarapur reactors and immobilize the associated wastes.

Facilities

* **Tarapur Fuel Reprocessing Plant (PreFre)**
  Mission: Reprocess natural and low-enriched UO_2 fuels.
  Design Basis: Chop-leach head-end; PUREX flowsheet; contact maintenance; capacity, 0.5 tHM/day.
  History: Construction completed, 1975; hot operation, 12/82.

* **WIP** (Waste Immobilization Plant)
  Mission: Vitrify Tarapur HLW.
  Design Basis: Two-step calcination and melting in drainable pot; capacity, 25 P/hr HLLW, 125 kg glass/canister, 1 canister/day; product, borosilicate glass blocks.
  History: Construction completed 1981. Hot startup 1985.

* **Solid Storage Surveillance Facility**
  Mission: Provide air-cooled storage for WIP products.
  Design Basis: Stack-induced natural-draft air cooling; capacity for 20 years' storage of Tarapur and Trombay waste.

* **ILW Bituminization Plant**

* **Polymerization Facility**

ITALY


SWITZERLAND
Lausanne
Geneva
FRANCE
AUSTRIA
Klagenfurt
HUNGARY
Ispra
Bergamo
Saluggia
Brescia
Padua
Trieste
Milan
Verona
Turin
Venice
Parma
Genoa
Bologna
YUGOSLAVIA
Savona
Ravenna
Pisa
SAN MARINO
LIGURIAN SEA
Florence
Livorno
Ancona
ADRIATIC SEA
ITALY
CORSICA (To France)
Rome
Naples
Bari
Salerno
Taranto
Brindisi
SARDINIA
Rotondella (Trisaia)
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Cagliari
Palermo
Messina
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ITALY

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
March 28	Good Friday
March 30-31	Easter
April 25	Liberation Day
May 1	Labor Day
May 18-19	Pentecost
August 15	Assumption
November 1	All Saints
December 8	Immaculate Conception
December 25-26	Christmas

TIME

Standard Time Washington D.C.: **+ 6 hours**

Daylight Saving Time period: **03/30 - 09/27/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States. A visa is currently not required for a visit to Italy, however, it is recommended to consult a travel agency for up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 1655.00 Lira
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Italy are complete as listed; dial international access code: **011**
+39 + local number.

US EMBASSY - ROME

American Embassy
Via Veneto 119/A
I-00187 Rome
Italy

Tel: 39-6-4674
Telex:

Science Counselor — Gerald Whitman

ENERGY

Population	1984	58 million
Energy Demand	1984	143 Mtoe (82% imported)
Oil Demand	1984	85 Mtoe (98% imported)
Electric Power Plant Capacity	1984	54 GWe
Electric Power Production	1983	182.9 TWh-- 50% oil 26% hydro/geoth. 14% coal 7% gas **3% nuclear**

NUCLEAR POWER

Policy: National government supports nuclear power growth, but is hampered by financial and siting problems.

Nuclear Power Plant Capacity	1986	1.3 GWe
	1995	4.8 GWe
	2000	6.7 GWe
Reactor Mix	1985	GCR: 1 (1964) PWR: 1 (1965) BWR: 1 (1981) 2 (1990) HWR: 1 (1986)
Reactor Development		HWR, FBR

INDUSTRIAL FUEL CYCLE

Policy: Reprocess spent fuel and recycle Pu to breeders; develop indigenous fuel cycle and waste treatment capability.

Waste Management Strategy: HLW--vitrify and store in engineered surface facility for 50-60 years; emplace canisters in geologic repository (clay).

Cumulative Spent Fuel Arisings (LWR)	1980	160 tU
	1985	330 tU
	1990	520 tU
	2000	2,000 tU

INTERNATIONAL RELATIONSHIPS

Member of EC, IAEA, and OECD/NEA. A CEC Joint Research Center laboratory is located in Northern Italy at Ispra. Participation in Eurodif and SuperPhenix projects. Cooperative agreement on HLW with Australia.

ORGANIZATION

- ENEA (National Commission for Nuclear and Alternative Energy Sources)--safety and regulatory; nuclear R&D (principally at Casaccia, Saluggia and Trisaia).
  - DISP (Directorate for Nuclear Safety and Health Protection)--safety inspection/control and health/environment protection.
- ENI--government-owned oil and energy holding company (of AGIP), which provides fuel cycle services.
- Nucleco--manages institutional and reactor LLW/ILW.
- CIPE (Interministerial Council for Economic Planning)--designates regions where nuclear plants are to be located.
- ENEL--state-owned power utility.

ENEA (National Commission for Nuclear and Alternative Energy Sources)

ENEA
Regina Margherita 125
I-00198 Rome
Italy

Tel: 39-6-85281
Telex: 61183

President — Prof. Umberto Colombo
Director General — Dr. Fabio Pistella

Function: Direct pure and applied nuclear research, maintain technical control over nuclear power plants, cooperate in international program.
Owner: Government.

ENEA-CASACCIA

ENEA-Casaccia Center
Via Anguillarese 351
I-00060 Rome
Italy

Tel: 39-6-9481
Telex: 613296

For Correspondence: C. P. 2400, I-00100 Rome, Italy

Director, Fuel Cycle	Dr. Paolo Venditti
Waste Management	Dr. B. Dello Vicario
Reprocessing	Dr. G. Rolandi

Mission: Applied research--advanced technology, fast breeder development; fuel cycle and alternative energies R&D.

Waste Management R&D: MOX fuel reprocessing, HLW solidification, actinide transmutation, treatment of LLW and characterization of waste forms, waste isolation in clay formations (site characterization and thermal properties).

ENEA-SALUGGIA

ENEA-Impianto Eurex
I-13040 Saluggia (Vercelli)
Italy

Tel: 39-161-48415
Telex: 38-0058 EURI

(Located about 35 km from Torino and 120 km from Milano.)

Director, Eurex Pilot Plant	Dr. Franco Pozzi
Deputy Director, Eurex	Dr. Arnoldo Hall

Mission: Applied nuclear research.

Facilities

* **EUREX** (fuel reprocessing pilot plant-radioactive)
Mission: Reprocess MTR and low-enriched uranium (including UO_2) fuels.
Design Basis: EUREX process for MTR fuel has capacity of 30 kg U-Al/day. Plant will be modified for LWR fuel.
History: Built and operated under a CNEN-Euratom convention 1964-1983. Startup, 1970. CANDU fuels from Canada processed in 1983. A unit will be added for MOX fuel reprocessing.

ENEA-Saluggia (contd)

- **IVEX** (HLW vitrification plant-radioactive) - Planned
  Mission: Immobilize EUREX HLW.

- **IFEC** (fuel element fabrication)

ENEA-TRISAIA

ENEA-Trisaia Center
S.S. 106 Ionica, km 419.5
I-75025 Rotondella (Matera) Tel: 39-835-972241
Italy Telex: 760085 ENEATR I

(Located about 5 km from the coast of the Ionian Sea in the Gulf of Taranto.)

Energy Research	Dr. G. Lapolla
ITREC Plant	Dr. T. Candeliteri
Tech. Devel./Backend Fuel Cycle	Dr. A. Canonico
Vitrif. Plant Operations	Dr. E. Scoditti

Mission: Applied nuclear research.

Waste Management R&D: Fuel reprocessing; centrifugal contactor development; cladding hulls compaction; HLW vitrification; D&D; waste isolation (clay repositories); operation of inactive vitrification pilot plant; remote technology development for HLW and reprocessing, optimization of glass composition.

Facilities

- **ITREC** (fuel reprocessing pilot plant-radioactive)
  Mission: Special fuel reprocessing R&D; reprocess thorium and MOX (FBR) fuels.
  Design Basis: Chop-leach headend; maintenance by remote removal of modules; capacity, 15 kg HM/day (ThO_2 and UO_2).
  History: Startup, 1975.

- **IVET-1** (vitrification pilot plant-nonradioactive)
  Owner: ENEA and AGIP.
  Mission: Develop full-scale HLW vitrification process.
  Design Basis: IVET-1 pot vitrification (rising-level process); capacity, 20 l/hr feed; product, borosilicate glass cylinders, 0.25 m dia x 1 m.
  History: Startup, July 1980.

ENEA-TRISAIA (contd)

* **IVET-2** (HLW vitrification pilot plant-radioactive) - Planned
Owner: ENEA.
Mission: Process development; solidify HLW from EUREX fuel reprocessing pilot plant.
Design Basis: Pot vitrification (rising-level process); capacity, 15 l/hr feed (2 canisters/wk) or 10 m^3 HLLW/a; product, borosilicate glass cylinders, 0.25 m dia x 1 m.
History: Startup, late 1980s.

ENEL (National Electric Energy Agency)

Ente Nazionale per l'Energia Elettrica
Casella Postale 386
Via Giovan Battista Martini 3
I-00198 Rome — Tel: 39-6-85091
Italy — Telex: 610518

President — Ing. Francesco Corbellini
Vice President — Dr. Marcello Inghilesi
Director General — Dr. Alberto Negroni

Function: Responsible for electric power produced by all sources.
Owner: Government.

ENI

Ente Nazionale Indrocarburi SPA
Piazza Enrico Mattei
I-00144 Rome — Tel: 39-6-59001
Italy — Telex:

President — Dr. Franco Reviglio

Mission: Provide nuclear fuel cycle services. Oil and energy holding company of AGIP (owned by the government).

NUCLECO

Nucleco
Via Anguillarese 351
I-00060 Rome — Tel: 39-6-948-3052
Italy — Telex: 61-3296 ENEA CAI

President — Ing. Silvio Cao

NUCLECO (contd)

Mission: Treat and dispose of low- and intermediate-level wastes from hospitals, laboratories, industrial establishments, and nuclear plants. Eventual plans include decommissioning work on nuclear installations.
Owner: Italian government (ENEA--40%; AGIP--60%).

SNIA TECHINT

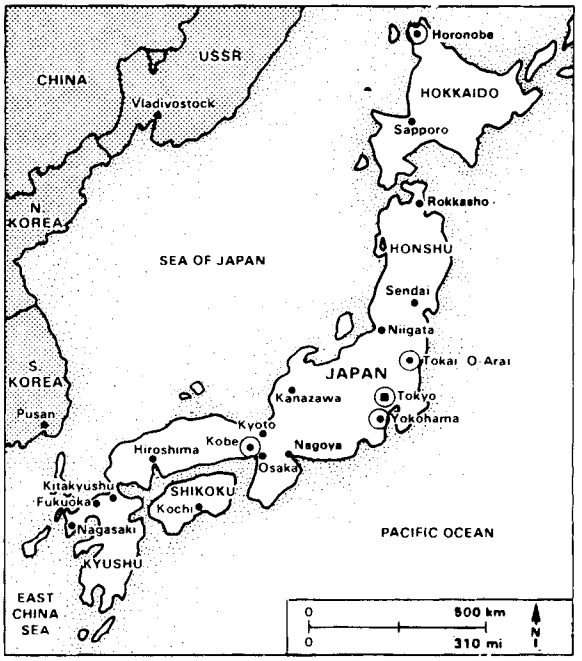
Snia Techint
Tecnologie Energetiche Avanzate SpA
Via A. Bargoni 34
I-00153 Rome
Italy

Tel: 39-6-589-4041
Telex: 61-4354 SNITEC

General Manager — Dr. Marino Fiorelli

Mission: Provide architect-engineering services for reprocessing, fuel handling and HLW conditioning facilities.

JAPAN


USSR
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Horonobe
HOKKAIDO
Sapporo
Rokkasho
N. KOREA
SEA OF JAPAN
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Sendai
Niigata
Tokai
Arai
S. KOREA
JAPAN
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Tokyo
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Pusan
Kyoto
Kobe
Nagoya
Hiroshima
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JAPAN

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
January 15	Adult's Day
February 11	National Foundation
March 20/21	Vernal Equinox
April 29	Emperor's Birthday
May 3	Constitution
May 5	Children's Day
Sept. 15	Respect for the Aged
Sept. 23/24	Autumnal Equinox
October 10	Physical Culture Day
November 3	Culture Day
November 23	Labor Thanksgiving

TIME

Standard Time Washington D.C.: **+ 14 hours**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States; in addition, a visa is currently required for a visit to Japan. Most travel agencies can provide up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 198.60 Yen
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Japan are complete as listed; dial international access code: **011**
+ 81 + local number.

US EMBASSY - TOKYO

American Embassy
Akasaka 1-chome, Minato-ku
10-1 Tokyo
Japan

Tel: 81-3-583-7141
Telex: 24-22118

Science Counselor — Gerald Helfrich
DOE Representative — Billy D. Hill

ENERGY

Population	1983	119.5 million
Energy Demand	1983	357 Mtoe (83% imported)
	1990	398 Mtoe (78% imported)
Oil Demand	1983	221 Mtoe (99% imported)
	1990	209 Mtoe (99% imported)
Electric Power Plant Capacity	1983	140 GWe **19% nuclear**
	1995	205 GWe **22% nuclear**
Electric Power Production	1983	618.4 TWh-- 40% oil **18% nuclear** 15% gas 14% hydro/geoth. 13% coal
	1990	685 TWh-- **28% nuclear**

NUCLEAR POWER

Policy: Strong nuclear power program to lessen dependence on foreign energy sources--install LWRs for near-term needs; develop advanced HWR; aim for commercial FBR operation, approximately 2010. Supply domestic needs and build export business.

Nuclear Power Plant Capacity	1986	23.7 GWe
	1990	29.4 GWe
	2000	46.6 GWe
Reactor Mix	1985	GCR: 1 (1966) BWR: 16 (1970-85) 5 (1985-90) PWR: 14 (1970-85) 6 (1986-94) HWR: 1 (1979) FBR: 1 (indef.)
Reactor Development		HWR (ATR), LMFBR, HTGR

INDUSTRIAL FUEL CYCLE

Policy: Obtain ownership of foreign uranium resources; develop complete fuel cycle capability (enrichment, reprocessing and waste treatment, buying foreign reprocessing services as long as necessary); recycle Pu to FBRs, HWRs, and LWRs.

Waste Management Strategy: HLW--vitrify with borosilicate glass, store for 30-50 years and dispose in geological formations. LLW--disposal on land, and at sea if politically feasible.

Cumulative Spent Fuel Arisings (LWR)	1980	1,450 tU
	1985	3,900 tU
	1990	7,800 tU
	2000	20,500 tU

Industrial-Scale Activities

- Uranium mining and conversion (tUF_6/a): 200
- Uranium reconversion (tU/a): 925
- Uranium enrichment (tSWU/a):

1981--50	1988--250	2000--3000

- Fuel fabrication

- UO_2 (tU/a):	1984--1,275			
- MOX--FBR (t/a):	1972--	1	1988--	11
ATR (t/a):	1972--	10	1991--	45

- Reprocessing (t/day): 1981-- 0.7 2000-- 4.7

Major Milestones

* Selection of candidate geological or seabed repository formations	~1985
* Pu waste treatment facility	1987
* Uranium enrichment demonstration plant (PNC)	~1987
* HLW vitrification pilot plant (PNC)	1990
* Return of HLW from COGEMA and BNFL	~1990
* Selection of repository test site for in situ test with a simulated waste package	~1990
* MONJU LMFBR	1991
* Commercial uranium enrichment plant (Rokkashomura; FEPC/JNFI)	~1991
* Completion of URL	1992
* HLW glass storage facility (Honorobe-PNC)	1992
* Commercial LWR fuel reprocessing plant (Rokkashomura; FEPC)	~1995

*	Selection of demonstration site for in situ test with actual waste package	~1995
*	FBR fuel reprocessing pilot plant	~1997
*	Commercial HLW vitrification plant	~1997
*	Startup of disposal site	After 2000
*	Experimental sea-dumping of LLW	TBD
*	Commercial LLW storage facility (Rokkashomura; FEPC/JNFI)	TBD

INTERNATIONAL RELATIONSHIPS

US: DOE/PNC Umbrella LMFBR Exchange Agreement
- Term: 3-4-69 to 1-31-89.
- Scope: Storage and disposal; treatment; D&D; transportation; public acceptance issues.
- Emphasis: Technical exchange of HLW and TRU waste conditioning technology.

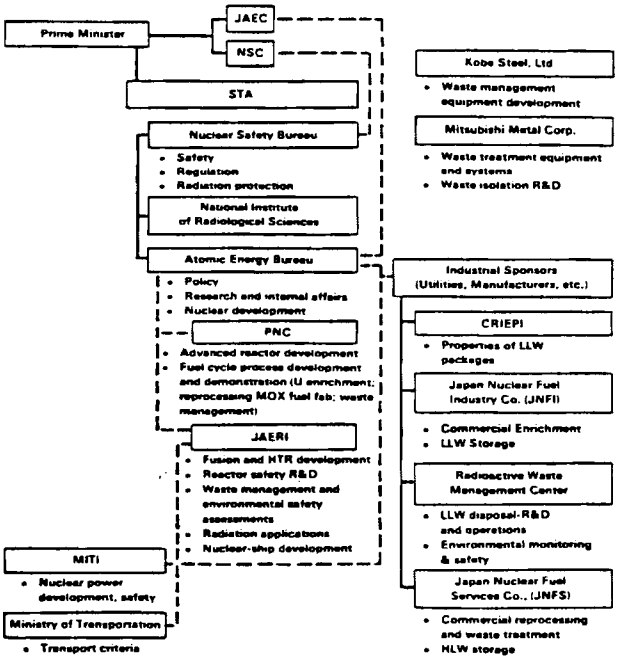
US: DOE/PNC Implementing Agreement for Collaborative Testing of the Radioactive Liquid-Fed Ceramic Melter
- Term: 3-29-85 to 3-29-90.
- Scope: PNC participation in startup and operation of radioactive ceramic melter facility at PNL, including testing of PNC components and simulated waste streams in PNL facility; DOE participation in similar PNC activities.

Member of IAEA and OECD/NEA. Cooperative agreements with Australia (SYNROC development), Canada, China, France, UK. Collaboration with Sweden and Switzerland in HLW glass characterization studies.

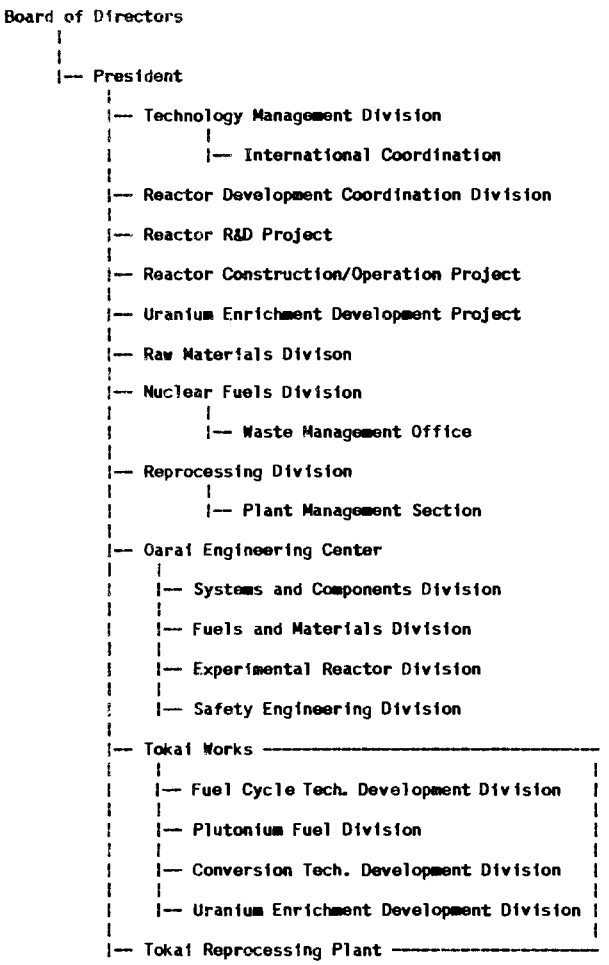
ORGANIZATION

Government funds nuclear R&D and is responsible for HLW disposal. Industry handles the commercial fuel cycle and LLW disposal, and pays for HLW disposal. See next three pages for organizational relationships and responsibilities.

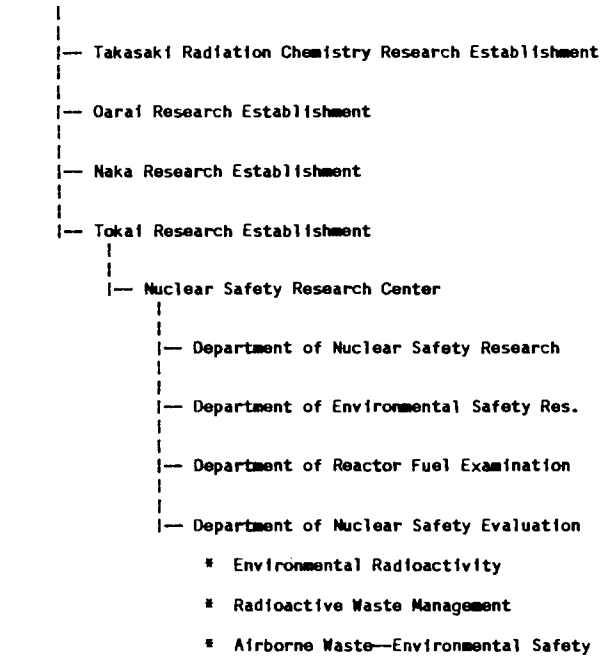
NUCLEAR FUEL CYCLE/WASTE MANAGEMENT RESPONSIBILITIES



PARTIAL PNC ORGANIZATION



PARTIAL JAERI ORGANIZATION



AEC

Atomic Energy Commission
2-2-1 Kasumigaseki
Chiyoda-ku, Tokyo 100
Japan

Tel: 81-3-581-2585
Telex:

Chairman (Minister of State for Science/Technology) — Reiichi Takeuchi
Deputy Chairman — Takahashi Mukaibo

Function: Formulate national policy on nuclear energy research, development and utilization.

CRIEPI

Central Research Institute
of Electric Power Industry
1-6-1, Ohtemachi
Chiyoda-ku, Tokyo 100
Japan

President — Hiroshi Narita

Function: Provide R&D support for utilities.

Waste Management R&D: Transportation, storage and disposal of LLW; intermediate and long-term storage of spent fuel; long-term storage and disposal of HLW.

Energy and Environmental
Research Laboratory
for Energy and Electric Power
2-11-1, Iwato-kita
Komae-shi, Tokyo 201
Japan

Tel: 81-3-480-2111
Telex: 2423098 CRIEPI J

GIRIO

Government Industrial Research
Institute, Osaka
1-8-31 Midorigaoka, Ikeda-shi
Osaka 563, Japan

Tel: 81-727-51-8351

Director, 4th Department — Dr. Ryozo Hayami
Nuclear Waste Program — Dr. Ryohei Terai

Waste Management R&D: Alternatives for HLW solidification; waste form characterization.

HITACHI

Hitachi, Ltd.
6, Kanda-surugada, 4-chome
Chiyoda-ku, Tokyo 101 — Tel: 81-3-258-1111
Japan — Telex: J26375 HITACHI

General Manager, Nuclear Power Generation — Yoshiaki Korei
Nuclear Power Development — Tsunetaka Wajima

Waste Management R&D: Development on volume reduction systems of radioactive waste. Application of automation and robot technology. Development of advanced control technology through use of fiter optics.

Hitachi Engineering Co., Ltd.
1-1 Saiwai-cho, 3-chome
Hitachi-shi, Ibaraki-ken, 317 — Tel: 81-294-21-1111
Japan — Telex: 03645511

Nuc. Power Plant Construction — Kiyoshi Shimizu
Nuc. Fuel Project — Yasuo Hirose
Nuc. Fuel Cycle Project — Sadatoshi Inoue

Waste Management R&D: Develop technology to reprocess spent LWR fuel; fixation, storage, and disposal of HLW; spent fuel storage; Pu fuel production; and decommissioning.

IHI

Ishikawajima-Harima
Heavy Industries Co., Ltd.
Tokyo-chu Bldg.
6-2, Marunduchi 1-chome
Chiyoda-ku, Tokyo 100 — Tel: 81-3-286-2185
Japan — Telex:

President — Kousaku Inaba
General Manager, Nuclear Power Division — Kugao Nojima

IHI Research Institute
Yokohama Branch
1, Shin-mokaharacho, Isogo-ku
Yokohama 235, Japan

Waste Management R&D: Development of nuclear waste management system.

JAERI

Japan Atomic Energy Research Institute
2-2, Uchisaiwai-cho, 2-chome
Chiyoda-ku, Tokyo 100 — Tel: 81-3-503-6111
Japan — Telex: J24596

President	Tsuneo Fujinami
Vice President	Hiroshi Ishikawa
Vice President	Hiroshi Ankubaga
Exec. Director, International	Yoshio Kawashima

Location: JAERI headquarters and Radioisotope Center are in Tokyo. The Tokai and Oarai Research Establishments share government reservations at Tokai-mura and Oarai-machi with PNC. Tokai and Oarai are 120 and 100 km, respectively, northeast of Tokyo, near the ocean. These sites can be reached by train from Tokyo to the city of Mito; then by taxi. The recently formed Naka Research Establishment (fusion energy) is in Naka-machi near Tokai-mura.

JAERI: OARAI

Oarai Research Establishment
Oarai-machi, Higashi-Ibaraki-gun
Ibaraki-ken Pref. 311-13 — Tel: 81-2926-7-4111
Japan — Telex:

JAERI: TOKAI

Tokai Research Establishment
Tokai-mura, Naka-gun
Ibaraki-ken Pref. 319-11 — Tel: 81-2928-2-5111
Japan — Telex: 3632340 J TOKAI J
3632339 JAERIF J

Vice President	Dr. Hiroshi Ishikawa
Executive Director	Tetsuo Aochi
Director, (DERS) Environmental Safety Research	Dr. H. Amano
Deputy Director, DERS	Dr. K. Araki

Facilities

- **WASTEF** (glove box and hot cell facilities)
  Mission: Safety evaluations for high level waste.
  History: Startup: cold, 1981; hot, 1982.

- **STEM** (simulation test for environmental radionuclide migration)
  Mission: Safety evaluation for land disposal of radioactive LLW.
  History: Startup, 1983.

JGC

JGC Corporation
Nuclear Project Division
New Ohtemachi Bldg.
2-1 Ohtemachi 2-chome
Chiyoda-ku, Tokyo 100
Japan

Tel: 81-3-279-5441
Telex: 02223096 JGCTOK J

General Manager — Takao Nakajima

Mission: Design and construction of fuel reprocessing and radwaste treatment facilities.

JGC Nuclear Research Center
2205 Narita-cho, Oharai-machi
Higashi-Ibaraki-gun
Ibaraki Pref. 311-13
Japan

Waste Management R&D: Wet oxidation process (decomposition of organic materials such as spent ion exchanger resin) incinerator; waste solidifation process (cementing, bituminization, plastic solidification); regeneration waste recycle process.

Facilities

* **Demonstration Incineration Plant**
  Mission: Simultaneously melt combustible and noncombustible wastes.
  Design Basis: 100 kg/h at 1500°C. Low-level radwaste combustion technology licensed from Belgonucleaire SA.

JNFI

Japan Nuclear Fuel Industries Co., Inc.
Daiichi Seimei Bldg.
Hirakawa-cho 1-7, Chiyoda-ku
Tokyo, Japan

Tel:
Telex:

President — T. Ohgaki
V. President, U Enrichment — Y. Yukawa
V. President, Envrnmtl. Adjmts. — E. Okumura

Mission: Construct and operate facilities for **Uranium enrichment**, at an estimated cost of US $ 865 million, with a capacity of 1.5 M SWU, and for **LLW terminal storage**, at an estimated cost of US $ 480 million, with a capacity for storing 1 million drums. Proposed site for both facilities is in the Ohishita area of Rokkasho-mura.

JNFS

Japan Nuclear Fuel Service Company, Ltd.
2-2, 2-chome, Uchisaiwaicho
Chiyoda-ku, Tokyo 100
Japan — Tel: 81-3-580 6911

President — Kenzaburo Kobayashi
Exec., Mg. Dir. - Technology — Shigefumi Tamiya
Dir., Plant Design/Reprocessing — Kentaro Nakajima

Facilities

* **Commercial Fuel Reprocessing Plant** (located in Ohishita area of Rokkasho-mura).
  Mission: Reprocess Japanese fuels.
  Design Basis: 800 tHM/a; 3000 tU storage pool; HLW vitrification/storage. Cost: ~700 billion yen.
  Milestone: FRP startup, 1995; spent fuel storage, 1991.

KOBE STEEL

Kobe Steel, Ltd.
No. 3-18, Wakinohamacho 1-chome — Tel: 81-78-251-1551
Chuoh-ku, Kobe 651 — Telex: 562-2177 KOBSTL J
Japan — Fax: 78-232-3459

General Manager, Mechical Eng. Research Lab. (MERL) — Hiroyasu Komatsu
Nuclear Engineering — Fumiaki Komatsu

Kobe Steel, Ltd.
Tekko Building
No. 8-2, Marunouchi 1-chome — Tel: 81-3-218-6408
Chiyoda-ku, Tokyo 100 — Telex: 222-6736 KOBSTL J
Japan — Fax: 3-287-2278

Nuc. Power R&D Planning — Tokuya Ishikawa
General Manager, Engineering — Dr. Takeshi Okada 81-3-459-4169
Technical Advisor — Dr. Yasuji Nakamura

Waste Management R&D: Development of radioactive waste treatment technology.

MITI

Ministry of International Trade and Industry
3-1, Kasumigaseki
Chiyoda-ku, Tokyo 100 — Tel: 81-3-501-1511
Japan — Telex:

Director, Nuc. Energy Industry — Tashimitsu Arai
Deputy Director — Masaki Mishiro

MMC

Mitsubishi Metal Corporation
5-2 Ohtemachi 1-chome,
Chiyoda-ku, Tokyo 100
Japan

Tel: 81-3-213-2111
Telex: 2226533 MMCTOKJ

General Manager, Nuc. Energy	Dr. Yumi Akimoto
Manager, Tech. Planning	Dr. Tamotsu Ishii
General Manager, Tech. Dept.	Eiji Yagi
General Manager, Nuc. Resources Development/Waste Mgmt.	Takaaki Kashiwagi

Waste Management R&D: Design and research on facilities for spent fuel storage and reprocessing, waste treatment and geologic disposal.

MOFA

Ministry of Foreign Affairs
2-2-1 Kasumigaseki
Chiyoda-ku, Tokyo 100
Japan

Tel: 81-3-580-3311
Telex:

Director, Nuclear Energy	Hiroshi Yamada
Deputy Director	Akio Shirota

NIRS

National Institute of Radiological Sciences
4-9-1, Anagawa
Chiba-shi, Chiba Pref. 260
Japan

Tel: 81-472-51-2111
Telex:

Director — Toshiyuki Kumatori

NSC

Nuclear Safety Commission
2-2-1, Kasumigaseki
Chiyoda-ku, Tokyo 100
Japan

Tel: 81-3-581-5271

Chairman — Keisuke Misonou

PNC

Power Reactor and Nuclear Fuel
Development Corporation
Sankaido Building
1-9-13 Akasaka
Minato-ku, Tokyo 107
Japan

Tel: 81-3-586-3311
Telex: 26462 J
Fax: 81-3-586-7726

President	Minoru Yoshida
Vice President	G. Nagane
Exec. Director	Kunihiko Uematsu
Director, Nuclear Fuels	Shosuke Watanabe
Waste Management	S. Araya
	T. Mishima
Director, Reprocessing	T. Koizumi
Director, Technology Mgmt.	M. Koizumi
Internatl. Cooperation	Tadatomo Yamaguchi
DOE Representative at PNC	D. H. Jones (HEDL) 81-3-586-3311 Ext. 471 9am-5pm Japan Time 81-3-584-3612 Home 5-7am/5:30-9pm (JA Time)

PNC Washington Office:
Power Reactor and Nuclear Fuel
Development Corporation
Suite 715
2600 Virginia Avenue N.W.
Washington, DC 20037

Tel: 202-338-3770
Telex: 892777
Fax: 202-333-1097

Manager: Masami Katsuragawa

PNC: OARAI

PNC Oarai Engineering Center
Oarai-machi, Higashi Ibaraki-gun
Ibaraki Pref. 311-13
Japan

Tel: 81-292-67-4141
Telex: J26482

Director	S. Nomoto
Waste Management	K. Otsuka

PNC: TOKAI

PNC Tokai Works
Muramatsu 3371,
Tokai-mura, Naka-gun
Ibaraki-ken 319-11
Japan

Tel: 81-292-82-1111

PNC: TOKAI (contd)

Director	S. Omachi
Deputy Directors	I. Tanaka, T. Ueno
Director, Reprocessing Plant	T. Yamanouchi
Director, Processing	K. Miyahara
Director, Reprocess. Tech. Devel.	F. Ohyama
Director, Fuel Cycle Tech. Devel.	M. Yamamoto
Director, Plutonium Fuel	J. Komatsu
Director, Conversion Tech. Devel.	N. Tsuji

Facilities

- **Fuel Reprocessing Plant**
  Mission: Reprocess low-enriched UO_2.
  Design Basis: Oxide fuels: chop-leach head-end. PUREX flowsheet; capacity, 0.7 tHM/day. Remote maintenance of chop-leach equipment; contact maintenance of other components.
  History: Startup, September 1977; 170 tU spent fuel processed through 12/83.

- **Co-Conversion Facility**
  Mission: Demonstrate PNC microwave process for co-conversion production of MOX.
  Design Basis: 10 kg/day MOX (50% PuO_2, 50% UO_2).
  History: Start-up of hot operation, 10/83.

- **Plutonium Fuel Development Facility**
  Mission: Fabricate FBR and ATR fuels.
  Design Basis: FBR fuels--15 kg/d (30% PuO_2 in enriched UO_2); ATR fuels--10 t/a (2% PuO_2 in UO_2).
  Throughput to Date: 52 t MOX; 440 kg Pu from Tokai-mura has gone into FUGEN ATR.

- **Plutonium Fuel Fabrication Plant**
  Mission: Fabricate MOX fuel for demonstration ATR, LWRs, prototype FBR and demonstration FBR.
  Design Basis: 40 t MOX/a.

- **Mockup Test Facilities**
  Mission: Nonradioactive, full-scale and/or engineering mockup tests of processes and equipment for vitrification, FBR spent fuel reprocessing.
  History: Startup, 3/82.

- **Engineering Test Facility**
  Mission: Develop full-scale engineering test of vitrification and ceramic melter technology.
  Design Basis: Joule-heated melter--45 kg/hr glass.
  History: Facility startup, 2/80.

PNC: TOKAI (contd)

* **Chemical Processing Facility** (reprocessing and HLW treatment)
  Mission: Radioactive studies of FBR spent fuel reprocessing and HLW solidification processes.
  Design Basis: Five standard hot cells for breeder-fuel reprocessing R&D, five cells for waste conditioning R&D. Reprocessing--1 kg/batch; HLW solidification--10 l/Batch HLW.
  History: Hot tests, 9/82.

* **^{85}Kr Recovery Pilot Plant**
  Mission: Demonstrate ^{85}Kr recovery from Tokai-mura reprocessing plant offgas.
  Design Basis: Cryogenic distillation and pressurized cylinder storage.
  History: In operation.

* **Bitumization Facility**
  Mission: Immobilize PNC's LLW.
  Design Basis: 200 l/hr.

* **Incinerator (Tokai)**
  Mission: Burn solid LLW.
  Design Basis: 100 kg/hr.

* **Incinerator (Oarai)**
  Mission: Burn solid LLW.
  Design Basis: Three chambers--pyrolysis, combustion, after-burning.

* **Acid Digestion Facility** (nonradioactive)
  Mission: Confirm laborary-scale results on acid digestion process for TRU wastes.
  Design Basis: 200-l tantalum digester vessel and ancillary equipment, glass-lined steel where necessary; capacity, 4-8 kg/hr.
  History: In operation.

* **Plutonium Waste Treatment Facility**
  Mission: Prepare PNC TRU wastes for disposal.
  Design Basis: Acid digestion of chloride-containing wastes; incineration of other combustibles; mechanical volume reduction.
  Milestone: Operation startup, 1987.

* **HLW Vitrification Pilot Plant**
  Mission: Vitrify and store HLW from the Tokai-mura fuel reprocessing plant; demonstrate technology.
  Design Basis: Ceramic melter to produce a borosilicate glass (tentative); capacity, 0.79 m^3 HLLW/day or 1 canister (76 l)/day of glass.
  Milestone: Startup, 1990.

PNC: TOKAI (contd)

- **FBR Fuel Reprocessing Pilot Plant** (reprocessing and HLW treatment)
  Mission: Demonstrate FBR fuel reprocessing and HLW solidification.
  Design Basis: 120 kg MOX/day (12 t/a).
  Milestone: Hot operation, 1997.

RMC

Radioactive Waste Management Center
No. 15, Mori Building
2-8-10, Toranomon
Minato-ku, Tokyo, 105
Japan — Tel: 81-3-504-1081

President	Syunichi Suzuki
Managing Director	Syunichi Murakoshi

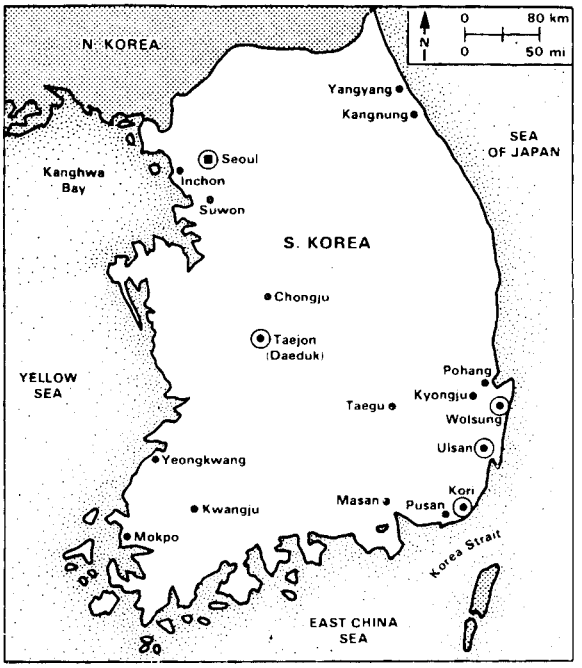
Mission: Promote the study of safe and rational operation of low-level radioactive waste disposal.
Owners: Japanese industry, MITI and STA.

STA

Science and Technology Agency
2-2-1 Kasumigaseki
Chiyoda-ku, Tokyo 100
Japan — Tel: 81-3-581-5271
Telex: 2226720 STASGD

Minister, Science/Technology	Reiichi Takeuchi
Deputy Minister	Ken Naitou
Admin. Vice Minister	Syozo Shimomura
Director-General, AEB	Moritaka Nakamura
Deputy Director-General	Takashi Matsui
Director, Nuclear Fuel	Hiroto Ishida
Deputy Director	Tsuyoshi Maruyama
Director-General, NBS	Eiichi Tsuji
Deputy Director-General	Toshihiko Hotta
Director, Nuc. Mtls. Regulations	Yuzuru Honami
Deputy Director	Shuji Ueda

KOREA
(Republic of Korea)



REPUBLIC OF KOREA

MAJOR PUBLIC HOLIDAYS (1986)

January 1-3	New Year
August 15	National (Independence) Day
Aug./Sept.	Chusok (Harvest Moon Fest)
October 3	National Foundation Day
October 9	Hangul (Korean Alphabet) Day

TIME

Standard Time Washington D.C.: **+ 14 hours**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States; in addition, a visa is currently required for a visit to Korea. Most travel agencies can provide up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 891.40 Won

per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Korea are complete as listed; dial international access code: **011 + 82 + local number.**

US EMBASSY - SEOUL

American Embassy
82 Sejong-Ro, Chongro-Ku
Seoul
Korea

Tel: 82-2-732-2601
Telex:

Science Attache — Dr. Jerome Bosken

ENERGY

Population	1983	40 million
Energy Demand	1980	44.1 Mtoe (73.6% imported)
	1985	58.1 Mtoe (78.2% imported)
Oil Demand	1980	26.6 Mtoe (100% imported)
Electric Power Plant Capacity	1983	13.1 GWe
Electric Power Production	1983	41.5 TWh-- 55% oil 15% nuclear 5% hydro

NUCLEAR POWER

Policy: Continue expansion of electric power capacity; reduce dependence on foreign oil by strong nuclear program with indigenous manufacturing capability; develop FBR capability.

Nuclear Power Plant Capacity	1986	3.6 GWe
	1990	7.4 GWe
	2000	9.3 GWe
Reactor Mix	1985	PWR: 2 (1978-85) 5 (1986-89) HWR: 1 (1983)
Reactor Development		FBR

INDUSTRIAL FUEL CYCLE

Policy: Develop long-term contracts for fuel supplies, holdings of foreign uranium resources; fabrication capability for PWP and CANDU fuels; "wait and see"--reprocessing and recycle of Pu to FBR, CANDU and LWRs.

Waste Management Strategy: Not yet defined.

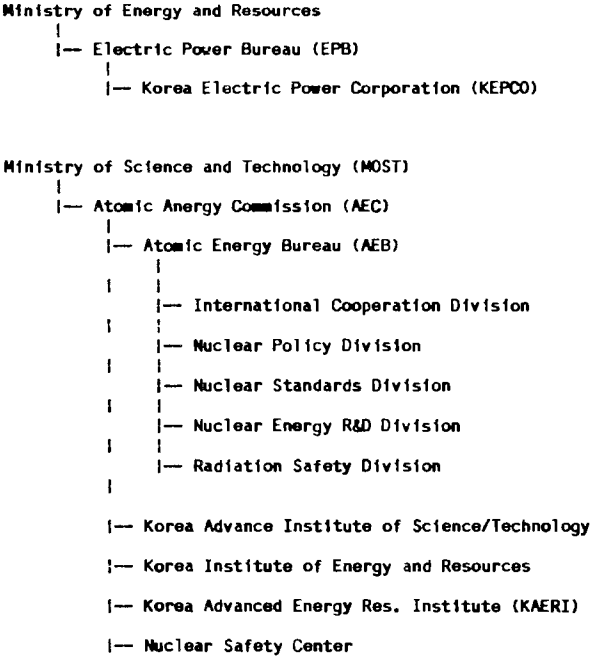
Cumulative Spent Fuel Arisings	1980	17 tU
	1985	60 tU
	1990	1,450 tU
	2000	4,400 tU

Industrial-Scale Activities

- Uranium milling--3 t ore/day pilot plant.
- Uranium conversion, yellowcake to UO_2--100 tU/a.
- UO_2 fuel fabrication pilot plant--10 tU/a.
- UO_2 fuel fabrication--200 tU/a. Startup, 1989.

ORGANIZATION

Fuel Cycle/Waste Management Responsibilities



AEB

Atomic Energy Bureau
Ministry of Science and Technology
Gwacheon 171-11 — Tel: 82-2-591-9038
Republic of Korea — Telex: K24230

Director-General	Shiyohl Park
Director, R&D Division	Uk Jong Yoo
Director, Nuclear Policy	Jae Choon Lim
Director, Nuclear Reactor	Kyong Chul Jang
Director, Internl. Cooperation	Tae Sik Min

AEC

Atomic Energy Commission
Ministry of Science and Technology
Gwacheon 171-11 — Tel: 82-2-591-7694
Republic of Korea — Telex: K24230

Commissioners	Dr. Yong-Kyu Lim
	Byoung Whie Lee

EPB

Electric Power Bureau
Ministry of Energy and Resources
Seoul — Tel: 82-2-720-2369
Republic of Korea — Telex: K23472

Director, Nuclear Power	Se-Jong Kim

KAERI

Korea Advanced Energy Research Institute
Head Office (Daeduk Center)
P.O. Box 7, Daedukdanji
Choongnam 300-32 — Tel: 82-42-822-6821
Republic of Korea — Telex: K45553

President	Dr. Pilsoon Han
	Ext. 231
Nuclear Fuel	Dr. Changsaeng Rim
Nuclear Fuel Cycle	Dr. Insuk Suh
Nuclear Safety	Dr. Sunggee Chai
Nuclear Policy	Dr. Poong-Eil Juhn

Waste Management R&D: Fuel fabrication, uranium ore processing and conversion, radioactive waste management, and post-irradiation examination.

KAERI: SEOUL

Korea Advanced Energy Research Institute
Seoul Research Center
P.O. Box 7, Cheongryang
Seoul 131
Republic of Korea

Tel: 82-2-972-2081
Telex: K24230

Vice President	Dr. Donghoon Kim
Nuclear Reactor Research	Dr. Changgun Lee
Nuc. Radiation Application	Dr. Yongkuk Kim

KEPCO

Korea Electric Power Corporation
87, Samseong-Dong
Gangnam-Ku
Seoul,
Republic of Korea

Tel: 82-2-562-9926
Telex: Kelecco K24287, K28350

President	Jung Ki Park
Nuclear Fuel	Chang Kook Yang

KNFC

Korea Nuclear Fuel Company, Ltd.
P.O. Box 7
Daedukdanji, Daejeon
Choongnam 300
Republic of Korea

Tel: 82-42-822-6821/9
Telex: K5553

President	Dr. Pilsoon Han
Director	Ui-Kyum Lee

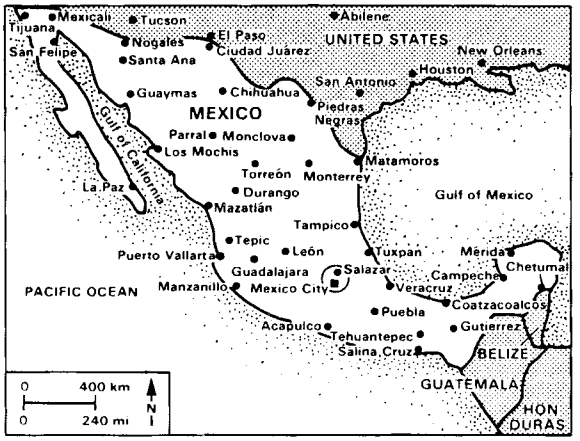
KOPEC

Korea Power Engineering Co., Inc.
P.O. Box 109
YOEUIDO
Seoul 150
Republic of Korea

Tel: 82-2-783-7606
Telex: KOPEN K22562

President — Dr. Kun-Mo Chung

MEXICO


Mexicali
Tucson
Abilene
Tijuana
El Paso
UNITED STATES
Nogales
Ciudad Juárez
New Orleans
San Felipe
Santa Ana
Houston
San Antonio
Guaymas
Chihuahua
Piedras Negras
MEXICO
Gulf of California
Parral
Monclova
Los Mochis
Matamoros
Torreón
Monterrey
La Paz
Durango
Gulf of Mexico
Mazatlán
Tampico
Tepic
León
Tuxpan
Mérida
Puerto Vallarta
Guadalajara
Salazar
Chetumal
Campeche
PACIFIC OCEAN
Manzanillo
Mexico City
Veracruz
Coatzacoalcos
Puebla
Acapulco
Gutierrez
Tehuantepec
Salina Cruz
BELIZE
GUATEMALA
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MEXICO

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
January 6	Epiphany
February 5	Promulgation of Constitution
March 21	Birthday of Benito Juarez
March 27	Holy Thursday
March 28	Good Friday
May 1	Labor Day
May 5	Victory of Gen. Zaragosa
September 16	Independence Day
October 12	Columbus Day
November 2	All Souls
November 20	Anniv. of the Revolution
December 8	Immaculate Conception
December 12	Our Lady of Guadalupe Day
December 25	Christmas

TIME

Standard Time Washington D.C.: (Mexico City) **- 1 hour**

Daylight Saving Time period: **04/27 - 10/25/86**

PASSPORT/VISA

In lieu of passport, identification such as birth certificate (driver's license not sufficient) is required, in addition to a tourist card, for a visit to Mexico. Most travel agencies can provide up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

The Mexican Peso was not quoted (floating rate) in the Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Mexico are complete as listed with the area code. However, calls can also be made by dialing the international access code: **011 + 52 + local number.**

US EMBASSY - MEXICO CITY

American Embassy
Paseo de la Reforma 305
Mexico 5, D.F.
Mexico

Tel: 905-211-0042
Telex: 84-621336

Science Counselor — Dr. Reynaldo Morales

ENERGY

Population	1984	80 million
Energy Demand	1979	77 Mtoe
Electric Power Plant Capacity	1983	18 GWe
Electric Power Production	1983	75.0 TWh 67% oil/gas 29% hydro/geoth. 4% coal

NUCLEAR POWER

Policy: Future is unclear; ambitious plans to use extensive uranium reserves in domestic nuclear power production have been thwarted by national economic problems, cost overruns with nuclear plant construction, etc.

Nuclear Power Plant Capacity	1987	0.7 GWe
	1990	1.3 GWe
	2000	1.3 GWe
Reactor Mix	1985	BWR: 2 (1987-89)

INDUSTRIAL FUEL CYCLE

Policy: Future is unclear; plans for pilot reprocessing and waste management facilities have been dropped, but uranium mining/milling and fuel fabrication work continues. Nuclear industry is being re-organized.
Waste Management Strategy: Not announced.

Cumulative Spent Fuel Arisings (LWR)	1990	100 tU
	2000	500 tU

ORGANIZATION

Nuclear activities controlled by federal government through:

* SEMIP (Secretariat of Energy, Mining & Industries)
* ININ (National Nuclear Research Institute)--R&D
* CNSNS (National Commission of Nuclear Security and Safeguards)--safety R&D and licensing of nuclear facilities.

CNSNS (National Commission of Nuclear Security and Safeguards)

Comisión Nacional de Seguridad
Nuclear y Salvaguardias
Av. Insurgentes Sur No. 1806
Colonia Florida
Delegacion Alvaro Obregon
01030 Mexico, D.F. Tel: 905-534-1404
Mexico Telex:

Director General Ing. Miguel M. Vaillard

ININ (National Nuclear Research Institute)

Instituto Nacional de
Investigaciones Nucleares
Agricultura No. 21
Colonia Escandon
Delegacion Miguel Hidalgo
06140 Mexico, D.F. Tel: 905-570-1289
Mexico Telex:

Director General Ing. Ruben Bello Rivera
Manager, Rad. Safety Ing. Alfonso Hernandes de la Torre
Manager, Interntl. Affairs David Sarquis

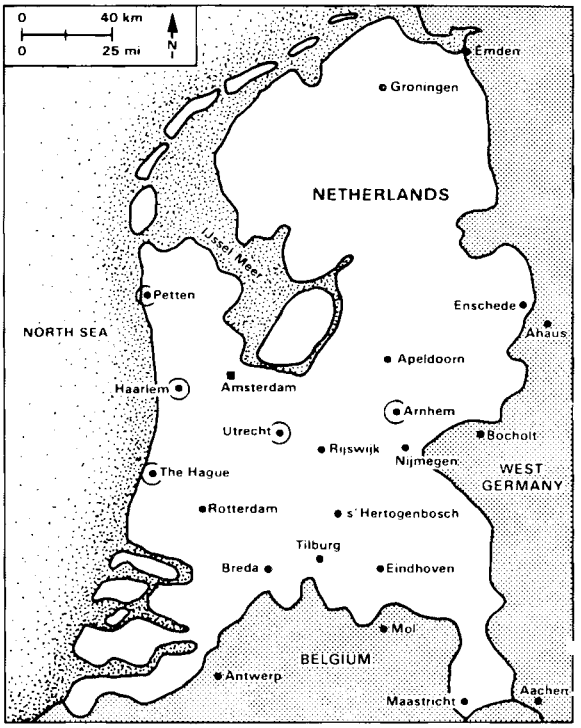
* Salazar Plant
(Located 36.5 km from Mexico City). Mail should be addressed to the Mexico City headquarters:
Carretera Mexico - Toluca km 35.6
Salazar, Edo. de Mexico
Mexico Tel: 905-518-2360

SEMIP

Subsecretaria de Energia
Av. Constityuentes 94779
Edificio C Planta Baja
01110 Mexico, D.F. Tel: 905-553-9119
Mexico Telex:

Director General, R&D Dr. Edmundo de Alba

NETHERLANDS



NETHERLANDS

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
March 28	Good Friday
March 30-31	Easter
April 30	Queen's Birthday
May 8	Ascension
May 18-19	Pentecost
December 25-26	Christmas

TIME

Standard Time Washington D.C.: **+ 6 hours**

Daylight Saving Time period: **03/30 - 09/27/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States. A visa is currently not required for a visit to the Netherlands, however, it is recommended to consult a travel agency for up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 2.747 Guilder (Fl.)
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to the Netherlands are complete as listed; dial international access code: **011 + 31 + local number.**

US EMBASSY - THE HAGUE

American Embassy
102 Lange Voorhout
2514 The Hague
The Netherlands

Tel:
Telex:

ENERGY

Population	1984	14.6 million
Energy Demand	1980	65.5 Mtoe
Oil Demand	1979	40.1 Mtoe (>90% imported)
Electric Power Plant Capacity	1983	13.9 GWe
Electric Power Production	1983	59.7 TWh-- 58% gas 26% coal 10% oil **6% nuclear**

NUCLEAR POWER

Policy: Parliamentary support was recently given to expand nuclear capacity (by at least two plants, 1000 MWe each), contingent on satisfactory answers to waste disposal questions.

Nuclear Power Plant Capacity	1985	0.5 GWe
	2000	2.5 GWe
Reactor Mix	1984	BWR: 1 (1969) PWR: 1 (1973)
Reactor Development		Participation in SNR-300 FBR

INDUSTRIAL FUEL CYCLE

Policy: Use foreign services (fuel fabrication, reprocessing). Participation with FRG and UK in URENCO (Uranium Enrichment Consortium).

Waste Management Strategy: Designate single centralized waste collection service; extend interim storage of all wastes, followed by disposal into geological formations within or (preferably) outside the Netherlands. Ocean-dumping of LL and ILW has been halted.

Cumulative Spent Fuel Arisings (LWR)	1980	103 tU
	1985	190 tU
	1990	270 tU
	2000	420 tU

ORGANIZATION

- Government--Ministries of Economic Affairs, Public Housing and Environment, and Social Affairs exercise overall control of nuclear matters with parliamentary approval of their decisions.
- ILONA (Integrated National Research Program Nuclear Waste Policy Committee)--supervises and coordinates waste disposal research.
- COVRA (Centrale Organisate Voor Radioactif Afval) --stores and collects all radioactive wastes (partially government-funded).
- ECN (Netherlands Energy Research Foundation)--government organization, provides nuclear-related services, including waste treatment and disposal research. Responsible for treatment of all LLW.

ECN (Netherlands Energy Research Foundation)

Stichting Energieonderzoek Centrum Nederland
Scheveningse Weg 112
P.O. Box 80404
2508 GK The Hague — Tel: 31-70-51-4581
The Netherlands — Telex: 31459

Chairman, Governing Board	G. W. van Stein Callenfels
Chairman, Scientific Advisory Center	Prof. J. van Loef
Chairman, Program Committee of the Energy Study Center	Prof. P. de Wolff

Function: Organize and sponsor energy research and development. (Government-owned).

ECN: PETTEN

Research Center
Netherlands Energy Research Foundation
P.O. Box 1
1755 ZG Petten — Tel: 31-2246-6262
The Netherlands — Telex: 57211 Reacp NL

Managing Director, Research	Prof. J. A. Goedkoop
Nuclear Waste	Dr. B. Verkerk
Technical Services	J. Hamstra
Geological Disposal	Dr. L. H. Vons
Rad. Migration	Dr. A. van Dalen
Rad. Waste Treatment	J. P. M. Smeets

ECN: PETTEN (contd)

Function: Scientific and technical center: applied energy research; treat and dispose of all Dutch radioactive waste. **Waste Management R&D:** Geologic waste isolation--salt dome repositories (conceptual design, thermal studies, and radionuclide migration), seabed disposal, sea disposal of ^{85}Kr, decontamination of large components.

GEOLOGICAL SURVEY OF THE NETHERLANDS

Geological Survey of the Netherlands
Nieuwe Gracht 13
Postbus 157
2000 AD Haarlem — Tel: 31-23-31-9362
The Netherlands — Telex: 71105 geold

Dr. H. M. van Montfrans

KEMA (Research and Testing Electrochemical Materials Company)

N.V. Tot Keuring van Elektrotechnische Materialen Arnhem
Utrechtseweg 310
P.O. Box 9035
6800 ET Arnhem — Tel: 31-85-45-7057
The Netherlands — Telex: 45016 Kema nl

Deputy Director, Research	Dr. M. E. A. Hermans
Research Technology	Dr. J. Kuypers
Nuclear Waste Research	Dr. H. Boekschoten
Acid Digestion/Incineration	Dr. J. Matteman
Incineration	

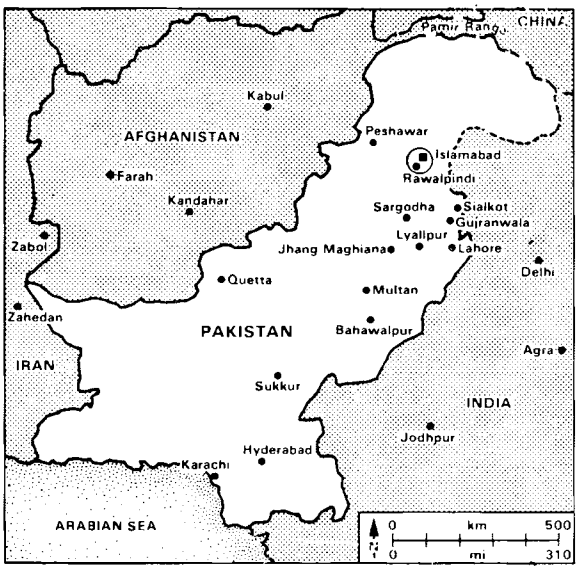
Function: Development and engineering for utilities. **Waste Management R&D:** Volume reduction and storage of reactor station wastes.

MINISTRY OF PUBLIC HOUSING AND ENVIRONMENT

Ministry of Public Housing and Environment
P.O. Box 5811
Koopmansstraat 1
2280 HV Rijswijk — Tel: 31-70-94-9505
The Netherlands — Telex: 32691

Deputy Chief	Dr. J. Ch. Cornelis
Director, Rad. Protection	Dr. J. L. Baas

PAKISTAN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Jhang Maghiana
Lahore
Delhi
Quetta
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PAKISTAN

MAJOR PUBLIC HOLIDAYS (1986)

January	Mavlid An-Nabi (Birth of the Prophet)
March 23	Pakistan Day
March 28	Good Friday
May 1	May Day
August	Id ul Sitr (End of Ramadan)
August 14	Independence Day
September 6	Defense of Pakistan
September 11	Death of Quaid-i-Azam
October	Id ul Azba (Feast of the Sacrifice)
November	Muhurran (Ashura)
December 25	Birthday of Quaid-i-Azam; Christmas

TIME

Standard Time Washington D.C.: **+ 10 hours**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States; in addition, a visa is currently required for a visit to Pakistan. Most travel agencies can provide up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 15.77 Rupee

per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

US EMBASSY - ISLAMABAD

American Embassy
Aid Bldg., 18
6th Avenue, Ramna 5
Islamabad
Pakistan

ENERGY

Population	1984	86.4 million
Energy Demand	1980	12.4 Mtoe
Electric Power Plant Capacity	1981	4.0 GWe
Electric Power Production	1981	14.2 TWh-- 50% thermal 46% hydro **4% nuclear**

NUCLEAR POWER

Policy: Provide up to 50% of electrical power supply with nuclear.

Nuclear Power Plant Capacity	1986	0.1 GWe
	1995	0.1 GWe
	2000	1.1 GWe
Reactor Mix	1985	HWR: 1 (1972)

INDUSTRIAL FUEL CYCLE

Policy: Develop complete domestic fuel cycle: uranium mining and milling; enrichment; fuel fabrication; reprocessing.

Cumulative Spent Fuel Arisings	1980	49 tU
	1985	110 tU
	1990	170 tU
	2000	440 tU

ORGANIZATION

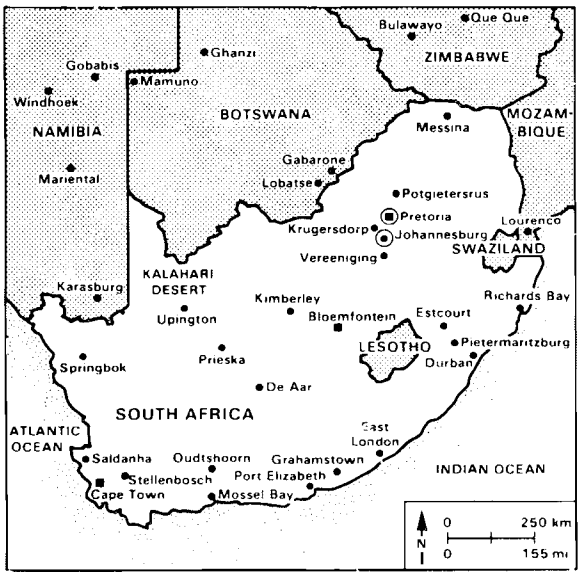
* Pakistan Atomic Energy Commission--control of nuclear matters.
* Pakistan Institute of Science and Technology (Rawalpindi)--fuel cycle R&D, including lab-scale reprocessing facility.

PAEC

Pakistan Atomic Energy Commission
P.O. Box 1114
Islamabad, Pakistan

Chairman — Dr. Munir Ahmad Khan

SOUTH AFRICA



SOUTH AFRICA

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
March 28	Good Friday
March 31	Family Day
April 6	Founder's Day
May 8	Ascension
May 31	Republic Day
October 10	Kruger Day
December 16	Day of the Vow
December 25	Christmas
December 26	Day of Goodwill

TIME

Standard Time Washington D.C.: **+ 7 hours**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States; in addition, a visa is currently required for a visit to South Africa. Most travel agencies can provide up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 2.5284 Rand

per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to South Africa are complete as listed; dial international access code: **011 + 27 + local number.**

US EMBASSY - PRETORIA

American Embassy
Thibault House, 225 Pretorius St.
Pretoria — Tel: 27-12-28-4266
South Africa — Telex:

Science Attache — Dr. Gilbert Melese

ENERGY

Population	1985	32 million
Energy Demand	1985	120 Mtoe
Oil Demand		(~60% imported)
Electric Power Plant Capacity	1984	24.5 GWe
	1985	40.0 GWe
		4.5% nuclear
Electric Power Production	1984	117 TWh--

NUCLEAR POWER

Policy: Expand electric power production capacity chiefly through coal-burning plants, but develop small nuclear capability.

Nuclear Power Plant Capacity	1986	1.8 GWe
	2000	1.8 GWe
Reactor Mix	1985	PWR: 2 (1984/85)

INDUSTRIAL FUEL CYCLE

Policy: Produce and export uranium (7,000-8,000 tU/a); develop enrichment capability (200-300 tSWU/a) by 1987. No current plans for fuel fabrication or reprocessing. UF_6 conversion plant of 400 tU/a by 1987.

Waste Management Strategy: Store reactor wastes at the reactor until a disposal site is operational (1994); build a repository for HLW or spent fuel at Vaalputs about 400 miles north of Cape Town (first acceptance of LL/ILW is scheduled for mid 1986).

Cumulative Spent Fuel	1985	22 tU
Arisings (LWR)	1990	254 tU
	2000	714 tU

ATOMIC ENERGY CORPORATION

Atomic Energy Corporation
of South Africa Ltd.
Private Bag X 256
Pretoria 0001
South Africa

Tel: 27-12-324-2811
Telex: 3-0253 SA

Chairman	Dr. J. W. de Villiers
Managing Director, R&D	Dr. J. P. Hugo
Managing Director, Nuc. Fuels	W. L. Grant

Function: Overall responsibility for nuclear matters, including R&D, construction, operations, regulations, licensing, waste disposal and respository, uranium enrichment.

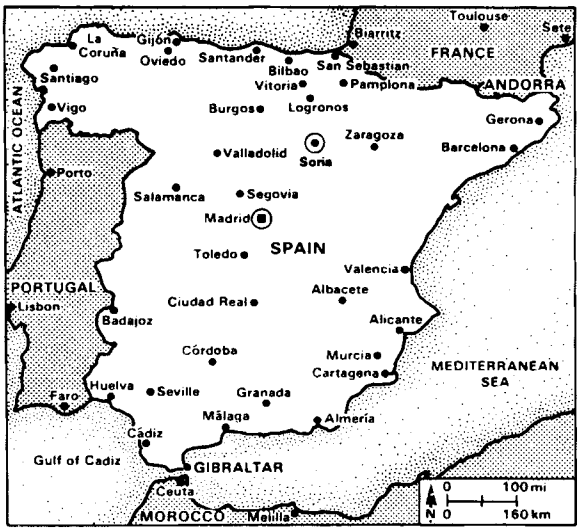
ESCOM (Electricity Supply Commission)

ESCOM
P.O. Box 1091
Johannesburg 2000
South Africa

Tel: 27-11-800-8111
Telex: 4-24 481 SA

Chairman, Electricity Council	John Maree
Chairman, Management Board	Jan H. Smith
Sr. General Manager	I. C. McRae

SPAIN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Córdoba
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SPAIN

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
January 6	Epiphany
March 19	St. Joseph
March 27	Holy Thursday
March 28	Good Friday
May 1	Labor Day
May 29	Corpus Christi
July 25	St. James
August 15	Assumption
November 1	All Saints
December 8	Immaculate Conception
December 25	Christmas

TIME

Standard Time Washington D.C.: **+ 6 hours**
Daylight Saving Time period: **03/30 - 09/27/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States. A visa is currently not required for a visit to Spain, however, it is recommended to consult a travel agency for up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 152.30 Peseta
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Spain are complete as listed; dial international access code: **011 + 34 + local number.**

US EMBASSY - MADRID

American Embassy
Serrano 75
Madrid
Spain

Tel: 34-276-3600
Telex:

Science Attache — Roy C. Simpkins

ENERGY

Population	1984	38.7 million
Energy Demand	1982	64.3 Mtoe
	1990	106.5 Mtoe
Oil Demand	1982	48.2 Mtoe (96% imported)
Electric Power Plant Capacity	1983	33.9 GWe
Electric Power Production	1983	117.2 TWh-- 42% coal 25% hydro/geoth. 21% oil **9% nuclear** 3% gas
	1984	**19% nuclear**

NUCLEAR POWER

Policy: Moratorium on new nuclear power plant construction has been in place for two years--though currently under review by the Ministry of Industry, no changes expected in near future.

Nuclear Power Plant Capacity	1986	5.5 GWe
	1990	7.5 GWe
	2000	10.2 GWe
Reactor Mix	1985	GCR: 1 (1972) PWR: 5 (1969-85) 2 (1987) BWR: 2 (1971-85) 2 (1987/88)

INDUSTRIAL FUEL CYCLE

Policy: No domestic reprocessing and no further contracts for foreign reprocessing.

Waste Management Strategy: Store spent fuels at the reactor sites for 10 years, then transfer to AFR engineered (dry) storage facility until geologic repository is ready to receive "high-level wastes" (spent fuels); locate AFR and fuel encapsulation facility at repository site (salt dome or granite formation). Shallow-land burial of LLW in trenches. Institutional radioactive wastes are currently placed in a worked-out uranium mine.

Cumulative Spent Fuel Arisings (LWR)	1980	176 tU
	1985	490 tU
	1990	1,300 tU
	2000	3,400 tU

Industrial-Scale Activities

- Uranium mining and milling: 200 tU/a.
- Uranium enrichment: 11.1% interest in Eurodif.
- Fuel fabrication: 200 tU/a.
- AFR spent fuel storage: 1500 tU.

CSN (Council of Nuclear Safety)

Consejo de Seguridad Nuclear
Sor Angela de Cruz, 3
E-28020 Madrid, Spain

Tel: 34-1-456-1812
Telex: 49051 CSNM E

President	Francisco Pascual
Commissioner	Dr. Luis Gutierrez-Jodra

Function: Assess the safety of nuclear technology and environmental protection; perform plant inspections and issue licenses.

ENRESA (National Waste Management Company)

Empresa Nacional de Residuos Radiactivos S.A. (ENRESA)
Paseo Castellana, 135
E-28046 Madrid, Spain

Tel: 34-1-279-2667
Telex: 41-429 ENRES E

President	Juan Manuel Kindelan
Director General	Alberto Lopez
Director, Engineering	Aurelio Ulibarri

Function: Supply waste management services and disposal facilities to all Spanish nuclear companies.

ENUSA (National Fuel Cycle Company)

Empresa Nacional del Uranio S.A.
Santiago Rusiñol 12
2803 Madrid, Spain

Tel: 34-1-233-6207
Telex: 43402 URAN E

Director General — Manuel Isla

Function: Supply fuel cycle services except waste management and disposal (uranium mining and milling; nuclear fuel) to all Spanish nuclear power plants.

JEN (Nuclear Energy Commission)

Junta de Energía Nuclear
Avenida Complutense 22
Ciudad Universitaria — Tel: 34-1-449-4400
Madrid 3, Spain — Telex: 23555 JUVIG E

President	Martin Gallego
General Director	Gonzalo Madrid
Director, Rad. Waste	Baldomero Lopez-Perez,
Waste Treatment	V. Gonzalez
Spent Fuel Storage	A. Uriarte
Waste Storage	A. Martinez Martinez

Function: R&D--nuclear fuel cycle, nuclear reactor technology, waste treatment, and terminal storage.

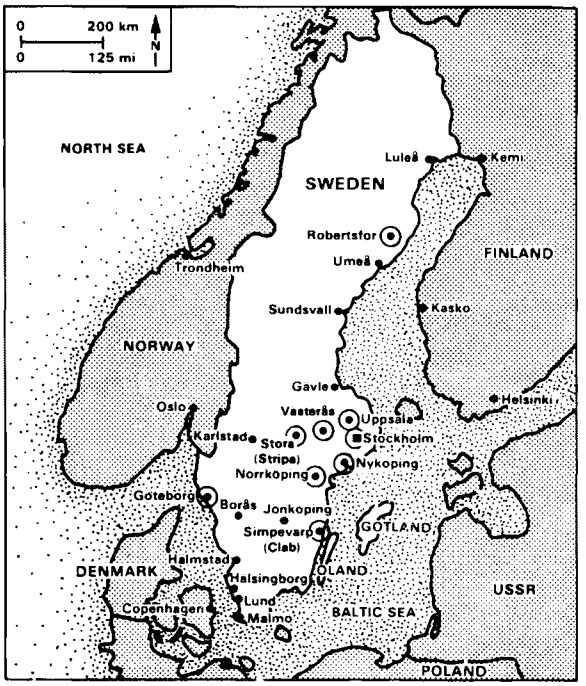
JUAN VIGON NATIONAL NUCLEAR ENERGY CENTER

Centro Nacional de Energía
Nuclear Juan Vigon
Avenida Complutense 22
Madrid 3, Spain

MINISTRY OF INDUSTRY AND ENERGY

Minister	Joan Majo
Director General of Energy	Maria del Carmen Mestre

SWEDEN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Oslo
Vasterås
Uppsala
Karlstad
Stora
(Stripa)
Stockholm
Nykoping
Norrköping
Goteborg
Borås
Jonkoping
Simpevarp
(Clab)
GOTLAND
Halmstad
DENMARK
Halsingborg
OLAND
USSR
Lund
Copenhagen
Malmo
BALTIC SEA
POLAND

SWEDEN

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
January 6	Epiphany
March 28	Good Friday
March 30-31	Easter
May 1	Labor Day
May 8	Ascension Day
May 18-19	Pentecost
June 21	Midsummer Day
November 1	All Saints
December 25-26	Christmas

TIME

Standard Time Washington D.C.: **+ 6 hours**

Daylight Saving Time period: **03/30 - 09/27/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States. A visa is currently not required for a visit to Sweden, however, it is recommended to consult a travel agency for up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 7.56 Krona (SEK)
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Sweden are complete as listed; dial international access code: **011 + 46 + local number.**

US EMBASSY - STOCKHOLM

American Embassy
Strandvagen 101
S-10000 Stockholm
Sweden

Tel: 46-8-63-0520
Telex:

ENERGY

Population	1985	8.3 million
Energy Demand	1984	51.9 Mtoe (33% imported)
Oil Demand	1984	17.3 Mtoe (100% imported)
Electric Power Plant Capacity	1984	31 GWe
Electric Power Production	1983	109.9 TWh-- 58% hydro/geoth. **37% nuclear** 3% oil 2% coal

NUCLEAR POWER

Policy: Phase out all nuclear plants at the latest by the year 2010. Change of this policy will require a new decision by Parliament.

Nuclear Power Plant Capacity	1986	9.4 GWe
	2000	9.4 GWe
Reactor Mix	1986	BWR: 9 (1972-85) PWR: 3 (1975-83)

INDUSTRIAL FUEL CYCLE

Policy: Sell present contract (690 tU) with foreign reprocessors. Direct disposal of spent fuel (~6,600 t). No Pu recycle is planned. Costs for waste management and for future decommissioning of nuclear power plants are paid by fees collected from the nuclear utilities. Present fee is 2.4 mil/kWh (0.019 SEK/kWh).

Waste Management Strategy: Store spent fuel for 30-40 years in an underground pool storage facility; encapsulate HLW glass and spent fuel in a corrosion-resistant canister; emplace in a deep geologic (crystalline rock) repository. New facilities: 3000 t AFR (completed 1985); interim storage plants for conditioned reprocessing wastes; spent fuel encapsulation plant; repositories for spent fuel, reactor and other long-lived wastes.

Cumulative Spent Fuel Arisings (LWR)	1985	1,330 tU
	1990	2,360 tU
	2010	7,800 tU

Cumulative Waste Arisings (conditioned and encapsulated--ready for disposal)	2020		
	Spent fuel	5,100	canisters
	HLW glass	550	canisters
	TRU waste	4,500	m^3
	Reactor waste	100,000	m^3
	" core comp.	15,000	m^3
	D&D waste	114,000	m^3

Industrial-Scale Activities:

* LWR fuel fabrication: 400 tU/a.

Major Milestones

* Repository for reactor wastes, SFR	1988
* HLW repository site selection	2000
* HLW repository operational	2020
* Interim HLW dry storage facility	1990
* Encapsulated spent fuel repository	2020-50

INTERNATIONAL RELATIONSHIPS

US: DOE/SKB Umbrella Agreement for Waste Management Exchange

- Term: 7-1-77 to 12-31-90
- Scope: Preparation and packaging of waste forms; storage; field and laboratory testing; geologic disposal; operations; safety and environment; institutional and public relationships.
- Emphasis: Collaboration in Stripa Mine test program (NEA coordination); US participation in performance assessment computer model and code intercomparison sponsored by SKB.

Member of IAEA and OECD/NEA. Waste management cooperative agreements with Canada, France, Switzerland. Host country for NEA Stripa Project.

ORGANIZATION

* Waste Management

  - SKB (Swedish Nuclear Fuel and Waste Management Company)--executes spent fuel and waste management program for the utilities; manages waste disposal R&D programs.

  - SKN (National Board for Spent Fuel)--administers waste management fund collected from the nuclear utilities; oversees back-end-of-the-fuel-cyle activities.

* Licensing Responsibilities

  - SKI (Swedish Nuclear Power Inspectorate)--erection and operation of nuclear facilities
  - SSI (Swedish National Institute of Radiation Protection)
  - National Swedish Franchise Board for Environment Protection
  - Municipality where the facility is to be located (right of veto).

CHALMERS (TECHNICAL UNIVERSITY)

Chalmers Tekniska Hoegskola
S-41296 Goeteborg
Sweden
Tel: 46-31-81-0100
Telex: 2369

Nuclear Chemistry
Jan Rydberg
Bert Allard
Jan Liljenzin

Waste Management R&D: Radionuclide transport by groundwater, sorption on natural clays and rock minerals.

KEMAKTA

Kemakta Konsult AB
Luntmakargatan 94
S-11351 Stockholm
Sweden
Tel: 46-8-15-0380
Telex: 15660

Bertil Grundfelt

Computer calculations on hydrology and nuclide migration.

KTH (Royal Institute of Technology)

KTH
S-10044 Stockholm
Sweden
Tel: 46-8-787-7000
Telex: 10389

Chemical Engineering
Inorganic Chemistry
Ivars Neretnieks
I. Grenthe
P. Wickberg

Waste Management R&D: Near- and far-field migration modeling, rock-matrix diffusion experiments. Actinide-chemistry, solubilit calculations, groundwater sampling and characterization.

NUCLEAR SAFETY BOARD (OF THE SWEDISH UTILITIES)

Raadet foer Kaernkraeftsaekerhet
Box 5864
S-10248 Stockholm — Tel: 46-8-67-9540
Sweden — Telex: 13108

Director — Thomas Eckered

Function: Promote coordination and cooperation among the Swedish utilities in their nuclear power plant safety work.

SGAB (Swedish Geological Company)

Sveriges Geologiska AB (SGAB)
Vretgraend 18
Box 670
S-75128 Uppsala — Tel: 46-18-15-5280
Sweden — Telex: 76154 GEOSWED S

Geology, Site Investigations	Kaj Ahlbom
Hydrogeology	Leif Carlsson
Geologic Waste Disposal	Otto Brotzen

Waste Management R&D: Evaluation of rock formations for use as waste disposal sites (permeability; groundwater behavior, age and chemistry).

SKB (Nuclear Fuel and Waste Management Company)

Svensk Kaernbraensle-Hantering
Box 5864
S-10248 Stockholm — Tel: 46-8-65-2800
Sweden — Telex: 13108 SKB

President	Sten Bjurstroem
Research and Development	Per-Eric Ahlstroem
Geology and Hydrology	Hans Carlsson
Material Sciences	Lars Werme
Nuclear Waste Services	Lars Bertil Nilsson
Planning/Systems Analysis	Hans Forstroem
Material Sciences	Lars Wermegstroem

Mission: Coordinate and arrange for nuclear fuel supply and reprocessing services for all Swedish nuclear power reactors; manage and fund R&D for the back end of the fuel cycle. Responsible for design, construction and operation of all necessary storage and disposal facilities. Demonstrate that spent nuclear fuel and fuel reprocessing wastes can be disposed of safely and permanently.

Owners: State Power Board and utilities (Sydkraft, Oskarshamn, Forsmark).

SKB (contd)

Facilities

* **CLAB** (Central Storage for Spent Fuel, located at Simpevarp)
  Mission: AFR storage facility.
  Design Capacity: Initially, 3000 t.
  History: Start of construction, 5/80; start of operation 1985.

* **Stripa Mine**

  Stripa Mine Service AB
  S-717 00 Stora
  Sweden
  Tel: 46-581-41420
  Telex:

  Stripa Project Manager — Hans Carlsson
  Mine Operations — Gunnar Ramquist

  (Near Kopparberg, 15 km north of Lindesberg and about 250 km west of Stockholm. Site of the NEA Stripa Project)

  Mission: Research in realistic environment of matters connected to disposal in crystalline rock. Development of investigation methods and instruments.
  Description: Granite body, about 350-400 m below surface, at the Stripa iron mine.

SKI (Nuclear Power Inspectorate)

Statens Kaernkraftinspektion
Box 27106
S-102 52 Stockholm
Sweden
Tel: 46-8-63-5560
Telex: 11961 Sweatom S

Director — Olaf Hoermander
Waste Management — Alf Larsson

SKN (National Board for Spent Nuclear Fuel)

Statens Kaernbraenslenaemnd
Box 2045
S-10311 Stockholm
Sweden
Tel: 46-8-23-4774
Telex:

Director — Olof Soederberg
Chief Engineer — Nils Rydell

Function: Serve as the government's control agency to oversee back-end fuel cycle technology, financing/information.

SSI

National Institute
of Radiation Protection
Box 60204
S-10401 Stockholm
Sweden

Tel: 46-8-24-4080
Telex: 11-771 SAFE RAD

Director — Gunnar Bengtsson
Rad Waste Group — Ragnar Boge

STUDSVIK

Studsvik Energiteknik AB
S-61182 Nykoeping
Sweden

Tel: 46-155-21-0000
Telex: 64013 studs s

Director, Nuclear Technology — Stig Bergstroem
Waste Systems — Goeran Carleson
Aake Hultgren

Function: Nuclear energy R&D and service to support Swedish power programs.

Owners: Government and industry (contract research).

Waste Management R&D: HLW waste form characterization, LLW and ILW treatment, D&D techniques, leaching of UO_2 from spent fuel, biosphere migration, dose-calculations. AMOS project: Waste treatment plant (1986), interim waste storage in a rock cavity (1985).

SWEDISH STATE POWER BOARD

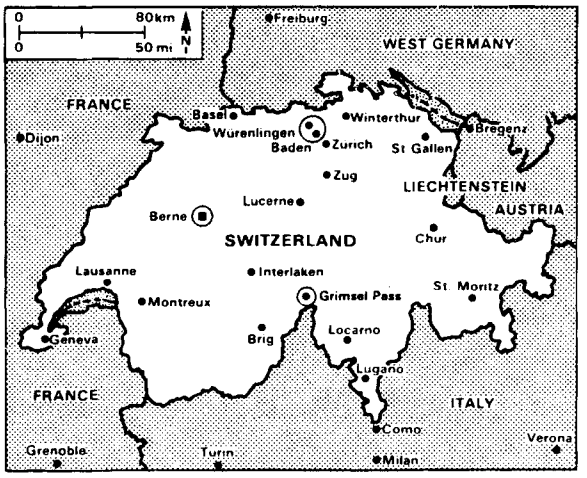
Statens Vattensfallswerk
S-162 87 Vaellingby
Sweden

Tel: 46-8-739-5000
Telex: 19653 Svtelvxs S

President — Carl-Eric Nyhvist
Vice President, Nuc. Power — Lars Gustafsson
Nuclear Safety — Hans Bartsch
Low- and Medium-Level Wastes — Stig Pettersson

Function: Operate the power distribution grid in Sweden, produce power. (Owner of Ringhals Power Plants).
Owner: Government (Ministry of Industry).

SWITZERLAND



SWITZERLAND

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
March 28	Good Friday
March 30-31	Easter
May 8	Ascension
May 18-19	Pentecost
August 1	Independence Day
December 25-26	Christmas

TIME

Standard Time Washington D.C.: **+ 6 hours**

Daylight Saving Time period: **03/30 - 09/27/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States. A visa is currently not required for a visit to Switzerland, however, it is recommended to consult a travel agency for up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 2.0415 Franc
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Switzerland are complete as listed; dial international access code: **011 + 41 + local number.**

US EMBASSY - BERN

American Embassy
Jubilaeumsstrasse 93
CH-3005 Bern
Switzerland

Tel:
Telex:

ENERGY

Population	1984	6.5 million
Energy Demand	1980	25.4 Mtoe (57% imported)
Oil Demand	1980	13.1 Mtoe (100% imported)
Electric Power Plant Capacity	1983	14.2 GWe
Electric Power Production	1983	53.6 TWh-- 68% hydro/geoth. **30% nuclear** 1% coal 1% oil
	1985	**40% nuclear**

NUCLEAR POWER

Policy: Government is pro-nuclear. Strong public opposition has weakened somewhat and authorities now predict the installation of additional nuclear power plants.

Nuclear Power Plant Capacity	1985	2.9 GWe
	2000	3.4 GWe
Reactor Mix	1985	BWR: 2 (1972-84) 1 (1993)
		PWR: 3 (1969-79)

INDUSTRIAL FUEL CYCLE

Policy: Foreign reprocessing of spent fuels and Pu recycle to either LWRs or FBRs.
Waste Management Strategy: Develop two waste repositories; a horizontally accessed rock cavern in a geologic host rock with considerable overburden for LLW/ILW, and a deep repository (crystalline rock) for HLW glass or unreprocessed spent fuel elements. Sea-dumping of LLW discontinued 1982, but still considered as an option.

Cumulative Spent Fuel Arisings (LWR)	1980	380 tU
	1985	650 tU
	1990	1,090 tU
	2000	2,000 tU

Cumulative Waste Arisings [After 40 years' operation of the nuclear power system (total 6,000 MGe)]	LLW/D&D Waste	100,000 m^3
	LLW/ILW	70,000 m^3
	HLW glass	1,000 m^3
		or
	Spent fuel	15,000 m^3

Major Milestones

*	Executive decision on acceptibility of NAGRA plan for safe and final HLW disposal	1985
*	Initial receipt of HLW glass from COGEMA (France)	1992
*	Intermediate-depth storage facility for ultimate repository for reactor wastes	1995
*	Geologic repository for HLW or spent fuels	After 2020

INTERNATIONAL FUEL CYCLE RELATIONSHIPS

US: **DOE/NAGRA Umbrella Agreement for Waste Management Exchange**
- Term: 4-19-85 to 4-19-90.
- Scope: Preparation and packaging of wastes; field and laboratory testing; storage; geologic disposal; environment and safety; design and operational issues; transportation requirements; public acceptance issues.
- Emphasis: Information exchange concerning Grimsel Pass URL activities.

Member of IAEA and OECD/NEA.

ORGANIZATION

* NAGRA--National Cooperative for the Disposal of Radioactive Waste--formed by utilities/government to handle fuel cycle/waste management activities. Budget for 1980-1985 is ~US $90 million

* EIR--Federal Institute for Reactor Research--nuclear R&D

* Federal Energy Office--sets criteria for waste management practices, including geologic disposal.

EIR (Federal Institute for Reactor Research)

Eidgenoessisches Institut fuer
Reaktorforschung (EIR)
CH-5303 Wuerenlingen
Switzerland

Tel: 41-56-99-2111
Telex: 53714 eir ch

Director	Prof.-Dr. H. Graenicher
Deputy Director	M. Breu
Staff Assistant, Research	Dr. U. Flueckiger
Materials Technology	D. H. P. Alder
Hot Laboratory	Dr. W. Hausmann
Metallurgy	G. Ullrich
Chemistry	Dr. P. Baertschi
Fuel Division	H. Flury
Radioactive Waste Project	Dr. G. Bart
Fuel Program	R. W. Stratton

Sponsor: Federal government--Department of Interior.

Waste Management R&D: Incineration of TRU wastes, modeling of radionuclide migration through heterogeneous geologic media, chemical behavior of radionuclides during migration, transport of radionuclides through the biosphere, hydrological studies, sorption constants on different rocks, immobilization of LLW and ILW in cements, leaching rates on LLW and ILW waste forms, and long-term corrosion tests on waste package materials.

Facilities

* **ADA** (Acid Digestion Plant for TRU Wastes)
  Design Basis: Carbonization/digestion in H_2SO_4/HNO_3 at 250 C; capacity, 1 kg/hr solid wastes.
  History: Non-Pu runs, late 1981; Pu runs, 1982.

FEDERAL OFFICE OF ENERGY

Federal Office of Energy
Nuclear Safety Inspectorate
CH-5303 Wuerenlingen
Switzerland

Tel: 41-56-98-2853
Telex: 59058

Waste Management	Dr. U. Niederer

Function: Licensing and inspection of nuclear installations.

NAGRA/CEDRA (NATIONAL COOPERATIVE FOR THE DISPOSAL OF RADIOACTIVE WASTE)

Nationale Genossenschaft fuer die Lagerung
Radioaktiver Abfaelle (NAGRA)
or
Société Coopérative Nationale pour l'Entreposage de
Déchets Radioactifs (CEDRA)
Parkstrasse 23
CH-5401 Baden
Switzerland
Tel: 41-56-20-5511
Telex: 57333

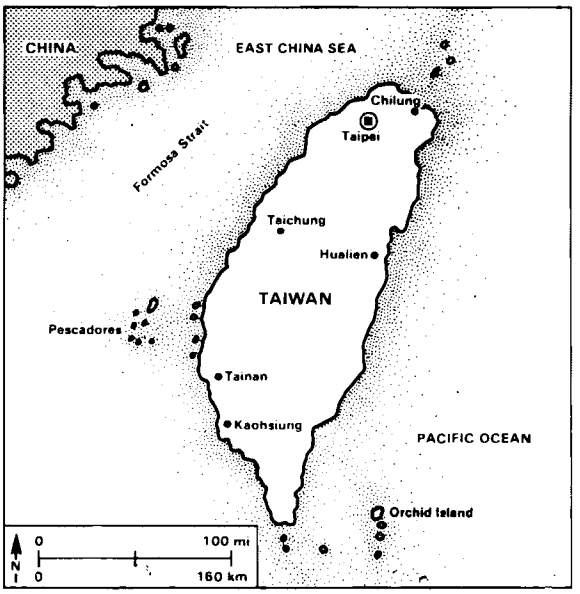
President	Dr. Rudolph Rometsch
Managing Director	Hans Issler
Geology	Dr. Marc F. Thury
Nuclear Technology	Dr. Charles McCombie
Facilities	Andreas L. Nold

Function: Provide for the safe disposal of radioactive wastes produced by the Swiss nuclear industry.
Sponsors: Utilities and government.

Facilities

* URL at Grimsel Pass--operational since 1984.

TAIWAN


CHINA
EAST CHINA SEA
Chilung
Taipei
Formosa Strait
Taichung
Hualien
TAIWAN
Pescadores
Tainan
Kaohsiung
PACIFIC OCEAN
Orchid Island
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100 mi
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160 km
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TAIWAN

MAJOR PUBLIC HOLIDAYS (1986)

January 1-2	Founding Day
March 29	Youth Day
April 5	Tomb Sweeping Day
September 28	Teacher's Day
October 10	National Day
October 25	Retrocession Day
October 31	Chiang Kai-Shek's Birthday
November 12	Sun Yat-Sen's Birthday
December 25	Constitution Day

TIME

Standard Time Washington D.C.: **+ 13 hours**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States; in addition, a visa is currently required for a visit to Taiwan. Most travel agencies can provide up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = 39.89 Taiwan Dollar
per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to Taiwan are complete as listed; dial international access code: **011 + 32 + local number.**

ENERGY

Population	1984	19 million
Electric Power Plant Capacity	1981	10.16 GWe-- **21.4% nuclear**
Electric Power Production	1982	40.9 TWh-- 48% oil **30% nuclear** 12% hydro 10% coal
	1984	**48% nuclear**

NUCLEAR POWER

Policy: Look to nuclear power to meet rapidly growing demand for electric energy.

Nuclear Power Plant Capacity	1986	4.9 GWe
	1995	6.7 GWe
	2000	8.7 GWe
Reactor Mix	1985	BWR: 4 (1978-83) PWR: 1 (1984/85)

INDUSTRIAL FUEL CYCLE

Policy: Develop indigenous fuel production capability: fuel assembly; fuel hardware; UO_2 pellets; UF_6 conversion.

Waste Management Strategy: Evaluating HLW interim storage options; may reprocess (in other countries); LLW to go to new National Waste Storage Facility on nearby Orchid Island.

Cumulative Spent Fuel Arisings (LWR)	1980	70 tU
	1985	430 tU
	1990	1,140 tU
	2000	2,600 tU

ORGANIZATION

* TAIPOWER (Taiwan Power Company)--operation of nuclear power plants (owned by the government).
* AEC (Atomic Energy Council)--regulatory functions; waste disposal.
* INER (Institute of Nuclear Energy Research)--nuclear R&D.

AEC

Atomic Energy Council
67, Lane 144
Keelung Road, Section 4
Taipei, Taiwan
Republic of China

Tel: 86-2-392-4180
Telex: 26554

Secretary General	Dr. Yu-Hao Lee
Director, Radwaste Admin.	Dr. Chao-Ming Tsai
Director, Planning Division	Chao-Chin Tung
Radwaste Protection	Dr. Yi-Ching Yang
Nuclear Energy Research	Kuang-Chi Liu

INER

Institute of Nuclear Energy Research
P.O. Box 3
Lung tan Taiwan
Republic of China

Tel: 86-2-381-4014
Telex: 34154 CAEC

Deputy Director	Sen-I Chang (Ext. 2302)
Health Physics	W. L. Chen
Eng. Development/Implementation	Tise-Sheng Chou (Ext. 2525)
Waste Mgmt./Decontamination	S. L. Hwang

Fuel Cycle R&D: Solvent extraction technology; yellowcake conversion to UO_2; production of Zr, TiO_2 and $TiCl_4$; cement and thermoplastic waste forms for reactor wastes; HLW conditioning processes; irradiation of sewage sludge with spent fuels; burial of LLW.

TAIPOWER

Taiwan Power Company
242 Roosevelt Rd., Sec. 3
Taipei, Taiwan 107
Republic of China

Tel: 86-2-396-7777
Telex: 2564 TPCAPD

Deputy Directors, Atomic Power	Mr. Eng Lin (Ext. 2521)
	Mr. Ching-Tang Hsu (Ext. 2522)

UNITED KINGDOM

UNITED KINGDOM

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
March 28	Good Friday
March 30-31	Easter
May 3	May Day
May 18-19	Pentecost
August 30	Summer Bank Holiday
December 25-26	Christmas

TIME

Standard Time Washington D.C.: **+ 5 hours**

Daylight Saving Time period: **03/30 - 10/25/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States. A visa is currently not required for a visit to the England, however, it is recommended to consult a travel agency for up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 US$ = .685 Pound

per Wall Street Journal, 01/03/86. As rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dialing to England are complete as listed; dial international access code: **011 + 44 + local number.**

US EMBASSY - LONDON

American Embassy
24/31 Grosvenor Square, W. 1A1AE
London
United Kingdom

Tel: 44-1-499-9000
Telex:

Science Counselor — Robert Stella

ENERGY

Population	1984	56 million
Electric Power Plant Capacity	1983	63.7 GWe
Electric Power Production	1983	276.2 TWh-- 70% coal **18% nuclear** 9% oil 2% hydro 1% gas

NUCLEAR POWER

Policy: Aggressive development of nuclear power, based to date on gas-cooled reactors but diversifying to PWRs and eventually to FBRs.

Nuclear Power Plant Capacity	1986	10.0 GWe
	1990	12.2 GWe
	2000	10.3 GWe
Reactor Mix	1985	GCR: 26 (1956-72) AGR: 10 (1976-85) 4 (1987-88) FBR: 1 (1976) HWR: 1 (1968)
Reactor Development		Major LMFBR development program, including fuel cycle

INDUSTRIAL FUEL CYCLE

Policy: Reprocess and recycle Pu to FBR system; develop and maintain complete fuel cycle capability (enrichment, UO_2 and MOX fuel fabrication, spent fuel reprocessing); sell fuel cycle services to foreigners.

Waste Management Strategy: Reprocess spent fuels as rapidly as plant capacity permits; vitrify HLW (French technology); long-term interim storage of HLW glass, deferring decision on disposal; shallow-land burial or sea-dump of LLW and ILW.

Cumulative Spent Fuel Arisings (LWR and AGR)	1985	830 tU
	1990	2,000 tU
	2000	5,330 tU

Industrial-Scale Activities

* Power production (GWe): 1981--9.8; 1990--14.8.

* Uranium conversion (Springfields)
  - UF_6 production--9500 t/a
  - UF_6-UO_2 conversion--700 t/a.

* Uranium enrichment (Capenhurst)
  - gas diffusion plant--400 tSWU/a
  - centrifuge plant--225 tSWU/a.

* Fuel fabrication
  - U metal (Magnox)--2500 t/a (Springfields)
    UO_2 fuels--500 t/a (Springfields)
  - MOX fuels for recycle to FBRs (BNFL/Sellafield): capacity (t/a): 1987 -- 50.

* Fuel reprocessing
  - Magnox fuels (Sellafield)--5 to 7 t/a
  - UO_2 fuels (THORP)--6 t/day (1990)
  - FBR fuels (PFR reprocessing pilot plant, Dounreay)--50 kg HM/day
  - FBR fuels (CDFR reprocessing plant, 1993).

* HLW vitrification. Design and construction of Sellafield Vitrification Plant (1988).

INTERNATIONAL RELATIONSHIPS

US: DOE/UKAEA Umbrella Agreement for LMFBR Development
- Term: 9-20-76 to 9-20-86.
- Scope: Waste management exchange: waste treatment and storage; sodium technology; quality assurance; environmental considerations; design and construction experience.
- Emphasis: Limited technical exchange, primarily TRU waste treatment.

DOE/UKAEA Implementing Agreement for Reactor Decommissioning Exchange
- Term: 3-1-85 to 3-1-89.
- Scope: Planning and accomplishment of the projects for decommissioning Shippingport, the Windscale AGR and other facilities in both countries; D&D technology.

Member of EC, IAEA and OECD/NEA. Agreements/partnerships with various nations.

ORGANIZATION

* UKAEA (United Kingdom Atomic Energy Authority)--nuclear research; laboratories at Harwell, Risley, Springfields, Dounreay

* DOE (Department of Environment)--develops waste management strategy, funds and coordinates generic waste management R&D

* BNFL (British Nuclear Fuels Ltd.)--commercial fuel cycle for domestic and foreign customers

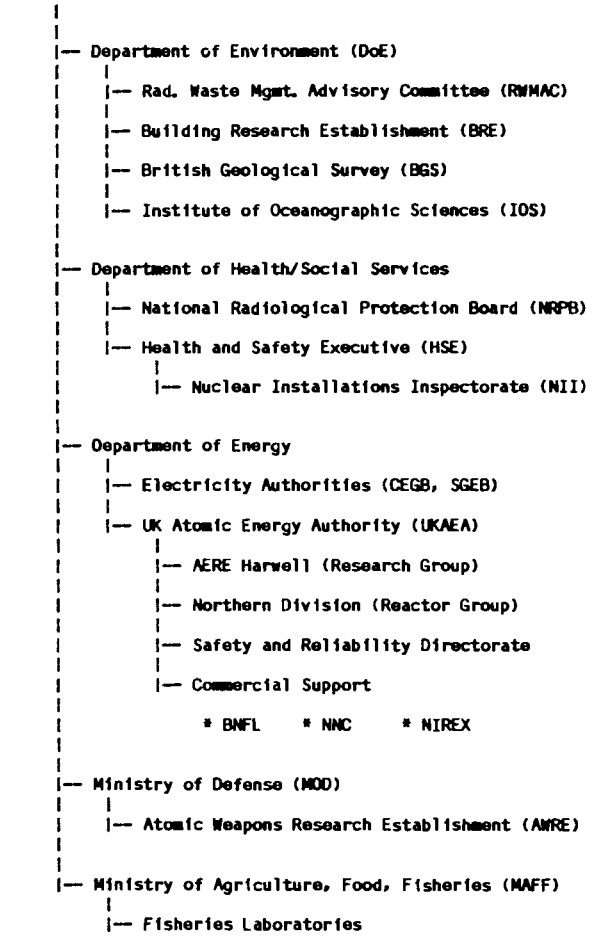
* NIREX (state-owned public company)--disposal of LLW and ILW

* BGS and IOS (British Geological Survey and Institute of Oceanographic Sciences)--supporting R&D for the waste management program

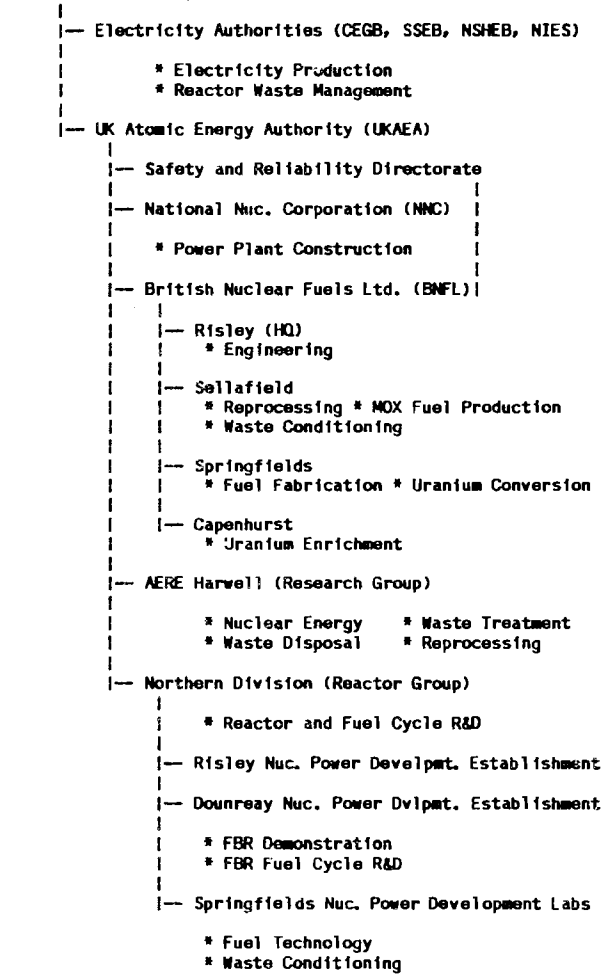
* NRPB (National Radiological Protection Board)--environmental R&D

* NII (Nuclear Installations Inspectorate)--licensing.

NUCLEAR FUEL CYCLE RESPONSIBILITIES



DoE FUEL CYCLE/WASTE MANAGEMENT RESPONSBILITITES



AWRE

Atomic Weapons Research
Establishment
Aldermaston, Reading RG7 4PR
United Kingdom

Tel: 44-7356-4111
Telex: 848104/5

Waste Management — E. Whitehead

BGS

British Geological Survey
Nicker Hill, Keyworth
Nottingham, NG12 5GG
United Kingdom

Tel: 44-6077-6111
Telex: 378173 ISGKEY G

Director — Dr. G. M. Brown

British Geological Survey
Harwell Laboratory
Building 151
Harwell, Oxon OX11 ORA
United Kingdom

Tel: 44-235-2-4141
Telex: 83135 ATOMHA G

BNFL: RISLEY

British Nuclear Fuels Ltd.
Risley, Warrington
Cheshire WA3 6AS
United Kingdom

Tel: 44-9253-5953
Telex: 627581

[About 20 miles by official car or taxi from Manchester International Airport; or train from London to Warrington (approx. 3 hours), then 6 miles by official car or taxi to Risley.]

Chairman	Christopher Harding
Chief Executive	Neville Chamberlain
Deputy Chief Executive	Jack Tatlock
Director, Reproc. Engineering	Jack Clarke

BNFL: SELLAFIELD

British Nuclear Fuels Ltd.
Sellafield, Seascale
Cumbria CA20 1PG
United Kingdom
Tel: 44-9402-8333
Telex: 64237/8

Director, Reproc. Operations Gordon Steele

[By train from London-Euston Station to Carlisle Station (4 hours); transport can be arranged by BNFL from Carlisle to site (approx. 1-1/2 hours). From Manchester International Airport to site by car is approx. 3 hours.]

Reprocessing Facilities:

* **B205**
  Mission: Reprocess Magnox (magnesium-clad, U metal) fuels from UK GCRs. Oxide head-end added in 1969 to handle AGR and LWR fuels.
  Design Basis: Magnox fuels: mechanical declad; PUREX flowsheet; "no-maintenance" concept; nominal capacity, 8 tHM/day. Liquid HLW storage: SS tanks, 70 m^3 and 150 m^3, in SS-lined concrete cells.
  History: Magnox fuels: B205 startup, 1967; annual throughput of Magnox fuels, 1000-1200 tHM. Oxide head-end (installed in B204), operated 1969-1973 and processed 90 t oxide fuel, before plant was shut down after a contamination release incident.

* **Reprocessing Test Unit** (nonradioactive)
  Mission: Test the THORP first solvent extraction cycle.
  Design Basis: PUREX flowsheet; nominal capacity, 4 t/a LWR fuels.
  History: Startup, 1979.

* **THORP** (Thermal Oxide Reprocessing Plant)
  Mission: Reprocess AGR and domestic or foreign LWR fuels.
  Design Basis: PUREX flowsheet, pulsed columns and mixer-settlers. AVM process for HLW vitrification. Nominal capacity, 6 tU/day.
  Milestone: Startup, 1990.

* **Reprocessing Pilot Plant** (radioactive)
  Mission: Support THORP design and operation.
  Design Basis: 1/5000 scale.

MOX Fuel Fabrication Facilities

* **MOX Fuel Fabrication Plant**
  Design Capacity: 10 t/a FBR fuels.

* **MOX Fuel Fabrication Plant**
  Design Basis: Gel precipitation; capacity, 0.5 kg/day.
  History: Startup, 1981-82.

* **MOX Fuel Fabrication Production Plants**
  Design Basis: Mechanical mixing or coprecipitation. 20 t/a (startup, 1984); 50 t/a (startup, 1987).

Waste Treatment Facilities

* **FSIF** (cold demonstration plant-vitrification)
  Mission: Test prototype equipment and maintenance techniques.
  Design Basis: French AVM process (rotating-tube calciner/metal melter); capacity, 11 kg/hr glass; product, borosilicate glass blocks.
  History: Startup, 1982.

* **Vitrification Plant**
  Mission: Solidify Sellafield HLW.
  Design Basis: AVM process; product, borosilicate glass blocks.
  Capacity: 25-20 kg/hr glass.
  Milestone: Startup, 1988.

* **Waste Treatment Complex**
  Mission: Prepare non-HLW for ocean dumping; extract Pu from process residues.
  Construction: Ten-year period, starting in 1981 (estimated cost: US$ 225 million).

BNFL: SPRINGFIELDS

British Nuclear Fuels Ltd.
Springfields Works
Salwick, Preston,
Lancashire PR4 0XJ
United Kingdom

Tel: 44-772-72-8262
Telex: 67526/7

Director, Fuels — Anthony Stephens

BRE

Building Research Establishment
Department of the Environment
Building Research Station
Garston, Watford WD2 7JR
United Kingdom

Tel: 44-9273-74040
Telex: 923220

Asst. Director, Geotechnics/ Structural Engineering — Dr. J. B. Menzies
Geotechnics Division — J. B. Boden
Seabed Disposal — T. Freeman
Continental Disposal — Ms. C. M. Cooling

Waste Management R&D: Emplacement engineering and related activities; rock mechanics.

CEGB

Central Electricity Generating Board
Sudbury House
15 Newgate Street
London, EC1A 7AU
United Kingdom

Tel: 44-1-248-1202
Telex: 883141

Chairman — Sir Walter Marshall
Director, Plant Engineering — P. M. Billam
Director, Research — Dr. J. K. Wright
Fuel and Core Division — Dr. B. C. Masters

DOE

Department of the Environment
Nuclear Waste Management Division
43 Marsham Street
London SW1 3PY
United Kingdom

Tel: 44-1-212-8673
Telex: 22221

Director, Radioactive Waste Professional Division — Dr. Frank Feates 44-1-212-8804

Waste Management Responsibility: Administer UK waste management programs; fund and coordinate waste treatment and waste isolation R&D at Harwell, BGS, NRPB, etc.; regulate discharge of radioactive materials to the environment.

IOS

Institute of Oceanographic Sciences
Brook Road
Wormley, Godalming
Surrey GU8 5UB — Tel: 44-42-879-4141
United Kingdom — Telex: 858833

Director — Dr. Anthony S. Laughton
Nuclear Waste — Dr. T. J. G. Francis

MAFF

Ministry of Agriculture, Fisheries, and Food
Fisheries Radiobiological Laboratories
Pakefield Road
Lowestoft, Suffolk NR32 OHT — Tel: 44-502-4381
United Kingdom — Telex: 97470

Director, Fisheries Research — Alan Presto
Aquatic Environment Protection — Harry Hill
44-502-62244

NII

Nuclear Installations Inspectorate
Thames House North
Millbank, London SW1P 4QJ — Tel: 44-1-211-3000
United Kingdom — Telex: 918777 ENERGY G

Nuclear Installations — R. Anthony
Overseas Liaison — J. S. MacLeod

NIREX

UK Nirex Ltd.
Harwell
Didcot, Oxon OX11 ORA — Tel: 44-235-24141
United Kingdom — Telex:

Chairman — John Baker
Chief Executive — Tom McInerney
Technical Program — Maurice E. Ginniff

Function: Locate, develop and operate facilities and sites for disposal of LLW and ILW.
State-owned public company: CEGB, BNFL, UKAEA and SSEB (South of Scotland Electricity Board) as partners, with Secretary of State for Energy having absolute powers of veto.

NRPB

National Radiological Protection Board
Chilton Didcot
Oxfordshire OX11 ORQ — Tel: 44-235-83-1600
United Kingdom — Telex: 837124

Director — H. J. Dunster
Secretary — Dr. R. H. Clarke
Asst. Director, Operations — G. A. M. Webb

SRD

Safety and Reliability Directorate
Wigshaw Lane, Culcheth
Warrington WA3 6AT — Tel: 44-925-31244
United Kindom — Telex: 629301 atomry-g

Function: Advise the UKAEA on safety, coordinate reactor safety research, and provide advice and services on safety to government and industry.

UKAEA

UK Atomic Energy Authority
11 Charles II Street
London SW1 4QP — Tel: 44-1-930-5454
United Kingdom — Telex: 22 565

Chairman — Arnold Allen

State-owned nuclear research agency, expected to become a commercial operation in April 1986.

UKAEA: DOUNREAY

Dounreay Nuclear Power Development Establishment
UKAEA (Northern Division)
Thurso, Caithness KW14 7TZ
Scotland — Tel: 44-847-62121
United Kingdom — Telex: 75297

[From London by air to Wick (via Aberdeen), then approx. 30 miles by car to Dounreay; or by train from London to Thurso (via Inverness), then approx. 10 miles by car to Dounreay.]

Director — Clifford W. Blumfield
Asst. Director, Fuels — O. Pugh

UKAEA: DOUNREAY (contd)

Facilities

* **PFR Reprocessing Plant**
  Mission: Reprocess Dounreay Prototype Fast Reactor (MOX) fuels.
  Design Basis: Shear single pins and leach; PUREX process; capacity 9-10 tHM/a of 180-day cooled PFR assemblies with 8-10% burnup.
  History: Dounreay Fast Reactor fuels processed from 1961 to 1975; plant rebuilt to handle PFR oxide fuels, resumed operation in October 1980.

* **Solidification Plant**
  Mission: Condition liquid wastes by cementation.
  Milestone: Construction--start 1985, completion 1987 (cost US$ 884 million)

UKAEA: HARWELL

Atomic Energy Research
Establishment
AERE, Harwell
Didcot, Oxon OX11 ORA
United Kingdom

Tel: 44-235-2-4141
Telex: 83135

Director	Dr. Gramme Low
Director, Fuel Processing	Dr. Ron H. Flowers (ext. 2323)
	Norm J. Keen
Director, Underlying Research	Dr. Jack Williams
Director, Nuc. Power Research	Dr. Stuart Nelson

Facilities

* **Harwell Ceramic Melter Test Unit** (nonradioactive)
  Mission: Develop ceramic melter capability for UKAEA.
  Design Basis: Liquid-fed ceramic melter; capacity, 700 kg/day glass; product, borosilicate glass.
  History: Initial studies in 1/3 (linear) scale unit 1982-84.
  Milestone: Startup, (full scale) 1986.

UKAEA: RISLEY

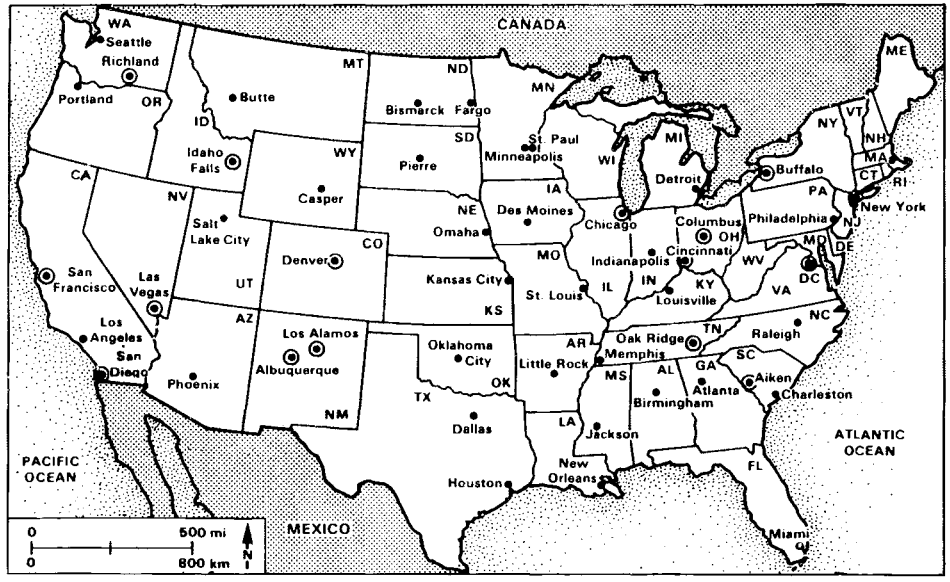
Risley Nuclear Power Development Establishment
UKAEA (Northern Division)
Risley, Warrington
Cheshire WA 3 6AT
United Kingdom
Tel: 44-925-31244
Telex: 629301

Director, Process Technology and Safety	R. Harry Allardice (ext. 2181)
Waste Management (General)	H. Barton (ext. 2451)
Decommissioning	D. F. Rawson (ext. 2919)

UKAEA: SPRINGFIELDS

UK Springfields Nuclear Power Development Laboratories
Salwick, Preston
Lancashire PR4 ORR
United Kingdom
Tel: 44-772-72-8262
Telex: 67545

Laboratory	John V. Shennan
Chem. Plant Development	P. Laurie Allen
Process Eng. Technology	Cliff Etherington
Head-End/Solid Waste Mgmt.	Brian E. Meredith



UNITED STATES

UNITED STATES (US)

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
February 17	Presidents Day
May 26	Memorial Day
July 4	Independence Day
September 1	Labor Day
November 11	Veterans Day
November 27	Thanksgiving
December 25	Christmas

STATE ABBREVIATIONS

AL - Alabama
AK - Alaska
AZ - Arizona
AR - Arkansas
CA - California
CO - Colorado
CT - Connecticut
DE - Delaware
DC - District of Columbia
FL - Florida
GA - Georgia
HI - Hawaii
ID - Idaho
IL - Illinois
IN - Indiana
IA - Iowa
KS - Kansas
KY - Kentucky
LA - Louisiana
ME - Maine
MD - Maryland
MA - Massachusetts
MI - Michigan
MN - Minnesota
MS - Mississippi
MO - Missouri
MT - Montana
NB - Nebraska
NV - Nevada
NH - New Hampshire
NJ - New Jersey
NM - New Mexico
NY - New York
NC - North Carolina
ND - North Dakota
OH - Ohio
OK - Oklahoma
OR - Oregon
PA - Pennsylvania
RI - Rhode Island
SC - South Carolina
SD - South Dakota
TN - Tennessee
TX - Texas
UT - Utah
VT - Vermont
VA - Virginia
WA - Washington
WV - West Virginia
WI - Wisconsin
WY - Wyoming

ENERGY

Population	1984	235 million
Electric Power Plant Capacity	1983	646 GWe
Electric Power Production	1983	2,449 TWh-- 55% coal 12% gas 14% hydro/geoth. **13% nuclear** 6% oil

NUCLEAR POWER GENERATION

Policy: Encourage construction and operation of nuclear power stations by private and public utilities under close regulatory control by NRC and State regulatory boards; continue R&D emphasizing LWR safety, liquid-metal breeder reactors, high-temperature graphite reactors, and small, modular concepts.

Nuclear Power Plant Capacity	1986	87.6 GWe
	1990	106.6 GWe
	2000	110.1 GWe
Reactor Mix	1985	PWR: 61 (1961-85) 23 (1986-2002) BWR: 35 (1960-85) 4 (1986-90) LGR: 1 (1966) HTR: 1 (1979)

NUCLEAR FUEL CYCLE

Policy: Current US industrial activities include all phases of the nuclear fuel cycle, except spent fuel reprocessing: uranium mining, milling, and enrichment; fabrication of UO^2 and MOX fuels; interim spent fuel and waste storage; transportation, conditioning, and disposal of radioactive waste. Mining, milling, fabrication of UO^2 fuel, and LLW disposal is done predominantly by private firms; enrichment and HLW disposal are the responsibilities of the federal government. While permitted by law, commercial reprocessing is not envisioned to come in the near future.

Waste Management Strategy: Hold fuel in storage at reactor until it can be reprocessed, immobilize the reprocessing waste and place the HLW glass and TRU waste packages in a geologic repository. However, there is a strong possibility that commercial reprocessing will not happen at all in the US - in which case direct disposal of the irradiated fuel will be necessary. The Nuclear Waste Policy Act (NWPA) of

1982 mandates a geologic repository be available in 1998 to receive immobilized HLW and/or spent fuel. Short-lived LLW/ILW is disposed of by shallow-land burial.

Cumulative Spent Fuel Arisings	1985	12,997 tHM
	1990	21,461 tHM
	2000	41,568 tHM

Major Milestones

*	Approval of three sites for characterization (First repository)	1986
*	Startup of Waste Isolation Pilot Plant	1989
*	Approval of three sites for characterization (Second repository)	1993
*	Recommendation of site for first repository to Congress	1991
*	Recommendation of site for second repository to Congress	1999
*	Startup of first repository for civilian waste	1998

INTERNATIONAL RELATIONSHIPS

Member in OECD/NEA and IAEA. Bilateral agreements for waste management cooperation with Belgium, Brazil, Canada, CEC, Germany (FRG), France, Japan, Sweden, Switzerland and the United Kingdom. A brief outline of the agreements is provided in the appropriate country's section. International cooperation and exchange of waste management technology is encouraged through visits by foreign nationals to US sites and through foreign travel by US staff.

ORGANIZATION

* **DOE** (Department of Energy) - Responsible for planning and implementing of programs for the safe handling of radioactive waste generated by federal activities, and for disposal of all high-level and TRU waste. Responsible also for ensuring availability of adequate technology for safe and efficient management of nuclear waste from both civilian and federal activities.

DOE (contd)

- HQ (Headquarters) - Responsibilities for the nuclear waste management and fuel cycle programs are divided among the offices of:
  - NE (Nuclear Energy) - R&D technologies for treatment of civilian radioactive waste; remedial action to treat or stabilize radioactive waste; D&D of selected facilities.
  - RW (Civilian Radioactive Waste Management) - Storage and disposal of spent nuclear fuel and HLW; development of monitored retrievable storage (MRS) facilities.
  - DP (Defense Programs) - Safe management, including disposal, of radioactive nuclear waste generated primarily by federal facilities.
  - IE (International Affairs and Energy Emergencies) - Coordination of DOE's international activities.
- **F.O.** (Field Offices) - Implement HQ policy and directives, issuing orders to specific sites. Direct efforts of DOE contractors.
- **Contractors** - Operate DOE facilities in accordance with HQ and F.O. guidance and orders.

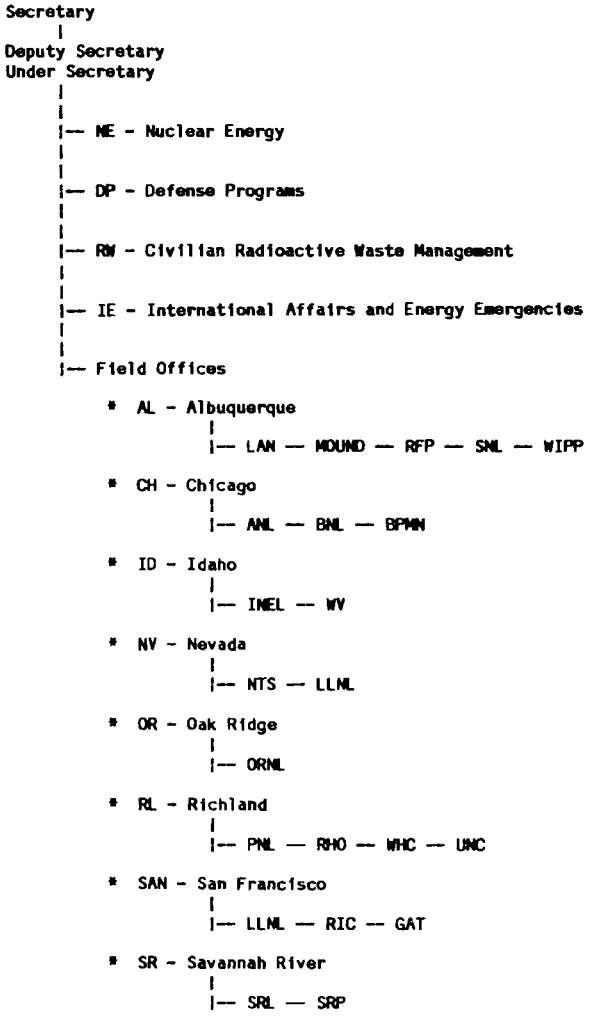
* **DOI** (Department of the Interior) -
- **USGS** (US Geological Survey) - Conducts laboratory and field geologic investigations in support of DOE's waste disposal programs; acts as consultant to NRC.
- **BLM** (Bureau of Land Management) - Reviews proposals to place waste disposal facilities on Federal Lands.

* **DOT** (Department of Transportation) - Development, issuance and enforcement of safety standards, governing all aspects of waste transit.

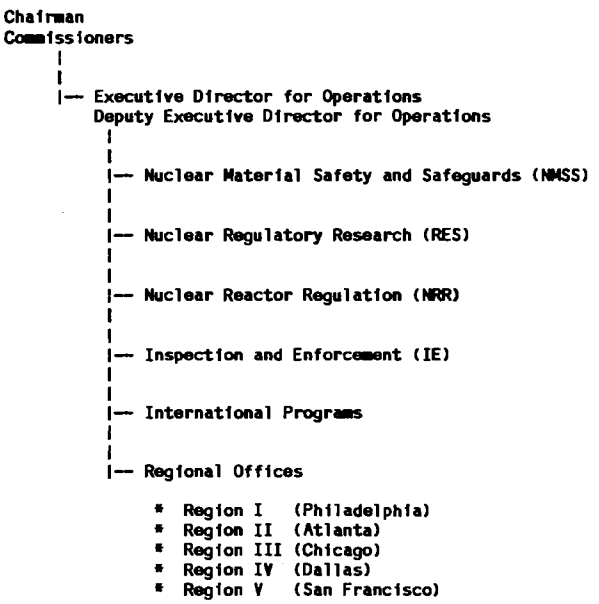
* **EPA** (Environmental Protection Agency) - Establishment and enforcement of standards for the protection of the general environment.

* **NRC** (Nuclear Regulatory Commission) - Issuance of regulations and licenses for commercial nuclear activities, in compliance with the general environmental standards issued by the EPA.

DOE (DEPARTMENT OF ENERGY) PARTIAL ORGANIZATION



NRC (NUCLEAR REGULATORY COMMISSION) PARTIAL ORGANIZATION



DOE

US Department of Energy
Forrestal
Washington, DC 20585

TEL: 202-252-5000
FTS: 252-5000
TWX: 710-822-0176
FAX: 252-8134
VERIF: 252-5100

US Department of Energy
Germantown
Washington, DC 20545

TEL: 202-252-5000
FTS: 252-5000
TWX: 710-828-0475
FAX: 233-4767
VERIF: 233-3486

Civilian Radioactive Waste Management

RW-1	Director	Ben C. Rusche	252-6850
RW-10	Admin. Mgmt.	Robert H. Bauer	252-6842
RW-20	Geo. Repositories	W. J. Purcell	353-4285
RW-30	Storage/Transportation	J. R. Hilley	252-6842
RW-40	Policy and Outreach	Roger W. Gale	252-2280

International Affairs and Energy Emergencies

IE-1	Assist. Secretary	George G. Bradley	252-5858
IE-12	Internatl. R&D Policy	Harold Jaffe	252-6777
IE-121	Internatl. R&D Coop.	John A. Dugger	252-6777

Nuclear Energy

NE-1	Assist. Secretary	James W. Vaughan	252-6450
NE-15	Interntl. Programs	Sol Rosen	353-3218
NE-20	Remedial Action/ Waste Technology	William R. Voigt	353-5006
NE-24	Waste Treatment	Joseph Coleman	353-4728

Defense Programs

DP-1	Assist. Secretary	Sylvester R. Foley	252-2177
DP-12	Waste/Transp. Mgmt.	Jill E. Lytle	353-3521
DP-122	Operations/Projects	James E. Dieckhoner	353-3273
DP-132	Waste R&D	Roger K. Heusser	353-5496
DP-12.1	Transportation	Larry H. Harmon	353-5505
DP-12.1	Remedial Action	Jerry H. Daly	353-4971

DOE OPERATIONS OFFICES

ALBUQUERQUE OPERATIONS (AL)

US Department of Energy
Albuquerque Operations Office
PO Box 5400
Albuquerque, NM 87115

TEL: 505-846-3118
FTS 846-3118
TELEX: 66-0424
FAX: 844-4197
VERIF: same

Manager	R. G. Romatowski	844-7231
Waste Mgmt./Transp.Devel.	J. M. McGough	846-2340
Waste Isolat'n Pilot Plant	W. R. Cooper	505-887-0586 ext. 217
Seabed Programs	W. O. Forster	505-766-3401
Uranium Mill Tailings	J. A. Morley	844-3941

CHICAGO OPERATIONS (CH)

US Department of Energy
Chicago Operations Office (CH)
9800 South Cass Avenue
Argonne, IL 60439

TEL: 312-972-2000
FTS: 972-2000
TWX: 910-258-3285
FAX: 972-2343
VERIF: 972-2209

Manager	Hilary J. Rauch	-2110
Cryst. Rock Proj. Office (CRPO)	Sally A. Mann	-2257
Waste Operations-Materials Integration Office (MIO)	Joel C. Haugen	-2093
Salt Rep. Proj. Office (SRPO) Columbus, OH	Jeff O. Neff	FTS 976-5916 ext. 28

IDAHO OPERATIONS (ID)

US Department of Energy
Idaho Operations Office
550 2nd Street
Idaho Falls, ID 83401

TEL: 208-526-0111
FTS: 583-0111
TWX: 910-977-5915
FAX: 583-0524
VERIF: 583-1503

Manager	Troy E. Wade II	-1322
Nuclear Programs	J. Phillip Hamric	-1395
Fuel Process/Waste	James Solecki	-1989
West Valley Project	Kent Hunter	-1986
TMI Project	Willis Young	-1415

ID (contd)

West Valley Proj. (Site)	W. H. Hannum	716-942-3235
	Eli Maestas	716-942-3235
TMI Site Manager	Willis W. Bixby	FTS 590-1011

NEVADA OPERATIONS (NV)

US Department of Energy
Nevada Operations Office
PO Box 14100
Las Vegas, NV 89114-4100

TEL:	702-295-1212
FTS:	575-1212
TWX:	910-397-6868
FAX:	575-1370
VERIF:	575-1369

Manager	Thomas R. Clark	-3211
Waste Management	Donald L. Vieth	-1092

OAK RIDGE OPERATIONS (OR)

US Department of Energy
Oak Ridge Operations Office
PO Box E
Oak Ridge, TN 37831

TEL:	615-576-5454
FTS:	626-5454
TWX:	810-572-1076
FAX:	626-1064
VERIF:	626-1057

Manager	Joe LaGrone	-4444
Nuclear R&D	Peter J. Gross	-0710

RICHLAND (HANFORD) OPERATIONS (RL)

US Department of Energy
Richland Operations Office
825 Jadwin Avenue
PO Box 550
Richland, WA 99352

TEL:	509-376-7411
FTS:	444-7411
TWX:	510-770-5108
FAX:	444-7280
VERIF:	444-7317

Manager	Michael J. Lawrence	-7395
Commercial Spent Fuel Mgmt.	Ron D. Izatt	-6152
Basalt Waste Isolation (ONWI)	O. Lee Olson	-7334
Waste Management	Jerry D. White	-1366
Surplus Facilities Mgmt.	Clarence E. Miller	-7473
Shippingport Stn. Decommissioning		-7134
Shippingport, PA site	J. J. Schreiber	FTS 722-2639

SAN FRANCISCO OPERATIONS (SAN)

US Department of Energy
San Francisco Operations Office
1333 Broadway, Wells Fargo Bldg
Oakland, CA 94612

TEL: 415-273-7111
FTS: 536-7111
TWX: 910-366-7228
FAX: 536-6207
VERIF: 536-7956

Manager	Richard A. DuVal	-7111
Nuclear Materials	F. T. Fong	-6444

SAVANNAH RIVER OPERATIONS (SR)

US Department of Energy
Savannah River Operations Office
PO Box A
Aiken, SC 29801

TEL: 803-725-6211
FTS: 239-6211
TWX: 810-771-2670
FAX: 239-2130
VERIF: 239-3160

Manager	Robert L. Morgan	-2277
Def. Waste Process Facility (DWPF)	S. P. Kowain	-2566

DOE CONTRACTORS

ANL

Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439

TEL: 312-972-2000
FTS: 972-2000
TWX: 910-258-3285
FAX: 972-2343
VERIF: 972-2209

Director	Allan Schriesheim	-3872
Waste Management	Stanley S. Borys	-6677
Materials Review Board	Martin J. Steindler	-4383
Natl. Energy Software Center	M. K. Butler	-7250
ANL-West, Manager	R. J. Teunis	FTS 583-7106

Fuel Cycle and Waste Management Activities:
Remedial action for formerly-used MED/AEC sites (FUSRAP) and for surplus facilities management program (SFMP) - D&D of ANL-East contaminated facilities - Materials review board and materials integration office - Proof of breeding program for light water breeders - Salt repository development - Crystalline rock repository development - Low-level waste technology - TRU waste technology - Manage national energy software center - Pyrometallurgical and pyrochemical fuel reprocessing - Sodium waste management.

Major Facilities:
ANL-West: Experimental Breeder Reactor No. 2 (EBR-II) - Zero Power Plutonium Reactor (ZPPR) - Transient Reactor Test Facility (TREAT) - Hot Fuel Examination Facility (HFEF) - Radioactive Scrap and Waste Facility - Sodium Process Demonstration (SPD) Facility - Radioactive Liquid Waste Treatment Facility (RLWTF).
ANL-East and ANL-West: High-Level Hot-Cell Facilities.

BPMD

Battelle Project Management Division
505 King Avenue
Columbus, OH 43201

TEL: 614-424-7365
FTS: 976-7365
TELEX: 24-5454
FAX: 976-4874
VERIF: 976-5600

General Manager	William J. Madia	-7359
Nuc. Waste Isolation (ONWI)	Wayne A. Carbiener	-4507
Transp.Syst. Planning (OTSP)	C. Charles Kimm	-6463
Cryst. Repos. Devel. (OCRD)	Billy Shipp(ANL)	FTS 972-2434

BPMD (cont'd)

Fuel Cycle and Waste Management Activities:
Salt repository development - Crystalline repository development.

Major Facilities:
Hot and Cold Development Laboratories - Hot Cells for Development Programs.

BNL

Brookhaven National Laboratory
Associated Universities, Inc.
Upton, NY 11973

TEL: 516-282-2123
FTS: 666-2123
TELEX: 96-7703
FAX: 666-3000
VERIF: 666-2546

Director	N. P. Samios	-2772
Nuclear Waste Management	D. G. Schweitzer	-3510

Fuel Cycle and Waste Management Activities:
Low-level waste form evaluation - Radiation effects in repositories - Waste management criteria for NRC.

Major Facilities:
Hot and Cold Development Laboratories.

GAI

GA Technologies Inc.
PO Box 85608
10955 John Day Hopkins Drive
San Diego, CA 92138

TEL: 619-455-3000
FTS: same
TELEX: 69-5065
TWX: 910-335-1260
FAX: 619-455-3621
VERIF: 455-3457

President	Harold Agnew	-2080
HTGR Fuel Cycle	B. J. Baxter	-2613
Transportation Systems	D. W. Ketchen	-3609

Fuel Cycle and Waste Management Activities:
HTGR spent fuel treatment - Transportation technology for commercial and defense waste.

Major Facilities:
Pilot Plant for HTGR Fuel Cycle Studies - Fuel Production Facility.

INEL

Idaho National Engineering Laboratory
EG&G Idaho, Inc.
PO Box 1625y
Idaho Falls, ID 83415

TEL: 208-526-0111
FTS: 583-0111
TWX: 910-977-5915
FAX: 583-1998
VERIF: 583-1771

Manager	James O. Zane	-9671
Waste Management	Dale L. Uhl	-1014
National LLW Technology	Ed A. Jennrich	-9490
TMI-2 Program (TMI Site)	P. J. Grant	FTS 590-1010

Fuel Cycle and Waste Management Activities:
National LLW technology - D&D (EBR-II, MTR, OMRE, Spent Reactors) - TMI-2 R&D - Development of stored waste examination pilot plant (SWEPP) for TRU waste - Development of process experimental pilot plant (PREPP) for TRU waste - Major test area North/spent fuel storage area.

Major Facilities:
Radioactive Waste Management Complex (RWMC) - Processing Experimental Pilot Plant (PREPP) - Waste Environmental Reduction Facility (WERF) - Loss-of-Fluid Test (LOFT) Facility - Stored Waste Examination Pilot Plant (SWEPP).

LLNL

Lawrence Livermore National Laboratory
University of California
PO Box 808
Livermore, CA 94550

TEL: 415-422-1100
FTS: 532-1100
TWX: 910-386-8339
FAX: 532-4660
VERIF: 532-4546

Director	Roger E. Batzel	-7401
Nuclear Waste Management	L. D. Ramspott	-4176

Fuel Cycle and Waste Management Activities:
Particulate filter development - Fundamental geoscience studies - CLIMAX spent fuel test at NTS - Development of waste package for Tuff repository - Waste package design criteria - Monitoring techniques for geologic repositories.

Major Facilities:
CLIMAX Spent Fuel Test Facility at NTS.

LANL

Los Alamos National Laboratory
University of California
PO Box 1663
Los Alamos, NM 87545

TEL: 505-667-5061
FTS: 843-5060
TWX: 910-988-1773
FAX: 843-6937
VERIF: 843-5113

Director	Donald M. Kerr, Jr.	-5101
Nuclear Waste Mgmt.	Donald T. Oakley	-1310

Fuel Cycle and Waste Management Activities:
Fundamental studies of waste materials (BES) - Migration from low-level waste sites (BES) - D&D of various site facilities - Tuff repository support (NNWSI).

Major Facilities:
Waste Disposal Field Experimental Facility - Controlled Air Incinerator Demonstration Facility - Glove Box Reduction Facility - TRU Waste Assay Systems.

MOUND

Mound Facility
Monsanto Research Corporation
PO Box 32
Miamisburg, OH 45342

TEL: 513-865-4020
FTS: 774-4020
TWX: 810-473-2974
FAX: 774-3742
VERIF: 774-3575

Director	Wylie Hogeman	-3222
Nuc. Waste Technology	Ralph R. Jaeger	-3275

Fuel Cycle and Waste Management Activities:
Solid waste volume reduction with glass melter - TRU waste technology/record systems, form development - TRU waste treatment/liquid waste, incineration - 3H recovery from waste - D&D of Pu-238 facilities.

Major Facilities:
Glass Melter - Incinerator - Waste Treatment - Combined Electrolysis catalytic Exchange System.

ORNL

Oak Ridge National Laboratory
Martin Marietta Energy
Systems, Inc.
PO Box X
Oak Ridge, TN 37831

TEL: 615-576-5454
FTS: 626-5454
TWX: 810-572-1076
FAX: 626-2912
VERIF: 624-6068

ORNL (contd)

Director	Herman Postma	6-2900
Nuclear & Chemical Waste	Thomas H. Row	4-5974

Fuel Cycle and Waste Management Activities:
Consolidated fuel reprocessing - Operate waste management facilities, including disposal by hydrofracture - Development of TRU waste technology, including assay and package certification - Low-level waste technology development - Hazardous chemical defense waste management - Beneficial uses of byproduct radionuclides - Repository development in sedimentary rocks - Remedial action surveys and certification activities.

Major Facilities:
Consolidated Fuel Reprocessing Program (CFRP) Pilot Plant: Integrated Equipment Test Facility, Fuel Element Shearing and Decladding Facilities, Rotary Dissolver - Fluorocarbon Pilot Plant for Kr-85 Recovery - Shallow-Land Burial Site - TRU Waste Assay Facility - Solvent Extraction Test Facility (TRU) - Sol-Gel Microsphere (UO_2 and U/PuO_2) Preparation Facilities.

PNL

Pacific Northwest Laboratory
Battelle Pacific Northwest Laboratories
Battelle Boulevard
PO Box 999
Richland, WA 99352

TEL: 509-375-2271
FTS: same
TELEX: 15-2874
FAX: 509-375-2718
VERIF: 509-375-2580

Director	William R. Wiley	-2201
Nuc.Fuel Cycle/WM Programs	Jack L. McElroy	-2532
Mtls. Characterization Ctr.	John E. Mendel	-2905

Fuel Cycle and Waste Management Activities:
Commercial spent fuel management - Civilian nuclear waste treatment (HLW/TRU) - Monitored retrievable storage - Materials characterization center - International program support - NRC environmental studies on LLW and Uranium mill tailing sites - Salt repository (ONWI) - Basalt repository (BWIP) - Granite repository (CR) - Tuff repository (NNWSI) - HLW technology (SR, WV, BRET, Hanford) - TRU technology (TWSO, Hanford) - LLW technology (LLWMP, Hanford) - Airborne waste technology (CFRP) - remedial action planning and technology - Byproduct utilization - Transport technology (TTC).

Major Facilities:
Hot and Cold Development Laboratories - Hot Cells for Development Programs.

RHO

Rockwell Hanford Operations
Energy Systems Group
PO Box 800
Richland, WA 99352

TEL: 509-376-7411
FTS: 444-7411
TWX: 510-770-5108
FAX: 444-6430
VERIF: 444-6793

General Manager	Paul G. Lorenzini	440-1277
Bas.Waste Isol.Proj. (BWIP)	Larry R. Fitch	444-6848
Waste Management	Ronald D. Prosser	440-3001

Fuel Cycle and Waste Management Activities:
Fuel reprocessing (PUREX) - HLW tank storage - Cs/Sr recovery and encapsulation - HLW concentration and solidification - Low-level liquid waste treatment and fixation - D&D (hot semi works) - TMI support/waste packaging and disposal - TRU waste assay - Basalt waste isolation program (BWIP) - Hanford waste disposal.

Major Facilities:
PUREX Reprocessing Plant - Cs/Sr Encapsulation Plant - BWIP site and Near Surface Test Facility (NSTF).

RFP

Rocky Flats Plant
Rockwell International Corporation
Energy Systems Group
PO Box 464
Golden, CO 80402-0464

TEL: 303-497-7000
FTS: 320-7000
TELEX:
FAX: 303-430-2909
VERIF: 303-430-2856

General Manager	Jack E. Dorr	-4361
Waste Management	C. E. Wicklund	-4294
Transuranic Waste	K. V. Gilbert	-2747

Fuel Cycle and Waste Management Activities:
Defense TRU waste technology - TRU waste technology development - Operate waste treatment facilities.

Major Facilities:
Solid Waste Reduction Facility - TRU Waste Incinerators - TRU Waste Assay - Liquid Waste Treatment and Fixation Facilities.

RIC

Rockwell International Corporation
Energy Systems Group
Atomics International Division
8900 DeSoto Avenue
Canoga Park, CA 91304

TEL: 818-700-8200
FTS: 983-3000
TELEX: 18-1017
FAX: 818-700-3862
VERIF: 818-700-4292

General Manager	G. Wayne Meyers	-4267
Waste Mgmt./Remote Systems	Don G. Mason	-4156

Fuel Cycle and Waste Management Activities:
Decladding of sodium-bonded fuels - Operate energy technology and engineering center (ETEC) - Remote handling development - Large component fabrication.

Major Facilities:
Large Inert Hot Cell - Energy Technology and Engineering Center (ETEC).

SNL

Sandia National Laboratories
PO Box 5800
Albuquerque, NM 87185

TEL: 505-844-5678
FTS: 844-5678
TWX: 910-989-1600
FAX: 844-1723
VERIF: same

President	Irwin Welber	-7261
Nuclear Fuel Cycle	A. W. Snyder	-8203
Nuc. Waste Mgmt./Transp.	Richard W. Lynch	-3763
Transp. Tech. Center	Joe Stiegler	6-0896
WIPP Scientific Support	Wendel D. Weart	-4855
Subseabed Disposal	D. R. Anderson	-6553

Fuel Cycle and Waste Management Activities:
Transportation of Pu and HLW - Subseabed disposal - Tuff repository support (NNWSI) - Operate transportation technology center - Salt repository scientific support (WIPP) - Safety assessment of facilities for NRC.

Major Facilities:
Transportation Technology Center.

SRL

Savannah River Laboratory
E. I. du Pont de Nemours & Co.
Aiken, SC 29808

TEL: 803-725-6211
FTS: 239-6211
TWX: 810-771-2670
FAX: 239-2130
VERIF: 239-3160

Director	John T. Lowe	-3422
Programs/Planning	J. K. Okeson	-1886
Defense Waste Processing	W. Ross Stevens III	-2410

Fuel Cycle and Waste Management Activities:

Fuel reprocessing R&D - HLW storage and solidification R&D-HLW form development and characterization - HLW packaging R&D - TRU technology development - LLW technology development - Defense HLW technology development.

Major Facilities:

TNX HLW Vitrification Pilot Plant - TNX HLW Tank Mockup - HLW Caves for Process Development - TRU Waste Incinerator.

SRP

Savannah River Plant
E. I. du Pont de Nemours & Co.
Aiken, SC 29808

TEL: 803-725-6211
FTS: 239-6211
TWX: 810-771-2670
FAX: 239-2130
VERIF: 239-3160

Manager	John T. Granaghan	-2701
Waste Management	E. O. Kaiger	-3320

Fuel Cycle and Waste Management Activities:

Operate fuel reprocessing facilities - Operate associated spent fuel storage, HLW tank storage and liquid waste treatment facilities - Operate LLW incinerator - Operate LLW shallow-land burial grounds - Build and operate defense waste processing facility.

Major Facilities:

F&H Reprocessing Plants - Canyon Mockup Shop - LLW Incinerator - HLW Tank Farm.

UNC

UNC Nuclear Industries, Inc.
PO Box 490
Richland, WA 99352

TEL: 509-376-7411
FTS: 444-7411
TWX: 510-770-5108
FAX: 444-6000
VERIF: 444-2726

President/Gen. Manager	Nick C. Kaufman	440-1123
Decommissioning	Robert F. Potter	444-0114
Shippingport Decom. Site	Len A. Pasquini	FTS 643-5552

Fuel Cycle and Waste Management Activities:
Waste management operations for N-Reactor - D&D Hanford reactors - DOE surplus facilities program.

Major Facilities:
N-Reactor - N-Reactor Fuel Fabrication Facilities.

WHC

Westinghouse Hanford Company
PO Box 1970
Richland, WA 99352

TEL: 509-376-7411
FTS: 444-7411
TWX: 510-770-5108
FAX:
VERIF: 444-5087

President	John E. Nolan	-3915
Fuel Cycle	Bruce H. Noordhoff	-3633

Fuel Cycle and Waste Management Activities:
Breeder fuel reprocessing (BRET) - Breeder fuel development and fabrication - Spent fuel integrity in storage.

Major Facilities:
Fast Flux Test Facility (FFTF) - Fuels and Materials Examination Facility (FMET) - Fuel Development Laboratories.

WV

West Valley Nuclear Services, Inc.
Subsidiary of Westinghouse Electric
PO Box 191
West Valley, NY 14171-0191

TEL: 716-942-3235
FTS: same
TELEX: none
FAX: same ext.246
VERIF: same ext.267

WV (contd)

President	M. Bruce Boswell	ext.324
Engineering	John L. Knabenschuh	ext.295

Fuel Cycle and Waste Management Activities:
Demonstration of HLW vitrification - D&D of West Valley reprocessing plant.

Major Facilities:
Reprocessing Plant - HLW Vitrification Component Test Stand.

WINCO

Westinghouse Idaho Nuclear Co., Inc.
Idaho Chemical Processing Plant
PO Box 4000
Idaho Falls, ID 83401

TEL:	206-526-0111
FTS:	583-0111
TELEX:	none
FAX:	583-5436
VERIF:	583-5233

President	Ed W. Pottmeyer	-0998
Production	W. C. Moffit	-3864
Technology	Bert R. Wheeler	-3373

Fuel Cycle and Waste Management Activities:
Operate associated spent fuel storage, HLW tank storage, and liquid waste treatment facilities.

Major Facilities:
Idaho Chemical Processing Plant (ICPP) - Waste Calcining Facility (WCF) and Remote Mockup - Wet Fuel Storage - Dry HTGR Fuel Storage - Kr-85 cryogenic recovery plant.

WIPP

WIPP Project
Westinghouse Electric Corporation
Advanced Energy Systems Division
PO Box 2078
Carlsbad, NM 88221

TEL:	505-887-0586
FTS:	same
TELEX:	none
FAX:	505-887-1077
VERIF:	505-887-0586 ext. 238

Manager	Raymond C. Mairson	ext. 187

Fuel Cycle and Waste Management Activities:
WIPP technical support, including design review, construction support, safety assurance, operational planning, quality assurance systems.

Major Facilities:
Waste Isolation Pilot Plant.

EPA

US Environmental Protection Agency
401 M Street S.W.
Washington, DC 20460

TEL: 202-655-2090
FTS: 382-2090
TELEX: 89-2758
FAX: 382-7883
VERIF: 382-2078

International Activities

	W. Grieder	-4887
	Glen L. Sjoblom	-4981

Waste Management Standards

	Floyd L. Galpin	703-557-8610

Radiation Programs

	Sheldon Meyers	-9710
	W. F. Holcomb	-8977

NRC

US Nuclear Regulatory Commission
Washington, DC 20555

TEL: 301-492-7000
FTS: 492-7000
TELEX: 90-8142
FAX: 492-7617
VERIF: 492-7371

Nuclear Material Safety and Safeguards -NMSS-

Director	John G. Davis	427-4063
Waste Management	Robert E. Browning	427-4069
Safeguards	Robert F. Burnett	427-4033
Fuel Cycle/Materials Safety	Richrd.E. Cunningham	427-4485

Nuclear Regulatory Research -RES-

Director	Robert E. Minogue	427-4341
Rad. Programs/Earth Sciences	Karl R. Goller	427-4350

Nuclear Reactor Regulation -NRR-

Director	Harold R. Denton	492-7691
Licensing	Darrell G. Eisenhut	-7672
TMI Program	Bernard J. Snyder	-7761

NRC (contd)

Inspection and Enforcement -IE-

Director	Richard C. DeYoung	492-7397

International Programs

Director	James R. Shea	492-7886

Regional Offices

Philadelphia - Region I	Th. E. Murley	215-337-5299
Atlanta - Region II	Jmes.P. O'Reilly	404-221-5500
Chicago - Region III	James G. Keppler	312-790-5677
Dallas - Region IV	Robert D. Martin	817-860-8225
San Francisco - Region V	John B. Martin	415-943-3707

USGS

US Geological Survey
410 National Center
12201 Sunrise Valley Drive
Reston, VA 22092

TEL: 202-860-7000
FTS: 860-7000
TELEX: 89-9153
FAX: 928-7793
VERIF: 928-7209

Director	Dallas L. Peck	-7411
Hazardous Waste Hydrol.	John B. Robertson	-6976
High-Level Waste	George A. Dinwiddie	-6976

WESTON

Weston
2301 Research Blvd.
Rockville, MD 20850

TEL: 301-963-6814
FTS: 202-963-6814
FAX: 840-1552
VERIF: 963-6800

CRWM Program	William M. Hewitt	-6810
Internatl. Programs	James F. Strahl	-6821

USSR
(Union of Soviet Socialist Republics)

MAJOR PUBLIC HOLIDAYS (1986)

January 1	New Year
March 8	Women's Day
May 1-2	May Day
May 9	Victory over Fascism
November 7-8	October Revolution
December 5	Constitution Day

TIME

Standard Time Washington D.C.: **+ 8 hours**

Daylight Saving Time period: **03/30 - 09/27/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States; in addition, a visa is currently required for a visit to the USSR. Most travel agencies can provide up-to-date information concerning requirements.

US EMBASSY - MOSCOW

American Embassy
Ulitsa Chaykovskogo 19/21/23
Moscow
USSR

ENERGY

Population	1984	275 million
Electric Power Plant Capacity	1982	281 GWe
	1983	460 GWe
Electric Power Production	1982	1376 TWh-- **7% nuclear**
	1985	1510 TWh-- **14% nuclear**

NUCLEAR POWER

Policy: Major program to develop nuclear power, to avoid transport of fossil fuels from east of the Ural Mountains to European Russia.

Nuclear Power Plant Capacity	1982	17 GWe
	1985	25 GWe
	1992	90-100 GWe
Reactor Mix	1985	LGR: 22 (1958-85) 4 (1986-90) PWR: 20 (1964-85) 12 (1986-88) BWR: 1 (1966) FBR: 2 (1973/80)
Reactor Development		LMFBRs, 1,500-MWe PWRs

INDUSTRIAL FUEL CYCLE

Policy: Complete domestic fuel cycle capability, including enrichment, fuel fabrication (UO_2 and MOX); develop commercial reprocessing capability; provide complete fuel cycle services, including spent fuel storage and waste disposal to foreign buyers of USSR reactors and fuel.

Waste Management Strategy: Vitrify HLW, provide terminal storage in geologic repository.

ORGANIZATION

Nuclear Program Control

* USSR State Committee on Utilization of Atomic Energy
* Ministry of Energy and Electrification

R&D

- Institute of Physical Chemistry, Moscow, a branch of the USSR Academy of Sciences (geologic waste disposal; waste form properties)
- V. G. Khlopin Radium Institute, Leningrad (chemical separation; fuels reprocessing; geochemistry)
- All-Union Scientific Research Institute for Inorganic Materials, Moscow [properties of solid waste forms)
- Chemical Plant Research Institute, Sverdlovsk (vitrification pilot plants)

STATE COMMITTEE ON THE UTILIZATION OF ATOMIC ENERGY

State Committee on the Utilization
of Atomic Energy
Staromonetny Pereulok 26
Moscow 109180
USSR

Chairman	A. M. Petrosyants
Deputy Chairman	Prof. I.D. Morokhov

Waste Management R&D: Develop processess for treating spent fuel (cladding, thermal decladding, meltdown of hulls), improved partitioning of TRU wastes, handling off-gases, and storing ^{85}Kr.

Facilities[a]

- **Reprocessing Pilot Plant** (radioactive)
  Owner: Khlopin Radium Institute, Leningrad
  Mission: Develop LWR fuel reprocessing technology.
  Design Basis: Chop-leach head-end; PUREX flowsheet; capacity, 3 kg/day uranium.
  History: Startup, 1973.

(a) Because there is only limited information available, it is not always known at which nuclear agency a facility is located.

STATE COMMITTEE ON THE UTILIZATION OF ATOMIC ENERGY (contd)

* **Cold Pilot Plant-Vitrification**
Mission: Develop waste vitrification technology.
Design Basis: Liquid-fed ceramic melter, two-chamber unit; 150 l/hr HLLW; 30 l/hr glass; product, phosphate glass blocks.
History: Startup, 1974.

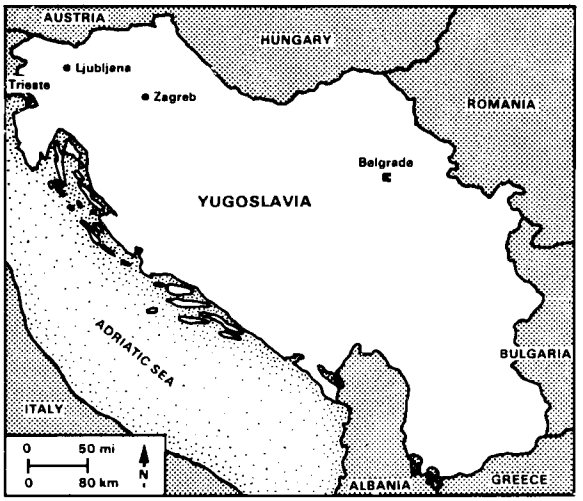
* **KS-KT-100** (cold pilot plant-vitrification)
Location: Chemical Plant Research Institute, Sverdlovsk.
Design Basis: Fluid bed calciner; in-crucible melter (two-stage process); capacity, 20 kg/hr glass; 160-180 kg glass/batch; product, phosphate glass blocks.

KHLOPIN RADIUM INSTITUTE

Khlopin Radium Institute
Ul. Rentgena 1
Leningrad 22
USSR

Chief of Laboratory — Yergeniy Shashukov

YUGOSLAVIA


AUSTRIA
HUNGARY
Ljubljana
Trieste
Zagreb
ROMANIA
Belgrade
YUGOSLAVIA
ADRIATIC SEA
BULGARIA
ITALY
0 50 mi
0 80 km
N
ALBANIA
GREECE

YUGOSLAVIA

MAJOR PUBLIC HOLIDAYS

January 1	New Year
May 1-2	Labor Day
July 4	Fighter's Day
November 29-30	Republic Day

TIME

Standard Time Washington D.C.: **+ 7 hours**

Daylight Saving Time Period **03/30 - 09/27/86**

PASSPORT/VISA

A passport is needed to depart and re-enter the United States; in addition, a visa is currently required for a visit to Yugoslavia. Most travel agencies can provide up-to-date information concerning requirements.

US EMBASSY - BELGRADE

American Embassy
Kneza Milosa 50
Belgrade
Yugoslavia

Tel: 38-11-645-655
Telex:

ENERGY

Population	1983	22.8 million
Electric Power Plant Capacity	1980	14.9 GWe 46% hydro 42% coal 12% gas/oil
Electric Power Production	1982	62.1 TWh-- **4% nuclear**
	2000	**25% nuclear**

NUCLEAR POWER

Policy: Start construction of four new nuclear 1000 MW power plants by the year 2000 (utilities have formally called for international bids to supply technology, equipment and services to the planned nuclear program, estimated at US$ 15 billion); develop indigenous plant construction capability.

Nuclear Power Plant Capacity	1986	0.6 GWe
	1990	0.6 GWe
	2000	1.6 GWe
Reactor Mix	1985	PWR: 1 (1981)

INDUSTRIAL FUEL CYCLE

Policy: Develop a high degree of fuel cycle self-sufficiency, including spent fuel reprocessing.

Waste Management Strategy: Keep spent fuel assemblies in storage pool at power station (15-17 years), then transport to reprocessing plant. Purify liquid waste at waste treatment facility; compress solid waste, encapsulate in steel casks and store at power station.

Cumulative Spent Fuel Arisings (LWR)	1985	50 tU
	1990	130 tU
	2000	420 tU

Industrial-Scale Activities

- Yellowcake production--at Zirovski VRH uranium mine (design capacity 120 t/a uranium concentrate) since 1984.
- Uranium recovery (85 tU/a)--planned, as a by-product of phosphoric acid production.

PROPOSED FUEL CYCLE R&D

- Geologic research to locate additional mineral resources
- Technological investigations of uranium ores and design parameters for uranium ore processing plants
- Obtaining uranium from unconventional sources
- Processes for production of pure uranium compounds from concentrates
- Processes for production of heavy water
- Uranium enrichment research: centrifuge, chemical exchange and laser enrichment
- Fuel element fabrication
- Spent fuel reprocessing
- Treatment and storage of radioactive wastes
- Safety and environmental studies

ORGANIZATION

- Nuclear Energy Commission and Committee for Energy and Industry--federal agency
- Savska Eletrarna (Serbia) and Eletroprivreda (Croatia)--utilities, industrial fuel cycle activities
- JUGEL--Association of Yugoslav Electric Utilities, coordination of fuel cycle planning
- NUKLIN--Association of Nuclear Research Institutes of Yugoslavia, R&D planning and coordination
- Boris Kidric Institut of Nuclear Sciences-Vinca 11001 Belgrade, Yugoslavia

INTERNATIONAL AGENCIES

CMEA

Council for Mutual Economic Assistance
Prospekt Kalinina 56
Moscow
USSR

MEMBER STATES

Bulgaria	Mongolia
Cuba	Poland
Czechoslovakia	Rumania
German Democratic Republic	USSR
Hungary	Yugoslavia

FUNCTION

Promote economic and industrial cooperation among the Member States with centrally-controlled economies.

ORGANIZATION

* Standing Commission on the Use of Atomic Energy for Peaceful Purposes. The Commission holds meetings to review national waste management R&D programs and defines areas for additional cooperation.

CEC

Commission of the European Communities
200 Rue de la Loi
B-1049 Brussels — Tel: 32-2-235-1111
Belgium — Telex: 21877 COMEU B

Vice-President for Industrial Affairs, Energy, Euratom Supply Agency, Research and Science, Joint Research Centre	Etienne Davignon
Director, Nuclear R&D	Sergio Finzi
Dir., Fuel Cycle	Serge Orlowski
Dir., Reactors/Technologies	Mario De Bacci
Dir., Nuclear Plant Safety	Willem Vinck
Director General, JRCs	Jean-Albert Dinkespiler

Function: Executive body for the European Communities [(EC) combined Euratom, Coal and Steel, Common Market].

CEC (contd)

FUEL CYCLE PROGRAM ADMINISTRATION

* R&D Programs
  - Direct action--fully funded by EC (by a tax on Member States), conducted by Joint Research Centre Establishments at Ispra (Italy) and Karlsruhe (FRG)
  - Indirect action--partly funded by EC under cost-sharing contracts, conducted by research centers in the member states:

    Belgium - Denmark - France
    Germany/FR - Greece - Ireland
    Luxembourg - Netherlands - United Kingdom

* Cooperation with US
  DOE/CEC UMBRELLA AGREEMENT FOR WASTE MANAGEMENT EXCHANGE
  - Term: 10-6-82 to 10-6-87.
  - Scope: Characterization of waste forms; disposal in geologic formations.

CEC-JRC: ISPRA

CEC Joint Research Center
Ispra Establishment
I-21020 Ispra (Varese)
Italy

Tel: 39-332-78-0131
39-332-78-0271
Telex: 380042/38058 euratom

Location: Northern Italy; may be reached by air-travel to Milan, ground transport to Ispra, about 50 km.

Director — George Robert Bishop
Waste Management Programs — Francesco Girardi

Waste Management R&D: R&D in treatment and storage of radioactive waste. TRU wastes--volume reduction and actinide separation; waste disposal--risk analysis, nuclide migration, and waste form properties.

CEC-JRC: KARLSRUHE

Karlsruhe Establishment
(European Institute for
Transuranium Elements)
Postfach 2266
D-7500 Karlsruhe
Federal Republic of Germany

Tel: 49-7247-841
Telex: 7825483 Eu D

CEC-JRC: KARLSRUHE (contd)

Director — Roland Lindner

Function: Basic research in the transuranium elements, especially plutionium, reactor fuels development.

Fuel Cycle R&D: Plutonium conversion and plutonium fuels, characterization of waste forms.

IAEA

International Atomic Energy Agency
P.O. Box 100
A-1400 Vienna
Austria

Tel: 43-222-23-600
Fax: 43-222-23-0184
Telex: 11-2645

Director General	Hans Blix
Deputy Director General	Leonard V. Konstantinov
Director, Nuc. Fuel Cycle	Jia-Luo Zhu
Waste Management	Jozsef Hirling
U.S. Waste Mgmt. Staff	Donald E. Saire

MEMBER STATES: Over 100 nations (UN members, incl. USA).

Function: Develop the peaceful use of atomic energy: safeguards, nuclear safety and standards, information exchange, and technical assistance.

Waste Management Activities

* Collection, review and dissemination of technical, scientific and regulatory information in the area of:
  - handling, treatment, storage and conditioning of waste
  - decontamination and decommissioning of nuclear facilities
  - underground disposal of waste
  - environmental consequences due to sea dumping and effluent discharges.
* Development of internationally acceptable guidelines, standards and codes of practice for use by national authorities.
* Protection of the environment (carry out responsibilities as requested under international conventions.

IAEA (contd)

- Promotion and sponsorship of research work and development of data and technology in promising areas.
- Technical advice and training to Member States upon request.

ICRP

International Commission
on Radiological Protection
Clifton Avenue
Sutton, Surrey SM2 5PU
United Kingdom

Tel: 44-1-642-4680
Telex: 895 1244 ICRPG

Chairman, Main Commission	Dr. B. Lindell
Scientific Secretary	Dr. F. D. Sowby
Committee Chairman, Radiation Effects	Dr. A. C. Upton

Function: Provide principles of radiation protection as a basis for each country to use in establishing technical codes of practice.

OECD (ORGANISATION FOR CO-OPERATION AND DEVELOPMENT)-NEA

OECD Nuclear Energy Agency (NEA)
38 Boulevard Suchet
F-75016 Paris
France

Tel: 33-14-524-8200
Telex: 630 668

MEMBER STATES

Australia	Germany (FRG)	Netherlands	United Kingdom
Austria	Greece	Norway	United States
Belgium	Iceland	Portugal	
Canada	Ireland	Spain	
Denmark	Italy	Sweden	
France	Japan	Switzerland	*New Zealand*
Finland	Luxembourg	Turkey	*Yugoslavia*

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* Not Member States, but participate in certain projects.

OECD-NEA (contd)

Function: Promote orderly development of peaceful uses of nuclear energy through cooperation among Member States. Initiate, encourage, and coordinate cooperative work in the following areas: reactor research, nuclear fuel cycle studies, radiation protection and waste management, nuclear safety, regulatory matters, and nuclear data collection.

Activities

* Workshops, technical meetings, symposia, and publications.

* Maintenance of the Multilateral Consultation and Surveillance Mechanism for Sea Disposal, which monitors sea dumping of LLW/ILW in the Northeast Atlantic.

* Joint activities.

US PARTICIPATION IN NEA JOINT WASTE MANAGEMENT ACTIVITIES

Committees and Coordinating Groups

* Radioactive Waste Management Committee (RWMC)
  - Performance Assessment Advisory Group
  - Advisory Group on Research and Investigations
  - Seabed Working Group (SWG)
    Participants: Belgium, Canada, CEC, France, FRG, Italy, Japan, Netherlands, Switzerland, UK, US
    Term: Not defined; feasibility report to be issued by 1989
    Scope: Site and barrier assessment; engineering emplacement studies; environmental, radiological and safety studies, regulatory/institutional issues.
  - Working Group on Decommissioning
  - Advisory Committee on Mill Tailings
  - Stripa Technical Committee (Stripa Mine test program)
    Participants: Canada, Finland, France, Japan, Spain, Sweden, Switzerland, UK, US
    Term: 5-1-80 to 1-1-87 for Phases 1 & 2
    7-1-86 to 7-1-90 (tentative) for Phase 3
    Scope: In-situ investigations in fractured-granite host rock
  - ISIRS Technical Committee (International Sorption Information Retrieval System)
  - Liaison Committee for D&D Project Exchange

OECD-NEA (contd)

* Committee on Radiation Protection and Public Health (CRPPH)

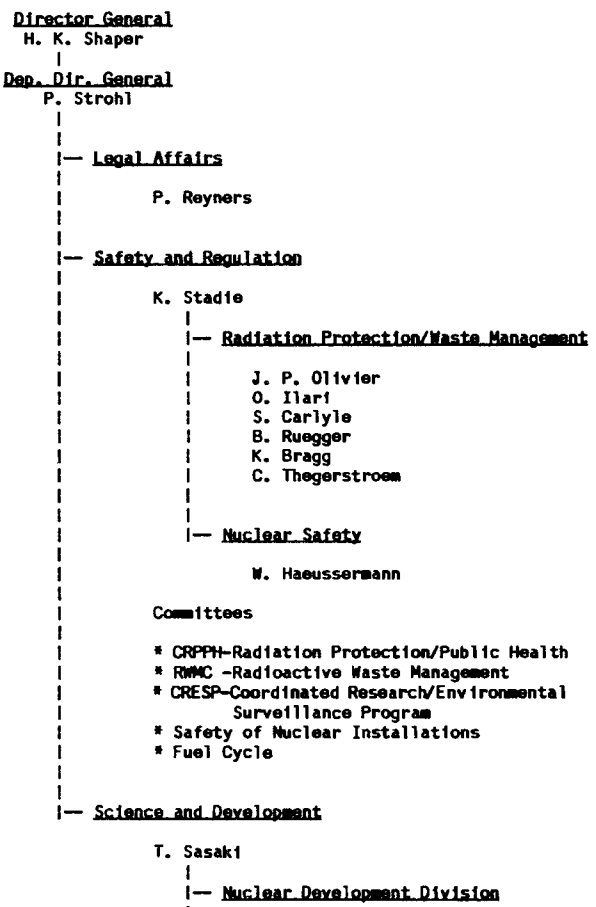
* Executive Group - Coordinated Research and Environmental Surveillance Program (CRESP)

US Mission to OECD
Nuclear Energy Agency
38 Boulevard Suchet
F-75016 Paris
France — Tel: 33-14-647-6327

DOE Representative — Andrew W. Reynolds
Ext. 25

US Mailing Address: c/o US Embassy, Paris, APO New York, NY 09777

NEA ORGANIZATION



ENERGY SUPPLY AND DEMAND

ENERGY SUPPLY AND DEMAND

ENERGY RESERVES

The world's measured, recoverable, nonrenewable energy reserves (as of 1974) are shown in Figure E-1 and listed by resource in Table E-1. The numbers are relatively old estimates but they do provide an order-of-magnitude picture. (The North American numbers are approximately 1/3 of US-ERDA 1976 estimates for the US alone.)

ENERGY DEMAND

According to the reference for Figure E-1, in 1974 the world consumed 1 percent of its recoverable, nonrenewable energy resources with the US accounting for 1/3 of that consumption. In 1978, the world consumed about 250 quads of energy, and the rate of energy use is accelerating, particularly for the developing countries (see Table E-2). The supply form of this 250 quads varied enormously from country to country.

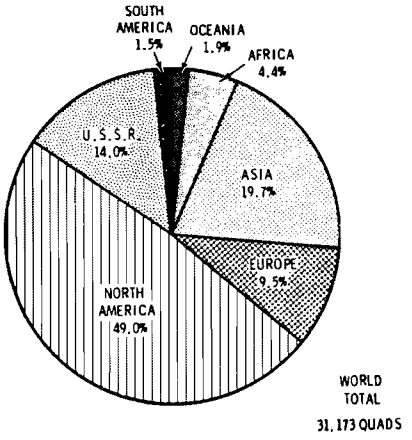


FIGURE E-1. World Recoverable, Nonrenewable Energy Reserves
Source: Energy Perspectives 2, June 1976, U.S. Department of Interior

TABLE E-1. Measured World Recoverable Energy Reserves, 1974 (Quads)[a]

Area	Solid Fuels	Crude Oil	Natural Gas	Oil Shale and Tar Sands[b]	Uranium (nonbreeder)[c]	Total
Africa	361.7	526.6	201.7	81.4	198.1	1,359.5
Asia (less USSR)	2,608.7	2,204.4	432.6	870.2	3.1	6,126.0
Europe (less USSR)	2,581.5	57.1	153.6	117.0	46.4	2,955.6
North America	5,070.9	301.0	380.6	9,111.0	422.7	15,286.2
South America	49.8	311.5	60.6	23.7	11.9	457.5
Oceania	459.8	9.4	24.9	9.2	99.1	602.4
Total	11,132.4	3,407.6	1,254	10,212.5	781.3	26,803.2

(a) Source: World Energy Conference, Survey of Energy Resources, New York, 1974.
(b) According to the U.S. Department of the Interior, Bureau of Mines, North American tar sands and shale oil reserves may be severely overstated. Development of most of these reserves is not economic at present.
(c) Energy content using breeders 60-100 times as great. Thorium resources neglected.

TABLE E-2. World Energy Usage (Quads)[a]

	1980	2000
Industrialized Countries (including CPEs)	224.8	340.4/386.1[b]
Developing Countries	69.8	173.1/215.7

(a) Source: IAEA Book: "Energy, Electricity, and Nuclear Power Estimates Up to 2000," April 1981.
(b) Low/high projections are given.

NUCLEAR POWER SUPPLY

Electricity generation by commercial nuclear power began in the early 1950s in a few highly industrialized countries. From that beginning it has grown to the point where 24 nations (19 WOCA countries) now operate commercial nuclear power plants and others have active nuclear power programs. Installed electric grid and nuclear power capacities as of the end of 1981 are shown in Table E-3, while Table E-4 provides growth projections into the twenty-first century.

FAST BREEDER REACTOR STATUS

The relative status of FBR development worldwide is provided in Figure E-2. The US clearly led the world in the initial stages of development. The Experimental Breeder Reactor, EBR-1, provided the first electricity ever generated by nuclear power. The US has maintained its lead in research and development in selected areas but three countries (France, the Soviet Union and the United Kingdom) are now operating large prototype reactors. The US prototype, CRBR, was cancelled in late 1983. A near commercial plant, the 1200 MWe SuperPhenix, is scheduled to be connected to the electrical grid in France in 1986.

CONVERSION FACTORS

Tables E-5 and E-6 provide heat content and energy conversion factors.

TABLE E-3. Installed Electrical Grid Capacities in Countries with Nuclear Power Programs

Country	Populations (millions, 1980)	Total Electric Power Plant Capacity (GWe, 1980)	Primary Energy Demand[a] Mtoe	Mtce	Year
Argentina	27	13	40	--	1979
Austria	7.1	13	27.0	--	1979
Belgium	9.8	13	49.5	--	1980
Brazil	119	31	95	--	1980
Canada	23.9	79	231.3	--	1980
China (PR)	972	60	--	766	1978
Egypt	42	4	--	18.3	1978
Finland	4.8	12	25.3	--	1981
France	53.5	73	193	--	1981
Germany (FRG)	61.5	86	257	--	1982
India	700	29	93	--	1979
Italy	56.7	47	142	--	1980
Japan	117	148	386	--	1980
Korea (ROK)	38	6	41.4	--	1981
Mexico	69	17	80	--	1979
Netherlands	14.1	17	75.7	--	1980
Pakistan	81.5	2	--	13	1978
Philippines	48	4.6	--	--	--
South Africa	28	19	40.1		1981
Spain	38.3	36	73.4		1979
Sweden	8.4	29	50.6		1979
Switzerland	6.3	15	25.4		1980
Taiwan	17.7	9	--	--	--
United Kingdom	56	82	201.5		1980
USA	--	623	1853		1980
USSR	265.5	270	--	--	--

(a) 1 Mtoe = 1.6-1.9 Mtce and is equivalent to 3.75 to 4.5 terawatt hrs electric (TWh).

TABLE E-4. Nuclear Power Growth Projections, GWe[a]

Country	Nuclear Power Capacity 1985	1990	1995	2000	Reactor Mix
Argentina	0.9	0.9	1.6	1.6	HWR
Belgium	5.4	5.4	5.4	6.7	PWR
Brazil	0.6	0.6	1.9	3.1	PWR
Bulgaria*	2.6	3.5	--	--	PWR
Canada	10.6	13.2	14.9	15.6	HWR
Cuba*	--	0.4	--	--	PWR
Czechoslovakia*	3.3	3.3	--	--	PWR
Egypt	--	--	--	1.8	LWR
Finland	2.3	2.3	2.3	3.3	BWR, PWR
France	39.1	52.3	57.6	61.6	PWR, GCR, FBR
Germany (DR)*	1.7	1.7	--	--	PWR
Germany (FR)	17.6	22.9	22.9	25.6	BWR, PWR, HTR, FBR
Hong Kong	--	--	1.8	1.8	
Hungary*	1.2	1.6	--	--	PWR
India	1.3	1.7	3.2	5.9	BWR, HWR
Italy	1.3	1.3	4.8	6.7	BWR, PWR, GCR
Japan	23.7	29.4	38.9	46.6	BWR, PWR, HWR, GCR
Korea (ROK)	3.6	7.4	7.4	9.3	PWR, HWR
Mexico	--	1.3	1.3	1.3	BWR
Netherlands	0.5	0.5	0.5	2.5	BWR, PWR
Pakistan	0.1	0.1	0.1	1.1	HWR, LWR
Philippines	--	0.6	0.6	1.2	PWR
Romania*	--	1.3	--	--	HWR
South Africa	1.8	1.8	1.8	1.8	PWR
Spain	5.5	7.5	8.4	10.2	BWR, PWR, GCR
Sweden	9.4	9.4	9.4	9.4	BWR, PWR
Switzerland	2.9	2.9	2.9	3.5	BWR, PWR
Taiwan	4.9	4.9	6.7	8.7	BWR, PWR
Turkey	--	--	0.7	0.7	
United Kingdom	10.0	12.2	9.7	10.3	GCR, PWR, FBR
USA	87.6	106.6	107.8	110.0	BWR, PWR, HTR
USSR*	25	90-100	--	--	PWR, FBR, LGR
Yugoslavia	0.6	0.6	0.6	1.6	PWR

(a) Capacity figures are taken from "NUKEM Market Report on the Nuclear Fuel Cycle", December, 1985, unless marked with an asterisk; the latter are taken from Nuclear Engineering International, August 1984.

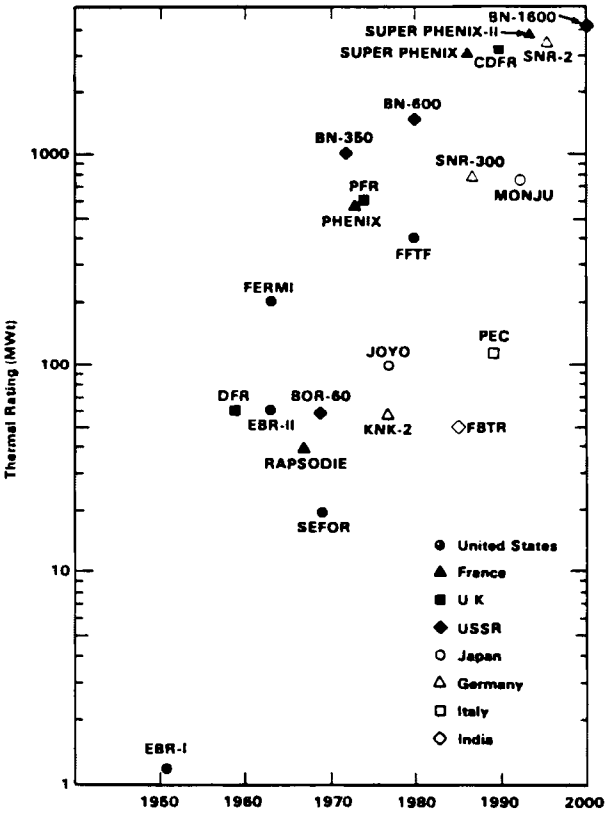


FIGURE E-2. International Fast Reactor Development

TABLE E-5. Heat Content Conversion Factors

To convert from million tonnes oil equivalent (Mtoe), multiply by the following conversion factors.

	Canada	U.S.	OECD Europe	Japan	Overall
Million tonnes coal equivalent[a]					
Hard Coal	0.69		0.70	0.73	
Lignite	0.34		0.20		
Terawatt hours[a] thermal (TWh[t])					12.5
Terawatt hours[a] electrical (TWh[e])	4.22	3.86	3.9-4.4	4.08	
Million therms[b]					425
Terajoules[b]					44,800
Barrels of oil					7.76×10^6

---

1 Barrel = 42 gallons
1 Terawatt hour = 10^9 kilowatt hours
1 Kilowatt hour = 3415 Btu = 8.60×10^5 calories
1 Therm = 10^5 Btu
1 Quad = 10^{15} Btu

(a) World Energy Outlook, OECD, 1977.
(b) The World Energy Book, Nichols Publishing Co., 1980.

TABLE E-6. Energy Conversion

1 Mile of Supply Train	10,000 T coal 50,000 bbl oil
Quads/Yr (input)	1.7 GWe capacity (32% thermal efficiency @ 0.63 capacity factor)
1 GWe power plant requires	51,000 T coal/week (at 32% thermal efficiency, 100 capacity)
U.S. coal-fired plants Actual coal consumption (1980)	56,900 miles of supply train or 569 x 10^6 T coal
U.S. oil-fired plants Actual coal consumption (1980)	8,420 miles of supply train or 421 x 10^6 bbl oil

FUEL CYCLE

TABLE F-1. Values of Selected Reactor Parameters[a]

Power Station	Core Power MWe(net)/MWt	Fuel Inventory (Mg HM)	Fuel Element Weight (Mg HM)
Tricastin-2 (PWR-France)	925/2785	72.46	0.46
Novo Voronezh (PWR-USSR)	420/1375	42	0.12
Krummel KKK (BWR-FRG)	1260/3690	155.8	0.185
Bruce 4 (PHWR-Canada)	740/2515	115	0.018
Wylfa 1 (GCR-UK)	420/1650	595	0.012
Hinckley Point B1 (AGR-UK)	621/1494	113.7	0.046
SuperPhenix (LMFBR-France)	1200/3000	32	0.089

(a) Information gathered from Nuclear Engineering International, July/August 1980 supplement; "World List of Nuclear Power Plants, Nuclear News, June 30, 1980; and Power Reactors in Member States, International Atomic Energy Agency, 1978.

TABLE F-2. Values of Selected Spent Fuel Parameters[a]

Power Station	Fuel Material	Cladding	Discharge Burnup (MW_t d/Mg HM)	Discharge Rate (Mg HM/ GWe Yr)
Tricastin-2 (PWR-France)	Enriched UO_2	Zr-4	33,000	33
Novo Voronezh (PWR-USSR)	Enriched UO_2	Zr	28,000	43
Krummel KKK (BWR-FRG)	Enriched UO_2	Zr-2	27,500	39
Bruce 4 (PHWR-Canada)	Natural UO_2	Zr-4	7,085	175
Wylfa 1 (GCR-UK)	Natural U	Magnox	3,500	409
Hinckley Point B1 (AGR-UK)	Enriched UO_2	SS	18,000	49
SuperPhenix (LMFBR-France)	19-27% PuO_2 in UO_2	SS	100,000	9

(a) Information gathered from Nuclear Engineering International, July/August 1980 supplement; "World List of Nuclear Power Plants, Nuclear News, June 30, 1980; and Power Reactors in Member States, International Atomic Energy Agency, 1978.

TABLE F-3. Forecast of Spent Fuel Arisings[a]

Country	Reactor Type	Total GWe (Net)	Spent Fuel Discharge Rate, MTHM	Est. Spent Fuel Arisings, MTHM 30-Year Reactor Life	Est. Spent Fuel Arisings, MTHM 40-Year Reactor Life
Argentina	PHWR	1.63	145	7,100	9,400
Austria	LWR	0.69	33	690	920
Belgium	LWR	5.48	26	4,260	5,700
Brazil	LWR	5.54	27.8	4,610	6,170
Bulgaria	LWR	7.37	33.6	7,400	9,900
Canada	PHWR	15.60	135	63,000	84,000
China	LWR	5.94	27	4,800	6,400
Cuba	LWR	0.81	33.6	800	1,075
Czechoslovakia	LWR	8.39	33.6	8,470	11,300
	HWR	0.10	710	2,100	2,800
Egypt	LWR	1.80	27	1,460	1,940
Finland	LWR	2.31	32	2,200	2,950
France	LWR	64.80	27	52,000	70,000
Germany (DRG)	LWR	5.78	33.6	5,800	7,700
(FRG)	LWR	30.50	31	28,000	38,000
Hungary	LWR	3.26	33.6	3,290	4,370
India	LWR	0.40	40	480	640
	PHWR	2.61	170	13,000	17,000
Italy	LWR	12.70	28	10,600	14,300
Japan	LWR	42.90	37	47,000	63,000
Korea (South)	LWR	8.37	30.6	7,650	10,000
	PHWR	0.63	135	2,500	3,300
Mexico	LWR	1.31	30	1,170	1,560
Netherlands	LWR	2.50	30	2,250	3,000
Pakistan	PHWR	0.125	130	490	650
Philippines	LWR	0.62	30	570	750
Poland	LWR	3.66	33.6	3,700	4,900
Romania	PHWR	2.52	135	10,000	13,000
	LWR	0.41	33.6	400	540
South Africa	LWR	1.84	26	1,430	1,920
Spain	LWR	14.60	25	11,000	14,500
Sweden	LWR	9.46	26	7,400	9,800
Switzerland	LWR	4.95	33	4,950	6,600
Taiwan	LWR	6.68	30	6,000	8,100
United Kingdom	AGR	8.69	39	10,000	13,000
	LWR	1.10	30	990	1,320
USA	LWR	116.00	30	104,000	139,000
USSR	LWR	64.70	33.6	65,000	87,000
Yugoslavia	LWR	1.51	30	1,350	1,800

(a) Estimated spent fuel arisings to the end of the national nuclear programs as now defined. Only the UO_2 fuels from LWRs, PHWRs and British AGRs are included.

(b) Data from Nuclear Engineering International, August 1985 Supplement. Includes reactors installed, under construction, on order and planned.

TABLE F-4. Spent Fuel Reprocessing Activities and HLW Inventories

Country (Site)	Operation Dates	Fuel Reprocessed	HLW Inventory
Eurochemic (Mol, Belgium)	1966-1974	1,360 kg HEU 181 t LEU	800 m^3 HEWC 67 m^3 LEWC
Canada	-1979	Lab studies	16 m^3
FRG (WAK)	1971-1980	100 t (43 t LWR)	65 m^3
France (UP-1) (AVM)	1958-1983 6/78-3/83	12,000 t (GCR)	 286 t HLW glass (836 canisters)
France (UP-2, La Hague)	1966-1977 1976-1983	4,000 t (GCR) 731 t (LWR)	
India (Trombay) (Tarapur)	1965-1974 1982-		
Italy (Saluggia) (Trisaia)			 100 m^3 3 m^3
Japan (Tokai)	1977-1983	170 t	
United Kingdom	1979 1952-1980 1969-1973	 20,000 t (GCR) 90 t (LWR)	1000 m^3
United States (Nuclear Fuel Services)	1966-1971	244 t oxides 375 t metal	2100 m^3