INTERNATIONAL NUCLEAR
WASTE MANAGEMENT FACT BOOK

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November 1995

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the U.S. Department of Energy
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Pacific Northwest National Laboratory
Richland, Washington 99352
PREFACE

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

The information contained in the International Nuclear Waste Management Fact Book has been obtained from many unclassified sources: contacts within the individual countries; nuclear trade journals and newsletters; reports of foreign visits and visitors; CEC, IAEA, and OECD/NEA activities reports; proceedings of conferences and workshops; and from the Internet. The data listed typically do not reflect any single source but represent a consolidation of information.

The organizations and agencies listed in this publication often have a much wider range of activities and many more facilities and staff than are described here. The intent of the Fact Book is to limit the listed information to that pertaining to the nuclear waste management area.

Every effort was made for all information to be as accurate and current as possible, incorporating updates as they became available until actual time of printing; however, the nature of the content makes it subject to frequent changes. If you have suggestions that would improve the usefulness of the book, or if you can provide more current information, please let us know so these changes can be included in future editions.

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Pacific Northwest National Laboratory
P.O. Box 999
Richland, WA 99352
Tel: 509-375-6485
Fax: 509-372-4394
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INTRODUCTION
INTRODUCTION

The International Nuclear Waste Management Fact Book has been compiled to provide current data on fuel cycle and waste management facilities, R&D programs, and key personnel in 24 countries, including the U.S.; four multinational agencies; and 20 nuclear societies. This document, which is in its second year of publication, supersedes the previously issued International Nuclear Fuel Cycle Fact Book (PNL-3594), which appeared annually for 12 years. The content has been updated to reflect current information.

The Fact Book is organized as follows: National summaries - a section for each country that summarizes nuclear policy, describes organizational relationships, and provides addresses and names of key personnel and information on facilities. International agencies - a section for each of the international agencies that has significant fuel cycle involvement and a list of nuclear societies. Glossary - a list of abbreviations/acronyms of organizations, facilities, and technical and other terms.

The national summaries, in addition to the data described above, feature a small map for each country and some general information that is presented from the perspective of the Fact Book user in the United States. Please note the following:

DIRECT DIALING

For convenience in direct dialing from the U.S. to foreign countries, complete telephone numbers are listed, including country and city codes. Outside the U.S., depending on the origin and destination of the call, some of these codes may not be necessary. Instead, "0" might need to precede the local number. Since it is impossible to cover all the various situations for calls originating outside the U.S., accurate information on direct dial is best obtained from local sources (telephone company or hotel operator).

HOLIDAYS

The major holidays have been listed as they generally apply to the entire country. Regional holidays are not included although they might also be considered major in a particular area.
MAPS

Most of the major facility locations are shown within a circle on each country's map for easier identification. Where space permitted, the name of the organization or facility has been added. The major cities are circled, and some of the smaller towns are listed to assist as a reference when consulting a large-scale map.

PASSPORT/VISA

Requirements listed are those applicable to U.S. citizens.

TIME

The hours listed reflect the standard time difference between the country and Washington, D.C. A specific reference area/town is identified if more than one time zone exists in a country. The stated time difference might be affected by applicable daylight savings time. Also, in some countries (where the seasons are reversed) the standard time period is listed instead of the time during which daylight savings time is in effect.

VISITS TO U.S. DOE FACILITIES

Foreign visitors to U.S. DOE facilities must complete and submit a form IA-473 (OMB 1910-2100), "Request for Foreign National Unclassified Visit or Assignment," to the DOE facility they wish to visit at least 45 days before the proposed visit. The itinerary should be based on prior arrangement with appropriate DOE or DOE contractor staff.
ARGENTINA

MAJOR PUBLIC HOLIDAYS (1995)

<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>New Year</td>
<td>Holy Thursday</td>
<td>Good Friday</td>
<td>Labor Day</td>
<td>Revolution Anniversary</td>
<td>Sovereignty</td>
<td>Flag Day</td>
<td>Independence Day</td>
<td>Gen. San Martin</td>
<td>Columbus Day</td>
<td>Immaculate Conception</td>
</tr>
</tbody>
</table>

TIME

Standard Time Washington, D.C. (Buenos Aires) + 2 hours
03/06 - 10/15/95

Standard Time Period:

PASSPORT/VISA

A passport is needed to depart and re-enter the U.S. Business-related travel to Argentina currently does not require a visa; however, it is recommended to consult a travel agency for up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 U.S. $ = 1.00 Peso

per Wall Street Journal, 10/01/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to Argentina are complete as listed, after dialing international access code: 011. Country code is 54; listed local numbers include city code.

U.S. EMBASSY - BUENOS AIRES

American Embassy
4300 Colombia
1425 Buenos Aires
Argentina

Tel: 54-1-772-1041
Fax: 54-1-772-0673

Science Counselor
Kenneth D. Cohen
### Argentina

<table>
<thead>
<tr>
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</tr>
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<tbody>
<tr>
<td><strong>Population</strong></td>
<td>33.9 million</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Energy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Power Capacity</td>
<td>14.3 GWe</td>
<td>17.4 GWe</td>
<td>20.1 GWe</td>
</tr>
<tr>
<td>1993</td>
<td>7% nuclear</td>
<td>9% nuclear</td>
<td>8% nuclear</td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Electric Power Production</strong></td>
<td>51.2 TWh</td>
<td>62.0 TWh</td>
<td>79.4 TWh</td>
</tr>
<tr>
<td>1993</td>
<td>14% nuclear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td>17% nuclear</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td>13% nuclear</td>
</tr>
</tbody>
</table>

### Nuclear Power

**Policy:** Pressurized heavy water reactors (PHWR) with natural uranium and indigenous fuel cycle. Two pressurized vessel reactors, Atucha I (1974) and Atucha II (startup 1996); one CANDU-type reactor, Embalse de Rio Tercero (1984). The government currently owns and operates all nuclear power plants (other options being evaluated); developing nuclear plants and services export capability.

<table>
<thead>
<tr>
<th>Nuclear Power Capacity</th>
<th>1993</th>
<th>1.0 GWe</th>
<th>1996</th>
<th>1.5 GWe</th>
<th>2000</th>
<th>1.6 GWe</th>
</tr>
</thead>
</table>

### Industrial Fuel Cycle

**Policy:** Develop all phases of the PHWR fuel cycle, gaseous diffusion capability for U enrichment (Pilcaniyeu), and D2O production. Interim AR and AFR storage of spent fuel.
Waste Management Strategy: Options for reprocessing spent fuel analyzed, including vitrification of HLW and disposal of HLW glass canisters in granite host-rock repository, but no decision made. Disposal of reduced volumes of LLW and short-lived ILW in near-surface engineered facilities. No decision made yet on disposal of long-lived ILW.

Cumulative SF Arisings (HWR)  
1993  1,900 t HM  
2000  3,300 t HM

Demonstration/Production Activities

- D$_2$O production (200 t/yr): D$_2$O enrichment plant started October 1994.
- Uranium mining and milling (t/yr): 1987, 100; 1993, 130.
- Uranium enrichment (kg/yr): Capacity being redefined.
- Fuel fabrication: The first of three planned fabrication lines started up in 1982, the second in 1985; they produce 400 elements/yr for Atucha I and 5,580 elements/yr for Embalse; the third will produce Atucha II fuel elements.

Major Milestones

- Dry SF interim storage (Embalse, Cordoba)  1993
- HLW geologic repository (under study)
- MLW interim storage plant (Ezeiza Atomic Center)  1995
- Atucha II Nuclear Power Plant (commissioning)  1998
- MLW near-surface engineered disposal facility  1998
INTERNATIONAL RELATIONSHIPS

Member of IAEA; has not signed nonproliferation treaty (NPT); Treaty of Tlatelolco has been signed and ratified.

ORGANIZATION

- CNEA (Comisión Nacional de Energía Atómica), National Atomic Energy Commission, owns and operates all nuclear facilities.

CNEA (National Atomic Energy Commission)

Comisión Nacional de Energía Atómica (CNEA)
Avenida del Libertador 8250
1429 Buenos Aires, Argentina

Tel: 54-1-704-1201
Fax: 54-1-701-2436

President
Jaime P. Campa
Tel: 54-1-704-1345
Fax: 54-1-704-1186

Directors
Horacio A. Osuna
Roberto G. Moritan
Guillermo Padín
Agustín Blanco

General Manager
Marta O. De Epperstein
Tel: 54-1-1470-1870
Fax: 54-1-704-1143

Technology Manager
Santiago Harriague
Tel: 54-1-704-1143
Fax: 54-1-704-1186

Manager, Centro Atomico Bariloche
Francisco Lovey
Tel: 54-944-61002
Fax: 54-944-61006

Manager, Centro Atomico Constituyentes
Miguel Audero
Tel: 54-1-754-7260 or 755-3137
Fax: 54-1-754-7371

Manager, Centro Atomico Ezeiza
Angel Mehlich
Tel: 54-1-379-8284
Fax: 54-1-379-8570

(contd next page)
CNEA (National Atomic Energy Commission) (contd)

Manager, Cooperation and Technology Transfer
Horacio A. Osuna
Tel: 54-1-704-1045
Fax: 54-1-704-1161

Director de Administracion
Ricardo Deza
Tel: 54-1-704-1203
Fax: 54-1-704-1159

Deputy, Radioisotopos y Radiaciones
Roberto Marques
Tel: 54-1-704-1418
Fax: 54-1-704-1153

Deputy, de Cielo de Combustible
Jose E. Gregui
Tel: 54-1-704-1217
Fax: 54-1-704-1165

Manager, Complejo Minero Fabril Cordoba
Eduardo Perez
Tel: 54-51-703450/639679
Fax: 54-51-703679

Manager, Minero Fabril San Rafael
Carlos Martin
Tel: 54-627-30833/30087
Fax: 54-627-30833/30087

Manager, Minero Fabril Malargue
Gualberto A. Cadena
Tel: 54-627-71712
Fax: 54-627-71159

Manager, Public Relations
Luis J. Colangelo
Tel: 54-1-704-1209
or -1011, or -1230
Fax: 54-1-704-1154

EMPRESAS ASOCIADAS

President, CONUAR S.A.
Hugo Erramuspe
Tel: 54-1-704-1308
Fax: 54-1-704-1169

President, FAESA
Hugo Erramuspe
Tel: 54-1-704-1308
Fax: 54-1-704-1169

(contd next page)
EMPRESAS ASOCIADAS (contd)

President, ENSI
Anibal Nunez
Tel: 54-1-704-1319

President, Nuclear Mendoza S.E.
Guillermo Ariza
Tel: 54-61-224675/223099
Fax: 54-61-350313

Ente Nacional Regulator Nuclear (ENREN)
Avda. Libertador 8250 1° PISO
1429 Capital Federal
Buenos Aires, Argentina

President
Dan Beninson
Tel: 54-1-704-1218
Fax: 54-1-704-1177

General Manager
Elias Palacios
Tel: 54-1-704-1348
Fax: 54-1-704-1151

INVAP E.E.
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C.C. 961
8400 San Carlos de Bariloche
PCIA. DE RIO NEGRO

President
Guillermo Padin

Nucleoelectrica Argentina B.A.
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1429 Capital Federal
Buenos Aires, Argentina

President
Eduardo Blanco

(contd next page)
Nucleoelectrica Argentina B.A. (contd)

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Tel: 54-1-701-6389
Fax: 54-1-701-0407

Manager, Central Nuclear Atucha I (NFF)
Miguel A. Joseph
Tel: 54-487-2461 a1 76
Fax: 54-953-0370

Manager, Central Nuclear Embalse (NPP)
Eduardo Diaz
Tel: 54-571-22000/22434
Fax: 54-51-244577
AUSTRALIA

MAJOR PUBLIC HOLIDAYS (1995)

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Holiday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>1-2</td>
<td>New Year</td>
</tr>
<tr>
<td>Jan</td>
<td>26</td>
<td>Australia Day</td>
</tr>
<tr>
<td>Apr</td>
<td>14</td>
<td>Good Friday</td>
</tr>
<tr>
<td>Apr</td>
<td>17</td>
<td>Easter Monday</td>
</tr>
<tr>
<td>Apr</td>
<td>25</td>
<td>ANZAC Day</td>
</tr>
<tr>
<td>Jun</td>
<td>12</td>
<td>Queen's Birthday</td>
</tr>
<tr>
<td>Oct</td>
<td>2</td>
<td>Labor Day</td>
</tr>
<tr>
<td>Dec</td>
<td>25</td>
<td>Christmas</td>
</tr>
<tr>
<td>Dec</td>
<td>26</td>
<td>Boxing Day</td>
</tr>
</tbody>
</table>

TIME

Standard Time Washington, D.C. (New South Wales) + 15 hours
Standard Time Period: 03/26 - 10/28/95

PASSPORT/VISA

A passport is needed to depart and re-enter the U.S.; 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 U.S. $ = 1.26 Australian Dollar per Wall Street Journal, 10/1/95. Since rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to Australia are complete as listed, after dialing international access code: 011. Country code is 61; listed local numbers include city code.

U.S. EMBASSY

United States Consulate General
Level 59, MLC Centre
19-29 Market Place
Sydney NSW 2000
Australia

Scientific Attaché

Tel: 61-2-373-9200
Fax: 61-2-221-0573

Zachary Z. Teich
Population 1994 18 million

ENERGY

Electric Power Capacity
1993 34.6 GWe
1995 36.3 GWe
2000 37.9 GWe

Electric Power Production 1993/94 156.6 TWh
80.9% coal
10.5% hydro
8.2% gas
0.4% oil

NUCLEAR POWER

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

INTERNATIONAL RELATIONSHIPS

Member of IAEA and OECD/NEA: cooperative agreements for radioactive waste management R&D (including development of the SYNROC process) with Japan, Italy, U.K., France, China, and Russia.

Bilateral nuclear safeguards agreements (controlled use of Australian-derived uranium) with Japan, Republic of Korea, Philippines, U.S., Canada, U.K., France, Switzerland, Sweden, Finland, Egypt, Russian Federation, Euratom (EU), Mexico, Singapore.

ORGANIZATION

- ANSTO - Australian Nuclear Science and Technology Organisation and Lucas Heights Research Laboratory
ANSTO - LUCAS HEIGHTS

Australian Nuclear Science and Technology Organisation
New Illawarra Rd, Lucas Heights
Private Mail Bag 1
Menai NSW 2234
Australia

Tel: 61-2-717-3111
Fax: 61-2-543-5097

Location: Approx. 30 km SW of Sydney (taxi from Kingsford Smith International Airport).

Executive Director
Chairman
General Manager, Scientific Environmental Science
Environmental Chemistry
Environmental Physics
Chemical Waste Engineering
Economic Impacts
Advanced Materials
Materials Assessment
Waste Conditioning Operations
Materials Science Engineering
Nuclear Technology
Nuclear Services

Helen Garnett (A)
C. Ralph Ward-Amblor
Helen Garnett
Wally Zuk
Richard Lowson
Ian Ritchie
Des Levins
Peter Airey
Adam Jostsons
Robert Harrison
E. R. Vance
Alan Kidal
C. J. Ball
Don. J. Mercer
George Malosh
Patrick Bull

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

(contd next page)
ANSTO - LUCAS HEIGHTS (contd)

Facilities

- **Non-radioactive SYNROC Demonstration Plant**
  
  Mission: Engineering-scale tests of SYNROC process to provide data for a conceptual radioactive SYNROC plant design.

  Design Basis: 10 kg/h SYNROC; all operations compatible with remote handling; highly instrumented and partly automated.


- **SYNROC Glove Box Line**
  
  Mission: Produce SYNROC containing actinides/\(^{99}\)Tc.

  Process Scale: Hundreds of grams/batch.


- **Hot-Cell Processing Line for SYNROC**
  
  Mission: Produce SYNROC containing beta/gamma-active fission products.

  Process Scale: Hundreds of grams/batch.

  History: Startup, 1984.

---

**ANU**

Australian National University  
P.O. Box 4  
Canberra 2600, Australia  
Tel: 61-6-249-4228  
Fax: 61-6-249-5989

Director  
Sue Kesson

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

MAJOR PUBLIC HOLIDAYS (1995)

<table>
<thead>
<tr>
<th>Jan</th>
<th>New Year</th>
<th>May</th>
<th>Labor Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Jan</td>
<td>Christmas (Orthodox)</td>
<td>May</td>
<td>Victory Day</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Mar</td>
<td>Women's Day</td>
<td>Jul</td>
<td>Independence Day</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Apr</td>
<td>Radunica</td>
<td>Nov</td>
<td>Memorial Day</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>2</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Dec</td>
<td>Christmas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

TIME

Standard Time Washington, D.C.:
Daylight Saving Time Period: 03/26 - 09/23/95 + 8 hours

PASSPORT/VISA

A passport is needed to depart and re-enter the U.S. In addition, a visa is currently required for a visit to Belarus. A visa is available, with certain prerequisites, at the Minsk airport upon entry into the country; however, it is advisable to obtain the visa prior to departure from the U.S. It is recommended to consult a travel agency for up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

Local currency, the Belarus ruble (note of National Bank of Belarus), is only available upon entry into Belarus. Exchange rates cannot be quoted because of continuing fluctuations. Payment in U.S. currency is apparently acceptable in many places. It is strongly recommended to consult with the U.S. embassy for up-to-date information.

DIRECT DIALING

Individual numbers for direct dial to Belarus are complete as listed, after dialing international access code: 011. Country code is 7; listed local numbers include city code.

U.S. EMBASSY - MINSK

American Embassy
Tel: 375-017-234-7761
375-017-234-6537

ul Starovilenskaya 46
Minsk, Belarus
Tel: 375-017-231-5000
Fax: 375-017-234-7853

Economic Section
George Krol
Population 1994 10.5 million

ENERGY

Electric Power Capacity 1992 7.0 GWe
2000 6.2-10.9 GWe
2005 6.4-12.1 GWe

Electric Power Production 1992 38.7 TWh
55% oil
40.6% gas
0.1% hydro/geothermal
<2.5% coal/peat
<1.8% solids
0% nuclear
2005 60% TWh
5% nuclear

NUCLEAR POWER

Although Belarus currently produces no nuclear power, approximately 25% of its total electricity consumption is provided by nuclear power plants at Ignalina in Lithuania and Smolensk in Russia. Construction of a nuclear power plant at Minsk, with projected capacity of 2,000 MWe and planned additional capacity of 6,000 MWe, was halted in 1986 due to the events at Chernobyl. The current government states that nuclear power is a necessity in the future of Belarus.

Nuclear Power Capacity 2005 1.0 GWe

Reactor Mix 2005 PWR 1 (2005)

INDUSTRIAL FUEL CYCLE

Policy: Because Belarus has no uranium natural resources, no uranium enrichment is foreseen, nor is fuel reprocessing.
Waste Management Strategy: A waste management concept and strategy for disposal of waste from the planned first Belarus NPP is now being developed. LLW generated during operation and from decommissioning of a research LWR (IPEP) was managed in accordance with known regulations in the former Soviet Union. This waste was stored in an engineered structure in an underground facility near Sosny that is also used for spent radioactive sources. Spent fuel from decommissioning the research LWR was sent to Russia for reprocessing.

INTERNATIONAL RELATIONSHIPS

Member of IAEA: Belarus has signed (in 1992) and ratified (in 1993) the NPT.

ORGANIZATION

Government Responsibilities - Nuclear Fuel Cycle/Waste Management

- Ministry of Power Engineering - controls all electric power production and its industrial consumption; operates electric power network; provides and conducts the National Power Development Program.

- Atompromnadzor (Committee on Supervision of Industrial and Nuclear Safety) - regulations, control of radiation-emitting facilities, licensing of nuclear installations, inspections.

- Goscomchernobyl (Chernobyl Committee) - responsible for National Chernobyl Program.

INDUSTRIAL/UNIVERSITY RESPONSIBILITIES

- BelNPI Energoprom (Belarus Research and Design Institute of Power Industry) - technical policy in the field of electric power/energy resources.

- GSP POLESJE (State Specialized Enterprise POLESJE/Chernobyl Committee) - decontamination of contaminated zone in southern Belarus.
- **IPEP** (Institute of Power Engineering Problems/Academy of Sciences) - waste management R&D and reactor physics/engineering.

- **IREP** (Institute of Radio-Ecological Problems/Academy of Sciences) - research related to radionuclide migration in biosphere, nuclear medicine, radiochemistry.

- **DD&FM** (Design Department and Pilot Manufacture/Academy of Sciences) - design/production of pilot installations related to nuclear power plant, engineering, and waste management technologies.

**BELSPORTERGROM**

Belarus Research and Design Institute of Power Industry
ul. Romanovskaja Sloboda 5A
220048 Minsk, Belarus

Tel: 375-017-226-5277
Fax: 375-017-226-5317

Director: Leonid Y. Kulebiakin

**Function:** Development of technical policy in the field of electric power/energy resources and of electric power network installations.

**ATOMPROMNADZOR**

Committee on Supervision of Industrial/Nuclear Safety
ul. Chkalova 6
220039 Minsk, Belarus

Tel: 375-017-224-5119
Fax: 375-017-224-3700

Chairman: Vladimir I. Iatzevich
Nuc./Rad. Safety Inspection: Peter V. Bulyga

**Function:** Responsible for regulations, control, and licensing of nuclear installations and radiation-emitting facilities.
BELARUS

GOSCOMCHERNOBYL

State Chernobyl Committee
ul. Lenin 14
220030 Minsk, Belarus
Tel: 375-017-227-4987
Fax: 375-017-229-3439

Chairman
Ivan A. Kenik

Dep. Chairman, WM/Science/
R&D, Internatl. Relations
Igor V. Rolevich
375-017-227-0770

Board on Protective
Measures/D&D/WM
Gennady V. Antzypov
375-017-227-0762

Function: Regulate, control, and finance the National Chernobyl Program; license decontamination/waste management activities for area affected by the Chernobyl fallout.

GSP POLESJE

State Specialized
Enterprise "POLESJE"
ul. Karpovich 11
246017 Gomel, Belarus
Tel: 375-017-253-1584
Fax: 375-017-253-7486

Function: Decontamination of affected zone in southern Belarus; treatment and conditioning of waste generated as a result of decontamination.

IPEP

Institute of Power Engineering Problems
Belarus Academy of Sciences
Sosny
220109 Minsk, Belarus
Tel: 375-017-226-0698
Fax: 375-017-226-7055

Director
A. A. Mikhalevich

Material Properties/
WM Technologies
Alexandre J. Grebenkov
375-017-246-7542

(contd next page)
IPEP (contd)

Nuclear Reactor Physics

Igor A. Savushkin
375-017-246-7434

**Function:** Research reactor operation and engineering; isotope application/production; waste management R&D, LLW/ILW immobilization, liquid LLW treatment, thermal/chemical processing of radioactive wood waste.

**Facilities**
- Pilot Plant for LLW/ILW Immobilization
- Pilot Installations for Liquid LLW Treatment/Conditioning
- Pilot Gas Generator with off-gas treatment system for radioactive wood waste conditioning

IREP

Institute of Radio-Ecological Problems
Sosny
220109 Minsk, Belarus
Tel: 375-017-246-7253
Fax: 375-017-246-7615

George A. Sharovarov
Yuri P. Davydov
375-017-246-7215

**Function:** R&D on radionuclide migration in biosphere, decontamination, conditioning of liquid LLW (generated after remediation of contaminated site), nuclear medicine, radiochemistry.
DD & PM

Design Department with Pilot Manufacture
Sosny
220109 Minsk, Belarus

Director
Vladimir A. Kosterov

Function: Design/production of pilot installations related to nuclear power plant/engineering/WM technologies

SOSNY (Academic Research Association)

ANTK Sosny
Belarus Academy of Sciences
Sosny
220109 Minsk, Belarus

Director General
Sergey E. Chigrinov

Location: 24 km southwest of Minsk, 2 km from Sosny settlement.


Specialized Enterprise "Sosny"

Director
Victor B. Ivanov

Function: Spent nuclear materials storage in engineered shallow-ground facility.
BELGIUM

MAJOR PUBLIC HOLIDAYS (1995)

Jan  1  New Year       Jul  21  National Day
Apr  17  Easter       Aug  15  Assumption
May  1  Labor Day     Nov  1  All Saints
May 12  Ascension     Nov  11  Armistice
May 23  Pentecost     Dec  25  Christmas

TIME

Standard Time Washington, D.C.  + 6 hours
Daylight Savings Time Period:  03/26 - 09/23/95

PASSPORT/Visa

A passport is needed to depart and re-enter the U.S.  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 U.S. $ = 29.45 Franc
per Wall Street Journal, 10/01/95.  Because rates fluctuate daily, it is rec-
ommended to obtain current rates from local banks or newspapers prior to
departure.

DIRECT DIALING

Individual numbers for direct dial to Belgium are complete as listed, after
dialing international access code:  011.  Country code is 32; listed local
numbers include city code.

U.S. EMBASSY - BRUSSELS

American Embassy
27 Boulevard du Regent
1000 Brussels  Tel:  32-2-513-3830
Belgium  Fax:  32-2-511-2725

Economics Section  Jerry Breese
### Population

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>10 million</td>
</tr>
</tbody>
</table>

### Energy

#### Electric Power Capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>14.2 GWe</td>
</tr>
<tr>
<td>1995</td>
<td>14.7 GWe</td>
</tr>
<tr>
<td>2000</td>
<td>16.1 GWe</td>
</tr>
</tbody>
</table>

- 39% nuclear
- 38% nuclear
- 35% nuclear

#### Electric Power Production

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>71.4 TWh</td>
</tr>
</tbody>
</table>

- 59% nuclear
- 26% coal
- 10% gas
- 2% oil
- <1% hydro

- 52% nuclear
- 56% nuclear

### Nuclear Power

**Policy:** Produce base-load electricity by nuclear and coal power plants. Decided against adding proposed eighth (1300 MWe) nuclear unit (at least during next few years).

#### Nuclear Power Capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>5.6 GWe</td>
</tr>
<tr>
<td>2000</td>
<td>5.6 GWe</td>
</tr>
</tbody>
</table>

#### Reactor Mix

- 1994: PWR 7 (1975-85)

### Industrial Fuel Cycle

**Policy:** Well-rounded capability: uranium enrichment (share in Eurodif); MOX and UO2 fuel fabrication; purchase of foreign reprocessing services; decision made to dismantle former Eurochemic reprocessing plant.

**Waste Management Strategy** (responsibility of ONDRAF): Vitrify HLW and store 50 years (investigation of HLW, ILW and LLW disposal in clay formations underway); treat and immobilize other wastes; sea-dumping of LLW halted, shallow-ground disposal of LLW under investigation.

---

BE-1
Belgium

Cumulative SF Arisings (LWR)

<table>
<thead>
<tr>
<th>Year</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>1,290 t U</td>
</tr>
<tr>
<td>2000</td>
<td>3,000 t U</td>
</tr>
</tbody>
</table>

**Major Milestones**

- Selection/characterization of site for LLW disposal facility: 1990-97
- Storage facility for waste from Belgian fuel reprocessed abroad: 1994
- Safety assessment/feasibility report for demonstration of HLW disposal operations in proposed clay repository: 1995
- Construction start of HLW repository: 2025
- Disposal start of HLW: 2030

**International Relationships**

DOE/SCK Agreement in the Field of Radioactive Waste Management

*Term:* 01-19-81 to 01-19-94.

*Scope:* Final disposal in geologic formations; retrievable storage; waste processing; environmental effects; emphasis on technology information exchange.

Member of EC, IAEA, OECD/NEA; partnership in Eurodif uranium enrichment plant (France); Belgian URL at Mol is cosponsored by CEC.

**Organization**

**Ministry of Economic Affairs**

<table>
<thead>
<tr>
<th>Private Interests</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEN/SCK-50%-&gt; BEGONUCLEAIRE &lt;------------------------ 50% -</td>
</tr>
<tr>
<td>ONDRAF/NIRAS - BELGOPROCESS</td>
</tr>
<tr>
<td>-------------------------- &gt; SYNATOM-------------------------- &gt; 100%</td>
</tr>
</tbody>
</table>

BE-2
BELGONUCLEAIRE

Belgonucleaire S.A.
Avenue Ariane 2-4
1200 Brussels, Belgium

Tel: 32-2-774-0511
Fax: 32-2-774-0547

General Director
Georges Cornet

Function: Provide engineering services for nuclear power plants, nuclear fuel cycle facilities, and waste treatment plants; fabricate MOX fuels.

Owner: CEN/SCK (50%), utilities/holding companies (50%).

MOX Plant
Europalaan 20
2480 Dessel, Belgium

Tel: 32-14-33-0211
Fax: 32-14-31-7046

Manager
Jean Van Vliet

Function: Produce MOX fuels (35 t/yr for LWR or 10 t/yr for FBR).

BELGOPROCESS

Belgoprocess
Gravenstraat 73
2480 Dessel, Belgium

Tel: 32-14-33-4111
Fax: 32-14-31-3012

[Brussels National Airport (Zaventem): then by rental car or train (1.5 hr) to Mol.]

Managing Director
Robert Vandenplaas

General Manager
Jef Claes

Deputy General Manager
Etienne Tranwaert

Operations
Paul Luycx

Decommissioning
Lucien Teunckens

Safety
Jean Paul Deworm

Activities: Maintenance/dismantling of ex-Eurochemic reprocessing facilities and obsolete waste treatment facilities formerly belonging to

(contd next page)
CEN/SCK: treatment/conditioning of all categories of low-, medium-, and high-level waste; from 1986 to 1991 joint operation of Pamela vitrification plant with WAK, now being kept in standby for potential future vitrification of HLLW from WAK pilot reprocessing plant at Karlsruhe, Germany.

**Owner:** ONDRAF/NIRAS

**Facilities**

- **Eurobitum (bituminization plant)**
  
  **Mission:** Immobilize ILW.
  
  **Design Basis:** Batch chemical pretreatment, screw extruder-evaporator (continuous); capacity, 650 m³/yr ILW.
  
  **History:** Startup, 1978; on-line time, 87% through June 1983. Plant now operated as needed.

- **PAMELA HLLW Vitrification Plant** [built by FRG (see under WAK in Germany) and operated by WAK/Belgoprocess team]. In standby for future vitrification of HLLW from WAK pilot reprocessing plant at Karlsruhe. Presently used for treatment and conditioning of HLSW.

- **LLW Treatment Facilities** (formerly of CEN/SCK)

  **Beta/Gamma Waste Incinerator:** capacity of 100 kg/hr solid waste and 40 L/hr of liquids. Combustion temperature of 900°C. Overall mass reduction factor is 20; combustion efficiency >99.9%; >800 t of waste throughput since early 1960s. Planned shutdown, 1996.

  **Water Treatment Facility:** capacity of >200,000 m³/yr; purification by flocculation; discharge of purified water to the river; conditioning of sludges into bitumen.

- **Low-Level Solid Waste Treatment Facility**

  Active startup June 1995; new integrated facility, including reception of waste and buffer storage, size reduction unit; supercompaction capacity of 220 drums per hour, incineration at 900°C, incineration capacity 100 kg/hr solid waste and 40 L/hr of liquids, supercompaction of ashes and cementation of all treated LLW in 400-L drums.
FBFC (Fuel Fabrication Company)

FBFC International
Europalaan 12
2480 Dessel, Belgium

Managing Director
Henri Potdevin

Plant Manager
Patrick Van Denhove


MINISTRY OF ECONOMIC AFFAIRS

Ministry of Economic Affairs
Administration of Energy
E. Jacquemainlutan 154
North Gate 3
1210 Brussels, Belgium

Tel: 32-2-206-4111
Fax: 32-2-206-5710

MINISTRY OF PUBLIC HEALTH AND ENVIRONMENT

Ministère de la Santé Publique
et de l'Environnement
Quartier Vésale 2-3
1010 Brussels, Belgium

Tel: 32-2-210-4966
Fax: 32-2-210-4967
ONDRAF/NIRAS (National Organization for Radioactive Wastes and Fissile Materials)

Organisme National des Déchets Radioactifs et des Matières Fissiles (ONDRAF/NIRAS)
Place Madou 1, B.P. 24
1030 Brussels, Belgium
Tel: 32-2-212-1011
Fax: 32-2-218-5165

Chair, Board of Directors
J. P. Poncelet
Chair, Perm. Tech. Committee
F. Deconinck
General Manager
F. Decamps

Owner: Government.

Function: Define Belgian waste management policy and R&D requirements; responsible for transportation of radioactive materials, waste treatment, conditioning and interim storage, spent fuel AFR storage, waste disposal, fissile material storage.

The organization 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.

SCK/CEN (Nuclear Energy Research Center)

Studiecentrum voor Kernenergie
Centre d’Etude de l’Energie Nucléaire
Laboratories
Boeretang 200
2400 Mol, Belgium
Tel: 32-14-33-2111
Fax: 32-14-31-5021

Chairman of the Board
J. M. Strydio
General Manager
Paul Goovderts
Waste/Disposal
Bernard Nerdael
Decommissioning
Guy Collard

(contd next page)
**SCK/CEN (Nuclear Energy Research Center)**

**Owner:** Government, Ministry of Economic Affairs.

**Waste Management R&D:** Geologic waste isolation in clay formations, waste treatment (decontamination and recycling of boric acid, removal of plutonium from waste generated by fuel fabrication, etc.), decommissioning (decontamination, dismantling, restoration) of nuclear facilities.

**Facilities**

- **BR3 Decommissioning Project**
  
  **Mission:** Optimization of the decommissioning of PWRs; radiological, technical, and financial management of decommissioning, applied on an actual PWR; all components of a power plant and all techniques to be used in decommissioning.
  
  **Process:** Internals are being dismantled, comparison of immediate and delayed decommissioning; optimum application.

- **HADES Underground Research Laboratory**
  
  **Mission:** In situ investigation to demonstrate the feasibility, construction, safety, and acceptability of disposal of ILW, TRU waste, and HLW in a deep clay formation.
  
  **Description:** Access shaft to 230-m level, 2.65 m useful diameter; laboratory gallery, 3.5 m useful dia. by 30 m length; cast iron liner.
  
  Demo/test gallery: 3.5 m dia., concrete-lined, 65 m length for large-scale integrated tests.
  
  **Test Program:** Migration of radionuclides and gas, near-field studies, thermohydraulic behavior, hydrogeochemistry of Boom clay and surrounding water-bearing formation, in situ tests on waste package components, characterization and compatibility studies of conditioned HLW, performance studies, including shallow-land burial of LLW.
  
  **History:** Laboratory operational, late 1984.
SYNATOM
SYNATOM S.A.
Avenue Marnix, 13
1050 Brussels, Belgium
Tel: 32-2-505-0711
Fax: 32-2-505-0790
F. Aerts
J. Laurent
Pierre Goldschmidt
Jean Danguy
Chairman, Board of Directors
Managing Director
General Manager
Fuel Reprocessing Service
Function: Provide commercial fuel cycle services for Belgian nuclear utilities.
Owners: Belgian Utilities (100%).
**BRAZIL**

**MAJOR PUBLIC HOLIDAYS (1995)**

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Holiday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>1</td>
<td>New Year</td>
</tr>
<tr>
<td>Feb</td>
<td>27, 28</td>
<td>Carnival</td>
</tr>
<tr>
<td>Apr</td>
<td>14</td>
<td>Good Friday</td>
</tr>
<tr>
<td>Apr</td>
<td>21</td>
<td>Tiradentes</td>
</tr>
<tr>
<td>Jun</td>
<td>15</td>
<td>Corpus Christi</td>
</tr>
<tr>
<td>Sep</td>
<td>7</td>
<td>Independence</td>
</tr>
<tr>
<td>Oct</td>
<td>12</td>
<td>N.S. Aparecida</td>
</tr>
<tr>
<td>Nov</td>
<td>2</td>
<td>All Souls</td>
</tr>
<tr>
<td>Nov</td>
<td>15</td>
<td>Republic Proclamation</td>
</tr>
<tr>
<td>Dec</td>
<td>25</td>
<td>Christmas</td>
</tr>
</tbody>
</table>

**TIME**

Standard Time Washington, D.C. (Brasilia) + 2 hours 03/05 - 10/16/95

**PASSPORT/Visa**

A passport is needed to depart and re-enter the U.S.; in addition, a visa is currently required for a visit to Brazil. Most travel agencies can provide up-to-date information on requirements.

**CURRENCY EXCHANGE RATE**

1 U.S. $ = 0.95 Real (R $)

per Wall Street Journal, 10/01/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

**DIRECT DIALING**

Individual numbers for direct dial to Brazil are complete as listed, after dialing international access code: 011. Country code is 55; listed local numbers include city code.

**U.S. EMBASSY - BRASILIA**

American Embassy  
Avenida das Nações, Lote 3  
CEP 70403, Brasilia  
Brazil  
Tel: 55-61-321-7272  
Fax: 55-61-225-9136

Science Counselor  
Roy C. Simpkins
**Population**

<table>
<thead>
<tr>
<th>Year</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>158.7</td>
<td>million</td>
</tr>
</tbody>
</table>

**ENERGY**

<table>
<thead>
<tr>
<th>Year</th>
<th>Electric Power Capacity</th>
<th>Value</th>
<th>Nuclear</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td></td>
<td>63 GWe</td>
<td>1%</td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td>78 GWe</td>
<td>1%</td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td>98 GWe</td>
<td>1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Electric Power Production</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td></td>
<td>220 TWh</td>
<td>hydro/thermal</td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td>1% nuclear</td>
<td>1% nuclear</td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td>1% nuclear</td>
<td>1% nuclear</td>
</tr>
</tbody>
</table>

**NUCLEAR POWER**

**Policy:** Complete nuclear industry with closed fuel cycle, based upon technology transfer from FRG and other countries.

<table>
<thead>
<tr>
<th>Year</th>
<th>Nuclear Power Capacity</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td></td>
<td>0.6 GWe</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td>1.9 GWe</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Reactor Mix</th>
<th>Reactor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>PWR</td>
<td>1 (1985)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 (1998/04)</td>
</tr>
</tbody>
</table>

**Reactor Development:** Low power PWR; research/isotope production reactor (light water/low enrichment); FBR (experimental).
INDUSTRIAL FUEL CYCLE

Policy: Development of full commercial capability for closed fuel cycle - U mining and milling; conversion of U₃O₈ to UF₆; enrichment; UO₂ fuel fabrication; fuel reprocessing.

Waste Management Strategy: Not yet defined for HLW; near-surface disposal for LLW, including the Cs-137 waste from the Goiania accident (1987). A final decision on thorium concentration has not yet been made, thorium is provisionally started in sheds. Isotopium CIPC will be placed in the local dam. A repository is planned for radioactive waste from Angra-1 and medical wastes; reprocessing of spent fuel has not been ruled out; it is currently started in pools.

Cumulative SF Arisings (LWR)

<table>
<thead>
<tr>
<th>Year</th>
<th>Arising (tU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>48</td>
</tr>
<tr>
<td>1995</td>
<td>162</td>
</tr>
<tr>
<td>2000</td>
<td>-412</td>
</tr>
</tbody>
</table>

Demonstration/Production Activities

- Uranium mining and milling: 300 t U₂O₇/yr, in operation.
- U₃O₈ to UF₆ conversion: (1984) 90 t U/yr; planned expansion delayed indefinitely.
- Uranium enrichment (Becker nozzle process) at Resende:
  - First Cascade, 24 stages; 6 k SWU/yr (1985); interrupted in 1993.
- Fuel fabrication: 100 t U/yr (1982); design capacity, 400 tU/yr.
- Spent fuel reprocessing: 10 kg/d pilot plant (1986 startup originally scheduled, currently delayed indefinitely).

INTERNATIONAL RELATIONSHIPS

Joint Natural Analogue Studies - Pocos de Caldas Project
Joint study of migration of radionuclides from uranium ore deposits in Brazil by Sweden, Switzerland, U.K., and U.S.
BRAZIL

Member of IAEA (has not signed NPT); dependence on nuclear technology transfer from other nations, principally from FRG. Quadripartite agreement signed in 1994 with Argentina, ABACC, and IAEA to implement full-scope safeguards.

ORGANIZATION

- Federal Republic -- President (Executive), Bicameral National Congress (Legislative), and Supreme Federal Tribunal (Judiciary).
  - SAE (Strategic Business Secretariat) - subordinated to the President, responsible for the planning, execution, and control of nuclear power program.
  - Eletrobrás (Centrais Eletricas Brasileiras) - planning/supervision of power plant construction and operation of transmission/distribution system. Established in 1961 to coordinate activities of state, municipal, and private utilities. Operates through regional subsidiaries, i.e., FURNAS. Also responsible for appropriate R&D.
  - ABACC (Argentina/Brazil Agency for Accounting/Control of Nuclear Materials) - bilateral safeguards agency, established in 1994.
  - CNEN (National Nuclear Energy Commission) - regulatory/R&D. Research Institutes: CDTN, IEN, IPEN, IRD.
  - INB (Brazilian Nuclear Industries) - commercial nuclear fuel cycle activities, uranium mining and processing.

CDTN (Center for the Development of Nuclear Technology)

Centro de Desenvolvimento de Tecnologia Nuclear de Nuclebras (CDTN)
Rua Gonçalves Dias No. 1054
Belo Horizonte, MG, Brazil

Superintendent

Fernando Lomeiras

Function: Applied research and industrial development of uses for atomic energy. Triga reactor (research/isotope production); laboratory scale enrichment nozzle process.
CNEN (National Nuclear Energy Commission)

Comissão Nacional de Energia Nuclear (CNEN)
Rua General Severiano 90
Botafogo ZC-82, CEP 22294-900
Rio de Janeiro, RJ, Brazil

Tel: 55-21-546-2232
Fax: 55-21-546-2379

President
Jose Marro Esteves Dos Santos

Director, Nuclear Safety
Ayrton Jose Caubet da Silva

Head, Waste Disposal
Ana Maria Xavier

Manager, Waste Management
Paulo Heilbron

Function: Regulation, surveillance, and licensing of nuclear reactors, fuel cycle facilities and radiation-emitting installations; promotion of nuclear technology R&D and technology transfer to private industry; promotion and training of personnel. Controls four research institutes: CDTN, IEN, IPEN, and IRD.

IEN (Nuclear Engineering Institute)

Instituto de Engenharia Nuclear
Cidade Universitária
ilha do Fundão
Caixa Postal 2186, CEP 20001
Rio de Janeiro, RJ, Brazil

Tel: 55-21-280-3113
Fax: 55-21-590-2692

Superintendent
Luiz Arrieta

Activities: Nuclear reactor physics, cyclotron radioisotope production, reactor engineering, research reactor operation, metallurgy, nuclear/applied chemistry, nuclear instrumentation (development/production), health physics, mathematics/computation and sodium technology, reactor development.

Facilities

- Laboratories for nuclear chemistry, metallurgy, and engineering
- Argonaut-type reactor - 10 kW

(contd next page)

BR-4
IEN (Nuclear Engineering Institute) (contd)

- Sodium loop - 300 kW
- Cyclotron

IPEN (Energy and Nuclear Research Institute)

Instituto de Pesquisas Energéticas e Nucleares
Cidade Universitária
Caixa Postal 11.049
Pinheiros, CEP 01000,
São Paulo, Brazil:

Tel: 55-11-211-6011

Superintendent

Claudio Rodrigues

Nuclear Activities: Nuclear physics, nuclear medicine, radiobiology, radiation health/safety, engineering/reactor technology/instrumentation, nuclear materials chemistry, isotope and radiation applications/production, nuclear waste disposal, nuclear metallurgy, radiochemistry.

Facilities

- \( \text{U}_3\text{O}_8-\text{UF}_6 \) conversion plant at Iperó (90 t U/yr)
- SF reprocessing laboratory
- Small experimental gas centrifuge (uranium enrichment)
- Low-power PWR reactor
- Swimming pool 10 MW reactor (isotope production)
IRD (Health Physics and Dosimetry Institute)

Instituto de Radioproteção e Dosimetria
Avenida das Américas Km 11.5
Barra Da Tijuca, CEP 22700
Rio de Janeiro, RJ, Brazil

Tel: 55-21-442-9777
Fax: 55-21-442-2950

Director
Eliana Amaral

Activities: Personal dosimetry control, calibration of radiation detectors, reactor environment control, nuclear medicine and X-ray equipment control, radiobiology, background evaluation, dosimetry research.

Facilities

- Brazilian Secondary Standards Dosimetry Laboratory
CANADA

MAJOR PUBLIC HOLIDAYS (1995)

| Jan 1 | New Year       | Sep 4 | Labor Day     |
| Apr 14 | Good Friday    | Oct 9 | Thanksgiving |
| May 22 | Victoria Day   | Nov 11 | Remembrance Day |
| Jul 1  | Canada Day     | Dec 25 | Christmas    |
| Aug 1  | Civic Day      | Dec 26 | Boxing Day   |

TIME

Time zones correspond to those in the United States.
Daylight Savings Time period: 04/24 - 10/30/95

PASSPORT/VISA

In lieu of passport, proof of U.S. citizenship 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 U.S. $ = 1.33 Canadian Dollar
per Wall Street Journal, 10/01/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to Canada are complete as listed. Dial long distance access code: 1, followed by three-digit area code plus seven-digit local number.

U.S. EMBASSY - OTTAWA

American Embassy
100 Wellington Street
Ottawa, ON
K1P 5T1 Canada

Tel: 613-238-5335
Fax: 613-238-5720

Science Counselor

Terry Jones
### ENERGY

<table>
<thead>
<tr>
<th>Year</th>
<th>Electric Power Capacity</th>
<th>Capacity</th>
<th>Nuclear</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>108.6</td>
<td>GWe</td>
<td>14%</td>
</tr>
<tr>
<td>1995</td>
<td>112.5</td>
<td>GWe</td>
<td>14%</td>
</tr>
<tr>
<td>2000</td>
<td>114.5</td>
<td>GWe</td>
<td>14%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Electric Power Production</th>
<th>Production</th>
<th>Hydro/geoth.</th>
<th>Coal</th>
<th>Nuclear</th>
<th>Oil</th>
<th>Gas</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>501.5</td>
<td>TWh</td>
<td>62%</td>
<td>17%</td>
<td>17%</td>
<td>3%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>2000</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### NUCLEAR POWER

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Nuclear Power Capacity</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>15.5</td>
<td>GWe</td>
</tr>
<tr>
<td>1995</td>
<td>15.5</td>
<td>GWe</td>
</tr>
<tr>
<td>2000</td>
<td>15.5</td>
<td>GWe</td>
</tr>
</tbody>
</table>

**Reactor Mix**

- **1994:** PHWR 22 (1971-93)

### INDUSTRIAL FUEL CYCLE

**Policy:** Interim storage of spent fuel for decades, pending an environmental assessment and review of a concept for the disposal of nuclear fuel waste (review process of concept has started).
**Waste Management Strategy:** Geologic disposal of nuclear fuel waste and spent CANDU fuel in a crystalline rock repository. Disposal of LLW in engineered, shallow-ground facility.

**Cumulative Used Fuel (PHWR)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Bundles</th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>1,060,478</td>
<td>20,520</td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Major Milestone**


**INTERNATIONAL RELATIONSHIPS**

**DOE/AECL Agreement for Cooperation in Radioactive Waste Management**

**Term:** 09-08-76 to 09-29-96

**Scope:** Waste treatment, storage, geological disposal, transportation requirements, operational considerations, environment and safety, public acceptance issues; information exchange in radioactive waste management, geological disposal, waste form characterization, waste/spent fuel storage, and intercomparison of performance assessment computer models and codes.

**DOE/AECL Subsidiary Agreement #2**

**Term:** 09-30-91 to 09-29-96

**Scope:** Joint project to study the preparation/packaging of radioactive wastes/disposal in geologic formation; fundamental materials investigations; in situ stress determination; SF dissolution model development; large block tracer test; laboratory and field tests of in situ hydrochemical tool; Cigar Lake analogue study; actinide/fission product geochemistry; performance assessment technology exchange; multiple-well hydraulic test and field tracer test development.

**Member of IAEA and OECD/NEA - Exchange agreements with the following agencies and countries:** DOE/U.S.; SKB/Sweden; U.K./NIREX/UK.; PNC, JAERI/Japan; KAERI/Korea; TVO, IVO, OH/Finland; ANDRA/France; ONDRAF/Belgium; ENRESA/Spain; EURATOM/Europe; PAKS NPP/Hungary; Radwaste Admin/Taiwan.
ORGANIZATION

- AECB (Atomic Energy Control Board) - federal nuclear control agency, answers to Parliament, responsible for health/safety regulation, compliance/licensing.

- AECL (Atomic Energy of Canada Limited) - Crown Corporation, answers to Parliament via Ministry of Natural Resources. R&D, design, engineering, and sale of CANDU and research reactors; proprietary rights on CANDU Nuclear Steam Supply Systems; waste management R&D at Whiteshell and Chalk River laboratories.

- OH (Ontario Hydro) - provincial public utility. Owns/operates 20 CANDU nuclear power plants, 15,340 MWe total capacity; responsible for developing interim fuel storage/transport technologies.

- HQ (Hydro Quebec) - provincial public utility. Owns/operates Gentilly 2, a 600-MWe CANDU station.

- NBEPC (New Brunswick Electric Power Commission) - provincial public utility. Owns/operates Point Lepreau Nuclear Generating Station, a 600-MWe CANDU.
FEDERAL GOVERNMENT RESPONSIBILITIES - FUEL CYCLE/WASTE MANAGEMENT

Ministry of Natural Resources Canada

- Atomic Energy Control Board (AECB)
  - Regulations, Licensing, Compliance

- Atomic Energy of Canada, Limited (AECL)
  - AECL, Sheridan Park
    - Reactor Design, Engineering, Export, proprietary rights on CANDU Nuclear Steam Supply Systems
  - AECL Chalk River and Whiteshell (see CA-5)

- Natural Resources Canada
  - Geological Survey of Canada (GSC)
    - Information/Services Branch
    - Minerals/Continental Geoscience Branch
    - Sedimentary/Cordilleran Geoscience Branch
    - Geophysics/Marine Science Branch
  - Mineral/Energy Technology (MET)

- Canadian Centre for Mineral/Energy Technology (CANMET)
  - Mining Research Laboratories
    - Sudbury Laboratory
    - Elliot Lake Laboratory
    - Canadian Mining Technology Laboratory
  - Mineral Sciences Laboratories
    - Radionuclide Recovery from Thorium Mill Tailings
  - Metals Technology Laboratories

CA-4
ATOMIC ENERGY OF CANADA LIMITED - WASTE MANAGEMENT ORGANIZATION

AECL

Whiteshell Laboratories (WL)
- Physical and Environmental Sciences
  - Waste Technology
    - Applied Geoscience
    - Environmental/Safety Assessment
    - Geotechnical Science/Engineering
    - Underground Research Laboratory
    - Environmental Science
    - Geochemistry Research
    - Fuel Waste Technology

Chalk River Laboratories (CRL)
- Waste Management Systems
  - Storage/Disposal
  - Waste Processing Technology
- Health and Environmental Sciences
  - Radiation Biology and Health Physics
  - Environmental Research

Head Office, Ottawa
- Low-Level Radioactive Waste Management Office (operated by AECL on behalf of Natural Resources)
Atomic Energy Control Board
270 Albert Street
Ottawa, ON
K1P 5S9 Canada
Tel: 613-995-5894
Fax: 613-995-5086

President and C.E.O.
Director General,
Fuel Cycle/Materials Regulations
Wastes/Impacts Div.
Compliance Serv./Laboratory Div.
Radioisotopes/Transportation Div.
Uranium Facilities Div.
Director, Research/Safeguards
Safeguards/Security Div.
Director, Analysis/Assessment
Safety Evaluation (Analysis) Div.
Safety Evaluation (Eng.) Div.

Agnes J. Bishop
Murray Duncan
Cait Maloney
Elizabeth Greaves (A)
Ross Brown
Tom Viglasky
Jim Harvie
John R. Coady
John Waddington
Peter Wigfull
Kurt Asnus

Atomic Energy of Canada Ltd.
344 Slater Street
Ottawa, ON
K1A OS4 Canada
Tel: 613-237-3270
Fax: 613-563-9499

Chairman
President, C.E.O.
Program Director, LLW Management

Robert Nixon
Reid Morden
Robert W. Pollock

AECL-CRL

AECL
Chalk River Laboratories
Chalk River, ON
ROJ 1JO Canada
Tel: 613-584-3311
Fax: 613-589-4024

(contd next page)
AECL-CRL (contd)

Env. & Health Sciences, Dir. Richard V. Osborne
Radiation Biology, Dir. Colin Allan
Waste Management Systems Colin Allan
Corporate Relations, V.P. JoAnne Cohen Sulzenko

Facilities

- **WTC (Waste Treatment Center)**
  
  **Mission**: Development and operation of processes for treatment of LLW and ILW using incineration, compaction, micro-filtration/reverse osmosis evaporation, ion exchange, and solidification in bitumen.

- **IRUS (Intrusion Resistant Underground Structure)**
  
  **Mission**: LLW/ILW repository consisting of prototype vault. Capacity of 2,000 m³ radwaste in drums or bales; when full, to be covered with backfill, roofed with concrete, and mounded with earth. Waste can be retrieved from the IRUS vault until concrete cap is placed.

**AECL-WL**

AECL
Whiteshell Laboratories
Pinawa, MB
ROE 1L0 Canada

Underground Research Laboratory

Tel: 204-753-2311
Fax: 204-753-2455

Tel: 204-345-8625
Fax: 204-345-8868

Gen. Mgr., Phys. and Earth Sciences Collin J. Allan
Dir., Nuc. Fuel WM. Program Ken W. Dormuth
Applied Geoscience Cliff Davison
Environmental and Safety Assessment Alf Wikjord
Geotech. Science and Engineering Mitch Ohta
Waste Technology Keith Nuttal
Geochemistry Research Peter Sargent
Fuel Waste Technology Lawrence Johnson
Environmental Science Reto Zach

(contd next page)
Facilities

- **BITF (Borehole Instrumentation Test Facility)**
  
  **Mission:** Test and calibrate geotechnical borehole instruments under pressure, temperature, and chemical conditions that could exist in exploration boreholes to depths of 1200 m below ground surface in granitic rock.

  **Design Basis:** Stainless steel vertical test chamber to simulate a 10-m-long borehole section, 76-mm inside diameter. Temperature, pressure, flow rates, and water chemistry can be precisely controlled and monitored.

  **History:** Startup, 1983.

- **URL (Underground Research Laboratory)**, located about 20 km northeast of WL in the Lac du Bonnet granite batholith.

  **Mission:** Operate facility ensuring compliance with regulatory standards and high level of safety/quality control; design and implement in situ and laboratory experiments/engineering demonstrations to investigate relevant issues.

  **Design Basis:** Access shaft and ventilation raised to 430-m depth with shaft stations at 130-, 240-, 300-, and 420-m depths. Licensed radioactive sources and tracers can be used, but no radioactive wastes can be employed. A series of nine experiments is in progress on the 240- and 420-m levels and in the surrounding rock mass.

  **History:** Underground access development complete in 1990; major experiments in solute transport, rock mass response, characterization method, and engineered sealing systems began in 1988.

- **IFTF (Immobilized Fuel Test Facility)**

  **Mission:** Test the effects of water, heat, and pressure on used fuels, container materials, buffer, and rock in the presence of a radiation field.

  **Design Basis:** A high-level radiation source is used in heated concrete canisters to provide a gamma radiation source. Pressure vessels adjacent to the source contain the material to be studied. Adjacent "warm cells" are available for experiments involving moderate levels of radiation.

  **History:** First canister loaded August 1984.
AECL-WL (contd)

- **LBRMF** (Large Block Radionuclide Migration Facility)
  
  **Mission:** Study the migration of reactive and nonreactive contaminants, including radionuclides, over a distance up to 1 m through natural fractures in quarried, intact rock; determine the spatial distribution of sorbed radionuclides on fracture surfaces and in the rock matrix at the end of the migration experiments.

  **Design Basis:** The facility consists of an experimental section equipped with moveable active fume hoods to hold quarried rock; an analysis section equipped with a 2-D gamma scanner, active fume hoods, and equipment to handle blocks of rock up to 2000 kg.

  **History:** Joint migration experiment with U.S. DOE using uranine (tracer dye), $^{131}$I, and $^{137}$Cs has been completed and results published. Second experiment, using uranine, $^3$H, $^{85}$Sr, $^{99m}$Tc, $^{137}$Cs, and $^{144}$Ce has been completed; third experiment, using $^{85}$Sr, $^{131}$I, $^{137}$Cs, $^{144}$Ce, $^{123}$Eu, $^{237}$Np and $^{239}$Pu has been carried out for PNC, Japan; colloid migration experiments are under way; migration experiments in fractures with simple, uniform geometries are planned in cooperation with LANL (U.S.).
NATURAL RESOURCES CANADA—CANMET

Natural Resources
Canada Centre for Mineral
and Energy Technology
555 Booth Street
Ottawa, ON
K1A 0G1 Canada

Tel: 613-995-4194
Fax: 613-996-9673

Mineral Technology, Dir. Roy Sage
Waste Mgmt., Elliot Lake, Dir. J. E. Udd
Sudbury Laboratories Manager Parviz Mottahed

NATURAL RESOURCES CANADA—GSC

Natural Resources
Geological Survey of Canada
601 Booth Street
Ottawa, ON
K1A 0E8 Canada

Tel: 613-992-5910
Fax: 613-995-3082

Assistant Deputy Minister E. A. Babcock
Chief Scientist Jim Franklin

ONTARIO HYDRO

Ontario Hydro
700 University Avenue
Toronto, ON
M5G 1X6 Canada

Tel: 416-592-5111
Fax: 416-592-4485

Nuclear Fuel Supply E. G. Bazeley
Design/Development Div., Director Hugh S. Irvine
Nuclear Engineering Don W. Souther
Radioactive Mtls. Management Peter Stevens-Guille
Rad. Waste Storage/Disposal P. J. Armstrong
Rad. Mtls. Transportation Joe F. Tanaka
SF Management/Decommissioning Syed J. Naqvi
Fuel Cycle, isotope R. A. McEachran

(contd next page)

Facilities

- WVRF (Waste Volume Reduction Facility)
  Processing Equipment: Two-chamber pyrolysis incinerator with a capacity of 30 kg/hr; box compactor with a compaction force of $2 \times 10^6$ N low force drum crusher. Startup, 1977 (box compactor replaced baler in 1993).

- LLW Storage Facilities
  - Five above-ground warehouse-type buildings. Waste with a radiation field of $<1$ R/hr at 30 cm is stored in stackable containers with a storage capacity of 8000 m$^3$ each.
  - 15 trenches. Reinforced concrete structures $\sim 3$ m below ground; designed for waste with radiation fields $>1$ R/hr but $<15$ R/hr, storage capacity ranges from 360 to 680 m$^3$ each.
  - 15 quadricells. Above-ground, reinforced concrete structures; sufficient shielding for storage of waste with radiation fields of $>15$ R/hr, e.g., ion exchange resins, filters, and reactor core components; storage capacity ranges from 1 to 18 m$^3$.  

(cont'd next page)
ONTARIO HYDRO (contd)

- **358 in-ground containers.** Welded steel liners concreted into augered holes, designed for storage of waste with radiation fields >15 R/hr, e.g., ion exchange resins, filters and reactor core components. In-ground storage consists of 224 1-m³ capacity tile holes and 134 in-ground containers; capacity ranges from 2 to 18 m³ (54 were added in 1993).

- **Paved area.** 4700 m² for storage of contaminated tooling in 6.1-m-long marine cargo containers stacked two high.

- **27 in-ground containers.** Various diameters/depths containing scrap heat exchangers; augered holes with crushed limestone backfill. Storage capacity ranges from 2 to 18 m³ each.
CHINA

MAJOR PUBLIC HOLIDAYS (1995)

Jan 1 New Year
Feb 19-21 Spring Festival
Mar 8 Women's Day
May 1 Labor Day
Oct 1-2 National Day

TIME

Standard Time Washington D.C. + 13 hours

PASSPORT/Visa

A passport is needed to depart and re-enter the U.S.; 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 U.S. $ = 8.14 Renminbi
Per Wall Street Journal, 10/01/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

U.S. EMBASSY - BEIJING

American Embassy
Xiu Shui Bei Jie 3
Beijing 100600
People's Republic of China

Tel: 86-10-532-3831 Ext. 453
Fax: 86-10-532-6423

Science Counselor
Marco S. Di Capua
<table>
<thead>
<tr>
<th>Year</th>
<th>Electric Power Capacity</th>
<th>GWe</th>
<th>Nuclear Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>183</td>
<td>GWe</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>1994</td>
<td>200</td>
<td>GWe</td>
<td>1.05%</td>
</tr>
<tr>
<td>1995</td>
<td>210</td>
<td>GWe</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>2000</td>
<td>285</td>
<td>GWe</td>
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</table>

<table>
<thead>
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<th>Year</th>
<th>Electric Power Production</th>
<th>TWh</th>
<th>Coal</th>
<th>Hydro</th>
<th>Oil</th>
<th>Nuclear</th>
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</thead>
<tbody>
<tr>
<td>1993</td>
<td>836</td>
<td>TWh</td>
<td>77%</td>
<td>18%</td>
<td>5%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>1994</td>
<td>928</td>
<td>TWh</td>
<td>75.9%</td>
<td>18%</td>
<td>4.7%</td>
<td>1.5%</td>
</tr>
<tr>
<td>1995</td>
<td>990</td>
<td>TWh</td>
<td></td>
<td></td>
<td></td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Year</th>
<th>Nuclear Power Plant Capacity</th>
<th>GWe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>0.3</td>
<td>GWe</td>
</tr>
<tr>
<td>1995</td>
<td>2.1</td>
<td>GWe</td>
</tr>
<tr>
<td>2000</td>
<td>6.0</td>
<td>GWe</td>
</tr>
</tbody>
</table>

**Reactor Mix**

- PWR 2 (2000/01)

**Reactor Development**

PWR, HTGR, FBR, LTR

CH-1
INDUSTRIAL FUEL CYCLE

Policy: Activities include uranium mining, milling, and diffusion enrichment; isotope separation; fuel fabrication; future spent fuel reprocessing.

Waste Management Strategy: Interim storage of spent fuel in pools for 5-8 years if greater than 1,000 t U, in transport/storage casks if less than 1,000 t U; interim storage, reprocessing, vitrification, and disposal all to be at one site, to be selected, located in northwest China or the Gobi Desert; final disposal in deep geologic formation; plan for a small pilot reprocessing plant, followed by a commercial-size facility, about 500 t U/yr.

INTERNATIONAL AGREEMENTS

Member of IAEA. Cooperative agreements have been signed with Argentina, Canada, France, Germany, Italy, Japan, Republic of Korea, and the U.S. (nuclear safety).

ORGANIZATION

- CNNC (China National Nuclear Corporation) - fuel cycle development
  - CIAE (China Institute of Atomic Energy)
  - CNEC (China Nuclear Engineering Corporation) - handles import and export
- China Zhongyuan Engineering Corporation - provides technical services and engineering work; contracts building projects.
- Southwest Institute of Physics - nuclear R&D.
- NNSA (National Nuclear Safety Administration) - responsible for standards/regulations, construction permits/operating licenses, monitoring plant operations; conducts joint safety research with other nations.
- INET (Institute of Nuclear Energy Technology), Tsinghua University
BINE

Beijing Institute of Nuclear Engineering
P.O. Box 840
Beijing 100840, PRC

Director
Director, Nuclear Waste Mgmt.
Director, International Affairs

Huang Pumin Ext. 2187
Zheng Jifu Ext. 2802
Liu Dinggin Ext. 5067

CIAE

China Institute of Atomic Energy
P.O. Box 275
Beijing 102413, PRC

Honorary Director
Director
Director, Radiochemistry

Wang Ganchang
Sun Zuxun
Luo Shanggeng

Function: Large comprehensive nuclear R&D institute. FBR development.
Waste Management R&D: HLW vitrification; waste form characterization; pilot plants to be built.

CNEIC

China Nuclear Energy Industry Corporation
P.O. Box 822
Beijing 100037, PRC

General Manager

Zhou Yuanquan

Function: Import/export company for the nuclear industry.
China National Nuclear Corporation
P.O. Box 2102
Beijing 100822, PRC
Tel: 86-10-851-2211
Fax: 86-10-851-2393
President
Jiang Xingxiong
Nuclear Fuel Department Director
Zhang Zhifeng
Nuclear Radiation Protection, Environment/Health Department Director
Pan Ziqiang

Conglomerate of over 200 enterprises and institutions. Plans to construct four regional final LLW/HW disposal facilities in northwest (Gansu), east, south, and southwest China for waste from nuclear facilities, including Qinshan and Daya Bay nuclear power stations.

Institute of Nuclear Energy Technology
Tsinghua University
P.O. Box 1021
Beijing 100084, PRC
Tel: 86-10-259-4533
Fax: 86-10-256-4177
Director
Wu Zongxin
Dep. Director
Xu Yuanhui
Academic Committee Director
Zhu Yongjun

Designed/built low-temperature reactor (5 MWth), which provides central heating for the institute’s off-campus research facility.

Nuclear Fuel Complex
P.O. Box 508
Lanzhou 732850, PRC
Tel: 86-931-841-7584
Director
Liu Qizhao
Nuclear Fuel Fabrication
P.O. Box 257
Yibin, Sichuan 644000
Factory Director: Chen Baoshan

Function: Production of fuel for the 300 MWe PWR being built at Pinshan (near Shanghai) and the two 900 MWe PWRs at Daya Bay (near Hong Kong).

National Nuclear Safety Administration
P.O. Box 8088
Beijing 100088, PRC
Director General: Huang Qitao

Function: Responsible for standards/regulations, construction permits/operating licenses; monitoring plant operations; joint safety research with other nations; cooperation with U.S. (NRC)

Nuclear Power Institute of China
P.O. Box 436
Chengdu 610041, PRC
Director: Zhao Chengkun

Function: Designing Qinshan II (600 MWe PWR); R&D on advanced PWRs.
SNERDI

Shanghai Nuclear Engineering
and Design Institute
29 Hongcao Lu
P.O. Box 233-008
Shanghai 200233, PRC

Tel: 86-21-6436-4700
Fax: 86-21-6439-0846

Director
Geng Qirui

Foreign Affairs
Du Li

Tel: 86-21-6470-5415

Function: Designing (300 MWs) PWRs for export; designed Qinshan I.
FINLAND

MAJOR PUBLIC HOLIDAYS (1995)

<table>
<thead>
<tr>
<th>Month</th>
<th>Day</th>
<th>Holiday</th>
<th>Month</th>
<th>Day</th>
<th>Holiday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>1</td>
<td>New Year</td>
<td>May</td>
<td>25</td>
<td>Ascension</td>
</tr>
<tr>
<td>Jan</td>
<td>6</td>
<td>Epiphany</td>
<td>Jun</td>
<td>23-24</td>
<td>Midsummer Eve/Day</td>
</tr>
<tr>
<td>Apr</td>
<td>14</td>
<td>Good Friday</td>
<td>Nov</td>
<td>4</td>
<td>All Saints</td>
</tr>
<tr>
<td>Apr</td>
<td>16-17</td>
<td>Easter</td>
<td>Dec</td>
<td>6</td>
<td>Independence Day</td>
</tr>
<tr>
<td>May</td>
<td>1</td>
<td>May Day</td>
<td>Dec</td>
<td>24-26</td>
<td>Christmas</td>
</tr>
</tbody>
</table>

TIME

Standard Time Washington D.C. + 7 hours
Daylight Saving Time Period: 03/26 - 09/22/95

PASSPORT/Visa

A passport is needed to depart and re-enter the U.S. 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 U.S. $ = 4.30 Markka (FIM)
per Wall Street Journal, 10/01/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to Finland are complete as listed, after dialing international access code: 011. Country code is 358; listed local numbers include city code.

U.S. EMBASSY - HELSINKI

American Embassy
Itäinen Puistotie 14A
Helsinki
Finland

Economic Section
Tel: 358-0-17-1931
Fax: 358-0-65-6846

Robert W. Boehme
<table>
<thead>
<tr>
<th>Population</th>
<th>1994</th>
<th>5 million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Power Capacity</td>
<td>1993</td>
<td>12.6 GWe</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td>15.0 GWe</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>15.5 GWe</td>
</tr>
<tr>
<td>Electric Power Production</td>
<td>1993</td>
<td>58.1 TWh</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td>26% hydro</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>15% solids</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14% coal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9% gas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2% oil</td>
</tr>
</tbody>
</table>

**NUCLEAR POWER**

| Nuclear Power Capacity | 1993 | 2.3 GWe |
| | 2000 | 2.3 GWe |
| | 1994 | PWR 2 (1977/81) |
| | | BWR 2 (1979/82) |

**INDUSTRIAL FUEL CYCLE**

**Policy:** Purchase fuel from other countries’ domestic waste management services.

**Waste Management Strategy:** Spent fuel from TVO’s power plants will be stored for at least 40 years, then disposed of in crystalline bedrock; IVO returns spent fuel from its (Russian-built) reactors to Russia until the end of 1997; thereafter will operate with the same principle as TVO; a joint company for the final disposal of TVO and IVO spent fuel will start its operation in January 1996; operating wastes are conditioned, stored above
ground, and disposed of in crystalline bedrock at the nuclear power stations; decommissioning wastes will be disposed of in extended operating waste repositories.

Cumulative SF Arisings (LWR), t U removed + cores

<table>
<thead>
<tr>
<th>Year</th>
<th>TVO</th>
<th>IVO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>450 + 177</td>
<td>330 + 75</td>
</tr>
<tr>
<td>2000</td>
<td>855 + 177</td>
<td>580 + 75</td>
</tr>
</tbody>
</table>

**Major Milestones**

- Complete LLW/ILW repository (IVO) 1997
- Complete SF repository site selection (IVO) 2000
- Complete SF repository (TVO + IVO) 2020

**INTERNATIONAL RELATIONSHIPS**

Member of IAEA and OECD/NEA; collaboration with Sweden, Canada, Denmark, Norway, and Switzerland in waste management studies.

Purchase of fuel-cycle services: uranium from Canada, Australia, Niger, China, and Russia; uranium conversion/enrichment from Canada, France, Germany, Russia, and U.K.; fuel element fabrication from Sweden, Germany, and Russia; return of spent fuel to Russia (IVO) temporarily until 1997.

**ORGANIZATION**

- Council of State (Cabinet of Ministers) - grants licenses.
- Nuclear Energy Commission - advisory organization for matters connected with the use of nuclear energy.
- Advisory Committee on Nuclear Safety - advisory organization.
- KTM (Ministry of Trade and Industry) - Energy Department, formulates energy policies, grants licenses.
- STUK (Finnish Centre for Radiation and Nuclear Safety) - regulatory authority which also conducts research, particularly related to transport of radionuclides in biosphere.
- **IVO** (government-owned power company) - operates two Russian-built PWRs.

- **TVO** (power company) - operates two Swedish-built BWRs.

- **N.N.** (spent fuel disposal company) - a joint company to be established by IVO and TVO starting January 1996.

- **VTT** (Technical Research Centre of Finland) - nuclear research, including waste management R&D.

- **Geological Survey of Finland** - bedrock-related research.

- **University of Helsinki** - basic research on radiochemistry.

- **Helsinki University of Technology** - basic research.

**ADVISORY COMMITTEE ON NUCLEAR SAFETY**

Advisory Committee on Nuclear Safety  
P.O. Box 14  
Laippatie 4  
FIN-00881 Helsinki  
Finland  
Tel: 358-0-75-9881  
Fax: 358-0-75988500

Chairman  
Lasse Mattila  
Secretary-General  
Hannu Koponen  

Function: Advisory organization for safety matters connected with the use of nuclear energy, coordinated by the Finnish Centre for Radiation and Nuclear Safety (STUK).
GEOLOGICAL SURVEY OF FINLAND

Geological Survey of Finland
Betonimiehenkuja 4
FIN-02150 Espoo, Finland
Tel: 358-0-469-31
Fax: 358-0-462-205

Director
Veikko Lappalainen
Nuclear Waste Disposal
Paavo Vuorela

R&D Activities: Geological studies for waste disposal in crystalline bedrock.

IVO (National Power Company)

Imatran Voima Oy
Rajatorpantie 8
FIN-01019 IVO, Finland
Tel: 358-0-85611
Fax: 358-0-563-6823

President, CEO
Kalevi Nurminnen
Exec. VP, Generation
Anders Palmgren
Director, Research
Pekka Salminen
Nuclear Waste
Jussi Palmu

Function: Operate two nuclear power plants (Russian-built) at Loviisa, southeastern Finland.

Owner: Government.

NEC (Nuclear Energy Commission)

Nuclear Energy Commission
Pohjoinen Makasiinikatu 6
FIN-00130 Helsinki
Finland
Tel: 358-0-160-4832
Fax: 358-0-160-2695

Chairman
Pekka Silvennoinen
Secretary-General
Sakari Immonen

Function: Advisory organization for general matters connected with nuclear energy, coordinated by the Ministry of Trade and Industry.
STUK

Finnish Centre for Radiation and Nuclear Safety
P.O. Box 14
Laippatie 4
FIN-00100 Helsinki, Finland

Tel: 358-0-759-881
Fax: 358-0-7598-8500

Director
Antti Vuorinen
Nuclear Safety Department
Jukka Laaksonen
Nuclear Fuel Cycle
Tero Varjoranta
Nuclear Waste
Esko Ruokola

Function: Regulatory enforcement and inspection authority; research related to transport of radionuclides in biosphere.

TVO (Industrial Power Company)

Teollisuuden Voima Oy
Annankatu 42C
FIN-00100 Helsinki, Finland

Tel: 358-0-6180-1
Fax: 358-0-6180-2570

Director
Mauno Paavola
Director, Development
Ami Rastas
Nuclear Fuel
Ilkka Mikkola
Nuclear Waste
Veijo Ryhänen

Function: Operate two nuclear power units (Swedish-built BWRs) at Olkiluoto in Eurajoki, southwestern Finland; manage fuel procurement and TVO-produced wastes.

Owners: 57% private, 43% public utilities/government-owned companies.

Facilities

- KFA-STORE (Interim storage facility for spent nuclear fuel) - located at reactor site, three pools with total capacity of 1200 t U; construction completed 1987.

(contd next page)
• **VLJ Repository** (Final repository for TVO's ILW/LLW) - located at reactor site; LLW and ILW packaged in metal drums/containers are buried in two silos 70-100 m deep; ILW silo has reinforced 0.6-m thick concrete liner; capacity 8400 m³; construction completed 12/1991.

**VTT (Technical Research Centre of Finland)**

**VTT Energy**
Nuclear Energy
Tekniikantie 4C, Espoo
FIN-2044 VTT, Finland
Tel: 358-0-456-1
Fax: 358-0-456-5000

Nuclear Energy Research
Reactor Physics
Lasse Mattila
Riitta Kyrki-Rajamäki
Seppo Vuori

**R&D Activities:** Reactor physics, nuclear power plant safety analyses; safety analysis of final disposal of wastes in bedrock, including groundwater flow modeling.

**VTT Chemical Technology**
Environmental Technology
Physics Bldg.
Otakaari 3A, Espoo
FIN-02044 VTT, Finland
Tel: 358-0-456-1
Fax: 358-0-456-5000

Head
Nuclear Waste
Markku Auer
Arto Muurinen

**R&D Activities:** Dissolution of spent fuel and actinides; geochemical modeling; migration in barriers and bedrock; characterization of ILW forms.

(contd next page)
VTT (contd)

VTT Communities/Infrastructure
Rock/Environmental Engineering
Betonimiehenkuja 1, Espoo
P.O. Box 19041
FIN-02044 VTT, Finland
Tel: 358-0-456-1
Fax: 358-0-467-927

Head, Waste Disposal
Hydrology
Jukka Pöllä
Petteri Pitkänen

R&D Activities: Hydrogeological and geomechanical measurements, characterization and performance of bedrock and engineered barriers.

VTT Manufacturing Technology
Materials/Structural Integrity
Kemistintie 3, Espoo
P.O. Box 1704
FIN-02044 VTT, Finland
Tel: 358-0-456-1
Fax: 358-0-456-7002

Head
Nuc. Materials Research
Rauno Rintamaa
Pertti Aaltonen

R&D Activities: Corrosion of encapsulation materials in repository conditions, material research of reactor components.

UNIVERSITY OF HELSINKI

University of Helsinki
Laboratory of Radiochemistry
P.O. Box 55 (A.T. Virtasen aukio 1)
FIN-00014 University of Helsinki
Tel: 358-0-191-1
Fax: 358-0-191-40121

Director
Timo Jaakkola

R&D Activities: Waste treatment processes, migration of radionuclides, and radiochemical analysis.
FRANCE

MAJOR PUBLIC HOLIDAYS (1995)

<table>
<thead>
<tr>
<th>Jan</th>
<th>1</th>
<th>New Year</th>
<th>Jul</th>
<th>14</th>
<th>Bastille Day</th>
</tr>
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<tbody>
<tr>
<td>Apr</td>
<td>17</td>
<td>Easter Monday</td>
<td>Aug</td>
<td>15</td>
<td>Assumption</td>
</tr>
<tr>
<td>May</td>
<td>1</td>
<td>Labor Day</td>
<td>Nov</td>
<td>1</td>
<td>All Saints</td>
</tr>
<tr>
<td>May</td>
<td>12</td>
<td>Ascension</td>
<td>Nov</td>
<td>11</td>
<td>Veterans Day</td>
</tr>
<tr>
<td>Jun</td>
<td>4-5</td>
<td>Whitsuntide</td>
<td>Dec</td>
<td>25</td>
<td>Christmas</td>
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<tr>
<td>Jun</td>
<td>23</td>
<td>Pentecost</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TIME

Standard Time Washington, D.C.
Daylight Savings Time Period: + 6 hours
03/26 - 09/23/95

PASSPORT/VISA

A passport is needed to depart and re-enter the U.S.; in addition, a visa is currently required when traveling on an official passport to France, but not when a personal passport is used. Most travel agencies can provide up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 U.S. $ = 4.888 Franc
per Wall Street Journal, 11/08/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to France are complete as listed, after dialing international access code: 011. Country code is 33; listed local numbers include city code.

U.S. EMBASSY - PARIS

American Embassy
2 Avenue Gabriel
75382 Paris Cedex 08
France

Tel: 33-1-42-96-12-02
Fax: 33-1-42-66-48-27

Science Counselor
Jerome J. Bosker
### Population

<table>
<thead>
<tr>
<th>Year</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>1994</td>
<td>57.8 million</td>
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### Energy

#### Electric Power Capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity</th>
<th>% Nuclear</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>107.0 GWe</td>
<td>55%</td>
</tr>
<tr>
<td>1995</td>
<td>107.5 GWe</td>
<td>54%</td>
</tr>
<tr>
<td>2000</td>
<td>118.3 GWe</td>
<td>54%</td>
</tr>
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</table>

#### Electric Power Production

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
<th>% Nuclear</th>
<th>Other Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>458.1 TWh</td>
<td>78%</td>
<td>15% hydro/geoth., 8% coal, 2% oil, 1% gas</td>
</tr>
<tr>
<td>1994</td>
<td>80% nuclear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>75% nuclear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>76% nuclear</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Nuclear Power

**Policy:** Vigorous nuclear power program, scaled down recently to construction of less than one new reactor per year; reprocessing-conditioning-recycling (RCR) fuel cycle policy; export of nuclear plants and services.

#### Nuclear Power Capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>59.0 GWe</td>
</tr>
<tr>
<td>1995</td>
<td>58.5 GWe</td>
</tr>
<tr>
<td>2000</td>
<td>64.3 GWe</td>
</tr>
</tbody>
</table>

#### Reactor Mix

<table>
<thead>
<tr>
<th>Year</th>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>PWR</td>
<td>55 (1972-94)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 (1996/98)</td>
</tr>
<tr>
<td></td>
<td>LMFBR</td>
<td>2 (1974)</td>
</tr>
</tbody>
</table>

(a) Initial criticality for SuperPhenix in 1986.
INDUSTRIAL FUEL CYCLE

Policy: Maintain full domestic fuel cycle capability and aggressive export of fuel cycle, products, 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 or clay). Immobilize LLW in bitumen, concrete, or resin and dispose in engineered surface facility.

<table>
<thead>
<tr>
<th>Cumulative (PWR)</th>
<th>1990</th>
<th>1993</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF Arisings, t U</td>
<td>7,300</td>
<td>10,000</td>
<td>19,000</td>
</tr>
</tbody>
</table>

Industrial-Scale Activities

- Uranium mining and milling (t U/yr): 1100 (1994)

- Uranium enrichment (k SWU/yr)
  - Eurodif, gaseous diffusion: 10,800

- Fuel fabrication (t HM/yr)
  - UO₂: 1,600
  - MOX: 50 (LWR fuels)

- Spent fuel reprocessing (t/yr)
  - Marcoule: 400 (U metal fuels)
  - La Hague: 1,600 (LWR fuels)

Major Milestones

- Melox (MOX fuel fabrication plant-Marcoule) 1995
- TRU disposal facility 2000
- Underground Research Laboratory (completion date uncertain)
- HLW (glass) disposal facility 2000
INTERNATIONAL RELATIONSHIPS

DOE/CEA Umbrella Agreement for Cooperative Radioactive Waste Management Technology Exchange

Term: 07-26-83 to 07-26-93 (extension in process)

Scope: Preparation/packaging, D&D, waste/spent fuel storage, geologic disposal, transportation requirements; 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 Nuclear Transport, Ltd. (Transnucléaire).

ORGANIZATION

- CEA (Atomic Energy Commission): controls practically all nuclear R&D.

  Nuclear Research Centers: Cadarache, Fontenay-aux-Roses, Grenoble, Valrbo, Saclay.

- CEA INDUSTRY: Industrial holding concerned with all industrial fuel cycle activities in France.

  - TECHNICATOME (CEA 90%): design, construction, operation of fuel cycle and/or waste facilities.

  - STMI (CEA 60%): waste management, decontamination, dismantling services.

- COGEMA (CEA 89.2%): nuclear fuel cycle.

- COMURHEX (COGEMA 100%): uranium conversion.

- EURODIF (COGEMA 56.5%): commercial enrichment.

- SICN (100%), FRAGEMA (50%), FBFC (49%), COMMDOX (60%) - COGEMA subsidiaries: fuel fabrication.
FRANCE

- SGN (COGEMA 66%): engineering.
- TRANSNUCLÉAIRE (51% COGEMA): transport.


- EdF (Electricité 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).

- Framatome
Minister of Industry, Telecommunication and Tourism

- ANDRA - Yves Kaluzny

- CEA High Commissioner - Robert Dautray
  Chairman R&D - Yannick d'Escatha
  Deputy Chairman - Yannick d'Escatha
  Chairman Industry - Philippe Rouvillois/
  Yannick d'Escatha

CEA OPERATIONS UNITS

- DAM - Military applications - Jacques Bouchard
- IPSN - Institut de Protection/de Sûreté
  Nucléaire - Philippe Vesseron
- DSM - Direction des Sciences de la Matière -
  Catherine Cesarsky
- DSV - Direction des Sciences du Vivant -
  André Syrota
- DRN - Direction des Reacteurs Nucléaires -
  Bertrand Barré
- DCC - Direction du Cycle du Combustible -
  Noel Camaroat
- DTA - Direction des Techniques Avancées -
  Alain Bugat
- INSTN - Institut des Sciences et Techniques
  Nucléaires - T.P. Georges Carola

RESEARCH CENTERS

- CEN

COGEMA

- La Hague Center
  - Reprocessing (LWR)
  - AVH - Vitrification
- Marcoule Center
  - AVM - Vitrification
  - Melox - MOX fuel fabrication
CEA RESEARCH CENTERS (CEN)

- Cadarache - Michel Suscillon, Director
  • TRU waste and LLW/ILW
  • Environmental

- Fontenay-aux-Roses - Alain Debiar, Director
  • Disposal R&D
  • MOX fuel
  • TRU waste and LLW/ILW
  • Engineered barriers
  • Safety and health protection

- Grenoble - Jean-Pierre Leroux, Director

- Saclay - Eliane Loquet, Director
  • MOX fuel fabrication
  • TRU waste and LLW/ILW treatment
  • Engineered barriers

- Valrdo - Claude Vergne, Director
  • APM - Reprocessing (metal)
  • FBR fuel cycle
  • Reprocessing
  • HLW
  • TRU waste and LLW/ILW R&D
ANDRA (National Agency for Radioactive Waste Management)

Agence Nationale pour la Gestion des Déchets Radioactifs
Poore de la Oapix R. Pasichie
1/7 Rue Jean Monet
92298 Chalenay-Malabry Cedex
France
Tel: 33-1-41-17-8000
Fax: 33-1-41-17-8100

Director
Deputy Director
Yves Kaluzay
Armand Faussat

Function: Design, site, construct, and manage long-term waste disposal facilities; establish radioactive waste packaging/disposal specifications and ensure compliance; contribute to R&D programs related to long-term waste disposal.

Facilities

• Centre de la Manche
B.P. 808
50448 Beaumont-Hague
Tel: 33-16-33-52-78-65


• Centre de l'Aube
B.P. 7
10200 Soulaines-Dhuys
Tel: 33-16-25-92-33-00

Mission: Replace La Manche site as disposal facility for ILW/LLW; located 120 miles east of Paris, in Aube; covers about 250 acres and will accommodate 1,000,000 m³ of ILW/LLW over a period of 30 years.
BRGM (Bureau of Geological and Mineral Research)

Bureau de Recherches Géologiques et Minières
B.P. 6009
45060 Orléans Cedex 2
France

Tel: 33-38-64-36-34
Fax: 33-38-64-36-43

Director
Managing Director, Geology
Waste Storage
Hydrogeology
Geotechnology

Jean Pierre Hugon
H. Astie
P. F. R. Peaudercerf
J. J. Collin
P. Masure

CEA (Atomic Energy Commission)

Commissariat à l'Energie Atomique (CEA)
Centre d'Etudes Nucléaires (CEN)
31-33, Rue de la Federation
75752 Paris Cedex 15
France

Tel: 33-1-40-56-10-00
Fax: 33-1-42-53-91-22

Yannick d'Escatha
Robert Dautray

Function: Responsible for R&D related to all areas of the nuclear fuel cycle through activities of several operational units (scientific directorates), research centers, and wholly/partially owned industrial concerns.
CEA-IPSN (Institute for Nuclear Safety)

Institute de Protection et de Sûreté Nucléaire (IPSN)
B.P. 6
92260 Fontenay-aux-Roses
France
Tel: 33-1-46-54-70-80
Fax: 33-1-47-35-14-23

Director
Philippe Vesseron
Michel Livolant
Daniel Queniart
Christian Devillers
Annie Sugier
Patricia Gourmelon
A. Chalot
G. Déan

Function: Research and development in environmental safeguards/security.

CEA/CEN-CA (Cadarache Nuclear Research Center)

Centre d'Etudes Nucléaires de Cadarache
13108 Saint Paul Lez Durance Cedex
France
Tel: 33-42-25-70-00
Fax: 33-42-25-45-45

Director
Michel Suscillon

Location: 65 km from Marseille-Marignane Airport (by car).

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

(concl next page)
Facilities

- Solid Waste Treatment Pilot Plant (Prolixe, Elise)
  Mission: TRU solid waste reduction by cryogenic crushing; Pu recovery by acid leaching.
  Design Capacity: Eight 100-liter drums/batch, one batch every 24-48 hours.
  History: Startup, 1985.

- Bituminization Plant
  Design Basis: Immobilize reactor wastes; twin-screw extruder; capacity, 260 m³/yr.
  History: Startup, 1977.

- LLW Incinerator

- Resin Embedding Pilot Facility

- Solvent Incinerator

**CEA/CEN-FaR (Fontenay-Aux-Roses Nuclear Research Center)**

Centre d'Etudes Nucléaires
de Fontenay-aux-Roses
B.P. 6
92265 Fontenay-aux-Roses Cedex
France

Tel: 33-1-46-54-70-80
Fax: 33-1-46-54-75-22

Director

Alain Debiar
CEA/CEN-G (Grenoble Nuclear Research Center)

Centre d'Etudes Nucleaires
de Grenoble
17, rue des Martyrs
38054 Grenoble Cedex 09
France
Tel: 33-76-88-44-00
Fax: 33-76-88-34-32

Director
Jean-Pierre Leroux

Facilities

- Waste Resin Embedding Facility

CEA/CEN-S (Saclay Nuclear Research Center)

Centre d'Etudes Nucléaires
de Saclay
91191 Gif-sur-Yvette Cedex
France
Tel: 33-1-69-08-60-00
Fax: 33-1-69-08-79-90

Director
Eliane Loquet

Dir., Fuel Cycle (DCC)
Noël Camaroat

Facilities

- Bituminization Plant (radioactive)
- Metal Waste Melter (startup, 1985)
Facilities

- **APM** (Cogema-operated demonstration reprocessing plant for FBR, MOX, and high-burnup fuels)
  
  **Mission**: Develop technology for FBR, MOX, and high-burnup fuels.
  
  **Design Basis**: PUREX flowsheet, mixer-settlers, and pulsed columns; 5 t HM/yr.

- **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 m³ HLW/yr; product, borosilicate glass blocks, 25-cm diameter by 2.5 m high.

  **History**: Decommissioned, then dismantled in 1991.

- **PIVER II** - Vitrification of HLW from APM (delayed)

- **Hull Fusion Non-Radioactive Prototype** - Startup, 1984

- **Hull Fusion Radioactive Facility in APM** - Startup, 1993

- **PEV Prototype** (full-scale, nonradioactive R7/T7 vitrification process) - Startup, 1984.
COGEMA (Fuel Cycle Company)

Cogema Direction Generale
2, Rue Paul-Dautier
B.P. 4
78141 Velizy-Villacoublay Cedex
France
Tel: 33-1-39-26-80-00
Fax: 33-1-39-26-27-00

President, CEO, COB
Jean Syrota
Executive Vice President
Christian Gobert
V.P., Reprocessing Division
Jean-Louis Ricaud
V.P., Uranium Division
Yues Coulier
V.P., International Affairs
Jean Pierre Roclother

Cogema, Inc.
7401 Wisconsin Ave.
Bethesda, Maryland 20814-3416
Tel: 301-986-608585
Fax: 301-652-5690

President, CEO
Michael McMurphy
V.P. Market Development
Frank A. Shallo

NUMATEC, Inc.
Subsidiary of Cogema, Inc.
7401 Wisconsin Ave.
Bethesda, Maryland 20814-3416
Tel: 301-986-8585
Fax: 301-652-8479

President
Robert Ihde

COGEMA-LA HAGUE

Cogema, Centre de La Hague
B.P. 508
50105 Cherbourg Cedex
France
Tel: 33-33-03-60-00
Fax: 33-33-02-60-13

Director
M. Lederman
33-33-03-60-01

(contd next page)
COGEMA-LA HAGUE (contd)

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. Transfer of all reprocessing of gas/graphite fuels to Marcoule UP1 has been completed, and La Hague is devoted to treating LWR fuels with occasional FBR fuel campaigns.

Facilities

- **UP2 (fuel reprocessing plant)**
  
  **Mission**: Reprocess oxide fuels from LWRs and Phenix FBR (Phenix fuel was reprocessed from 1979 to 1984, diluted with natural uranium fuel for criticality control).
  
  **Design Basis**: PUREX flowsheet, oxide fuels: shear-leach head-end oxide (HAO); remote maintenance.
  
  **Capacity**: 400 t/yr of LWR fuels.
  
  **History**: UP2 startup, 1967; HAO startup, 1976. From June 1976 through December 1993, total HAO throughput was 4,091 t HM fuel from LWRs and 10 t HM from Phenix.

- **UP2-800 (fuel reprocessing plant)**
  
  **Mission**: Reprocess UO₂ and MOX fuels from French LWRs.
  
  **Design Basis**: Progressive expansion of UP2 plant from 400 to 800 t HM/yr of LWR fuel started in 1984, to be completed in 1994. Chop-leach head-end, PUREX flowsheet, AVM vitrification process [R7 vitrification plant: rotary calciner, metallic melter; capacity, 600 m³/yr HLW feed three lines - 60 L/hr HLW, 25 kg/hr glass; canister dimensions: 42 cm diameter x 1.3 m high (400 kg glass)].
  
  **Capacity**: 800 t HM/yr.
  
  **History**: Startup, 1994; R7 startup, 1989.

- **UP3 (fuel reprocessing plant)**
  
  **Mission**: Reprocess LWR fuels.
  
  **Design Basis**: Chop-leach head-end; PUREX flow-sheet; AVM vitrification process (T7 plant: identical to R7 vitrification plant).
  
  **Capacity**: 800 t HM/yr.
  
  **History**: Startup, 1990; throughput of 1,626 t HM as of December 1993.

(contd next page)
• STE3 (liquid waste treatment facility)
  Mission: Processing/encapsulation in bitumen of LLLW and ILW from reprocessing of spent fuel at the La Hague installations.
  History: Startup, 1989.

COGEMA-MARCOULE

Cogema, Centre de Marcoule
B.P. 170
30200 Bagnols-sur-Ceze
Marcoule, France
Tel: 33-66-79-60-00
Fax: 33-66-89-38-50

Location: Approx. 70 km from Marseille-Marignane Airport (by train or car), near Avignon.

Director
Hughes Delaunay
Reprocessing Plant
Maurice Mellano
AVM Manager
Jean-Claude Batailles-Lannes

Facilities

• UP1 (reprocessing plant)
  Mission: Reprocess magnesium-clad natural uranium metal fuels from military reactors.
  Design Basis: Mechanical declad; PUREX flowsheet; contact maintenance.
  Capacity: 400 t U/yr of reactor fuel (gas/graphite).
  History: Startup, 1958; 5,085 t U total gas/graphite power reactor fuels processed up to December 1993.

• AVM (Ateliers de Vitrification de Marcoule)
  Mission: Demonstrate AVM process: vitrify Marcoule UP1 wastes.
  Design Basis: Rotary calciner feeding an induction-heated metallic melter; nominal capacity 30-L/hr HLW feed and 360 kg/d (one canister) borosilicate glass product; waste form, glass blocks 0.5 m diameter x 1.0 m high.

(contd next page)
COGEMA-MARCOULE

History: Hot startup, June 1978; as of December 1993, 2,145 glass canisters.

- Incinerator
- Bituminization Facility
- Melox: MOX fuel fabrication (120 t HM/yr) - 1995.

**DAM (Directorate of Military Applications)**

Direction des Applications Militaires
Commissariat à l'Energie Atomique
31-33 Rue de la Fédération
B.P. 510
75752 Paris, Cedex 15
France
Tel: 33-1-40-56-10-00
Fax: 33-1-40-56-14-29

Director, Quality/Security
Jean Ohmann

**ENSM (PARIS SCHOOL OF MINES)**

Ecole Nationale Supérieure des Mines de Paris
Centre d'Informatique Géologique
35 Rue Saint-Honore
77305 Fontainebleau France
Tel: 33-1-64-22-48-21
Fax: 33-1-64-22-39-02

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

Waste Management R&D: Geologic waste isolation (fluid flow, heat transport/mass transport studies; theoretical, lab/field tests).
FBFC (Franco-Belge Company for Fuel Fabrication)

Société Franco-Belge de Fabrication de Combustibles
Tour Fiat, Cedex 16
92084 Paris la Défense
France

Tel: 33-1-47-96-56-00
Fax: 33-1-47-96-56-03

Director General
Philippe Darmayan

Facilities

- **Fuel Fabrication Plant (Romans, France)**
  Mission: Fabricate UO₂ fuels for power reactors.
  Design Capacity: 750 t HM/yr.

- **Fuel Fabrication Plant (Pierrelatte, France)**
  Mission: Fabricate UO₂ fuels.
  Design Capacity: 400 t HM/yr.

- **Fuel Fabrication Plant (Dessel Belgium)**
  Mission: Fabricate UO₂ fuels.
  Design Capacity: 450 t HM/yr.

SGN

Société Générale pour les Techniques Nouvelles
1 Rue des Hérons
Montigny-le-Bretonneux
78182 Saint-Quentin en Yvelines Cedex
France

Tel: 33-1-30-58-60-00
Fax: 33-1-30-58-65-22

Chairman/Board, CEO
Colette Lewiner
CEO, Eng. Branch Leader
Serge Lefranc

Function: Provide a variety of services related to the fuel cycle.
Transnucleaire
11 Rue Christophe-Colomb
75008 Paris
France

Chairman
Jean Louis Ricaud

Technical Manager
B. Kirchner

Function: Provide spent fuel/radwaste storage and transport services.
GERMANY

MAJOR PUBLIC HOLIDAYS (1995)

<table>
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TIME

Standard Time Washington, D.C.
Daylight Saving Time Period: + 6 hours
03/27 - 09/24/95

PASSPORT/VISA

A passport is needed to depart and re-enter the U.S. 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 U.S. $ = 1.75 Mark (DM) per Wall Street Journal, 11/08/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to Germany are complete as listed, after dialing international access code: 011. Country code is 49 listed local numbers include city code.

U.S. EMBASSY - BONN

American Embassy
Deichmanns Aue 29
53170 Bonn, Germany

Tel: 49-228-339-1
Fax: 49-228-339-2663

Science Counselor
Richard R. Ries
<table>
<thead>
<tr>
<th></th>
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<th>81</th>
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</table>
INDUSTRIAL FUEL CYCLE

Policy: Full commercial capability, enrichment, fuel fabrication, plutonium recycle to LWRs; reprocessing is to be handled by foreign plants. The amendment of the German Nuclear Act of 1994 permits to handle S. F. in both ways via reprocessing or via direct final disposal.

Waste Management Strategy: Vitrification of HLW (by foreign plants) and interim storage of HLW glass; disposal of reprocessing wastes in future salt-dome repository; interim storage of ILW/LLW wastes; future disposal of reactor and decommissioning wastes in abandoned iron mine or salt repository.

Cumulative SF Arisings (LWR)  
1990  3,800 t U  
2000  10,150 t U  

Cumulative LLW/ILW Arisings  
2000  175,000 m³ conditioned, radioactive waste with negligible heat production  

Cumulative Heat-Producing Waste Arisings  
2000  3,250 m³ conditioned, radioactive waste with heat production  

Industrial-Scale Activities

- Fuel fabrication capacity  
  - UO₂ fuel: 1500 t U/yr  
  - MOX fuel: 130 t HM/yr-LWR/10 t HM/yr-FBR fuel elem. (no operating license shut down decision passed)

- AFR spent fuel storage capacity  
  - 1,500 t dry storage (Gorleben)  
  - 1,500 t dry storage (Ahaus)
Major Milestones

- Acceptance of HLW from Cogema/La Hague and BNFL/Sellafield 1995
- Konrad (iron mine) repository (date pending) 1997/98
- Gorleben repository, HLW 2010

INTERNATIONAL RELATIONSHIPS

DOE/BMFT Agreement for Cooperative Radioactive Waste Management Technology Exchange

Term: 12-20-74 to 06-30-__ (has been extended in November 95)

Scope: Geologic disposal in salt deposits; retrievable surface storage; D&D; operational aspects of LL/ILW storage and disposal; transportation. Emphasis: waste treatment technology (design/operation of HLW vitrification pilot plants, conditioning of LLW/TRU wastes, waste form characterization), waste package development; collaboration with in situ tests at Asse salt mine; U.S. observation of shaft drilling at the Gorleben repository site; cooperation in tests of transport/storage casks; and waste transportation studies.

Member of EC, IAEA, and OECD/NEA. Cooperative agreements and joint projects as well as commercial activities with numerous countries.

ORGANIZATION

- Federal Government
  - Coordinate nuclear program
  - Sponsor R&D
  - Construct/operate radioactive waste disposal facilities
  - Establish licensing requirements

- States (Länder)
  - License nuclear installations
  - Provide LLW interim storage

- Utilities
  - Provide spent fuel/reactor waste storage, contract for reprocessing and waste treatment
  - Pay for waste transport and disposal

GE-3
GOVERNMENT RESPONSIBILITIES
NUCLEAR FUEL CYCLE/WASTE MGMT.

BMFT (Federal Ministry for Education and Research)
- Government fuel cycle/waste management R&D program administration

GSF/IfT
- Geologic waste disposal R&D
- Supporting lab work - salt properties
- Asse studies

FZK
- LWR fuel cycle waste treatment/packaging R&D
- LWR SF management alternatives - R&D
- HLW vitrification R&D
- Support work - geological/direct disposal of waste

KFA
- Waste treatment
- Support work - LLL/ILW disposal, including HTGR fuel elements

BMW (Federal Ministry for Economics)

BGR
- Geologic survey
- Salt dome repository R&D (salt properties, rock mechanics)
GOVERNMENT RESPONSIBILITIES
NUCLEAR FUEL CYCLE/WASTE MGMT. (contd)

BMU (Fed. Ministry-Environmental Protection/Reactor Safety)
- Storage/transp./disposal of rad. Wastes
- Supervision of state licensing procedures
- Nuclear safety/radiation protection

RSK (Reactor Safety Commission)

SSK (Radiation Protection Commission)

BfS
- Transportation/storage/licensing
- Responsibility for repository
  Construction/operation

LÄNDER (State Governments)
- Licensing of nuclear installations
- NMU (Lower Saxony Ministry of Environment)
- Licensing of final repositories (Konrad and Gorleben)

INDUSTRIAL/UNIVERSITY RESPONSIBILITIES

-DBE - Owned by 4 shareholders (one of them is GNS
  - Construction/operation (repositories)
  - Gorleben and Konrad projects
  - Morsleben LLW disposal facility (ERAM)

DWK - Owned by Nuclear Utilities

WAK (DWK Subsidiary)

NUKEM - Owned by RWE
- LLW/TRU waste treatment R&D facility design
- R&D SF packaging for disposal
GERMANY

GNS - Owned by Nuclear Utilities
- Waste treatment/conditioning
- Transportation of radioactive materials
- Shipping cask development
- Engineering/D&D services

- BLG (GNS Subsidiary)
  - Operation of Gorleben SF/LLW storage facilities
  - Construction of PKA

- BZA (GNS Subsidiary)
  - Operation of Ahaus SF interim storage facility

NCS - Nuclear Cargo Service
- Transportation of radioactive materials
  (owned by Deutsche Bahn AG)

SBH - Owned by Siemens AG
- Fabrication of uranium/MOX fuels, including R&D/waste management

TUM - Technical University Munich
- Actinide chemistry R&D
BAM (Federal Materials Research/Testing Institute)

Bundesanstalt für Materialforschung und -prüfung (BAM)
Unter den Eichen 87
12205 Berlin, Germany
Tel: 49-30-8104-0
Fax: 49-30-811-5066

Function: Testing and evaluation of materials used in nuclear programs.

BfS (Federal Institute for Radiation Protection)

Bundesamt für Strahlenschutz
Postfach 10 01 49
38201 Salzgitter, Germany
Tel: 49-5341-188-0
Fax: 49-5341-188-188

Chief Executive
Alexander Kaul
Vice-President
H. Rösel

BfS, Department of Nuclear Waste Disposal/Transport
Bundesallee 100
38116 Braunschweig, Germany
Tel: 49-531-592-7601
Fax: 49-531-592-7614

Director
Helmut Röthermeyer
Bruno Thomauske
Heinrich Illi
Peter W. Brennecke
49-531-592-7641

Geoscience
Radiology/Radiation Protection
System Analysis
Dir., Transport/Storage of Rad. Mtl./Fuel Cycle

Function: Execution of the federal responsibilities concerning testing/standards for radiation protection, nuclear safety, radioactive waste disposal, and transport/storage of radioactive materials; in particular, responsible for construction and operation of repositories.

(contd next page)
Facilities

- **Gorleben Site** (planned repository), 100 km northeast of Braunschweig
  **Mission:** disposal of all types of solid radioactive waste.
  **Repository Concept:** 300- to 600-m-deep boreholes in tunnel floors at depths of about 850 m in the Gorleben salt dome.
  **Milestone:** startup of disposal, 2010.

- **Konrad Site** (planned repository in a former iron ore mine), 10 km southwest of Braunschweig.
  **Mission:** disposal of waste with negligible thermal impacts on host rock formation.
  **Milestone:** Startup of disposal, 1997/98.

- **Marsleben Site** (ERAM), 40 km west of Magdeburg, former salt mine
  **Mission:** LAW disposal facility
  **Milestone:** Startup of disposal 1981

---

**BGR (Federal Institute for Geosciences and Natural Resources)**

Bundesanstalt für Geowissenschaften und Rohstoffe
Stilleweg 2
Postfach 510153
30655 Hannover, Germany

Tel: 49-511-643-0
Fax: 49-511-643-2304

Director, Engineering,
Geology/Geotechniques
Rock Mechanics
Engineering Seismology
Salt Mechanics
Mining Rock Mechanics
Salt Geology
Numerical Modeling
Hydrogeology
Groundwater Geophysics

Michael Langer
A. Pahl
R. Lüdeling
H. Albrecht
D. Meister
W. Jaritz
Manfred Wallner
H. Vierhuff
W. Giesel

(continued on next page)
Function: Responsible to BMWI for all geological/geotechnical aspects related to planning, construction, and operation of a final repository for radioactive wastes; conducts special research for BMU.

**BMFT (Federal Ministry for Research and Technology)**

Bundesministerium für Bildung und Forschung

Heinemannstrasse 2
Postfach 200240
53175 Bonn, Germany

Minister, Science/Technology: Jürgen Rüthgers
Director General, Energy: Eckhard Lübbe
Fuel Cycle/D&D: Klaus Komorowski
Waste Mgmt./D&D/Fuel: B. Abendroth
U Enrichment/Safeguards: A. H. Remagen
Waste Disposal: Diethard Lummerzheim
Direct Disposal: Hans G. Riotte
Geological Disposal: W. Busch

Function: Responsible for R&D programs on fuel cycle and radioactive waste management.
BMU (Federal Ministry for Environmental Protection/Reactor Safety)

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit
Kennedyallee 5
53175 Bonn, Germany
Tel: 49-228-305-0
Fax: 49-228-305-3225

Minister
Angelika Merkel
Hennen Lüden

M. Stein Kempen
49-228-305-2805

Director, Radiation Protection
Dr. Goust
49-228-305-2905

Director, Fuel Cycle
Arnolf Matting
49-228-305-2950

Policy
Dr. Brocking
49-228-305-2930

Reprocessing/Conditioning
K. H. Berg
49-228-305-2821

Treatment/Storage/Transp.
Herbert Dreisvogt
49-228-305-2721

Final Repository
Manfred Bloser
49-228-305-2951

Chairman, Reactor Safety Commission (RSK)
Adolf Birkhofer

Chairman, Radiation Protection Commission (SSK)
Christian Steffen

Function: Responsible for storage, transportation, and disposal of radioactive wastes; supervision of state licensing procedures; federal standards for nuclear safety and radiation protection.
DBE (German Company for Construction/Operation of Waste Disposal Facilities)

Deutsche Gesellschaft zum Bau und Betrieb von Endlagern für Abfallstoffe mbH
Woltorfer Strasse 74
31224 Peine, Germany

Managing Directors
Jürgen P. Lempert
Manfred Florl
Hans-Jürgen Krug
Wolfgang Schulz
Rüdiger Putzer
Hans-Jürgen Engelmann

Activities: Conceptual design of repositories; site investigations; construction of surface/subsurface facilities for repositories; heat-related stress analyses; development of emplacement techniques; construction of emplacement equipment; risk assessments; safety analysis operational and post-operational phases; design/construction of engineered barriers.

DWK (German Fuel Reprocessing Company)

Deutsche Gesellschaft für Wiederaufarbeitung von Kernbrennstoffen mbH
Baringstrasse 6
30022 Hannover, Germany

Manager
Bernd Zur Nedden

Function: Support WAK; resolve issues from consequences of cancellation of reprocessing plant Wackersdorf and resulting transfer of site from "nuclear" to "industrial"; plan for decommissioning/dismantling of WAK pilot-scale reprocessing plant.
**ERAM (LLW Repository)**

Endlager für Radioaktive Abläle Morsleben
Am Schacht 105  
39343 Morsleben, Germany

Manager  
Klaus Ebel  
49-39050-8-200

**Function:** Final repository for LLW of the former East Germany, now operated by DBE under contract to BfS.

**FZR (Forschungszentrum Rossendorf)**

Research Center Rossendorf, Inc.

The Research Center Rossendorf, Inc. ("FZR"), is located on the eastern outskirts of Dresden. It was founded in January 1992 on a research site existing since 1956.

The Research Center Rossendorf, Inc. Is engaged in pure and application oriented basic research. Research topics are Biomedicine/Chemistry, Radioecology, Materials Science, Nuclear Physics, and Safety Research.

The FZR is funded in equal parts by the Federal Republic of Germany and Free State of Saxony. Permanent staff are approximately 450 people. Additionally, there is a scientific staff of about 150 people mainly based on project sources. The FZR operates several different linear accelerators and cyclotrons and other special experimental facilities.

Scientific Director:  
W. Hafele  
Tel: 49-351-260-3350

Administrative Director:  
G. Panuewski  
Tel: 49-351-260-3350

- Research Divisions
- Technical Divisions
- Publications
- WWW

(contd next page)
FZU (contd)

FORSCHUNGSGESELLSCHAFT ROSSENDORF e.V.
P.O. Box 51 01 19
D-01314 Dresden
Tel: 49-351-260-0
Fax: 49-351-269-0461

Research Divisions

Institutes:
- Ion Beam Physics and Materials Research
- Bioinorganic and Radiopharmaceutical Chemistry
- Radiochemistry
- Nuclear and Hadronic Physics
- Safety Research

Director: H. Mitsche
Tel: 49-351-260-3210


Scientific Departments:
- Experimental facilities and information technology
- Analytical Chemistry
- New Accelerators

Technical Divisions:
- Communication and data processing
- Library
- Technical Services
- Safety and Security
GNS (Company for Nuclear Service)

Gesellschaft für Nuklear-Service mbH
Hollestrasse 7A
45130 Essen, Germany

Managing Directors
Wolfgang Hawickhorst
49-201-109-1200
Klaus Janberg
49-201-409-1400
Norbert Semann
49-201-109-1600

Function: Service to nuclear facilities, including waste treatment/conditioning, transportation of radioactive materials, shipping cask development, and facility dismantling.

Ownership: Nuclear utilities.

Facilities

- AFR Spent Fuel Storage Facilities (Gorleben and Ahaus sites, operated by GNS subsidiaries, BLG, and BZA, respectively)
  Design Basis: Dry storage in CASTOR casks - 400 casks (in 183 x 138 x 19-m-high building).
  Capacity: 1500 t each facility.
  History: Startup of AFR at Gorleben has been delayed due to litigation. Ahaus went into operation in 1992.

- PKA Pilot Fuel Conditioning Plant (Gorleben)
  Mission: Demonstration of SF conditioning and encapsulation to meet the requirements for interim storage and final disposal.
  Design Basis: Hot cell with installations for rod consolidation, compaction of fuel assembly hardware, loading of canisters; maximum throughput 35 t HM/yr.
  Milestone: Startup, 1996.
GRS (Company for Reactor Safety)

Gesellschaft für
Reaktorsicherheit mbH
Schwertnergasse 1
50667 Köln, Germany
Tel: 49-221-2068-0
Fax: 49-221-2068-442

General Manager
Adolf Birkhofer

Function: Provide technical support to BMU and other regulatory/licensing entities concerned with reactor safety issues.

GSF/FBA (Research Center for Environmental Sciences/Asse Research Mine)

GSF-Forschungbergwerk Asse
Postfach 1461
38284 Wolfenbüttel, Germany
Tel: 49-5336-880
Fax: 49-5336-89379

Director:
Manfred W. Schmidt
Tel: 49-5336-89-219

Scientific Advisor
Volker Schauermann
Tel: 49-5336-89-232

Mine Surveying:
Gerd Hense
Tel: 49-5336-89-213

Radiation Protection:
Herbert Meyer
Tel: 49-5336-89-234

Finance/Controlling
Rolf Stippler
Tel: 49-5336-89-360

Construction:
Helmut Kolditz
49-5336-89-350

Facilities
- Asse Research Mine (12 km southeast of Wolfenbüttel) 38319
  Remlingen, Germany
  Tel: 49-5336-890

Mission:
- In-situ-testing for a salt dome repository
- Backfilling of old mine workings
- From 1967 through 1978, disposal of LLW and HLW.
KFA (Jülich Research Center)

Forschungszentrum Jülich GmbH
Postfach 1913
52245 Jülich, Germany
Tel: 49-2461-61-0
Fax: 49-2461-61-5327

Director, Institute of Chemical Technology (ICT) TBD
Hubertus Nickel 49-2461-61-3058
Heiner Brücher 49-2461-61-6409

Director, Institute of Reactor Materials (IRW) Stephan R. Halaszovich 49-2461-61-5288
Reinhard Odoj 49-2461-61-6190

ILW/SF/HTGR Fuel Disposal Günter Pott 49-2461-61-3196

Waste Treatment (ZFK-DE)

Quality Assurance (PKS)

Hot Cell Facility (GHZ)

Function: Develop advanced waste management technologies.

Activities: Hot cell experiments dealing with the development of advanced ILW/HLW conditioning processes; characterization of waste products/packages; conditioning of radioactive wastes generated from research center; development/demonstration of quality assurance measures for waste packages; retrievable in situ testing of ILW disposal techniques in Asse salt mine, including direct disposal of HTR fuel elements; LLW incineration using Jülich furnace design.

FZK (Research Center Karlsruhe)

Kernforschungszentrum Karlsruhe GmbH
Postfach 3640
76021 Karlsruhe, Germany
Tel: 49-7247-820
Fax: 49-7247-82-5070

(Contd next page)
FZK (contd)

Director, Inst. for Technology and Institute for trade Chemistry (ITC)  
Director, Institute for Nuc. Waste Technology (INE)  
Process Engineering  
Director, Institute for Radiochemistry (IRCh)  
Director, Ctrl. Eng. Dept. (HIT)  
Decommissioning of WAK and research reactors, operated by FZK  
Program Management "Entsorgung" (PTE)

Facilities

- Ceramic Melter  
  Mission: HLW vitrification process development with ceramic melter for the PAMELA pilot plant.
  
  Design Basis: Liquid-fed, joule-heated melter; PAMELA capacity: 30 L/hr HLLW or 30 kg/hr glass.
  
  History: Startup PAMELA melter, 1976; Mark 1, 1985, hot; Mark 2, 1990, cold; Mark 3 1993, cold.

- Waste Concreting Plant (radioactive)  
  Mission: Immobilize KfK ILW.
  Design Capacity: 1.2 m³/d waste.
  History: Startup, 1986.
NMU (Lower Saxony Ministry of Environment)

Niedersächsisches Umweltministerium
Archivstrasse 2
Postfach 4107
30041 Hannover, Germany
Tel: 49-511-104-0
Fax: 49-511-104-3399

Minister
Monika Griefahn

Dir., Nucl. Energy/Rad. Protection
Klaus-Dieter Becherer

Final Repositories
Klaus-Arno Beckers
49-511-104-3550

NFC (WM/Reprocessing/SF)
Dietmar A. Kopp
49-511-104-3503

Function: State authority for licensing of nuclear facilities in Lower Saxony, including planned repositories at Gorleben and Konrad.

NUKEM

NUKEM GmbH
Industriestrasse 13
P.O. Box 1313
63754 Alzenau, Germany
Tel: 49-6023-91-01
Fax: 49-6023-91-1222

Managing Directors
L. Aumüller, H. A. Pirk
H. W. Binzel,
P. Schmidt
O. Prahls

Process Engineering

Fuel Cycle Services
H. Keese

Non-Destructive Testing
H. Hüschelrath

Environmental Technology
P. G. Maurer

Solar Energy Technology
W. Hoffmann

Nuclear Engineering
E. Wehner

Function: Nuclear fuel cycle services; environmental technology; hazardous waste/toxic residues treatment; off-gas/exhaust gas treatment; mist eliminator filters; general/nuclear process engineering; safety engineering; container systems.
DETEC

Decommissioning Technologies, GmbH
Industriestrasse 13
63755 Alzenau, Germany
Tel: 49-6023-91-04
Fax: 49-6023-91-1222

Managing Directors
Gerwin Rasche
Peter Mildwein

Function: Provide services for D&D, engineering, remote handling systems.

SBH

Siemens AG Brennelementewerk Hanau
Postfach 110060
63434 Hanau, Germany
Tel: 49-6181-58-0
Fax: 49-6181-58-3502

Production Manager
Jürgen Krellmann
49-6181-58-4599
F. W. Ledebrink
49-6181-58-4169

Function: Fabrication of uranium fuel for BWR/PWR and MOX for BWR/PWR, including R&D on waste management.

Facilities

Fuel Fabrication Plants
Capacity: UO₂ - 1500 t HM/yr LWR fuel
(Will be decommissioned in 1995).
MOX - 130 t HM/yr LWR fuel or 10 t HM/yr FBR fuel
(Plant constructed, no operating license will be decommissioned).
**TUM (Technical University Munich)**

Technische Universität München  
Institut für Radiochemie  
Walther-Meissner-Strasse 3  
85748 Garching b. München  
Germany  
Tel: 49-89-3209-220  
Fax: 49-89-3209-2204  
Director  
Franz Baumgärtner

**VKTA (Nuclear Engineering/Analytics Company)**

Verein für Kernverfahrenstechnik  
und Analytik Rossendorf e.V.  
Postfach 510 mg  
01314 Dresden, Germany  
Tel: 49-351-260-0  
Fax: 49-351-269-0461  
General Manager  
Wolf Häfele  
49-351-260-3350

Activities: Decommissioning nuclear facilities of the former Central Institute for Nuclear Research (ZfK Rossendorf): zero power reactors, RFR research reactor (10 MW), and special radioisotope production facilities; waste treatment/nuclear services; nuclear/chemical analyses; assessment of industrial/mining wastes; radioisotope production.

**Facilities**

- **ABÜS (Waste treatment plant)**  

- **SWA (Waste water processing/treatment plant)**  
  Treatment consisting of mechanical filtration, ion exchange for low-salt wastes, and evaporation for high-salt wastes and wastes containing boric acid.

- **Radioisotope Production Facilities**
WAK (Fuel Reprocessing Company)

Wiederaufarbeitungsanlage Karlsruhe
Betriebsgesellschaft mbH
Postfach 1263
76339 Eggenstein-Leopoldshafen
Germany

Tel: 49-7247-88-0
Fax: 49-7247-4755

Location: WAK and the WAK plant are located on the site of the Karlsruhe Research Center (WAK is a subsidiary of DWK).

Chief Executive
R. Heere
49-7247-88-2201

Technical Oversight and dismantling work
Horst P. Wiese
49-7247-88-2118

Plant Manager
Martin Weishaupt
49-7247-88-2298

Decommissioning
Klaus Eiben
49-7247-88-2117

Waste Conditioning/Transport
Joachim Fleisch
49-7247-88-2230

Facilities

- **WAK Reprocessing Plant** (owned by FZK)
  Mission: Reprocess UO₂ and MOX fuels; recover plutonium for recycle; test advanced technology.
  Design Basis: Chop-leach head-end; PUREX process; capacity, 0.175 t HM/d.
  History: On-line from September 1971 to early 1980, when it was shut down for dissolver replacement; operation resumed October 1982; total throughput to December 1990, approx. 210 t HM (130 t HM from LWR fuel); shut down December 31, 1990; decommissioning/dismantling plans in progress.

- **PAMELA Pilot Plant** (Mol, Belgium - ownership transferred to Belgoprocess in 1986; operated by WAK/Belgoprocess team)
  Mission: Demonstrate ceramic melter and VITROMET production with stored Eurochemic HLLW.

(contd next page)
**WAK** (contd)

**Design Basis:** Liquid-fed ceramic melter, 0.72 m² surface area; capacity, 36 L/hr feed, 25 kg/hr glass (three canisters/d of 150-kg glass/canister); product, borosilicate glass blocks, 0.3 m diameter by 1.2 m high.

**History:** Hot operation, startup 1985 (KfK development); as of August 1991: 910 m³ waste vitrified, 2,180 canisters filled; tanks now empty, plant in standby condition, to vitrify WAK-WAWC.
INDIA

MAJOR PUBLIC HOLIDAYS (1995)

<table>
<thead>
<tr>
<th>Jan 26</th>
<th>Republic Day</th>
<th>Jun 9</th>
<th>Muharram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb 27</td>
<td>Mahashivratri</td>
<td>Aug 10</td>
<td>Milad-un-Nabi</td>
</tr>
<tr>
<td>Mar 3</td>
<td>Idul Rotr</td>
<td>Aug 15</td>
<td>Independence Day</td>
</tr>
<tr>
<td>Mar 17</td>
<td>Holi</td>
<td>Aug 18</td>
<td>Janamask tam</td>
</tr>
<tr>
<td>Apr 13</td>
<td>Mahavir Jaganti</td>
<td>Oct 2</td>
<td>Mahatma Gandhi's Birthday</td>
</tr>
<tr>
<td>Apr 14</td>
<td>Good Friday</td>
<td>Oct 3</td>
<td>Dussehra</td>
</tr>
<tr>
<td>May 11</td>
<td>Idul Zuha</td>
<td>Oct 23</td>
<td>Festival of Lights</td>
</tr>
<tr>
<td>May 14</td>
<td>Buddha Purnima</td>
<td>Nov 7</td>
<td>Guru Nanak’s B’day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dec 25</td>
<td>Christmas</td>
</tr>
</tbody>
</table>

TIME

Standard Time Washington, D.C. + 9.5 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 U.S. $ = 34.6 Rupee

per Wall Street Journal, 11/08/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to India are complete as listed, after dialing international access code: 011. Country code is 91; listed local numbers include city code.

U.S. EMBASSY - NEW DELHI

American Embassy
Shanti Path
Chanakyapuri
New Delhi 110021, India

Science Counselor
Paul C. Maxwell

Tel: 91-11-600-651
Fax: 91-11-687-2391 (Embassy)
Fax: 91-11-687-6033 (Science office)
### Population

<table>
<thead>
<tr>
<th>Year</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>919.9</td>
<td>million</td>
</tr>
</tbody>
</table>

### Energy

<table>
<thead>
<tr>
<th>Year</th>
<th>Electric Power Capacity</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td></td>
<td>70.7</td>
<td>GWe</td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td>100</td>
<td>GWe</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Electric Power Production</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td></td>
<td>323.5</td>
<td>TWh</td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Nuclear Power

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

Due to resource and technical problems, it is doubtful that 1997 nuclear power forecasts (end of eighth five-year plan) can be met; commissioning of the 500 MW FBR by the year 2000 is highly unlikely.

<table>
<thead>
<tr>
<th>Year</th>
<th>Nuclear Power Capacity</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td></td>
<td>1.7</td>
<td>GWe</td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td>2.2</td>
<td>GWe</td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td>3.5</td>
<td>GWe</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Reactor Mix</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>BWR</td>
<td>2</td>
<td>(1969)</td>
</tr>
<tr>
<td></td>
<td>HWR</td>
<td>8</td>
<td>(1973-94)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>(1996-01)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Reactor Development</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>FBR</td>
<td>12-15 MWe</td>
<td>test unit</td>
</tr>
<tr>
<td>2000</td>
<td>FBR</td>
<td>500 MWe</td>
<td>commercial</td>
</tr>
</tbody>
</table>
INDUSTRIAL FUEL CYCLE

Policy: Achieve self-sufficiency in CANDU-type and LWR fuel cycle - uranium mining and milling, conversion to \( \text{UO}_2 \), fuel fabrication, reprocessing (in small plants adjacent to power stations); if enriched \( \text{UF}_6 \) supply for India's BWRs is cut off, they might fuel with \( \text{UO}_2 \)-PuO\(_2\).

Waste Management Strategy: Vitrification of HLW, interim storage for at least 20 years and geologic disposal in a crystalline rock formation; disposal of LLW and short-lived ILW in near-surface engineered facilities; disposal of long-lived ILW in a deep geological repository.

<table>
<thead>
<tr>
<th>Cumulative Spent Fuel Arisings (LWR/HWR)</th>
<th>1990</th>
<th>1,580 t U</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td></td>
<td>5,000 t U</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cumulative Waste Arisings</th>
<th>1982</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary solid wastes</td>
<td>1,700 m(^3)</td>
<td>107,000 m(^3)</td>
</tr>
<tr>
<td>LLW concentrates</td>
<td>2,500 m(^3)</td>
<td>77,000 m(^3)</td>
</tr>
<tr>
<td>ILW</td>
<td>650 m(^3)</td>
<td>20,000 m(^3)</td>
</tr>
<tr>
<td>HLW</td>
<td>350 m(^3)</td>
<td>8,000 m(^3)</td>
</tr>
</tbody>
</table>

Industrial-Scale Activities

- Heavy-water design capacity (t/yr): 1993 719
- Uranium mining and milling (t/yr): 1985 130; 1988 170
- \( \text{UO}_2 \) fuel fabrication (t/yr): 1984 210; 2000 1,500
- Fuel reprocessing (t/yr):
  - Trombay pilot plant 1962 30
  - Tarapur plant 1982 100
  - Kalpakkam plant 1992/93 100
- HLW vitrification: Tarapur (1985)
Major Milestones

- Interim Storage Plant - Tarapur 1990
- Interim Storage/Waste Immobilization Plant - Kalpakkam 1993

INTERNATIONAL RELATIONSHIPS

Member of Board and Governors of IAEA since its inception. Agreement with U.S. on peaceful nuclear cooperation. Elected Chairman of the Board of Governors of IAEA (September 94 - September 95).

India has not signed the NPT and has generally resisted the imposition of safeguards by individual suppliers (this has led to difficulties with supply of enriched uranium, reactor equipment, and heavy water).

India has agreements with several countries on various aspects of the nuclear fuel cycle. Among them, signed in mid-1990, agreements with Vietnam (pilot plant for monazite processing supplied by India) and Cuba (Cuban scientists being trained in nuclear power generation in India) for expanded cooperation in nuclear energy.

Prime Minister

- Atomic Energy Commission
  - Department of Atomic Energy
    - Atomic minerals
    - Nuclear fuels
    - Power project engineering
    - Research and development
      - Bhabha Atomic Research Centre, Trombay, Bombay
        - Fuel cycle R&D
        - Waste management R&D
        - Research reactors
      - Indira Gandhi Centre for Atomic Research, Kalpakkam
        - Fuel cycle R&D
        - Waste management R&D
        - Fast reactor technology
Activities: BARC has six test reactors; radiochemistry, radiometallurgy, and isotope laboratories; an isotope production and processing unit; pilot plants for production of heavy water, zirconium, and titanium; a thorium plant; a uranium metal plant; a pilot-scale 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/d.
  History: On-line, 1965-1974; modified and being readied to operate again.

• WIP (Waste Immobilization Plant) - Trombay

• Experimental Uranium Enrichment Facility
**INDIA**

**DAE**

Atomic Energy Commission (AEC)
Tel: 91-22-202-2543
91-22-202-6823
Fax: 91-22-204-8476

Chairman
R. Chidambaram

Secretary
K. V. Mahadeva Rao

Department of Atomic Energy
Chatrapati Shivaji Maharaj Marg
Bombay 400 039, India

Minister, Science/Technology
Bhuunesh Chaturvedi

Atomic Energy Regulatory Board (AERB)
Chairman
A. Gopalakrishnan

Function: Regulation and licensing of nuclear facilities.

Nuclear Power Corporation (formerly Nuclear Power Board)
Managing Director
Y.S.R. Prasad

Function: Design, construction, and operation/maintenance of nuclear power stations; help realize nation's goal of having 10,000 MWe of nuclear power on-line by the year 2000.

**IGCAR**

Indira Ghandi Centre for Atomic Research
Kalpakkam 603 102
Tamil Nadu, India
Tel: 91-4117-40240
Tlx: 041-6244
Fax: 91-4117-40360

Fast Breeder Reactor Centre, Director
Placid Rodriguez

Located near Madras power station.

(contd next page)
IGCAR (contd)

Function: Fuel cycle R&D; FBR technology; reprocessing of FBR fuels.

Facilities

- Fast Breeder Test Reactor
- Kalpakkam Fuel Reprocessing Laboratory
  Mission: Develop and test equipment and unit operations for FBR fuel reprocessing.

KAPS

Kakrapar Atomic Power Station (2 x 220 MWe PHWRs)
Gujaral

KOLAR WASTE DISPOSAL RESEARCH STATION

Located in the Kolar gold mine area near Bangalore, Karnataka State.

Function: Assess the suitability of peninsular gneisses for location of a deep geologic 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.

MAPS

Madras Atomic Power Station
Kalpakkam, India

Function: Nuclear power production, fuel reprocessing, and waste treatment; plutonium fuel fabrication for FBRs.

(Contd next page)
Facilities

- **Fuel Reprocessing Plant Kalpakkam**
  **Mission:** Reprocess spent fuel from the Kalpakkam reactors and from the 15-MW FBTR commissioned in 1985.

  **Design Basis:** PUREX process, with a separate line for FBTR mixed-carbide fuels; capacity, originally 0.5 t HM/d for PHWR fuels, now increased to 200 t HM/yr; cold operation, 1991.

- **WIP (Waste Immobilization Plant)-Kalpakkam**

- **ISF (Interim Storage Facility)-Kalpakkam**

**NAPs**

Narova Atomic Power Station (2 x 220 MWe PHWRs)
Uttar Pradesh.

**NFC**

Nuclear Fuel Complex
Hyderabad, India

Facilities

- **Fuel Fabrication Plant** - Initial throughput of 50 t/yr increased by 1990 to 350 t/yr; expected to go to 600 t/yr; manufactures seamless stainless tubes and produces special materials; NFC has produced a special alloy of niobium, hafnium, and titanium for India's space programs that has been successfully tested.
Function: Established through the University Grants Commission to encourage nuclear research outside of government-sponsored work. The facility below is only available to university researchers.

Facilities

• **Pelletron Accelerator Facility** - Commissioned early in 1991; housed in 30-m-high tower; can accelerate atoms up to 16 MeV.

---

**RAPS**

Rajasthan Atomic Power Station (100, 200 MWe PHWRs) Rajasthan.

Function: Both reactors have been shut down indefinitely since April 1995 due to heavy water leakage in the core.
INDIA

TAPS
Tarapur Atomic Power Station
Tarapur, Maharashtra, India

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

Facilities

- PREFRE (Fuel Reprocessing Plant) - Tarapur
  Mission: Reprocess natural and low-enriched UO₂ fuels.
  Design Basis: Chop-leach head-end; PUREX flowsheet; contact maintenance; capacity, 150 t HM/yr.
  History: Construction completed, 1975; hot operation, 12/1982.

- WIP (Waste Immobilization Plant)
  Mission: Vitrify Tarapur HLW.
  Design Basis: Two-step calcination and melting in drainable pot; capacity, 25 L/hr HLLW, 125 kg glass/canister, one canister/d; product, borosilicate glass blocks.

- SSSF (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 vitrified HLW from Tarapur and Trombay.
  History: Completion, 1990.

- ILW Bituminization Plant

- Polymerization Facility

- Pilot (hot cell-sized) Mox Fuel Fabrication Facility (1990)
ITALY

MAJOR PUBLIC HOLIDAYS (1995)

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Holiday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>1</td>
<td>New Year</td>
</tr>
<tr>
<td>Jan</td>
<td>6</td>
<td>Epiphany</td>
</tr>
<tr>
<td>Apr</td>
<td>14</td>
<td>Easter</td>
</tr>
<tr>
<td>Apr</td>
<td>25</td>
<td>Liberation Day</td>
</tr>
<tr>
<td>May</td>
<td>1</td>
<td>Labor Day</td>
</tr>
<tr>
<td>Aug</td>
<td>15</td>
<td>Assumption</td>
</tr>
<tr>
<td>Nov</td>
<td>1</td>
<td>All Saints Day</td>
</tr>
<tr>
<td>Dec</td>
<td>8</td>
<td>Immaculate Conception</td>
</tr>
<tr>
<td>Dec</td>
<td>25-26</td>
<td>Christmas</td>
</tr>
</tbody>
</table>

TIME

Standard Time Washington, D.C.
Daylight Savings Time Period: + 6 hours
03/26 - 09/23/95

PASSPORT/Visa

A passport is needed to depart and re-enter the U.S. A visa is currently not required for a visit to Italy.

CURRENCY EXCHANGE RATE

1 U.S. $ = 1593.25 Lira
per Wall Street Journal, 11/08/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to Italy are complete as listed, after dialing international access code: 011. Country code is 39; listed local numbers include city code.

U.S. EMBASSY - ROME

American Embassy
Via Veneto 119/A
00187 Rome
Italy

Tel: 39-6-4674-2275
Fax: 39-6-4674-2663

Science Counselor
Gregory J. Dunn
ITALY

Population 1994 58.1 million

ENERGY

Electric Power Capacity 1993 62.4 GWe
1995 66.5 GWe
2000 76.6 GWe

Electric Power Production 1992 222.7 TWh
52% oil
19% hydro
16% gas
11% coal
2% geothermal

NUCLEAR POWER

Policy: The current national energy plan calls for abandonment of nuclear power and increased use of coal and natural gas for electricity generation; research into nuclear energy will continue but with a reduced R&D budget.

INDUSTRIAL FUEL CYCLE

Waste Management Strategy: Spent fuel from previous nuclear power plant operations has been reprocessed abroad; vitrified HLW will be returned, starting in 1995; canisters will be temporarily stored until a final repository is available (clay formations are being considered); dry storage onsite is presently planned by ENEL; no site for disposal of LLW/LILW has been selected.

Cumulative SF Arisings 1990 342 t U LWR
1,353 t U GCR

INTERNATIONAL RELATIONSHIPS

Member of EC, IAEA, and OECD/NEA; CEC Joint Research Center establishment is located in northern Italy at Ispra.
ORGANIZATION

- **ENEA** (Agency for New Technologies, Energy and Environment) - applied R&D activities carried out in the three sites of Casaccia, Saluggia, and Trisaia.

- **ANPA** (National Agency for Environmental Protection) - regulatory body; inspection/control and health/environment protection.

- **ENI** - government-owned oil and energy holding company.

- **Nucleco** - company jointly owned by ENEA/ENI; LLW/ILW management (except disposal).

- **FN** (Fabricazioni Nucleari) - former fabrication factory; presently developing new materials.

- **ENEL** - state-owned power utility.

### ENEA (Agency for New Technologies, Energy & Environment)

**Ente per le Nuove Tecnologie, l’Energia e l’Ambiente**

Viale Regina Margherita 125  
00198 Rome, Italy

**Tel:** 39-6-8528-1  
**Fax:** 39-6-8528-2591

**President**  
Nicolo Caribbo

**Director General**  
Fabio Pistella

**Director, Energy Dept.**  
Sergio Garribba

**Director, Fusion**  
Roberto Andreani

**Dir., D&D/WM**  
Franco Pozzi

**Asst. Dir., SF/WM**  
Piero Risoluti

**Function:** Direct basic and applied research on energy and environment (mostly non-nuclear). Current nuclear-related work includes cooperation in international programs and is carried out in three sectors: Fusion, Innovative Reactors, and Decommissioning and Waste Management.
**Nuclear Activities - Dismantling:** Decommission facilities, remove stored nuclear material. Tasks: condition liquid/solid radioactive wastes stored at the Eurex (Saluggia) and Itrec (Trisaia) plants and the Casaccia Center; remove spent fuel from reprocessing pilot plants; decontaminate and dismantle plants and laboratories, including plutonium oxide fuel fabrication laboratory.

**Owner:** Government.

**ENEL (National Electric Energy Agency)**

Ente Nazionale per l'Energia Elettrica
Casella Postale 386
Via Giovan Battista Martini 3
00198 Rome, Italy

Chairman
Franco Viezzoli

Government body responsible for all electric power production.

**FN**

Fabricazioni Nucleari
P.O. Box 16
15062 Bosco Marengo (AL)
Italy

Chairman
C. Boffa

**Function:** Fabrication and development of special oxide nuclear fuels and special ceramic materials.

**Owner:** ENEA (95%); AGIP, Fiat (5%)
NUCLECO

Nucleco
Via Anguillarese 351
00060 Rome, Italy

Chairman
P. Venditti

Function: Treat and dispose of LLW/ILW from hospitals, laboratories, industrial establishments, and nuclear plants; plans include eventual decommissioning work on nuclear installations.

Owner: ENEA (40%); AGIP (60%).
JAPAN

MAJOR PUBLIC HOLIDAYS (1995)

| Jan  1 | New Year |
| Jan 15 | Adult’s Day |
| Feb 11 | Nat’l Foundation |
| Mar 21 | Vernal Equinox |
| Apr 29 | Greenery Day |
| May  3 | Constitution |
| May  5 | Children’s Day |
| Sep 15 | Respect for Aged |
| Sep 23 | Autumnal Equinox |
| Oct 10 | Sports Day |
| Nov  3 | Culture Day |
| Nov 23 | Labor Thanksgiving |
| Dec 23 | Emperor's Birthday |
| Dec 29- | |
| Jan  3 | Govt. Off-Season |

TIME

Standard Time Washington, D.C. + 14 hours

PASSPORT/VISA

A passport is needed to depart and re-enter the U.S.; a visa is currently not required for a visit to Japan. Most travel agencies can provide up-to-date information on requirements.

CURRENCY EXCHANGE RATE

1 U.S. $ = 103.18 Yen

per Wall Street Journal, 11/08/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to Japan are complete as listed, after dialing international access code: 011. Country code is 81; listed local numbers include city code.

U.S. EMBASSY - TOKYO

American Embassy
10-1, Akasaka 1-chome, Minato-ku
Tokyo 107, Japan
Tel: 81-3-3224-5000
Fax: 81-3-3589-4235

Science Minister-Counselor
Michael A. Michaud
Tel: 81-3-3224-5500
Fax: 81-3-3224-5229

DOE Representative
Milton A. Eaton
Tel: 81-3-3224-5444/78
Fax: 81-3-3224-5769
Population

1994 125.1 million

ENERGY

Electric Power Capacity

1993 186.2 GWe
20% nuclear
1995 195 GWe
20% nuclear
1997 212 Gwe
21% nuclear
2000 222.7 GWe
21% nuclear
2002 262 GWe
21% nuclear

Electric Power Production

1993 888.3 TWh
31% oil
30% nuclear
20% gas
15% coal
9% hydro
1995 31% nuclear
1997 33% nuclear
2000 35% nuclear
2002 34% nuclear

NUCLEAR POWER

Policy: Strong nuclear power program to lessen dependence on foreign energy sources; install LWRs for near-term needs; develop advanced HWR (ATR); aim for commercial FBR operation ~2020 - 2030; supply domestic needs and build export business.
<table>
<thead>
<tr>
<th>Year</th>
<th>Nuclear Power Capacity</th>
<th>Reactor Mix</th>
<th>Reactor Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>36.7 GWe</td>
<td>GCR 1 (1966)</td>
<td>HWR (ATR), LMFBR, HTGR</td>
</tr>
<tr>
<td>1995</td>
<td>39.6 GWe</td>
<td>HWR 1 (1979)</td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>45.1 GWe</td>
<td>BWR 25 (1969-93)</td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td>3 (1995-97)</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>47.5 GWe</td>
<td>PWR 21 (1970-94)</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>54.1 GWe</td>
<td>2 (1995-97)</td>
<td></td>
</tr>
</tbody>
</table>

**INDUSTRIAL FUEL CYCLE**

**Policy:** Obtain ownership of foreign uranium resources; develop complete fuel cycle capability (enrichment, reprocessing, and waste treatment; buy foreign reprocessing services until domestic capacity is available); 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 - dispose in engineered structures in shallow-land facility and at sea, if politically feasible.

**Cumulative SF Arisings (LWR)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Arisings (t U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>7,500</td>
</tr>
<tr>
<td>1991</td>
<td>12,400</td>
</tr>
</tbody>
</table>

**Industrial-Scale Activities (Capacity)**

- Uranium mining and conversion (t UF₆/yr): 200
- Uranium reconversion (t U/yr): 1,028
- Uranium enrichment (t SWU/yr):
  - 1981: 50
  - 1988: 250
  - 2000: 3,000
PNL-9450-2

JAPAN

• Fuel fabrication
  - UO₂ for LWR (t U/yr): 1987 2,495
  - MOX for FBR (t/yr): 1988 6
  - MOX for ATR (t/yr): 1988 10; 1993 50

• Reprocessing (t/yr): 1981 210; 2000 1,010

Major Milestones

• Storage facility for vitrified HLW from COGEMA/BNFL 1995
• Fuel reprocessing plant (Rokkasho-mura) SF storage reprocessing operation 1995
• Selection of demonstration site for in situ test with HLW disposal package 1999
• FBR fuel reprocessing pilot plant operation >2000
• Startup of HLW disposal site >2000
• Experimental ocean disposal of LLW TBD

INTERNATIONAL RELATIONSHIPS

DOE/PNC Agreement for Cooperation in the Area of Radioactive Waste Management

Term: 12-3-86 to 12-3-96
Scope: HLW/TRU waste; waste form development, assay, and characterization; treatment/packaging/transportation; storage/disposal; D&D; facility operations; environment/safety and public acceptance issues. Emphasis on information exchange of HLW and TRU waste conditioning technology.

Member of IAEA and OECD/NEA; cooperative agreements with Australia (SYNROC development), Canada, China, France, U.K.

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.
NUCLEAR FUEL CYCLE/WASTE MANAGEMENT ORGANIZATION

Prime Minister

- AEC
  * Nuclear program policy
  * Advisory Committee on Radioactive Waste
  * HLW Overall Program Committee

- NSC
  * Safety

MITI

- Nucl. power development
- Nucl. power reactor licensing
- Comm. fuel cycle/waste management
- Indus. sponsors (util., manufacturers, etc.)

CRIEPI

- R&D for utilities
- SF storage tech.
- Properties of LLW packages

JNFL

- HLW storage
- LLW storage/disposal
- U enrichment
- Reprocessing
- Waste Treatment
- Fuel Cycle Equipment

RMC

- LLW disposal R&D
- Environmental monitoring/safety

- STA

- NSB
  * Tech. support to NSC
  * Safety
  * Regulation
  * Radiation protection

- NIRS
  * Radiological sciences

- AEB
  * Tech. support to AEC
  * Policy
  * Research
  * Development

- PNC
  * Fuel cycle process development/demonstration (U enrichment, reprocessing, MOX fuel fabrication waste management)
  * Advanced reactor development

- JAERI
  * Reactor safety R&D
  * Waste management & environmental safety assessments
  * HLW partitioning

---

JA-4
PARTIAL PNC ORGANIZATION

President-Board of Directors

- Technology Management Division
- Policy Planning Division
- Safety Division
- International Division
- Reactor Technology Development Division
- Reactor Construction/Operation Project
- Radioactive Waste Management Project
- Nuclear Fuel Cycle Development Division
- Nuclear Fuel Cycle Engineering Division
- Nuclear Material Control Division
- Fuel Cycle Training Coordination Office
- Oarai Engineering Center
  - Technology Development Division
  - Health/Safety Division
  - Systems and Components Division
  - Fuels and Materials Division
  - Experimental Reactor Division
  - Safety Engineering Division
- Tokai Works
  - Nuclear Fuel Technology Development Div.
  - Plutonium Fuel Division
  - Reprocessing Technology Development Div.
  - Waste Technology Development Division
  - Nuclear Waste Treatment Division
  - Tokai Reprocessing Plant
PARTIAL JAERI ORGANIZATION

President

- Takasaki Radiation Chemistry Research Establishment
- Oarai Research Establishment
- Naka Fusion Research Establishment
- Tokai Research Establishment
  - Department of Reactor Engineering
  - Department of Fuels and Materials Research
  - Department of High Temperature Engineering
  - Department of Research Reactor Operation
  - Department of JPDR
  - Department of Radioisotopes
  - Nuclear Safety Research Center
    - Department of Reactor Safety Research
    - Department of Fuel Safety Research
    - Department of Reactor Fuel Examination
    - Department of Environmental Safety Research
      - Environmental Radioactivity
      - Radioactive Waste Management
      - Airborne Waste-Environmental Safety
AEB

Atomic Energy Bureau
Science and Technology Agency
2-1 Kasumigaseki 2-chome
Chiyoda-ku, Tokyo 100, Japan

Director General
Deputy Director General
Director, Policy Div.
Dir., Power Reactor Dev. Div.
Dir., Nuclear Fuel Div.

Isamu Sasayama
Toshio Okazaki
Tetsuhsa Shirakawa
Ryo Kimura
Shiniehiro Izumi
Hiroshi Nagano

Function: Provide support to the Atomic Energy Commission (AEC).

AEC

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

Chair (Minister of State for Science/Technology)
Vice-Chairman Chair

Yasuoki Urano
Yoshinori Ihara

Function: Formulate national policy on nuclear energy R&D and utilization; advise Prime Minister.

CRIEPI

Central Research Institute of Electric Power Industry
1-6-16, Otemachi
Chiyoda-ku, Tokyo 100, Japan

President

Susumu Yoda

(contd next page)
CRIEPI (contd)

Function: Provide R&D support for utilities.

Waste Management R&D: Transportation, storage, 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, Iwate-kiita
Komae-shi, Tokyo 201, Japan

Function: Laboratory under CRIEPI.

GIRIO

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

Director, Department of Optical Materials
Teruo Kodama

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

Hitachi, Ltd.
6, Kanda-surgadai, 4-chome
Chiyoda-ku, Tokyo 101, Japan
Tel: 81-3-3258-1111
Fax: 81-3-3258-6218

President
Sr. Chief Engineer
Nuclear Power Development

Waste Management R&D: Development of volume reduction systems for radioactive waste; application of automation and robotics technology; development of advanced control technology using fiber optics.

Hitachi Engineering Co., Ltd.
2-1 Saiwai-cho, 3-chome
Hitachi-shi, Ibaraki-ken, 317
Japan
Tel: 81-294-24-1111
Fax: 81-294-22-8987

President

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

IHI

Ishikawajima-Harima
Heavy Industries Co., Ltd.
Shin-Ohtemachi Bldg.
2-1, Ohtemachi 2-chome
Chiyoda-ku, Tokyo 100, Japan
Tel: 81-3-3244-5111
Fax: 81-3-3286-2440

President
Senior Managing Director
Gen. Mgr., Nucl. Power Sales

(contd next page)
IHI Research Institute
1, Shin-nakaharacho, Isogo-ku
Yokohama 235, Japan
Tel: 81-45-751-1231
Fax: 81-45-753-9564

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: 81-3-3592-2111
Fax: 81-3-3580-6107

President
Shozo Shimomura
Vice President
Masaji Yoshikawa
Vice President
Shojiro Matsuura
Exec. Director, International
Hirofumi Satake

Location: JAERI headquarters and radioisotope center are in Tokyo; the Tokai and Oarai research establishments share government reservations with PNC at Tokai-mura and Oarai-machi; 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 Naka Research Establishment (fusion energy) is in Naka-machi near Tokai-mura.

Function: Semi-governmental research organization implementing national long-term programs in nuclear energy, including joint projects and international cooperation.
JAERI: OARAI

Japan Atomic Energy Research Institute
Oarai Research Establishment
Oarai-machi
Higashi-Ibaraki-gun
Ibaraki-ken Pref. 311-13, Japan
Tel: 81-292-67-4111
Fax: 81-292-66-2235
Director General
Yoshiiiko Kaneko

JAERI: TOKAI

Japan Atomic Energy Research Institute
Tokai Research Establishment
Tokai-mura, Naka-gun
Ibaraki-ken Pref. 319-11
Japan
Tel: 81-292-82-5111
Fax: 81-292-82-0528
Director General
Michio Ichikawa
Deputy Director General
Takeshi Tamagawa
Deputy Director General
Takeshi Tsujino
Deputy Director General
Shinzo Saito

Facilities

• WASTE (glove box and hot cell facilities)
  Mission: HLW safety evaluations.

• STEM (Simulation Test for Environmental Radionuclide Migration)
  Mission: Safety evaluation for land disposal of LLW.
  History: Startup, 1983.

• NUCEF
  Facility to conduct research on safety of SF reprocessing and treatment of radioactive wastes to support licensing review by STA on reprocessing plant being constructed by JNFL.

STACY (Static Experimental Critical Facility)

(contd next page)
JAERI: TOKAI (contd)

TRACY (Transient Experimental Critical Facility)

Experimental Facility for TRU (research on separation/recovery of TRU)

JGC

JGC Corporation
Nuclear and Advanced Technology
New Ohtemachi Bldg.
2-1 Ohtemachi 2-chome
Chiyoda-ku, Tokyo 100, Japan
Tel: 81-3-3279-5441
Fax: 81-3-3273-8050

President
Takao Nakajima
Director Advisor
Hiroshi Kuribayashi
General Manager, Director
Keisuke Okazaki
Deputy General Manager

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

JGC Nuclear Research Center
2205 Narita-cho, Oarai-machi
Higashi-Ibaraki-gun
Ibaraki Pref. 311-13
Japan
Tel: 81-292-66-3311
Fax: 81-292-66-8810

Nuc. & Adv. Tech. Projects
Tomiaki Yamada

Waste Management R&D: Wet oxidation (organic materials, e.g., spent ion exchanger resin) incinerator; waste solidification processes (cementing, bituminization, plastic solidification); regeneration waste recycle process; selective nuclide removal process; ash melting process.

(contd next page)
Facilities

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

- **Contaminated Liquid Waste Recycle Plant**
  Mission: Recovery of clean water from LLLW for re-use.
  Design Basis: 75 L/min.; filtration; reverse osmosis; active carbon bed adsorption; chelate resin adsorption; ion-exchange adsorption; evaporation.

**JNFL**

Japan Nuclear Fuel Limited
1-12-15 Honcho, Aomori-shi
Aomori 030, Japan

President
Kiyoshi Nozawa
Vice Presidents
Tetsuo Hirasawa
Kiyoshi Fuseya
Hiroshi Takashina
Hideto Kamekawa

Function: Construct/operate facilities for uranium enrichment, fuel reprocessing, and LLW disposal in the Oishitai area of Rokkasho-mura.

Owner: Japanese utilities (10).

**JNFL Tokyo Branch Office**
Daiichi Seimei Bldg.
2-10 Hirakawa-cho 1-chome
Chiyoda-ku, Tokyo, Japan

Tel: 81-3-3239-6521
Fax: 81-3-3239-6479

(contd next page)
Facilities

- **Uranium Enrichment Plant** (at Oishitai, Rokkasho-mura).
  
  **Mission:** Enrich uranium for Japanese utilities to establish indigenous nuclear fuel cycle (cost: U.S. $1.38 billion).
  
  **Capacity:** 150 t SWU/yr initially; 1500 t SWU/yr final capacity.
  
  **History:** Initial startup, 1992; 1500 t SWU/yr ~2000.

- **LLW Disposal Facility** (at Oishitai, Rokkasho-mura).
  
  **Mission:** Dispose of Japanese utilities-generated LLW (cost: U.S. $1.23 billion).
  
  **Capacity:** Approximately 1 million drums initially; final capacity, 3 million drums.
  
  **History:** Startup, December 1992.

- **Fuel Reprocessing Plant** (at Iyasakatai, Kamikita-gun, Rokkasho-mura).
  
  **Mission:** Reprocess Japanese fuels.
  
  **Design Basis:** 800 t HM/yr; 3000 t U storage pool; HLW vitrification/storage; partial design by SGN, France; construction start, 1992; operations, 1995.
  
  **Milestones:** SF storage, 1995; FRP startup, 1999.
KOBE STEEL

Kobe Steel, Ltd.
No. 3-18, Wakahamacho 1-chome
Chuoh-ku, Kobe 651, Japan
Tel: 81-78-251-1551
Fax: 81-78-232-3459

General Manager
Toru Abe
Takao Mizguchi
Nuclear Engineering
Fumiaki Komatsu

Function: Manufacture SF transportation/storage casks; waste treatment equipment/systems; LLW/HW handling/storage.

MITI

Ministry of International Trade and Industry
3-1, Kasumigaseki 1-chome
Chiyoda-ku, Tokyo 100, Japan
Tel: 81-3-3501-1511
Fax: 81-3-3501-0643
or 81-3-3501-0644

Minister
Hiroshi Kumagai
V. Minister
Hideaki Kumano
International Affairs
Sozaburo Okamatsu

MITI/ANRE

Agency of Natural Resources and Energy
Ministry of International Trade and Industry
3-1, Kasumigaseki 1-chome
Chiyoda-ku, Tokyo 100, Japan
Tel: 81-3-3501-1511
Fax: 81-3-3501-0643
or 81-3-3501-0644

Director-General
Tomio Tsutsumi
Dep. Director-General
Yasuho Hayashi
Dep. Dir.-Gen., Nucl. Energy
Tohru Namiki
Dir., Nuclear Industry
Hideo Matsui
Dir., Internatl. Nuc. Affairs
Reiji Nagase
MMC

Mitsubishi Materials Corporation
5-2 Ohtemachi 1-chome
Chiyoda-ku, Tokyo 100, Japan
Tel: 81-3-3213-2111
Fax: 81-3-3215-2435

Vice President
Gen. Mgr., Nuc. Energy
Gen. Mgr., Nuc. Resources
Development/Waste Mgmt.

Yuumi Akimoto
Eiji Yagi
Tamotsu Ishii
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
2-1 Kasumigaseki 2-chome
Chiyoda-ku, Tokyo 100, Japan
Tel: 81-3-3580-3311
Fax: 81-3-3581-9470

Minister
Director General, Disarmament/Scientific Affairs
Director, Nuclear Energy
Deputy Director

Tsutomu Hata
Akira Hayashi
Yukiya Amano
Yoshifumi Okamura

NIRS

National Institute of Radiological Sciences
9-1, Anagawa 4-chome
Chiba-shi, Chiba Pref. 260, Japan
Tel: 81-472-51-2111
Fax: 81-472-56-8301

Director General

Hiromichi Matsudaira

Function: Attached to the Science & Technology Agency; responsible for carrying out studies on radiation hazards, applications for medical use, and education/training of engineers in these areas.
NSB

Nuclear Safety Bureau
Science and Technology Agency
2-1, Kasumigaseki 2-chome
Chiyoda-ku, Tokyo 100, Japan
Tel: 81-3-3581-5271
Fax: 81-3-3581-0774

Director-General
Deputy Director-General
Dir., Safeguards Division
Dir., Radiation Protec. Div.

Isamu Sasaya
Hisaharu Dosho
Itsuro Misumi
Kimihiko Oda
Mitsuo Hayashi
Kiyoshi Honma
Kaoru Naito
Haruo Suzuki

Function: Provide support to the Nuclear Safety Commission.

NSC

Nuclear Safety Commission
2-1, Kasumigaseki 2-chome
Chiyoda-ku, Tokyo 100, Japan
Tel: 81-3-3581-5271
Fax: 81-3-3581-0774

Chairman
Yasumasa Togo

Function: Responsible for carrying out national policy for safety and security of nuclear energy, its utilization, and related R&D; advisory body to the Prime Minister's office.
Power Reactor and Nuclear Fuel Development Corporation
Sankaido Building
1-9-13 Akasaka
Minato-ku, Tokyo 107, Japan

President
Exec. Vice Presidents
Exec. Dir., WM
Exec. Deputy Directors, WM
Deputy Director, WM
Coordination
Conditioning Research
Isolat'n Syst. Research
International Project
Geoscience Research
Dir., Fuel Cycle Develop.
Dir., Fuel Cycle Engineering
Dir., International
Deputy Dir., International
International Cooperation

U.S. DOE Tech. Representative

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

Tel: 81-3-3586-3311
Fax: 81-3-3583-6386

Takao Ishiwatari
Mitsuo Taguchi,
Hirosi Ohishi
Hiroyoshi Kurihara
Masao Yamamoto
Yoichi Asakura
Aiji Yamato
Kouichi Tasurumaki
Tomohiro Asami
Yasumasa Ando
Noriaki Sasaki
Hideki Sakuma
Minoru Yamakawa
Hidechiyo Kashihara
Naomi Tsunoda
Tadatomo Yamaguchi
Takao Yagi
Takashi Kano
Jim Scott
81-3-3586-3311

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

Masayori Tsutsumi
PNC: OARAI

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

Director
Gen. Mgr., Waste Management
Director, Fuels / Materials

Facilities

- **Incinerator**
  
  **Mission:** Burn solid LLW.
  
  **Design Basis:** Three chambers - pyrolysis, combustion, afterburning.

- **WDF (Waste Dismantling Facility)**
  
  **Mission:** Condition large contaminated equipment; develop D&D technology.
  
  **Design Basis:** Capacity to condition 5.5 t/yr.
  
  **History:** Hot startup, 1984.

PNC: TOKAI

PNC Tokai Works
4-33 Muramatsu
Tokai-mura, Naka-gun
Ibaraki-ken 319-11, Japan

Tel: 81-292-82-1111
Fax: 81-292-82-1469
or 81-292-82-9398

Director
Deputy Directors

Dir., Reprocessing Plant
Dir., Technology Dev. Coord.
Dir., Health/Safety
Dir., Waste Technology Dev.
HLW Technology
LLW Technology
Geological Isolation Tech.

(contd next page)
PNC: TOKAI (contd)

Facilities

- **Fuel Reprocessing Plant**
  
  **Mission:** Reprocess low-enriched UO₂.
  
  **Design Basis:** Oxide fuels: chop-leach head-end; PUREX flowsheet; capacity, 0.7 t HM/d; remote maintenance of chop-leach equipment; contact maintenance of other components.
  
  **History:** Startup, 1977; 509 t U spent fuel processed through 1990.

- **Tokai Plutonium Conversion Development Facility**
  
  **Mission:** Demonstrate PNC microwave process for co-conversion production of MOX.
  
  **Design Basis:** 10 kg/d MOX (50% PuO₂, 50% UO₂).
  
  **History:** Hot startup, 1983.

- **Tokai Plutonium Fuel Fabrication Facility**
  
  **Mission:** Fabricate FBR and ATR fuels.
  
  **Design Basis:** FBR fuels-1 t/yr (30% PuO₂ in enriched UO₂); ATR fuels-10 t/yr (2% PuO₂ in UO₂).
  
  **Throughput:** 100 t MOX produced from 1979 - 1989.

- **Tokai Plutonium Fuel Production Facility**
  
  **Mission:** Fabricate large quantities of MOX fuel for FBR and ATR.
  
  **Design Basis:** FBR fuels, 5 t/yr; ATR fuels 40 t/yr.
  
  **History:** Hot startup, 1988.

- **EDF (Engineering Demonstration Facility)**
  
  **Mission:** Nonradioactive, full-scale and/or engineering mockup tests of processes and equipment for FBR spent fuel reprocessing.
  
  **History:** Startup, 1982.

  (contd next page)
PNC: TOKAI (contd)

- ETF (Engineering Test Facility)
  Mission: Develop engineering test of HLW vitrification and ceramic melter technologies.
  Design Basis: Joule-heated melter.
  History: Startup, 1980.

- CPF (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, 1982.

- KRF - Krypton Recovery Facility (pilot plant)
  Mission: Demonstrate 85Kr recovery from Tokai-mura reprocessing plant off-gas.
  Design Basis: Cryogenic distillation and pressurized cylinder storage.

- Bitumization Demonstration Facility
  Mission: Immobilize LLLW concentrate.
  Design Basis: 200 L/hr.

- Incinerator
  Mission: Burn solid LLW.
  Design Basis: 600 kg/d.

- PWTF (Plutonium-Contaminated Waste Treatment Facility)
  Mission: Prepare PNC TRU wastes for disposal.
  Design Basis: Incineration of combustibles/chloride-containing wastes, mechanical volume reduction.

(contd next page)
PNC: TOKAI (contd)

- PWSF (Plutonium-Contaminated Waste Storage Facility)
  Mission: Store PNC TRU waste.
  Design Basis: 6000-drum capacity.
  History: Operation startup, 1981.

- TVF (Tokai Vitrification Facility)
  Mission: Vitrify and store HLW from the Tokai reprocessing plant; demonstrate technology.
  Design Basis: Ceramic melter to produce a borosilicate glass; capacity, 0.35 m³ HLW/d.
  History: Construction start, 1988; cold test, 1992.

- Recycle Equipment Test Facility
  Mission: Demonstrate FBR fuel reprocessing equipment and process technology.
  Design Basis: 10 kg/hr

- FBR Fuel Reprocessing Pilot Plant (reprocessing and HLW treatment)
  Mission: Demonstrate FBR fuel reprocessing and HLW solidification.
  Design Basis: 120 kg MOX/d (12 t/yr).

RWMC

Radioactive Waste Management Center
Mori Building #15
8-10, Toranomon 2-chome
Minato-ku, Tokyo 105, Japan
Tel: 81-3-3504-1081
Fax: 81-3-3504-1297
Toshio Fukuda
Takashi Tsusuki

Function: R&D on safe and effective treatment and disposal techniques for radioactives wastes.

Owners: Japanese industry, MITI, and STA.
Science and Technology Agency
2-1 Kasumigaseki, 2-chome
Chiyoda-ku, Tokyo 100
Japan

Minister, Science/Technology
Vice Minister
Deputy Minister
Director-General, AEB
Dep. Director-General, AEB

Dir., Policy Division, AEB
Director-General, NSB
Dep. Director-General, NSB

Function: Established as an extra-ministerial agency of the Prime Minister’s office for comprehensive administration and promotion of science and technology; the Atomic Energy Bureau (AEB) and the Nuclear Safety Bureau (NSB) are under STA jurisdiction; appropriate listings are under AEB and NSB, respectively.
### REPUBLIC OF KOREA

#### MAJOR PUBLIC HOLIDAYS (1995)

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Holiday</th>
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<tbody>
<tr>
<td>Jan</td>
<td>1-2</td>
<td>New Year</td>
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<tr>
<td>Feb</td>
<td>18-20</td>
<td>Lunar New Year</td>
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<tr>
<td>Mar</td>
<td>1</td>
<td>Independence</td>
</tr>
<tr>
<td>Apr</td>
<td>5</td>
<td>Arbor Day</td>
</tr>
<tr>
<td>May</td>
<td>5</td>
<td>Children's Day</td>
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<tr>
<td>May</td>
<td>14</td>
<td>Buddha's Birthday</td>
</tr>
<tr>
<td>Jun</td>
<td>6</td>
<td>Memorial Day</td>
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<tr>
<td>Jul</td>
<td>17</td>
<td>Constitution Day</td>
</tr>
<tr>
<td>Aug</td>
<td>15</td>
<td>National Day</td>
</tr>
<tr>
<td>Sep</td>
<td>26-28</td>
<td>Chusok (Thanksgiving)</td>
</tr>
<tr>
<td>Oct</td>
<td>3</td>
<td>National Foundation Day</td>
</tr>
<tr>
<td>Dec</td>
<td>25</td>
<td>Christmas</td>
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</table>

#### TIME

Standard Time Washington, D.C. + 14 hours

#### PASSPORT/VISA

A passport is needed to depart and re-enter the U.S.; 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 U.S. $ = 768.35 Won (W)

per Wall Street Journal, 10/01/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

#### DIRECT DIALING

Individual numbers for direct dial to Korea are complete as listed, after dialing international access code: 011. Country code is 82; listed local numbers include city code.

#### U.S. EMBASSY - SEOUL

American Embassy  
82 Sejong-Ro, Chongro-Ku  
Seoul, Republic of Korea  
Tel: 82-2-397-4114  
Fax: 82-2-738-8845  
Science Counselor  
F. Ken Crosher
### KOREA

**Population**

<table>
<thead>
<tr>
<th>Year</th>
<th>Population (million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>45</td>
</tr>
</tbody>
</table>

**ENERGY**

<table>
<thead>
<tr>
<th>Year</th>
<th>Electric Power Capacity (GWe)</th>
<th>Nuclear %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>27.1</td>
<td>28%</td>
</tr>
<tr>
<td>1995</td>
<td>31.1</td>
<td>28%</td>
</tr>
<tr>
<td>2000</td>
<td>42.3</td>
<td>32%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Electric Power Production (TWh)</th>
<th>Nuclear %</th>
<th>Coal %</th>
<th>Oil %</th>
<th>Hydro %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>144</td>
<td>40%</td>
<td>-30%</td>
<td>-25%</td>
<td>5%</td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NUCLEAR POWER**

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Nuclear Power Plant Capacity (GWe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>7.6</td>
</tr>
<tr>
<td>1995</td>
<td>8.6</td>
</tr>
<tr>
<td>2000</td>
<td>13.7</td>
</tr>
</tbody>
</table>

**Reactor Mix**

<table>
<thead>
<tr>
<th>Year</th>
<th>Reactor Type</th>
<th>Units (Year Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>PWR</td>
<td>8 (1978-89)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 (1995-99)</td>
</tr>
<tr>
<td></td>
<td>HWR</td>
<td>1 (1983)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 (1997/99)</td>
</tr>
</tbody>
</table>

**Reactor Development (feasibility studies)**

- Advanced PWR
- KS-1
INDUSTRIAL FUEL CYCLE

Policy: Develop long-term contracts for fuel supplies, holdings of foreign uranium resources; fabricate fuel for PWR and HWR (CANDU); "wait and see" on reprocessing and recycle of Pu for FBR, CANDU, and LWR.

Waste Management Strategy: LLW/ILW repository to be constructed by mid-1990s with emphasis on engineered barriers; candidate sites have been identified in Koolup Island; utility surcharge of 2 mil/kWh to fund waste management; extended storage (~60 years) of SF planned in AR and AFR facilities; no decision has been made on reprocessing or disposal of SF/HLW.

<table>
<thead>
<tr>
<th>Cumulative SF Arisings</th>
<th>1990</th>
<th>1,500 t U</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1995</td>
<td>2,600 t U</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>4,400 t U</td>
</tr>
</tbody>
</table>

Industrial-Scale Activities

- Uranium milling-3 t ore/d pilot plant.
- Uranium conversion, yellowcake to UO₂ - 100 t U/yr.
- UO₂ fuel fabrication pilot plant - 10 t U/yr.

Major Milestones

- LLW disposal site (500,000 drums) 1996

INTERNATIONAL RELATIONSHIPS

Member of IAEA; agreement with U.S. for peaceful nuclear cooperation.
ORGANIZATION

Deputy Prime Minister ---- Atomic Energy Commission (AEC)

- Ministry of Trade, Industry and Energy (MOTIE)
  - Electric Power Bureau (EPB)
    - Korea Electric Power Corporation (KEPCO)
    - Korea Power Engineering Company (KOPEC)
    - Korea Electric Power Operating Service Company, Ltd. (KEPOS)
    - Korea Heavy Industries/Construction Co. (KHIC)
    - Korea Nuclear Fuel Company, Ltd. (KNFC)

- Ministry of Science and Technology (MOST)
  - Atomic Energy Office (AEO)
    - Nuclear Policy Office (NPO)
      - Nuclear Policy Division
      - Nuclear R&D Division
      - Atomic Energy International Cooperation Division
    - Nuclear Safety Office (NSO)
      - Nuclear Licensing Division
      - Nuclear Inspection/Enforcement Division
      - Radiation Safety Division
      - Nuclear Control Division
    - Korea Advanced Institute of Science/Technology (KAIST)
    - Korea Atomic Energy Research Institute (KAERI)
    - Korea Institute of Nuclear Safety (KINS)
    - Korea Institute of Geology, Mining and Materials (KIGAM)
    - Korea Institute of Energy Research (KIER)
Atomic Energy Office  
Ministry of Science and Tech.  
1 Chungang-dong, Kyonggi-do  
Kwacheon 171-11  
Republic of Korea  
Tel: 82-2-503-7654  
Fax: 82-2-503-7673

Asst. Minister, AEO  
Director General, NPO  
Dir., Nuclear Policy  
Dir., Nuclear R&D  
Dir., Internatl. Cooperation  
Director General, NSO  
Dir., Nuclear Licensing  
Dir., Nuc. Inspection/Enforcement  
Dir., Radiation Safety  
Dir., Nuclear Control

Se Jong Kim  
Chung-Won Cho  
Yong Hwan Kim  
Jin Kyung Kim  
Young Sik Kim  
Nam Huh  
Jong Hyuk Chung  
Young Chud Kang  
Jae Ok Jang  
Dong Dae Sul

Function: License nuclear power plants and fuel cycle facilities; manage nuclear waste fund; sponsor nuclear R&D.

Atomic Energy Commission  
1, Chungang-dong  
Kwacheon 171-11  
Republic of Korea  
Tel: 82-2-503-7646  
Fax: 82-2-507-0558

Chairman: Deputy Prime Minister  
Jae Hyung Hong

Function: Decision-making body for policies on nuclear energy; R&D plan for nuclear fuel and nuclear energy applications; chaired by Deputy Prime Minister; ministers of MOST and MOTIE are required members.
Electric Power Bureau
Ministry of Trade, Industry and Energy
Kwacheon 171-11
Republic of Korea

Dir. General for Energy Policy
Joo Suck Suh

Function: Establish plans and policies on energy and resources in coordination with MOST and AEO; manage nuclear fuel acquisition.

Korea Atomic Energy Research Institute
150 Tukjin-dong
Daeduk-gu, Taejon
Republic of Korea

President
Jae In Shin

Sr. VP, Nuclear
Sung Ki Chae

VP, MRR Project
Sung Nyun Kim

Dir., Nuclear Safety/Research
Chang Guy Park

Dir., Spent Fuel Management
Hyun Soo Park

Function: Develop reactor engineering and nuclear fuel cycle technology; assist government (MOST) with regulatory/licensing issues and in establishing national nuclear policy.

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

Korea Advanced Institute of Science and Technology
373-1 Kusong-dong, Yusong-gu
Taegon 305-701, ROK

President
Duk Yong Yoon
Kun Jai Lee

Function: Research-oriented graduate school, conducting advanced research and development.

KEPCO

Korea Electric Power Corporation
167, Samsung-dong
Kangnam-Gu
Seoul, Republic of Korea

President
Chong Hun Lee
Ke Hwee Kim

Function: Develop power resources; generate/transmit electricity (operates all nuclear and conventional power plants in Korea); responsible to the government (MER).

KIER

Korea Institute of Energy and Resources
71-2 Chang-dong
Chung-gu, Taegon
Republic of Korea

President
Young Mok Sohn

Function: Development of energy technologies and exploitation of energy.
KINS

Korea Institute of Nuclear Safety Technology
P.O. Box 7
Daeduk-Danji, Taejon
Republic of Korea
President
Vice President
Dir., Safety Review
Director, Safety Inspection
Director, Standards Development

Function: Independent regulatory organization (established 1990) to develop technical standards for nuclear safety.

KIGAM

Korean Institute of Geology, Mining and Materials
30 Gajung-dong
Yusong-gu, Taejon
Republic of Korea
President

Function: Development and utilization of resources.

KNFC

Korea Nuclear Fuel Company, Ltd.
150 Tukjin-dong, Daeduk-gu
Taejon, Republic of Korea
President

Function: Develop domestic nuclear fuel fabrication.

(contd next page)
KNFC (contd)

Owners: KEPCO (95%); KAERI (5%).

Facilities

- Fuel Fabrication Plant, Daeduk site, 200 t U/yr.

KOPEC

Korea Power Engineering Co., Inc.
87 Samsong-dong, Kangnam-gu
Seoul, Republic of Korea

President
Ki Oak Chang

Function: Architect-engineering services for nuclear and conventional power plants.

MOST

Ministry of Science and Technology
1. Chungang-dong
Kwachon, Kyonggi-do
Republic of Korea

Tel: 82-2-503-7171
Fax: 82-2-503-7673

Minister
Kun Mo Chung
Vice Minister
Bon Young Ku
Asst. Minister, AEO
Se Jong Kim
Director General, NPO
Chung-won Cho
Dir., Nuclear Policy
Young Hwan Kim
Dir., Nuclear R&D
Jim Kyung Kim
Dir., Internatl. Cooperation
Young Suk Kim
Director General, NSO
Nam Hun
Dir., Nuclear Licensing
Jong Hyuk Chung
Dir., Nuc. Inspection/Enforcement
Yong Chul Kang
Dir., Radiation Safety
Jae Ok Kang
Dir., Nuclear Control
Dong Dae Sul

Function: Authority over virtually all scientific and technological efforts in Korea.
MTIE

Ministry of Trade, Industry
and Energy
1, Chungang-dong
Kwacheon, Kyonggi-do
Republic of Korea

Minister
Vice Minister
Director General, EPB

Tel: 82-2-503-9641
Fax: 82-2-503-9649

Joe Yoon Park
Un Suh Park
Joo Suck Suh

Function: Lead government agency in power development and resource utilization.
NETHERLANDS

MAJOR PUBLIC HOLIDAYS (1995)

Jan  1 New Year
Apr 14 Good Friday
Apr 16-17 Easter
Apr 30 Queen's Birthday
May  5 Liberation Day
May 12 Ascension
May 22-23 Pentecost
Dec 25-26 Christmas

TIME

Standard Time Washington, D.C.
Daylight Savings Time Period: + 6 hours
03/26 - 09/23/95

PASSPORT/Visa

A passport is needed to depart and re-enter the U.S. 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 about requirements.

CURRENCY EXCHANGE RATE

1 U.S. $ = 1.60 Guilder (Fl.)
per Wall Street Journal, 10/01/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to the Netherlands are complete as listed, after dialing international access code: 011. Country code is 31; listed local numbers include city code.

U.S. EMBASSY - THE HAGUE

American Embassy
Lange Voorhout 102
2514 E The Hague
Netherlands

Tel: 31-70-310-9209
Fax: 31-70-361-4688

Economic Section

Daniel T. Fantozzi
Population 1994 15.3 million

ENERGY

Electric Power Capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity</th>
<th>Nuclear</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>17.6 GWe</td>
<td>2.8%</td>
</tr>
<tr>
<td>1995</td>
<td>20.6 GWe</td>
<td>2.6%</td>
</tr>
<tr>
<td>2000</td>
<td>18.7 GWe</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

Electric Power Production

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
<th>Gas</th>
<th>Coal</th>
<th>Nuclear</th>
<th>Oil</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>69.2 TWh</td>
<td>61.4%</td>
<td>31%</td>
<td>5.3%</td>
<td>0.1%</td>
<td>2.2%</td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4%</td>
</tr>
</tbody>
</table>

NUCLEAR POWER

Policy: Lifetime of both nuclear power plants ends in 2004; during this Cabinet period no decisions on new nuclear capacity will be made; in general, there is no need for additional capacity in the coming years.

INDUSTRIAL FUEL CYCLE

Nuclear Power Capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>0.5 GWe</td>
</tr>
<tr>
<td>1995</td>
<td>0.5 GWe</td>
</tr>
<tr>
<td>2000</td>
<td>0.5 GWe</td>
</tr>
</tbody>
</table>

Reactor Mix

<table>
<thead>
<tr>
<th>Year</th>
<th>Reactor</th>
<th>Reactor Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>BWR</td>
<td>1 (1969)</td>
</tr>
<tr>
<td></td>
<td>PWR</td>
<td>1 (1973)</td>
</tr>
</tbody>
</table>
NETHERLANDS  

INDUSTRIAL FUEL CYCLE

Policy: Use foreign services (fuel fabrication, reprocessing); participate with FRG and U.K. in URENCO (uranium enrichment consortium).

Waste Management Strategy: Use single centralized waste collection service; extend interim storage of all wastes (50-100 years) until decisions are made on disposal; studies on final disposal of all radioactive wastes in geologic formations are executed in the framework of the national research program (OPLA); ocean dumping of LLW and ILW has been terminated; the Netherlands contributed to NEA feasibility study of subseabed disposal; feasibility of disposal within international or bilateral framework is also being explored.

Cumulative SF Arisings (LWR)  

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount (t U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>228</td>
</tr>
<tr>
<td>2000</td>
<td>369</td>
</tr>
</tbody>
</table>

INTERNATIONAL RELATIONSHIPS

Member of EC, IAEA, and OECD/NEA.

ORGANIZATION

- **Government** - Ministries of Economic Affairs; Housing; Physical Planning/Environment; and Social Affairs/Employment exercise overall control of nuclear matters with Parliamentary approval of their decisions.

- **COVRA** (Centrale Organisatie Voor Radioactief Afval) - stores and collects all radioactive wastes.
  - Interim storage center, 1994.

- **ECN** (Netherlands Energy Research Foundation) - provides nuclear-related services, including waste treatment and disposal research.

- **ILONA** (Integrated National Research for Nuclear Waste Policy Committee) - supervises and coordinates waste disposal research.
Major Milestone
- Interim Storage Center 1994

**COVRA (Central Organization for Radioactive Waste)**

Centrale Organisatie Voor Radioactief Afval
Spanjeweg 1, P.O. Box 34
4453 ZG 's-Heerenbroek, Netherlands

Tel: 31-1196-13900
Fax: 31-1196-13950

Director: Jan Vrijen
Deputy Director: H.D.K. Codee
Waste Storage/Transportation: U. Bakema

**Function:** Responsible for collection, treatment, and storage of all waste (multi-funded: utilities, government, ECN).

**Facilities**
- Interim storage center (located in Borsele) for all radioactive wastes; fully operational in 1994.

**ECN (Netherlands Energy Research Center)**

Stichting Energieonderzoek Centrum Nederland
Westerduinweg 3
1755 ZG Petten, Netherlands

Tel: 31-2246-4949
Fax: 31-2246-4480

Chairman, Governing Board: G.M.V. van Aardenne

**Function:** Organize and sponsor energy research and development (partially government-funded).

**Research Center**

Managing Director: H. H. van den Kroonenberg
Nuclear Energy Research: A. M. Versteegh

(contd next page)
Netherlands

ECN (contd)

Nuc. Waste/Geologic Disposal  L. H. Vons
Safety Assessment  J. Prij
Radionuclide Migration  R.J.M. Koning
Actinide Burning  A. Abrahams

Function: Scientific and technical center; applied energy research, waste treatment.

Waste Management R&D: Geologic waste isolation in salt dome repositories (conceptual design, thermo-mechanical, safety, and radionuclide migration studies), seabed disposal, actinide burning, and decontamination study of large components.

Geological Survey of the Netherlands

Richard Hokade 10
Postbus 157
2000 AD Haarlem, Netherlands

Director
Deep Subsurface Dept.

KEMA (Research/Testing Electrochemical Materials Company)

N.V. Tot Keuring van Elektrotechnische Materialen Arnhem
Utrechtseweg 310
Postbus 9035
6800 ET Arnhem, Netherlands

R&D Division  A. M. van Dort
Nuc. Research Program  J.B.W. Kanij
Quality Assurance  H.A.W. Cornelissen
High-Level Waste  F.J.J.G. Janssen
Aqueous Waste Mgmt.  J. L. Matteman

(contd next page)

NL-4
Function: Research and consulting development; services for utilities; waste management R&D; characterization, quality assurance, volume reduction, and storage of radioactive wastes.

**MINISTRY OF ECONOMIC AFFAIRS**

Ministerie van Economische Zaken  
Postbus 20101  
NL-2500 EC The Hague, Netherlands  
Tel: 31-70-3798911  
Fax: 31-70-3796358

Dir. Electricity/Nuclear Energy  
H.F.G. Geyzers  
31-70-3796471  
J. N. A. Enst  
31-70-3797849

**MINISTRY OF HOUSING, PHYSICAL PLANNING AND ENVIRONMENT**

Ministerie van Volkshuisvesting  
Ruimtelijke Ordening en Milieubeheer  
Postbus 20G51  
Rijnstraat 0  
2500 EZ Den Haag  
Netherlands  
Tel: 31-70-3393939  
Fax: 31-70-3391355

Directors, Rad. Protection  
C. M. Plug  
R. Dortland  
M.A. Selling

**MINISTRY OF SOCIAL AFFAIRS AND EMPLOYMENT**

Ministry of Social Affairs and Employment  
Postbus 90801  
2509 LV The Hague, Netherlands  
Tel: 31-70-3335549  
Fax: 31-70-3334018

Nuclear Safety  
J. Versteeg
RIVM (National Institute of Public Health and Environment Protection)

Rijksinstituut voor Volksgezondheid en Milieuhygiene
Antonie van Leeuwenhoeklaan 9
Postbus 1
3720 BA Bilthoven, Netherlands
Tel: 31-30-749111
Fax: 31-30-742971

Safety Assessment of Underground Disposal Studies
A. van den Berg
31-30-743397
PAKISTAN

MAJOR PUBLIC HOLIDAYS (1995)

Feb 1 Start of Ramadan
Mar 2-4 Ramadan
Mar 23 Pakistan Day
May 1 May Day
May 10-12 Sacrifice Feast
Jun 8-10 Muharram
Jul 3 Bank Holiday
Aug 10 Prophet's Birthday
Aug 14 Independence
Sep 6 Defense of Pakistan
Sep 11 Death of Quaid-I-Azam
Nov 9 Iqbal Day
Dec 25 Quaid-I-Azam Birthday

TIME

Standard Time Washington, D.C.
Work week:

+ 10 hours
Sunday - Thursday

PASSPORT/VISA

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

CURRENCY EXCHANGE RATE

1 U.S. $ = 31.58 Rupee

per Wall Street Journal, 10/01/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to Pakistan are complete as listed, after dialing international access code: 011. Country code is 92; listed local numbers include city code.

U.S. EMBASSY - ISLAMABAD

American Embassy
Diplomatic Enclave, Ramna 5
P.O. Box 1048
Islamabad, Pakistan

Tel: 92-51-82-6161
Fax: 92-51-21-4222

Economics/Science Officer
Craig Curtiss
Population 1995 130 million

ENERGY

Electric Power Capacity 1992 13.7 GWe 1.5% nuclear 1995 12,530 MW 2000 13.8 GWe <1% nuclear

Electric Power Production 1992 54.3 TWh 64% gas/oil 39% hydro >1% nuclear 1995 39% hydro <1% coal 1% nuclear

NUCLEAR POWER

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

Nuclear Power Capacity 1992 0.1 GWe 2000 0.1 GWe


INDUSTRIAL FUEL CYCLE

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

Cumulative SF Arisings 1993 170 t U 2000 440 t U
INTERNATIONAL RELATIONSHIPS

Member of IAEA; agreement with U.S. and other nations on peaceful nuclear cooperation; has not signed NPT.

ORGANIZATION

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

PAEC

Pakistan Atomic Energy Commission  
P.O. Box 1114  
Islamabad, Pakistan  
Tel: 92-51-82-4276  
Fax: 92-51-82-4908

Chairman  
Ashfaq Ahmad

Secretary  
Muhammad Azfal

Waste Management  
Raze ur-Rehman

**Function**: Advocate increased nuclear energy generation to overcome serious energy shortages in a country substantially lacking in natural energy resources. In an effort to accelerate Pakistan's overall economic development, the Commission also promotes the use of nuclear technologies in other areas, such as enhancing agricultural production and medical diagnosis/therapy.

(contd next page)
Facilities

- **Fuel Fabrication Plant** at Kundian - manufacturing fuel for KANUPP since 1978, located near the Chashma site, where SGN was to build a 50-100 t U/yr spent fuel reprocessing plant (project started in 1974, halted in 1977).

- **A. Q. Khan Research Laboratory** at Kahuta - provides nuclear training and R&D on centrifuge enrichment.

- **Centrifuge Enrichment Plant** at Kahuta - 1000 centrifuges operational at startup, in 1984, with potential of additional 2000-3000 units; facility not under international safeguards.

- **Chasnupp Plant** - new nuclear power plant, 300 MW, to be fully operational in early 1999.
- light water, low-enriched uranium
- China turnkey construction of the Chasnupp plant
- now under construction

---

**PINS TECH**

Pakistan Institute of Science & Technology
P.O. Nilore
Islamabad, Pakistan

Tel: 92-51-84-7601-9

Director

I. H. Qureshi

(a) Based on publicly available information, organizational responsibility and specific location of some facilities cannot be identified with certainty; e.g., some reports appear to discuss the same facility, but their location is referred to variously as Kahuta, Rawalpindi, or Islamabad, which are relatively close to one another.
Function: Fuel cycle R&D activities, including analytical chemistry, nuclear materials, metallurgy, fuel development, digital electronics, control instrumentation, and computational physics. Basic research facilities are open to scientists/engineers from universities as well as research organizations.

Facilities (*a*)

- CNS - Center for Nuclear Studies - offers a master's degree in nuclear engineering and fulfills training requirements in health physics, nuclear medicine, instrumentation, and basic nuclear orientation.

PARR-1 - research reactor, designed for highly-enriched (90% uranium) fuel, commissioned in 1965, is being raised from 5 MWt to 9 MWt and converted to low-enriched (20%) fuel in 1990.

PARR-2 - training reactor, 27 kW, designed and built in collaboration with the Chinese Institute of Atomic Energy (Beijing), went critical in late 1989.


- CTC - Computer Training Center established in collaboration with a consortium of universities.

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(a) Based on publicly available information, organizational responsibility and specific location of some facilities cannot be identified with certainty; e.g., some reports appear to discuss the same facility, but their location is referred to variously as Kahuta, Rawalpindi, or Islamabad, which are relatively close to one another.

PK-4
RUSSIA

MAJOR PUBLIC HOLIDAYS (1995)

Jan  1 New Year
Jan  7 Christmas (Orthodox)
Mar  8 Women's Day
May  1-2 Solidarity Day
May  9 Victory Day
June 12 Independence
Dec 12 Constitution Day
Nov  7-8 Revolutionary Days

TIME

Standard Time Washington, D.C. (Moscow) +8 hours
Daylight Savings Time Period: 03/26 - 09/23/95

PASSPORT/Visa

A passport is needed to depart and re-enter the U.S.; in addition, a visa is currently required for a visit to Russia. Most travel agencies can provide up-to-date information on requirements.

CURRENCY EXCHANGE RATE

1 U.S. $ = 4578 Rubles
as of 12/01/95; rates continue to fluctuate. The Russian ruble is available only in Russia. Payment in U.S. currency and credit cards is rarely accepted. Consult the U.S. embassy for up-to-date information.

DIRECT DIALING

Individual numbers for direct dial to Russia are complete as listed, after dialing international access code: 011. Country code is 7; listed local numbers include city code.

U.S. EMBASSY - MOSCOW

American Embassy
Novinskiy Bul'var 19/23
121099 Moscow, Russia
Tel: 7-095-252-2451 through 2459
Fax: 7-095-956-4261
E-mail: usembest@glas.apc.org

Minister, Environ., Science, and Tech. John Zimmerman
<table>
<thead>
<tr>
<th></th>
<th>1994</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td></td>
<td>149.6</td>
<td>million</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ENERGY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Power Capacity</td>
<td>1992</td>
<td>212 GWe</td>
<td>12% nuclear</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>245 GWe</td>
<td>10% nuclear</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>270 GWe</td>
<td>11% nuclear</td>
</tr>
<tr>
<td>Electric Power Production</td>
<td>1992</td>
<td>1066 TWh</td>
<td>43% gas</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>21% coal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15% hydro/geo.th.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>12% nuclear</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9% oil</td>
</tr>
<tr>
<td><strong>NUCLEAR POWER</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major program to develop nuclear power to avoid transport of fossil fuels from east of the Ural Mountains to the more densely populated western areas.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuclear Power Capacity</td>
<td>1994</td>
<td>20.2 GWe</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>25.0 GWe</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>36.5 GWe</td>
<td></td>
</tr>
</tbody>
</table>
RUSSIA

Reactor Mix 1994
GR 1 (Indef.)
PWR 1 (Indef.)
FBR 1 (1981)
2 (Indef.)

Reactor Development advanced PWRs (VVER-500, VVER-1000, VPBER-600), LGRs (MKER-800), LMFBRs

INDUSTRIAL FUEL CYCLE

Policy: Complete domestic fuel cycle capability, including enrichment, fuel fabrication (UO$_2$ and MOX), and reprocessing; complete fuel cycle services, including SF storage and LLW/ILW disposal; shift to PWRs (since Chernobyl accident in 1986).

Waste Management Strategy: Spent nuclear fuels from PWRs are stored 3-10 years, then reprocessed to recycle fissile materials and separate a number of other specific radionuclides for beneficial uses and different disposition; HLW is vitrified for disposal in a future geologic repository; HLW partitioning processes are being developed to recover most long-lived radionuclides. SF from RBMK (Soviet acronym for light-water-cooled, graphite-moderated) reactors is stored, pending decision on ultimate disposition.

Liquid LLW from nuclear reactor operations is currently evaporated, incorporated into bitumen or cement, and stored and/or disposed of at disposal facilities at each reactor station. Thirty-six other, regional facilities exist for medical, industrial, and radioactive waste disposal. Efforts are under way to decrease liquid LLW volumes and to recycle them in water and reactant circuits.

Solid LLW, compacted at each nuclear power station, is stored/disposed of at reactor sites; regional burial facilities are being considered to minimize transportation-related risks.

RS-2
INTERNATIONAL RELATIONSHIPS

DOE/MAPI

Agreement on Scientific and Technical Cooperation in the Field of Peaceful Uses of Atomic Energy

Term: 05-25-90 to 05-24-95 (initiated 1973)

Scope: Technology information exchange.

Memorandum of Cooperation in the Fields of Environmental Restoration and Waste Management

Term: 09-18-90 to 09-17-95

Scope: Technology information exchange on policy and practices; evaluation of problems in environmental remediation, D&D of facilities and materials; R&D; analysis/investigations of waste partitioning; vitrification and geologic disposal of radioactive waste.

Member of IAEA and WANO; cooperation with CERN and JINR.

ORGANIZATION

Nuclear Program Control

- MINATOM (Ministry for Atomic Energy, Russian Federation) - nuclear safety; territory rehabilitation; defense conversion programs; regulation and policy; weapons/disarmament; civilian and defense nuclear fuel cycle; waste management; successor to MAP! (Ministry of Atomic Power and Industry).


- GOSATOMNADZOR (Russian Federal Authority for Nuclear and Radiation Safety).
Research and Development

- **All-Russian Research Institute for Inorganic Materials**, Moscow, reprocessing, solidification, and disposal of HLW; properties of solid waste forms.

- **All-Russian Research Institute for Nuclear Power Plant Operation**, Moscow, reprocessing/disposal of NPP radioactive wastes.

- **Institute of Physical Chemistry**, Moscow (branch of the Russian Academy of Sciences), radionuclide migration; waste form properties.

- **Kurchatov Institute** (Russian Scientific Centre), Moscow, major independent scientific center; nuclear power R&D, physics, superconductivity, fusion.

  V. G. Khlopin Radium Institute, St. Petersburg, reprocessing, HLW partitioning/solidification, solid waste form properties, off-gasses, waste storage/disposal, environmental remediation.

- **Scientific Research Institute of Chemical Engineering**, Ekaterinburg, vitrification/bitumenization pilot plants.

- **Institute of Theoretical and Experimental Physics (ITEP)**, Moscow, wide-scale fundamental theoretical and experimental nuclear and particle physics.

- **Institute of High-Energy Physics (IHEP)**, Protvino, Moscow Region, basic particle research; building 3000 GeV proton accelerating storage ring.

- **Institute of Innovation and Thermonuclear Research**, Troitsk, Moscow Region, thermonuclear fusion, plasma physics, laser physics and technology, development and application of MHD generators.

- **All Russian Research Institute of Chemical Technology (VNIKIT)**, Moscow, conducts research into leaching of radioactive, rare, noble, and other metals, and reprocessing of liquid and solid wastes.
- **Institute of Physics and Power Engineering (IPPE), Obninsk**, develops nuclear power plants, monitoring systems, instrumentation; full-scale testing of nuclear power plant prototypes; supplies radioactive isotopes to world market, produces medical isotopes.

- **Institute of Electrophysical Equipment (NIEFA), St. Petersburg**, designs and manufactures linear electron accelerators for radiation technology; supplies thermonuclear and electrophysical devices to Kurchatov, Khlopin, IHEP.

- **Research Institute of Atomic Reactors (NIIAR), Dimitrovgrad**, large nuclear center researches complex problems in nuclear power, reactor materials science, and transuranic elements and atomic physics; operates eight research and experimental reactors.

- **Scientific Engineering Center (SNIIP), Moscow**, develops/manufactures instrumentation and systems for nuclear power plants and characterization and monitoring of radioactive contamination.

- **Research and Design Institute of Installation Technology (Research and Production Asso., NIKIMT), Moscow**, develops nuclear facility installation and repair technologies, maintenance and backfitting for nuclear reactors and thermonuclear devices.

- **Russian Federal Nuclear Center - All-Russian Research Institute of Experimental Physics (VNIEF), Nizhni Novgorod Region**, conducts theoretical and analytical research in nuclear physics, gas dynamics, radiation, nuclear kinetics, thermonuclear reaction.

- **Russian Federal Nuclear Center - All Russian Research Institute of Technical Physics (VNIITF), Urals Region near Chelyabinsk**, basic/applied research in nuclear physics, nuclear charges, nuclear explosion recorders. Science and design support for weapons dismantlement is high priority.

- **VNIPIET (All-Russian Design and Research Association for Energy Technology), St. Petersburg**, design of SF reprocessing facilities, SF transportation/storage.
ALL-RUSSIAN RESEARCH INSTITUTE FOR INORGANIC MATERIALS

All-Russian Research Institute for Inorganic Materials
Rogov Str. 5a
123060 Moscow, Russia

Director
Mikhail I. Solonin
Deputy Director
Anatoliy C. Mamayev

Function: R&D on SF reprocessing, radioactive waste processing/solidification (bitumenization/vitrification, etc.), off-gases.

ALL-RUSSIAN RESEARCH INSTITUTE FOR NUCLEAR POWER PLANTS

All-Russian Research Institute for Nuclear Power Plants
Ferganskaya Str. 25
109507 Moscow, Russia

Director General
A. Armen Abagyan
Deputy Director
Valentin N. Shpyakin

Function: Processing and disposal of NPP radioactive wastes; decontamination of equipment/facilities; emergency situation studies.
GOSATOMNADZOR
(Russian Federal Authority for Nuclear/Radiation Safety)

GOSATOMNADZOR
Taganskyaya Str. 34
109147 Moscow, Russia

Chairman
Deputy Chairman
Administration

Tel: 7-95-272-4710
Fax: 7-95-278-8090
Yuri G. Vishnevsky
Alexander Gutsalov
Valentin A. Rekunov

Function: Supervision of all safety aspects of Russian nuclear industry.

KHLOPIN

Research Production Association
V. G. Khlopin Radium Institute
Shverniki pr. 28
194021 St. Petersburg, Russia

Director-General
Deputy Directors
Laboratory Manager
Chief Scientist

Tel: 7-812-247-5641
Fax: 7-812-534-7752
Alexander I. Karelin
Evgeny B. Anderson
A. A. Rimskij-Korsakov
Valeriy N. Romanovskiy
Leonard N. Lasarev

Activities: Development of SF treatment (reprocessing, thermal decladding, meltdown of hulls); improved HLW partitioning; waste immobilization; off-gas treatment; \(^{131}\)Kr storage; waste disposal; geochemistry; studies on solidified waste properties; environmental remediation, protection, and monitoring.

(contd next page)
KHLOPIN (contd)

Facilities

- **Ecology Laboratory** (located 90 km from St. Petersburg in Sosnovo Bor)
  Studies conducted on ecological aftermath of Chernobyl; impact of radionuclides, assessment of dose/risk; methods for monitoring radioactivity in the environment.

- **Reprocessing Research & Development Facility**
  **Mission:** Develop LWR fuel reprocessing technology.
  **Design Basis:** Chop-leach head-end; PUREX flowsheet; capacity, 3 kg/d uranium.
  **History:** Startup, 1973.

KURCHATOV

Russian Scientific Centre
Kurchatov Institute
Kurchatov Square 1
123182 Moscow, Russia

President: Evgeniy P. Velikhov
Vice-President: Nicolai N. Ponomarev-Stepnoy
Nuclear Safety: Ilya V. Elkin
Yuri P. Buzulukov

**Function:** Nuclear power research, R&D on LLW/ILW.

MAYAK

Production Association ‘MAYAK’
Lenin Str. 31
454065 Chelyabinsk-65, Russia

Director: Victor Fetisov
Chief Engineer: Alexander P. Suslov
Dir., Radiochemical Plant: Vladimir K. Sazhnov
Chief Engineer, Radiochem. Plant: Evgeniy G. Dzekun

(contd next page)
MAYAK (contd)

Location: Near city of Kyshtym.

Function: Nuclear complex with multitude of activities and facilities, including radiochemical processing, weapon materials production reactors, isotope production, special waste storage, and burial sites; produced first Soviet weapons-grade plutonium.

Facilities

• Power Reactor Fuel Reprocessing Plant

• Fully Radioactive HLW Vitrification Plant
  Design Basis: Single-stage joule-heated ceramic melter with feed rate of 500 L/hr; ~160 t of HLW phosphate glass produced 1987-1988; melter was shut down due to electrode problems; similar melter was modified and started operation in June 1991. As of April 1992, 50 MCl of HLW have been incorporated into phosphate glass.

MINATOM

Ministry for Atomic Energy of the Russian Federation
Bol’shay Ordynka Str. 24/26
101000 Moscow, Russia

Tel: 7-095-239-4545
Fax: 7-095-230-2420

Minister
First Deputy Minister
Deputy Ministers

General Manager
International Relations

(contd next page)
MINATOM (contd)

Function: Manage all aspects of nuclear power industry. Established in January 1992; successor to MAPI.

MINING/CHEMICAL COMBINE

Mining and Chemical Combine
53 Lenin ul
660033 Krasnoyarsk, Russia

Director
Chief Engineer
Dep. Chief Engineer
Dir., Radiochemical Plant
Chief Eng., Radiochemistry

Tel: 7-391-232-1251
Fax: 7-391-232-0374

Valeriy A. Lebedev
Urij S. Volzhanin
Yuri A. Revenko
Gennadi A. Demidov
Yuri P. Sorokin

Function: SF reprocessing, waste management, underground disposal.

MINISTRY FOR ECOLOGY/NATURAL RESOURCES

Ministry for Ecology and Natural Resources
B. Gruzinskaya Str. 4/6
123812 GSP Moscow, Russia

Minister
Deputy Minister

Tel: 7-095-252-2305
Fax: 7-095-254-8283

Victor I. Danilov-Danilyan
Nikolai G. Rybalskiy

Function: Responsible for control and standardization of releases containing radionuclides.
Function: Research and production association; disposal of institutional radioactive/hazardous waste; R&D on waste treatment/conditioning; engineering design/support services; environmental protection services; special accident-related emergency services/investigations.

Facilities

- **Sergiev Posad Disposal Site** (formerly Zagorsk, located 75 km NE of Moscow)
  Largest facility (about 170 acres) with capacity for 3500 m³ (including 500 m³ liquids) waste per year (capacity at 15 other facilities <1000 m³/yr each); waste from scientific, industrial, medical, and other producers; waste characteristics similar to reactor waste, including spent radiation sources, liquid concentrates, combustible liquids, highly active research reactor core components (with short-lived nuclides and limited alpha emitters); treatment/conditioning of wastes is by compaction, combustion, cementation, bitumenization, vitrification, and special immobilization in metal matrix; disposal is in engineered concrete in-ground structures.
RESEARCH AND PRODUCTION
ASSOCIATION OF INSTALLATION TECHNOLOGY

Research and Production Association
of Installation Technology
Alufjevskow sh. 43
Moscow, Russia

Director
Deputy Director

Function: assemble and repair multipurpose nuclear facilities; R&D; reconstruction.

SCIENTIFIC RESEARCH INSTITUTE
OF CHEMICAL ENGINEERING

Scientific Research Institute
of Chemical Engineering
Griboyedov Str. 32
620010 Ekaterinburg, Russia

Director
Deputy Director

Facilities

- KS-KT-100 (cold pilot plant - HLW vitrification)
  Mission: Develop waste vitrification technology.
  Design Basis: Fluid bed calciner, in-crucible melter (two-stage process); capacity, 100 L/hr HLLW, 20 kg/hr glass; 160-180 kg glass/batch; product, phosphate glass in crucibles.
  History: Startup, approximately 1975.
VNIPLET
(Planning, Design, Research and Technological Association)

VNIPLET
Savushkin Str. 82
197228 St. Petersburg, Russia

Director-General
Vladimir A. Kurnosov
Deputy Director
N. V. Stakhov

Function: Design plants/facilities for SF reprocessing, waste processing, storage/disposal; SF transport/storage; decontamination.
SOUTH AFRICA

MAJOR PUBLIC HOLIDAYS (1995)

<table>
<thead>
<tr>
<th>Jan</th>
<th>1</th>
<th>New Year</th>
<th>June</th>
<th>16</th>
<th>Youth Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar</td>
<td>21</td>
<td>Human Rights Day</td>
<td>Aug</td>
<td>9</td>
<td>Women’s Day</td>
</tr>
<tr>
<td>Apr</td>
<td>17</td>
<td>Family Day</td>
<td>Sept</td>
<td>24</td>
<td>Heritage Day</td>
</tr>
<tr>
<td>Apr</td>
<td>14</td>
<td>Good Friday</td>
<td>Dec</td>
<td>16</td>
<td>Reconciliation Day</td>
</tr>
<tr>
<td>Apr</td>
<td>27</td>
<td>Freedom Day</td>
<td>Dec</td>
<td>25</td>
<td>Christmas</td>
</tr>
<tr>
<td>May</td>
<td>1</td>
<td>Worker’s Day</td>
<td>Dec</td>
<td>26</td>
<td>Day of Goodwill</td>
</tr>
</tbody>
</table>

TIME

Standard Time Washington, D.C. + 7 hours

PASSPORT/VISA

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

CURRENCY EXCHANGE RATE

1 U.S. $ = 3.66 Rand

per Wall Street Journal, 10/01/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to South Africa are complete as listed, after dialing international access code: 011. Country code is 27; listed local numbers include city code.

U.S. EMBASSY - HOHANNESBURG

American Embassy
11th FL. Kine Ctr
Commissioner and Kruls Sts
PO Box 2155
Johannesburg, South Africa

Tel: 27-11-331-3937
Fax: 27-11-331-6178

Economic Affairs Counselor: J. Michael Cleverley
<table>
<thead>
<tr>
<th>Population</th>
<th>1994</th>
<th>43.9 million</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ENERGY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Power Capacity</td>
<td>1993</td>
<td>33.2 GWe</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td>34.1 GWe</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>37.9 GWe</td>
</tr>
<tr>
<td>Electric Power Production</td>
<td>1993</td>
<td>154 TWh</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NUCLEAR POWER</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy: Expand electric power production capacity chiefly through coal-burning plants but develop modest nuclear capability to complement coal, particularly after 2000.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuclear Power Capacity</td>
<td>1993</td>
<td>1.8 GWe</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>1.8 GWe</td>
</tr>
<tr>
<td>Reactor Mix</td>
<td>1994</td>
<td>PWR 2 (1984/85)</td>
</tr>
<tr>
<td><strong>INDUSTRIAL FUEL CYCLE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste Management Strategy: Interim storage of LLW/ILW at the reactor, followed by shallow-land disposal; interim storage of spent fuel for ~40 years; plans for disposal not defined.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SOUTH AFRICA

Cumulative SF Arisings (LWR)  
1990  180 t U  
2000  520 t U

Major Milestones

• Dry SF storage facility (Vaalputs)  
  2000

INTERNATIONAL RELATIONSHIPS

Member of IAEA.

ORGANIZATION

Ministry of Mineral and Energy Affairs

- Atomic Energy Corporation (AEC)

  Pelindaba Site
  • R&D
  • Research reactor
  • Isotope production
  • Fuel fabrication
  • LLW disposal

  Vaalputs National LLW Disposal Facility
  • LLW/ILW disposal
  • Site characterization

  Valindaba Site
  • Uranium conversion

- National Energy Council (NEC)

- Council for Nuclear Safety (CNS)
  • Independent regulatory licensing authority

Eskom
  • Electricity production
Atomic Energy Corporation of South Africa Ltd.
P.O. Box 582
Pretoria, South Africa

Tel: 27-12-316-4911
Fax: 27-12-316-3111

Chief Executive Officer
Waldo E. Stumpf

Senior General Managers
- P. J. Venter
- K. F. Fouche
- L. S. Snyders
- A. G. M. Jackson
- B. B. Hambleton-Jones

Function: Overall responsibility for government nuclear activities including uranium conversion, R&D, radioisotope production, radwaste disposal, and repository, fuel fabrication.

Facilities

- **Pelindaba Site**
  
  Mission: Perform nuclear R&D; operate research reactor, isotope production line, food irradiation facility; manufacture fuel; operate LLW treatment/shallow-land disposal facilities. Enrichment facilities at Pelindaba are now closed and are being decommissioned.

- **Vaalputs National LLW Disposal Facility**
  
  Private Bag X7
  Springbok 8240, South Africa
  Tel: 27-251-22832
  Fax: 27-251-81220
  
  Mission: Operate LLW/ILW shallow-land disposal facilities; perform site characterization and environmental studies.
  Design Basis: 1,470 m³/yr LLW/ILW disposal.

- **Valindaba Uranium Conversion Plant**
  
  Design Basis: 700 t U/yr conversion.
SOUTH AFRICA

CNS

Council for Nuclear Safety
P.O.B. 7106
Hennopsmeir 0046, South Africa
Tel: 010-27-12-663-5508
Fax: 010-27-12-663-5513

Chairman: J. B. Martin
Vice-Chairman: D. Reitmann
Exec. Officer: B. C. Winkler
General Manager: J. Leaver

Function: Independent regulatory/licensing agency for construction and operation of nuclear installations (established by the 1988 Nuclear Energy Amendment Act).

ESKOM

ESKOM
P.O. Box 1091
Johannesburg 2000
South Africa
Tel: 27-11-800-8111
Fax: 27-11-800-4390

Chief Executive/COB: A. J. Morgan
Chairman, Electricity Council: John B. Maree
Exec. Dir., Technology: J. A. de Beer

Function: Provide electricity for public use.
SPAIN

MAJOR PUBLIC HOLIDAYS (1995)

<table>
<thead>
<tr>
<th>Jan</th>
<th>1</th>
<th>New Year</th>
<th>Oct</th>
<th>12</th>
<th>National Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>6</td>
<td>Epiphany</td>
<td>Dec</td>
<td>6</td>
<td>Constitution Day</td>
</tr>
<tr>
<td>Apr</td>
<td>13</td>
<td>Holy Thursday</td>
<td>Dec</td>
<td>8</td>
<td>Immaculate Conception</td>
</tr>
<tr>
<td>Apr</td>
<td>14</td>
<td>Good Friday</td>
<td>Dec</td>
<td>25</td>
<td>Christmas</td>
</tr>
<tr>
<td>May</td>
<td>1</td>
<td>Labor Day</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TIME

Standard Time Washington, D.C.
Daylight Savings Time Period: + 6 hours
03/27 - 09/24/95

PASSPORT/VISA

A passport is needed to depart and re-enter the U.S.A. In addition, a visa is currently required for travel to Spain, unless a personal passport is used for the visit. Most travel agencies can provide up-to-date information concerning requirements.

CURRENCY EXCHANGE RATE

1 U.S. $ = 124.18 Peseta
per Wall Street Journal, 10/01/95. Because 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, after dialing international access code: 011. Country code is 34; listed local numbers include city code.

U.S. EMBASSY - MADRID

American Embassy
75, Serrano
28006 Madrid, Spain

Science Attaché

Tel: 34-1-577-4000
Fax: 34-1-577-5735
Helen B. Lane


<table>
<thead>
<tr>
<th>Energy Data</th>
<th>1993</th>
<th>1995</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electric Power Capacity</strong></td>
<td>42.4</td>
<td>46.2</td>
<td>51.4</td>
</tr>
<tr>
<td></td>
<td>GWe</td>
<td>GWe</td>
<td>GWe</td>
</tr>
<tr>
<td></td>
<td>17.5% nuclear</td>
<td>15.9% nuclear</td>
<td>14.3% nuclear</td>
</tr>
<tr>
<td><strong>Electric Power Production</strong></td>
<td>153.2</td>
<td>165.5</td>
<td>195.3</td>
</tr>
<tr>
<td></td>
<td>TWh</td>
<td>TWh</td>
<td>TWh</td>
</tr>
<tr>
<td></td>
<td>39.3% coal</td>
<td>27.4% nuclear</td>
<td>23.2% nuclear</td>
</tr>
<tr>
<td></td>
<td>34.8% nuclear</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.2% hydro</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.3% oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.7% other</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nuclear Power Policy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy: Continue to operate existing nuclear power plants. Moratorium on new nuclear power plant construction has been in place for several years (confirmed 1991).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nuclear Power Capacity</strong></td>
<td>7.4</td>
<td>7.4</td>
<td>7.4</td>
</tr>
<tr>
<td></td>
<td>GWe</td>
<td>GWe</td>
<td>GWe</td>
</tr>
<tr>
<td><strong>Reactor Mix</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>PWR</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 (1969-88)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 (Indef.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BWR</td>
<td>2 (1971-85)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 (Indef.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
INDUSTRIAL FUEL CYCLE

Policy: Once-through fuel cycle for LWRs; no domestic reprocessing and no further contracts for foreign reprocessing, except GCR fuel (Vandellos I).

Waste Management Strategy: Store spent fuels at the reactor sites for at least 10 years; reracking in some reactor pools and dry storage in dual-purpose casks planned to provide additional capacity until geologic repository is ready to receive HLW (spent fuel); granite, salt, and clay are being considered as host rock for repository; shallow-land burial of LLW in fully engineered facility at El Cabril, province of Cordoba, in operation since October 1992.

<table>
<thead>
<tr>
<th>Cumulative SF Arisings (LWR)</th>
<th>1990</th>
<th>930 t U</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1995</td>
<td>1,800 t U</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>2,000 t U</td>
</tr>
</tbody>
</table>

Industrial-Scale Activities (Capacity)

- U mining/milling: 270 t U/yr
- U enrichment: 11.1% interest in Eurodif
- Fuel fabrication: 200 t U/yr
- Intermediate SF storage: 3,000 t U

INTERNATIONAL RELATIONSHIPS

DOE/Empresa Agreement in the Field of Radioactive Waste Management

Term: 12/16/92 - 12/16/97
Scope: Exchange of technology for management of radioactive wastes, i.e., characterization of geologic formations; preparation/packaging; disposal; surface/subsurface storage; performance and transportation assessments; mutually agreed-upon topics associated with management of radioactive waste.

Member of EU, IAEA, and OECD/NEA.
CIEMAT (Energy Research Center)

Centro de Investigaciones Energéticas, MedioAmbientales y Tecnológicas
22, Avenida Complutense
Ciudad Universitaria
28040 Madrid, Spain

Tel: 34-1-346-6000/01
Fax: 34-1-346-6005

President
General Director
Dir., Nuclear Tech. Institute
Dir., Environment Institute
Waste Management Unit
A. Lafuente Félez
José Ángel Azuara Solís
Manuel Montes Ponce de León
J. G. Maganto Fernández
Armando Uriarte Hueda

Function: Organized into five research institutes: Nuclear Technology (R&D on nuclear fuel cycle, decommissioning, material sciences, and safety analyses); Technology Institute; Environment Institute (radiation protection included); Basic Research Institute (fusion research included); and Renewable Energy Institute.

CSN (Council of Nuclear Safety)

Consejo de Seguridad Nuclear
11, Justo Dorado
28020 Madrid, Spain

Tel: 34-1-346-0100
Fax: 34-1-346-0471

President
Commissioners
J. M. Kindelán
A. Alonso Santos
R. Caro Manso
A. Martín

Function: Independent body, responsible to Parliament, with regulatory powers on nuclear safety and radiation protection matters.

(a) Nominations pending.
ENRESA (National Waste Management Company)

Empresa Nacional de Residuos Radiactivos S.A.
7, Emilio Vargas
28043 Madrid, Spain
Tel: 34-1-519-5255
Fax: 34-1-519-5268

President
J. A. Pina Barrio
34-1-279-2667

General Director
Alberto López García
34-1-279-2858

Engineering Director
Aurelio M. Ulibarri
Valentín González
34-1-519-5314

Function: Provide waste management services and disposal facilities to all Spanish nuclear companies and radwaste producers; responsible to the Ministry of Industry and Energy; funded by CIEMAT (80%) and the National Institute of Industry (20%).

ENUSA (National Fuel Cycle Company)

Empresa Nacional del Uranio S.A.
12, Santiago Rusinol
28040 Madrid, Spain
Tel: 34-1-347-4200
Fax: 34-1-347-4215

President
Alfredo Llorente Legaz

Function: Supply fuel cycle services except waste management and disposal (uranium mining and milling, fuel fabrication) to Spanish nuclear power plants.
MINISTRY OF INDUSTRY AND ENERGY

Minister
J. M. Eguíegaray Ucelay

Secretary General,
Energy/Mineral Resources
A. Lafuente Félez

General Director of Energy
Maria Luisa Huidobro Arreba
SWEDEN

MAJOR PUBLIC HOLIDAYS (1995)

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Holiday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>1</td>
<td>New Year</td>
</tr>
<tr>
<td>Apr</td>
<td>14</td>
<td>Good Friday</td>
</tr>
<tr>
<td>Apr</td>
<td>17</td>
<td>Easter Monday</td>
</tr>
<tr>
<td>May</td>
<td>25</td>
<td>Ascension</td>
</tr>
<tr>
<td>June</td>
<td>5</td>
<td>Pentecost Monday</td>
</tr>
<tr>
<td>June</td>
<td>24-25</td>
<td>Midsummer</td>
</tr>
<tr>
<td>Nov</td>
<td>1</td>
<td>All Saints</td>
</tr>
<tr>
<td>Dec</td>
<td>24-25</td>
<td>Christmas</td>
</tr>
<tr>
<td>Dec</td>
<td>26</td>
<td>Boxing Day</td>
</tr>
</tbody>
</table>

TIME

Standard Time Washington, D.C.
Daylight Savings Time Period: 03/26 - 09/23/95

PASSPORT/Visa

A passport is needed to depart and re-enter the U.S. 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 on requirements.

CURRENCY EXCHANGE RATE

1 U.S. $ = 6.6855 Krona (SEK)

per Wall Street Journal, 11/08/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to Sweden are complete as listed, after dialing international access code: 011. Country code is 46; listed local numbers include city code.

U.S. EMBASSY - STOCKHOLM

American Embassy
Strandvägen 101
100 00 Stockholm, Sweden

Tel: 46-8-783-5300
Fax: 46-8-661-1964

Economic Section
Kenneth H. Kolb
## Population

| Year | 1994 | 8.7 million |

## Energy

### Electric Power Capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>1993</th>
<th>34.2 GWe</th>
<th>29% nuclear</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1995</td>
<td>34.8 GWe</td>
<td>29% nuclear</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>35.0 GWe</td>
<td>29% nuclear</td>
</tr>
</tbody>
</table>

### Electric Power Production

<table>
<thead>
<tr>
<th>Year</th>
<th>1993</th>
<th>140.8 TWh</th>
<th>52% hydro</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>42% nuclear</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td></td>
<td>6% coal, oil, solids, gas</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td></td>
<td>43% nuclear</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td></td>
<td>44% nuclear</td>
</tr>
</tbody>
</table>

### Nuclear Power

**Policy:** Phase out all nuclear plants by the year 2010; changing this policy will require a new decision by Parliament.

<table>
<thead>
<tr>
<th>Year</th>
<th>1993</th>
<th>10.0 GWe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000</td>
<td>10.0 GWe</td>
</tr>
</tbody>
</table>

### Reactor Mix

<table>
<thead>
<tr>
<th>Year</th>
<th>1995</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BWR 9 (1972-85)</td>
</tr>
<tr>
<td></td>
<td>PWR 3 (1975-83)</td>
</tr>
</tbody>
</table>

## Industrial Fuel Cycle

**Policy:** Direct disposal of spent fuel; no Pu recycle is planned; costs of waste management and future decommissioning of nuclear power plants are paid by fees collected from the nuclear utilities.
**Waste Management Strategy:** Store spent fuel for 30-40 years in an underground pool storage facility; encapsulate spent fuel in a highly corrosion-resistant canister; emplace in a deep geologic (crystalline rock) repository.

<table>
<thead>
<tr>
<th>Cumulative SF Arisings (LWR)</th>
<th>1993</th>
<th>2,560 t U</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010</td>
<td>7,800 t U</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cumulative Waste Arisings</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>(conditioned and encapsulated, ready for disposal)</td>
<td>SF</td>
</tr>
<tr>
<td></td>
<td>TRU</td>
</tr>
<tr>
<td></td>
<td>Reactor waste</td>
</tr>
<tr>
<td></td>
<td>Reactor core comp.</td>
</tr>
<tr>
<td></td>
<td>D&amp;D</td>
</tr>
</tbody>
</table>

**Industrial-Scale Activities**

- LWR fuel fabrication: 400 t U/yr.

**Major Milestones**

(Deep Repository Project)

- Collect information for general and feasibility studies | 1993-95
- Site investigations | 1995-98
- Regulatory review, stage 1 | 1999
- Detailed characterization | 1999-2004
- Regulatory review, stage 2 | 2004-05
- Construction of deep repository | 2005-08
- Regulatory review of construction | 2007-08
- Operation start, initial stage disposal activities | 2008

**INTERNATIONAL RELATIONSHIPS**

**DOE/SKB Agreement for Cooperation in Waste Management**

**Term:** 07-01-77 to 09-09-95

**Scope:** Preparation and packaging of waste forms; storage, field, and laboratory testing; geologic disposal; safety, environment, institutional, and public relations issues. Collaboration in Stripa Mine
test program (NEA coordination). U.S. participation in performance assessment computer model and code intercomparison sponsored by SKB.

Member of IAEA and OECD/NEA; waste management cooperative agreements with Canada, EC, Finland, France, Spain, 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.

- **Licensing Responsibilities**
  - SKI (Swedish Nuclear Power Inspectorate) - licensing for construction/operations of nuclear facilities; administers waste management fund collected from nuclear utilities; oversees back-end fuel cycle activities.
  - 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
412 96 Goeteborg, Sweden

Nuclear Chemistry

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

Kemakta Konsult AB
Pipersgatan 27
112 28 Stockholm, Sweden

Tel: 46-8-654-06-80
Fax: 46-8-652-16-07

Manager
Bertil Grundfelt

Function: Computer calculations on hydrology/nuclide migration.

KTH (Royal Institute of Technology)

KTH
100 44 Stockholm, Sweden

Tel: 46-8-790-60-00
Fax: 46-8-109-199

Chemical Engineering
Inorganic Chemistry

Ivars Neretnieks
I. Grenthe

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

NUCLEAR SAFETY AND TRAINING CENTER

Kärnkraftssäkerhet och Utbildning AB
PO Box 1039
S-61129 Nykoping, Sweden

Tel: 46-155-263-500
Fax: 46-155-263-074

President
Svante Nyman
Manager
Lars R. Erikson

Function: Promote coordination/cooperation among the Swedish utilities in their nuclear power plant safety work; nuclear simulator training in Sweden.
SGAB (Swedish Geological Company)

Geosigma AB
P.O. Box 894
75108 Uppsala, Sweden

Tel: 46-18-65-08-00
Fax: 46-18-12-32-02

Director
Nils-Ake Larsson

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 Kärnbränslehantering AB
P.O. Box 5864
102 40 Stockholm, Sweden

Tel: 46-8-665-28-00
Fax: 46-8-661-57-19

President
Sten Bjurström
46-8-665-2834

Vice President
Per-Eric Ahlström
46-8-665-2838

Systems/Facilities, Director
Hans Forsström
46-8-665-2832

Director, R&D/Safety Anal.
Tönis Papp
46-8-665-2801

Geoscience
Lars Olof Ericsson
46-8-665-2830

Chemistry
Fred Karlsson
46-8-665-2811

Design & Engineered Barriers
Christer Svermar
46-8-665-2825

Material Sciences
Lars Werme
46-8-665-2883

International Relations
Monica Hammarström
46-8-665-2883

Nuc. WM Int'l Consult. Services
Bo Gustafsson
46-8-665-2816

(contd next page)
**SKB (Nuclear Fuel and Waste Management Company) (contd)**

**Function:** 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 SF and other long-lived wastes can be disposed of safely and permanently; provide transportation of SF outside reactor sites.

**Owners:** Utilities.

**Facilities**

- **CLAB (Central Storage for Spent Fuel, located at Simpevarp, adjacent to Oskarshamn Power Station)**
  - **Mission:** AFR storage facility.
  - **Design Capacity:** Initially 3000 t; being upgraded to 5000 t.
  - **History:** Startup construction, May 1980; startup operation, 1985.

- **SFR (Swedish final repository for LLW and ILW, located in rock 50 m below seabed, 1 km outside Forsmark harbor on Gulf of Bothnia).**
  - **Design:** Concrete silos inside cylindrical rock caverns isolated by layer of bentonite clay backfill between silo and rock for high-activity ILW; conventional tunnel rooms for LLW; low-activity ILW is in concrete-walled "hot-cells" in tunnels; 1-km-long tunnels leading to repository will be plugged with concrete.
  - **Capacity:** 90,000 m³.
  - **History:** Phase-1 construction startup, 1983; operation startup, 1988; Phase-2 operations startup, late 1990s.

- **Äspö Hard Rock Laboratory**

  SKB Development/Äspö Hard Rock Laboratory
  Project Office
  Box 5864
  102 48 Stockholm, Sweden

  **Project Manager**
  Olle Olsson

  (contd next page)
SKB (Nuclear Fuel and Waste Management Company) (contd)

SKB Åspö Hard Rock Laboratory
Site Office, Pl 300
570 93 Figeholm, Sweden
Tel: 46-491-82000
Fax: 46-491-82005

Site Manager
Olle Olsson

Underground research laboratory (located on Åspö Island at Simpevarp) under construction; startup/operation 1994.

SKI (Nuclear Power Inspectorate)

Statens Kärnkraftinspektion
Box 27 106
102 52 Stockholm, Sweden
Tel: 46-8-665-44-00
Fax: 46-8-661-90-86

Director
Waste Management
Lars-Olof Högberg
Soeren Norrby

Function: Responsible for licensing nuclear facilities; administers waste management fund collected from nuclear utilities; oversees back-end fuel cycle activities.

SSI (National Institute of Radiation Protection)

Statens Straalskyddsinstitut
Box 60204
104 01 Stockholm, Sweden
Tel: 46-8-729-71-00
Fax: 46-8-729-71-08

Director
Radwaste Group
Gunnar Bengtsson
Gunnar Johansson (A)

Function: Responsible for establishing and enforcing radiation protection regulations.
STUDSVIK RADWASTE AB

Studsvik Radwaste AB
611 82 Nyköping, Sweden

Director
Olle Andersson

Function: Nuclear waste R&D and services to support Swedish power programs (contract research) on LLW and ILW treatment, D&D techniques, SF leaching, biosphere migration, dose calculations.

Owner: Vattenfall (via Studsvik AB).

VATTENFALL

Vattenfall
162 87 Vaellingby
Sweden

President
Carl-Eric Nyquist
Stig Sandklef

Function: Operate the power distribution grid in Sweden; produce power (owner of Ringhals Nuclear Power Plants).
SWITZERLAND

MAJOR PUBLIC HOLIDAYS (1995)

Jan
Apr 14
Apr 16-17
May 1
May 12
Jun 4
Jun 5
Jun 22-23
Aug 1
Sept 13
Dec 25-26

New Year
Good Friday
Easter
Labor Day
Ascension
Whitsuntide
White Monday
Corpus Christi
Pentecost
National Day
Fed Day of Prayers
Christmas

TIME

Standard Time Washington, D.C.
+ 6 hours
Daylight Savings Time Period:
03/27 - 09/24/95

PASSPORT/VISA

A passport is needed to depart and re-enter the U.S.; 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 U.S. $ = 1.1513 Franc
per Wall Street Journal, 10/01/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to Switzerland are complete as listed, after dialing international access code: 011. Country code is 41, listed local numbers include city code.

U.S. EMBASSY - BERN

American Embassy
Jubiläumstrasse 93
3005 Bern, Switzerland
Tel: 41-31-357-7011
Fax: 41-31-357-7336
Population 1994 7 million

ENERGY

Electric Power Capacity
- 1993: 15.5 GWe, 19% nuclear
- 1995: 15.9 GWe, 20% nuclear
- 2000: 17.0 GWe, 19% nuclear

Electric Power Production
- 1993: 57.8 TWh, 57% hydro/geoth, 38% nuclear, 1% oil, 1% other
- 1995: 38% nuclear
- 2000: 36% nuclear

NUCLEAR POWER

Policy: Federal government is in favor of nuclear power, but local opposition has delayed its expansion.

Nuclear Power Capacity
- 1993: 3.0 GWe
- 2000: 3.2 GWe

Reactor Mix
- 1994: BWR 2 (1972/84)
- PWR 3 (1969-79)

INDUSTRIAL FUEL CYCLE

Policy: Purchase most services from other countries, including reprocessing of spent fuels; recycle Pu to LWRs or FBRs.

Waste Management Strategy: Develop two waste repositories: a horizontally accessed rock cavern in a host rock with considerable overburden for LLW/ILW, and a deep repository in crystalline rock or sedimentary SZ-1
formations for HLW glass, unprocessed SF elements, and alpha wastes; interim storage of all waste at common center until repositories available.

Cumulative SF Arisings (LWR) 1990 1,090 t U
2000 2,000 t U

Cumulative Waste Arisings (a) LLW/D&D waste 100,000 or 100,000 m³
(Planning basis: after 40-yr operation at 3 GWe) LLW/ILW 15,000 or 10,000 m³
HLW glass 500 or 160 m³

Major Milestones
- Initial receipt of HLW glass from COGEMA (France) 1996
- Intermediate-depth repository for LLW/ILW 2003
- Geologic repository for HLW, SF, and alpha wastes 2020

INTERNATIONAL RELATIONSHIPS

DOE/NAGRA Agreement for Cooperation in Radioactive Waste Management
Term: 04-19-85 to 09-22-96
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; information exchange and direct cooperation, particularly concerning Grimsel Pass URL activities.

Member of IAEA and OECD/NEA; cooperative agreements with SKB/Sweden, CEA/France, ANDRA/France, Euratom/EC, ONDRAF/Belgium, PNC/Japan, NIREX/U.K., BfS, BMFT, GSF, and BGR/Germany, TVO/Finland.

(a) Two scenarios considered: complete reprocessing (left column) or no reprocessing (right column) after the year 2000.
ORGANIZATION

- **NAGRA** - National Cooperative for the Disposal of Radioactive Waste - formed by utilities/government to handle fuel cycle/waste management activities.

- **GNN** - Scnossenschaft für die Nukleare Entsorgung, Wellenberg - new company formed in 1994 for construction and operation of a LLW/ILW repository at Wellenberg in central Switzerland.

- **PSI** - Paul Scherrer Institut - formed (1987) through merger of EIR (Federal Institute for Reactor Research) and SIN (Swiss Institute for Nuclear Research).

- **Federal Energy Office** - sets criteria for waste management practices, including geologic disposal.

**BEW (Federal Office for Energy)**

Bundesamt für Energiewirtschaft
Nuclear Safety Inspectorate (HSK) 
CH-3003 Bern, Switzerland

Tel: 41-31-61-56-11  
Fax: 41-31-26-43-07

Waste Management Section  
Director 
Vice Director

Auguste Zurkinden  
E. Kiener  
A. J. Baer

Function: Licensing and inspection of nuclear installations.
NAGRA/CEDRA/CISRA (National Cooperative for the Disposal of Radioactive Waste)

Nationale Genossenschaft für die Lagerung Radioaktiver Abfälle (Nagra)

or

Société Coopérative Nationale pour l'Entreposage de Déléchets Radioactifs (CÉDRA)

or

Società Cooperativa Nazionale per l'Immagazzinamento di Scorie Radioattive (CISRA)

Hardstrasse 73
CH-5430 Wettingen, Switzerland

Tel: 41-56-37-11-11
Fax: 41-56-37-12-07

President
Hans Issler

Director, Science/Technology
Charles McCombie

Chief Geologist
Marc F. Thury

Site Characterization
Ch. Sprecher

Nuclear Technology and Safety
Piet Zuidema

Function: Provide for safe disposal of radioactive wastes produced by the Swiss nuclear industry; funded by utilities and government.

Facilities

• URL at Grimsel Pass - operational since 1984 (tests/experiments in crystalline rock).

• Gessellschaft für die nukleare Entsorgung Wellenberg - c/o Nagra, Hardstrasse 73, 5430 Wettingen Switzerland

President
P.U. Fischer

Directors
H. Beeler
J. Peter
E. Kowalski
C. McCombie

SZ-4
Paul Scherrer Institut
5232 Villigen, Switzerland

Director
Manager, Waste Mgmt. Proj.

Function: Federal (Department of Interior) institute for reactor and nuclear R&D.

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; natural analogue studies; hydrological studies; sorption constants on different rocks; immobilization of LLW/ILW in cement; leaching rates on LLW/ILW forms; and long-term corrosion tests on waste package materials.

Facilities

- Hot cells, radioactive laboratories, incinerator.
- ADA (Acid Digestion Plant) for TRU wastes.

Design Basis: carbonization/digestion in H₂SO₄/HNO₃ at 150°C; capacity, 1 kg/hr solid wastes.


ZWILAG (Interim Waste Storage Facility)

Zwischenlager Würenlingen AG
Parkstrasse 23
5401 Baden, Switzerland

Director
Tech. Project Manager

Tel: 41-56-20-31-11
Fax: 41-56-20-37-58

Hans R. Lutz
C. Vuilleumier

(contd next page)
**ZWILAG (contd)**

**Function:** Provide interim storage for spent fuel, HLW, LLW, and ILW; the facility was voter-approved in 1989 and will be managed by the local council and the nuclear utilities; construction is expected to take at least two years (startup in 1998) and cost about (U.S.) $350 million; organization is a consortium of Swiss nuclear utilities.
## TAIWAN

### MAJOR PUBLIC HOLIDAYS (1995)

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Holiday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>1-3</td>
<td>Commemoration Day</td>
</tr>
<tr>
<td>Jan</td>
<td>29 - Feb. 2</td>
<td>Lunar New Year</td>
</tr>
<tr>
<td>Mar</td>
<td>29</td>
<td>Youth Day</td>
</tr>
<tr>
<td>Apr</td>
<td>4</td>
<td>Women/Children's Day</td>
</tr>
<tr>
<td>Apr</td>
<td>5</td>
<td>Tomb Sweeping Day</td>
</tr>
<tr>
<td>Jun</td>
<td>2</td>
<td>Dragon Boat Fest</td>
</tr>
<tr>
<td>Sep</td>
<td>9</td>
<td>Mid-Autumn Day</td>
</tr>
<tr>
<td>Sep</td>
<td>28</td>
<td>Confucius Birth</td>
</tr>
<tr>
<td>Oct</td>
<td>10</td>
<td>National Day</td>
</tr>
<tr>
<td>Oct</td>
<td>25</td>
<td>Taiwan Restoration</td>
</tr>
<tr>
<td>Oct</td>
<td>31</td>
<td>Ch. Kai-Shek's Birth</td>
</tr>
<tr>
<td>Nov</td>
<td>12</td>
<td>Sun Yat-Sen's Birth</td>
</tr>
<tr>
<td>Dec</td>
<td>25</td>
<td>Constitution Day</td>
</tr>
</tbody>
</table>

### TIME

Standard Time Washington, D.C. + 13 hours

### PASSPORT/VISA

A passport is needed to depart and re-enter the U.S. In addition, a visa is recommended for a visit to Taiwan; short-term visas are available under certain conditions. Most travel agencies can provide up-to-date information about requirements.

### CURRENCY EXCHANGE RATE

1 U.S. $ = 26.89 Taiwan Dollar per Wall Street Journal, 10/01/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

### DIRECT DIALING

Individual numbers for direct dial to Taiwan are complete as listed, after dialing international access code: **011**. Country code is **886**; listed local numbers include city code.

### AIT - TAIPEI

American Institute in Taiwan  
7 Lane 134  
Hsin Yi Road, Sec. 3  
Taipei, Taiwan  
Science Officer

Tel: 886-2-709-2000  
Fax: 886-2-702-7675  
Della Knox-Bennett
Population 1994: 21.2 million

**ENERGY**

Electric Power Capacity 1994: 21.0 GWe
- 27% nuclear

Electric Power Production 1994: 21.0 TWh
- 35% coal
- 32% nuclear
- 16% oil
- 10% other
- 7% hydro

**NUCLEAR POWER**

Policy: Plan for nuclear power to meet rapidly growing demand for electric energy; continue with nuclear power at about 1/3 of total electricity.

Nuclear Power Plant Capacity 1994: 4.9 GWe
- BWR 4 (1978-83)
- PWR 2 (1984/85)

1995: 4.9 GWe
2003: 6.7 GWe
INDUSTRIAL FUEL CYCLE

Policy: Purchase fuel materials and enrichment; develop indigenous fuel production capability: UF₆ conversion; UO₂ pellet preparation; fuel hardware fabrication; fuel assembly.

Waste Management Strategy: Provide spent fuel/HLW interim storage, may reprocess (in other countries); maximize existing SF pool storage capacity by reracking; build MRS facility at existing reactor site for interim storage until final disposal in geologic repository. LLW stored in National Waste Storage Facility on nearby Orchid Island will eventually be disposed in a shallow-land facility.

Cumulative SF Arisings (LWR)

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount (tU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>1,600</td>
</tr>
<tr>
<td>2000</td>
<td>2,600</td>
</tr>
</tbody>
</table>

Major Milestones

- LLW disposal facility
  - Selection of site/method
  - Site characterization, engineering, design and licensing
  - Completion, start of operation HLW disposal facilities
- SF interim storage facility
  - Commission MRS at Chinshan reactor site
  - Commissioning of Kuosheng reactor site
- SF disposal facility
  - Geologic repository site selection
  - Commission final repository

ORGANIZATION

- TAIPOWER (Taiwan Power Company) - operation of nuclear power plants (owned by the government), country's only electric utility; radwaste disposal.
- AEC (Atomic Energy Council) and RWA (Radwaste Administration) - regulatory functions.
- INER (Institute of Nuclear Energy Research) - nuclear R&D.
Atomic Energy Council
67, Lane 144
Keelung Road, Section 4
Taipei Taiwan, 106
Tel: 886-2-363-4180
Fax: 886-2-363-5377

Chairman
Sr. Vice Chairman
Vice Chairman
Secretary General
Dir., Planning
Dir., Rad. Protection
Dir., Nuc. Regulations
Dir., Technology

INER

Institute of Nuclear Energy Research
P.O. Box 3
Lung-Tan 32500, Taiwan
Tel: 886-2-365-1717
Fax: 886-2-471-1064

Director
Dep. Directors

Nuclear Engineering
Nuclear Instrumentation
Nuclear Fuel/Mats. Research
Health Physics

Fuel Cycle R&D: Solvent extraction technology; yellowcake conversion to UO₂; cement and thermoplastic waste forms for reactor wastes; HLW conditioning processes; burial of LLW.
TAIWAN

RA-AEC

Radwaste Administration of AEC
5f, 37, San Min Rd., Sec. 2
Panchiao, Taiwan 220
Director

Tel: 886-2-964-7401
Fax: 886-2-964-7464

Syh-Tsong Chiou

TAIPower

Taiwan Power Company
17F, 242 Roosevelt Rd., Sec. 3
Taipei 107, Taiwan
Chairman
President
Vice President
Dir., Nuclear Engineering
Dir., Nuclear Operation
Dir., Nuclear Safety
Dir., Nuclear Backend Management

C. C. Chang
S. C. Chi
M. C. Tsai
Victor Y.C. Liao
A. H. Jeng
S. J. Tsuei
F. H. Chen

Tel: 886-2-365-1234
Fax: 886-2-396-8593

TRMC-AEC

Taiwan Radiation Monitoring Center of AEC
823 Cherng-Ching Rd.
Kaohsiung, Taiwan 83
Director

Tel: 886-7-380-2326
Fax: 886-7-381-1660

Yu-Ming Lin
UNITED KINGDOM

MAJOR PUBLIC HOLIDAYS (1995)

| Jan  | May 27 | Spring Holiday |
| Apr  | Jun 10 | Queen's Birthday |
| Apr  | Aug 26 | Summer Holiday |
| May  | Dec 25 | Christmas |
| May  | Dec 26 | Boxing Day |

TIME

Standard Time Washington, D.C. + 5 hours
Daylight Savings Time Period: 03/27 - 10/22/95

PASSPORT/VISA

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

CURRENCY EXCHANGE RATE

1 U.S. $ = 1.55 Pound
per Wall Street Journal, 11/16/95. Because rates fluctuate daily, it is recommended to obtain current rates from local banks or newspapers prior to departure.

DIRECT DIALING

Individual numbers for direct dial to the United Kingdom are complete as listed, after dialing international access code: 001. Country code is 44; listed local numbers include city code.

U.S. EMBASSY - LONDON

American Embassy
24/31 Grosvenor Square
London W1A 1AE, United Kingdom
Tel: 44-71-499-9000
Fax: 44-71-409-1637

Science Counselor
Jeffrey T. Lutz
### UNITED KINGDOM

#### Population
- **1995**: 58.4 million

#### ENERGY

<table>
<thead>
<tr>
<th>Description</th>
<th>1993</th>
<th>1995</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Power Capacity GWe</td>
<td>65.3</td>
<td>76.9</td>
<td>82.4</td>
</tr>
<tr>
<td>Nuclear (%)</td>
<td>18%</td>
<td>17%</td>
<td>16%</td>
</tr>
<tr>
<td>Electric Power Production TWh</td>
<td>325.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal (%)</td>
<td>62%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuclear (%)</td>
<td>27%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil (%)</td>
<td>9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas (%)</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydro (%)</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuclear (%)</td>
<td>29%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuclear (%)</td>
<td>27%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### NUCLEAR POWER

**Policy:** Continue nuclear power as a significant element of total electricity production; substantially based to date on gas-cooled reactors, but now diversifying to PWRs; eventual active FBR pursuit expected.

<table>
<thead>
<tr>
<th>Description</th>
<th>1995</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear Power Capacity GWe</td>
<td>13.1</td>
<td>12.9</td>
</tr>
<tr>
<td>Reactor Mix</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GCR 20 (1956-72)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGR 14 (1976-89)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PWR 1 (1995)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Reactor Development:** PWRs; future LMFBR development.

UK-1
INDUSTRIAL FUEL CYCLE

Policy: Reprocess and recycle U to AGR and LWR systems; develop and maintain complete fuel cycle capability (UF₆ conversion, enrichment, UO₂ and MOX fuel fabrication, spent fuel reprocessing); sell fuel cycle services abroad.

Waste Management Strategy: Reprocess spent Magnox/AGR fuels as rapidly as plant capacity permits; reprocess other thermal reactor fuel after several years' cooling; vitrify HLW (French process); long-term interim storage of HLW glass for at least 50 years before disposal; shallow-land burial of LLW currently; future deep-land disposal of LLW and ILW.

Cumulative SF Arisings (AGR) 1990 1,300 t U 2000 3,250 t U

Industrial-Scale Activities (Capacity)

- Uranium conversion (Springfields)
  - UF₆ production: 9,000 t/yr
  - UO₂ conversion: 10,000 t/yr

- Uranium enrichment (Capenhurst)
  - Centrifuge plant: 800 t SWU/yr

- Fuel fabrication
  - Springfields
    - U metal (Magnox): 1,300 t U/yr
    - AGR/LWR fuels: 300 t/yr
  - Sellafield
    - MOX fuels capacity, 1992: 6 t/yr (LWR)

- Fuel reprocessing
  - Magnox fuels (Sellafield): up to 1500 t/yr
  - UO₂ fuels (THORP, Sellafield): 1200 t/yr (1992)
  - FBR fuels (PFR, Dounreay): 50 kg HM/d

- HLW vitrification
  - Sellafield Vitrification Plant, radioactive operation, 1990
INTERNATIONAL RELATIONSHIPS

DOE/UKAEA Agreement in the Field of Decommissioning Nuclear Facilities

Term: 03-01-85 to 03-01-93

Scope: Techniques used, schedules, costs, manpower, radiation exposures, and waste arisings relevant to decommissioning projects (U.S./Shippingport Station - U.K/Windscale AGR); treatment, packaging, storage, transportation, disposal methods, and costs for wastes arising from the decommissioning operations; emphasis on exchange of technical information, specialists, samples, materials, instruments, and testing equipment.

DOE/UKAEA Agreement in the Field of Radioactive Waste Management Technology

Term: 10-30-86 to 10-29-91

Scope: LLW/ILW, TRU waste and D&D technology; treatment; geologic disposal; transportation; storage; environment/safety and public acceptance issues; performance assessment; packaging; emphasis on technical information exchange, primarily TRU waste treatment.

Member of EC, IAEA, and OECD/NEA: agreements/partnerships with various nations.

UK-3
UNITED KINGDOM

ORGANIZATION

• AEA Technology: nuclear research; laboratories at Harwell, Risley, Sellafield, Springfields, Dounreay.

• DoE (Department of Environment): develops waste management strategy, funds and coordinates generic waste management R&D.

• HMIP (Her Majesty's Inspectorate of Pollution): regulates effluent discharges to the environment.

• BNFL (British Nuclear Fuels plc): commercial fuel cycle and engineering services for domestic and foreign customers.

• NIREX ("private limited"/government-owned company): LLW and ILW disposal in deep repository.

• 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.

• MAFF (Ministry of Agriculture, Fisheries, and Food): regulation of waste management.
NUCLEAR FUEL CYCLE/WASTE MANAGEMENT ORGANIZATION

National Government

- Department of Environment (DoE)
  - H.M. Inspectorate of Pollution (HMIP)
  - Radioactive WM Advisory Committee (RWMAC)
  - Building Research Establishment (BRE)

- Department of Health/Social Services
  - National Radiological Protection Board (NRPB)

- Department of Trade and Industry (DTI)
  - Nat. Environment Research Council (NERC)
    - British Geological Survey (BGS)
    - Inst. of Oceanographic Sciences (IOS)
    - Nuclear Electricity Authorities
    - NIREX
    - British Nuclear Fuels plc (BNFL)
    - AEA Technology

- Health and Safety Executive (HSE)
  - Nuclear Installations Inspectorate (NIH)

- Ministry of Defense (MOD)
  - Atomic Weapons Res. Establishment (AWE)

- Ministry of Agriculture, Fisheries and Food (MAFF)
  - Fisheries Laboratories
UNITED KINGDOM

FUEL CYCLE/WASTE MANAGEMENT RESPONSIBILITIES

Department of Energy (DEN)

- Nuclear Electricity Authorities (Nuclear Electric, Scottish Nuclear)
  - Nuclear Electricity Production
  - Reactor Waste Management

British Nuclear Fuels plc (BNFL)

- Risley (HQ)
  - Engineering

- Sellafield
  - Reprocessing
  - Waste Conditioning
  - MOX Fuel Production
  - LLW Disposal (Drigg)

- Springfields
  - Fuel Fabrication
  - UO₂ Production
  - Uranium Conversion

- Capenhurst
  - Uranium Enrichment

AEA Technology

- Decommissioning and Radwaste
- Environment & Energy
- Fuel Services
- Fusion
- Industrial Technology
- Safety & Reliability
- Reactor Services

NIREX

UK-6
Government-owned nuclear research and applications agency, since 1986 operating on a fully commercial basis; supply a range of products and services for the nuclear industry in the U.K. and worldwide.

UKAEA Government Division
Nuclear Site Operations
Dounreay
Caithness KW14 7TZ
United Kingdom
Tel: 44-1847-804000
Fax: 44-1847-802697

Director
John Baxter
Mgr., Customer Mgmt., Finance
David Thom

Fuel reprocessing of special nuclear fuels.

UKAEA Government Division
Fusion
Culham, Abingdon
Oxon, OX14 3DB
United Kingdom
Tel: 44-1235-521840
Fax: 44-1235-463682

Director
D. R. Sweetman
Research Director
D. C. Robinson

Responsibility for the U.K. contribution to the international fusion program.
UN IT E D KI N GDOM

AWE

Atomic Weapons Establishment
Aldermaston, Reading RG7 4PR
United Kingdom

Waste Management
S. Hunter

BGS

British Geological Survey
Nicker Hill, Keyworth
Nottingham, NG12 5GG
United Kingdom

Director
P. J. Cook

BNFL

British Nuclear Fuels plc
Risley, Warrington
Cheshire WA3 6AS
United Kingdom

Location: About 20 miles by car from Manchester International Airport, or by train from London to Warrington (approximately three hours), then six miles by car to Risley.

Chairman
John Guiness
44-925-83-5000

Chief Exec. Officer
N. L. Chamberlain
44-925-83-5006

Dep. Chief Exec. Officer
Greg G. Butler

Dir., International Group
Graham Watts

Dir., Engineering Group
Ken G. Jackson

Dir., U.K. Group
Graham Smith

(contd next page)
BNFL, Inc.
1776 I Street NW
Washington, DC  20006

Tel: 202-785-2635
Fax: 202-785-4037

President
R. "Landy" Langley

BNFL, Inc. is a nuclear technology applications company specializing in radioactive waste management, decontamination and decommissioning of outmoded facilities, technology development and application, special nuclear materials handling, and safety and health protection in the North American market.

BNFL, Japan KK
Toranamon Wing Building
Third Floor
12-10 Nishi Shinbashi 1-Chome
Minato-Ku
Tokyo 105, Japan

Tel: 00-813-3593-7151
Fax: 00-813-3593-7160

President
David Woolf

BNFL, Japan Liaison Office
Fourth Floor Doo-Kyoung Building
64-1 Hannam-Dong
Yongsan Ku, Seoul

Tel: 00-8227-49-1611/1612/1613
Fax: 00-8227-49-1614

General Manager
John Ireland

URENCO
Capenhurst Works
Chester
Cheshire CH1 6ER
United Kingdom

Tel: 44-51-339-4101
Fax: 44-51-339-5541

Dir., Enrichment Division
Pat C. Upson

Function: Enrichment of U by centrifuge process (URENCO).

UK-9
BNFL: SELLAFIELD

British Nuclear Fuels plc
Sellafield, Seascale
Cumbria CA20 1PG
United Kingdom

Tel: 44-9402-8333
Fax: 44-9467-28987

Location: From London Euston Station to Carlisle Station by train, about four hours; transport can be arranged by BNFL from Carlisle (approximately one and a half hours; from Manchester International Airport by car takes about three hours.

Dir., Magnox Reprocessing: Grahame K. Smith
Tel: 44-9402-74245

Dir., THORP Division: Chris Loughlin

Dir., Waste Mgmt.: Peter Manning

Dir., Decom. Div.: Sam Kelly

Dir., Reactor Division: Bill McLaughlan

Function: Provide spent fuel management services, including storage, reprocessing, and waste management; transport of SF/wastes and complete fuel cycle services.

Facilities

- **B205 (Magnox Fuel Reprocessing Plant)**
  
  **Mission:** Reprocess Magnox (magnesium-clad, U metal) fuels from U.K. GCRs.

  **Design Basis:** Magnox fuels - mechanical declad; PUREX flowsheet; "no maintenance" concept; nominal capacity, 1500 t/yr; HLLW storage - SS tanks, 70 m³ and 150 m³, in SS-lined concrete cells.

  **History:** Magnox fuels - startup, 1964; annual throughput of Magnox fuels, 1000-1200 t HM; oxide head-end (installed in B204), operated 1969-1973 and processed 90 t oxide fuel, shut down after a contamination release incident.

- **Magnox Fuel Handling Plant**
  
  - Storage/decanning of Magnox fuel.
  - Storage/dismantling of AGR fuel.
BNFL: Sellafield (contd)

- **THORP** (Thermal Oxide Reprocessing Plant)
  Mission: Reprocess AGR, domestic and foreign LWR fuels.
  Design Basis: PUREX flowsheet, pulsed columns and mixer-settlers;
  "no maintenance" concept; nominal capacity, 1200 t U/yr.
  History: Startup, February 1994.

- **Drigg Waste Disposal Facility** (300-acre site, four miles from Sellafield)
  Mission: LLW disposal.
  Design Basis: Shallow-land disposal in clay-based trenches and recently, in concrete vaults.
  Capacity: 650,000 m³ LLW disposed of through 1989.

- **MOX Fuel Fabrication Facilities**
  - Pilot plant, capacity - 7 t/yr
  - Production plants, capacity - 120 t/yr; startup, 1997.

- **Vitrification Plant**
  Mission: Solidify Sellafield HLW.
  Design Basis: AVM process; product, borosilicate glass blocks.
  Capacity: 250-300 t/yr glass.
  History: Startup, 1990.

- **WTC (Waste Treatment Complex)**
  Mission: Prepare TRU waste for disposal; underground refurbishment to include supercompaction.
  Milestone: Startup, 1995

- **EP-1 and EP-2**

(contd next page)
BNFL: Sellafield (contd)

- EARP (Enhanced Actinide Removal Plant)
  Mission: Remove actinides from liquid effluents by ultra-filtration and flocculation.
  Capacity: 1000 m³/d.

BNFL: SPRINGFIELDS

British Nuclear Fuels plc
Springfields Works
Salwick, Preston
Lancashire PR4 0XJ
United Kingdom
Tel: 44-772-72-8262
Fax: 44-772-72-5607

Director, Fuel Division
Ted Williams

Function: Supply fuel for U.K. reactors; UF₆ conversion to UO₂ powder/pellets production; fabricate PWR fuel; provide recycle services (enrichment in conjunction with URENCO).

BRE

Building Research Establishment
Department of the Environment
Building Research Station
Garston, Watford WD2 7JR
United Kingdom
Tel: 44-927-894040

J. B. Menzies
T. Freeman
C. M. Cooling
R. M. C. Driscoll

Waste Management R&D: Emplacement engineering and related activities; rock mechanics.
HMIP

H.M. Inspectorate of Pollution
Department of the Environment
Romney House, 43 Marsham Street
London SWIP 3PY
United Kingdom

Chief Executive
David Slater
44-71-276-8080

Director, Regulatory Systems Div.
Alan Duncan
44-71-276-8129

Research
Steven Brown

Waste Management Responsibility: Administer U.K. waste management programs; fund and coordinate waste treatment and waste isolation R&D at Harwell, BGS, and NRPB; regulate discharge of radioactive materials to the environment.

IOS

Institute of Oceanographic Sciences
Brook Road, Wormley, Godalming
Surrey GU8 5UB
United Kingdom

Director
C. Summershayes

Function: Model radionuclide transport in the ocean.
UNITED KINGDOM

MAFF

Ministry of Agriculture, Fisheries and Food
Ergon House, Room 231
c/o Nobel House
17 Smith Square
London SW1P 3JR, U.K.

Chief Inspector
M. A. Segal

Function: Regulate, jointly with HMIP, management of waste prior to disposal.

MAFF Fisheries Laboratory
Pakefield Road
Lowestoft, Suffolk NR33 OHT
United Kingdom

Director, Research
P. Greig-Smith

NII

Nuclear Installations Inspectorate
Baynards House
1 Chepstow Place
Westbourne Grove
London W2 4TF, U.K.

Chief Inspector/Nuc. Installations
Sam Harbison

Function: Licensing of nuclear facilities.
NIREX

U.K. Nirex Ltd.
Curie Avenue, Harwell
Didcot, Oxon OX11 ORH
United Kingdom
Tel: 44-235-82-5500
Fax: 44-235-83-1239

Managing Director
Technical/Projects
M. Folger
C. Bayliss

Function: Commission/manage research and development to propose a site suitable for a deep repository for LLW/ILW; construct and operate the repository; continue necessary R&D on long-term waste emplacement.

Owners: BNFL (42.5%), Nuclear Electric plc (42.5%), Scottish Nuclear Ltd. (7.5%), and UKAEA (7.5%) are partners in the "private limited" company. One special share, having absolute power of veto, is held by the Secretary of State for Energy.

NRPB

National Radiological Protection Board
Chilton Didcot
Oxfordshire OX11 ORQ
United Kingdom
Tel: 44-235-83-1600
Fax: 44-235-83-3891

Director
Roger H. Clarke
Secretary
M. O. Riordan
J. W. Stather
Asst. Dir., Physical Sci.
A. D. Wrixon
Asst. Dir., Medical Sci.
J. R. Harrison

(contd next page)
NRPR (contd)

Function: Independent board, established in 1970 as a result of the Radiological Protection Act; members appointed by the Health Ministry; advise governmental/industrial organizations on radiological protection matters and standards; contract research to improve radiological protection; provide some technical services.
UNITED STATES

MAJOR PUBLIC HOLIDAYS (1995)

Jan  1  New Year
Jan 16  M. L. King Day
Feb 20  Presidents Day
May 29  Memorial Day
July 4  Independence
Sep  4  Labor Day
Oct  9  Columbus Day
Nov 11  Veterans Day
Nov 23  Thanksgiving
Dec 25  Christmas

Daylight Savings

STATE ABBREVIATIONS

AL - Alabama
AK - Alaska
AZ - Arizona
AR - Arkansas
CA - California
CO - Colorado
CT - Connecticut
DE - Delaware
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 - New Brunswick
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

FOREIGN NATIONAL VISITS TO U.S. DOE FACILITIES

Foreign visitors to U.S. DOE facilities must complete and submit an IA-473 form (OMB 1910-2100) "Request for Foreign National Unclassified Visit or Assignment" to the laboratory, contractor, or site to be visited at least 30 days before the proposed visit. In certain cases, in lieu of form IA-473, a DOE Operations Office (site specific) form may be used but must be submitted within the same time frame. The request to visit must be based on prior arrangements with appropriate DOE or DOE contractor staff.
PNL-9450-2

UNITED STATES

Population 1994 260.7 million

ENERGY

Electric Power Capacity 1993 752 GWe

1995 766 GWe

13% nuclear

2000 793 GWe

13% nuclear

Electric Power Production 1993 3271 TWh

53% coal

20% nuclear

13% gas

9% hydro./geotherm

3% oil

1995 19% nuclear

2000 18% nuclear

NUCLEAR POWER

Policy: Construction and operation of nuclear power stations is by private and public utilities under close regulatory control by the Nuclear Regulatory Commission (NRC) and state Public Review Commissions; R&D emphasizes increased inherent LWR safety and small, modular reactor concepts.

Nuclear Power Capacity 1993 99 GWe

1995 100 GWe

2000 101 GWe

Reactor Mix 1993 PWR 73 (1968-95)

5 (Indef.)

BWR 37 (1965-90)

1 (Indef.)

US-1
NUCLEAR FUEL CYCLE

Policy: Current U.S. commercial nuclear fuel cycle activities include all phases: uranium mining, milling, and enrichment; fuel fabrication; interim spent fuel and waste storage; transportation, conditioning, and disposal of radioactive waste. Disposal of spent fuel and HLW will be implemented in the future. Mining, milling, fabrication of UO₂ fuel, and LLW disposal are done predominantly by private firms; enrichment and HLW/spent fuel disposal are the responsibilities of the federal government; a private enrichment enterprise is being started.

Waste Management Strategy: Disposal of U.S. commercial spent fuel in a geologic repository is planned, after interim storage at reactor sites and possibly after interim storage in a monitored retrievable storage (MRS) facility; small amounts of existing commercial HLW and all defense HLW will be vitrified and disposed of in the SF repository; the Nuclear Waste Policy Act (NWPA) of 1982 and its 1987 amendments (NWPAA) mandate start of spent fuel acceptance in 1998 by the government for eventual disposal; short-lived LLW is disposed of in regional near-surface disposal facilities; states and regional compacts of states are developing new commercial LLW disposal facilities; demonstration of defense transuranic (TRU) waste disposal is planned in a geologic repository in a salt formation.

Cumulative Spent Fuel Arisings

<table>
<thead>
<tr>
<th>Year</th>
<th>Arising (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>27,800 t IHM</td>
</tr>
<tr>
<td>1995</td>
<td>31,400 t IHM</td>
</tr>
<tr>
<td>2000</td>
<td>40,400 t IHM</td>
</tr>
</tbody>
</table>

Major Milestones

- Demonstration start of disposal of defense TRU waste at Waste Isolation Pilot Plant (WIPP) TBD
- Candidate site identified for MRS facility TBD
- States/compacts must have civilian LLW disposal capability or manage their own LLW 1994
- States not having LLW disposal capability must take title to all LLW produced within their state 1996
- Startup of MRS facility with limited SF acceptance 1998
- Start construction of geologic repository for commercial SF/HLW 2004
- Startup of repository for spent fuel and HLW 2010
- Start of study on need for second repository for SF/HLW 2007-2010
- Environmental cleanup of DOE sites complete 2019

INTERNATIONAL RELATIONSHIPS

Member of OECD/NEA and IAEA. Bilateral agreements for cooperation (extension of several agreements in process) Canada, CEC, China, Germany, France, Japan, Spain, Sweden, Switzerland, Russia and the U.K; a brief outline of DOE agreements, primarily related to waste management, is provided in the appropriate section of other countries in this report. International cooperation and exchange of waste management technology is encouraged.

ORGANIZATION

- DOE (Department of Energy) - Responsible for planning and implementing programs for the safe handling of radioactive wastes generated by its federal activities and for disposal of all HLW, SF, TRU waste, and greater-than-class-C LLW; responsible for ensuring availability of adequate technology for safe and efficient management of nuclear wastes from both civilian and federal activities.

- HQ (Headquarters) - Provides policy, guidance, and funding for nuclear waste management, including environmental restoration and fuel cycle programs. Specific responsibilities are divided among the following offices:

- EM (Office of Environmental Management) - Environmental cleanup, compliance, technology development, transportation, and waste management activities for DOE sites identified in the Environmental Restoration and Waste Management Five-Year Plan.
- **RW (Office of Civilian Radioactive Waste Management)** - After-reactor interim storage, transportation, and disposal of spent nuclear fuel and HLW; development of an MRS facility.

- **PO (Office of International Research and Development Policy, Assistant Secretary for Policy, Planning and Program Evaluation)** - Coordinates DOE's international activities.

- **OP (Operations Office)** - Implements HQ policy and directives at DOE sites; issues orders to specific sites, directs efforts of DOE contractors.

- **Contractors** - Manage and operate DOE facilities in accordance with HQ and OP guidance and orders; national R&D laboratories.

- **DOI (Department of the Interior)**
  - **USGS (U.S. Geological Survey)** - Laboratory and field geologic investigations.

- **DOT (Department of Transportation)** - Develop, issue, and enforce safety standards governing aspects of hazardous materials transport, including radioactive materials.

- **EPA (Environmental Protection Agency)** - Establish and enforce general standards for protection of the environment.

- **NRC (Nuclear Regulatory Commission)** - Issue and enforce regulations and licenses of commercial nuclear activities and disposal of spent fuel and HLW, in compliance with general environmental standards issued by the EPA; through agreements with states that so desire, delegate the licensing of selected types of nuclear facilities.
DOE (DEPARTMENT OF ENERGY) PARTIAL ORGANIZATION

Secretary

Deputy Secretary

Under Secretary

- EM - Office of Environmental Management
- RW - Office of Civilian Radioactive Waste Management
- YMPO
- PO - Office of International Research and Development Policy, Assistant Secretary for Policy, Planning and Program Evaluation

Other Offices
- Operations Offices
  - AL - Albuquerque
    - LANL - MOUND - RFP - SNL - WIPP
  - COO - Chicago
    - ANL - BNL - BCO
  - ID - Idaho
    - INEL - WINCO - WVNS
  - NV - Nevada
  - OR - Oak Ridge
    - ORNL
  - OAK - Oakland Operations Office
    - ETEC - LLNL
  - RL - Richland
    - PNNL - WHC
  - SR - Savannah River
    - WSRC
NRC (NUCLEAR REGULATORY COMMISSION) PARTIAL ORGANIZATION

Chairman

Commissioners

- Executive Director for Operations
  - OIP - Office of Internatl. Programs
  - NMSS - Nuclear Material Safety and Safeguards
  - RES - Nuclear Regulatory Research
  - NRR - Nuclear Reactor Regulation

- Regional Offices
  - Region I (Philadelphia)
  - Region II (Atlanta)
  - Region III (Chicago)
  - Region IV (Dallas)
**DOE-Headquarters**

**U.S. Department of Energy**  
1001 Indep. Avenue  
Washington, DC 20585  
Tel: 202-586-5000  
Fax: 202-586-5049  
Verif: 202-586-5100

**U.S. Department of Energy**  
Germantown  
Washington, DC 20545  
Tel: 301-903-4511  
Fax: 301-903-3888  
Verif: 301-903-5465

**Secretary**  
Hazel R. O'Leary  
202-586-6210

**Office of Environmental Management (EM)**  
[Proposed Organization]

**Assistant Secretary for EM**  
Thomas P. Grumbly  
202-586-7710

**Principal Deputy**  
Richard J. Guimond  
-7745

**Strategic Planning & Analysis**  
James P. Werner  
-9280

**Health and Safety**  
John C. Tseng  
301-903-7170

**DAS/Management & Finance**  
Gail M. Pesyna  
202-586-1665

**DAS/Waste Management**  
Stephen P. Cowan  
202-586-0370

**Eastern Operations**  
Ralph E. Erickson  
301-903-7188

**Central Operations**  
Joseph A. Coleman  
-7410

**Western Operations**  
James A. Turi  
-7147

**Hanford Operations**  
Maureen A. Hunemuller  
-1446

**Technical Services**  
James V. Antizzo  
-7180

**DAS/Environmental Restoration**  
James Owendoff  
202-586-6331

**Eastern Area**  
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301-903-2328

**Northwestern Area**  
Sally A. Robison  
-3626

**Southwestern Area**  
Ralph G. Lightner  
-3850

**Program Integration**  
William E. Wisenbaker  
-3124

**DAS/Science & Technology**  
Clyde W. Frank  
202-586-6382

**Science & Risk Policy**  
Mark A. Gilbertson  
-5042

**Technology Development**  
Stephen Lien  
301-903-7911

(contd next page)
DOE-HQ (contd)

Technology Integration
International Programs
John M. Lankford
Ray G. De La Torre
202-586-6121

DAS/Nuclear Material & Facility
Stabilization
Jill E. Lytle
202-586-5151
Nuclear Material Stabilization
Henry F. Dalton
301-903-1450
Spent Fuel Management
George F. Cole

DAS/Site Operations
Transportation, Emergency
Management & Analytical Services
Willis W. Bixby
202-586-8754
Richard W. Brancato
301-903-7278

Office of Civilian Radioactive Waste Management (OCRWM)

Director
Daniel H. Dreyfus
202-586-6842
Dep. Director
Lake Barrett
6850
Quality Assurance
Donald G. Horton
702-794-7675
Human Resources
James C. Bresee (A)
202-586-9173
& Administration
Program Mgmt
& Integration
Ronald A. Miner
9694
Waste Acceptance
& Transportation
Samuel Rousso
9116

Yucca Mountain Site Characterization
Office (YMSCO)

702-794-7900
Fax: 7907
Verif: 7919

101 Convention Ctr. Dr.
Las Vegas, NV 89109

Project Manager
Wesley E. Barnes
5170
J. Russell Dyer
7586
Scientific Programs
Susan B. Jones
7613
Eng./Field Operations
Richard L. Craun
7787
Env., Health/Safety
Wendy R. Dixon
7946
Suitability/Licensing
Steve J. Brocoum
7971

(contd next page)
DOE-HQ (contd)

Public Affairs
Gregory N. Cook
Administration
Jerri J. Adams
Quality Assurance
Donald G. Horton
International Programs
Robert A. Levich

Office of Policy

PO-1 Assistant Secretary
Susan F. Tierney
202-586-5800
PO-7 D.A.S. Intl. Affairs
David J. Jhirad
-5493
John Brockman
-5915
PO-9 DAS Nat. Sec. and ER Mgmt. Policy
Robert Alveraz
-4640

DOE OPERATIONS OFFICES

ALBUQUERQUE OPERATIONS OFFICE (AL)

U.S. Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, NM 87115

Manager
Bruce G. Twining
-6049
Environment/SPEC Proj.
John Arthur (A)
-6210
Uranium Mill Tailings
UMTRA Team
-5640

DOE Rocky Flats Office (Denver Site)
Rocky Flats Plant
P.O. Box 464
Golden, CO 80402-0464

Manager
Robert M. Nelson, Jr.
-2025
Dep. Manager
David P. Simonson
-2025
Dir., Env. Restoration
Richard Schassburger (A)
-4888
WIPP

Waste Isolation Pilot Plant
P.O. Box 2078
Carlsbad, NM 88221-3090

Manager (DOE) George E. Dials
Carlsbad Operations Center Paul E. Brewer
WIPP Sci. PM (SNL) Wendell D. Weart
Operating Contractor Mgr (WEC) Carl M. Cox
Tel: 505-887-8100
Fax: -0707
Verif: -8110
505-234-7300
-0025
505-848-0788
505-234-8202

Fuel Cycle and Waste Management Activities: WIPP construction technical support, including design review, construction, safety assurance, operational planning, and quality assurance systems.

Function: Demonstrate defense transuranic waste disposal in a deep salt formation; if successfully demonstrated, WIPP will become a repository for this type of defense waste.

CHICAGO OPERATIONS OFFICE (COO)

U.S. Department of Energy
Chicago Operations Office
9800 South Cass Avenue
Argonne, IL 60439

Manager Cherri J. Langenfeld
Fax: 2110
-2209
-2206
-2236
-2206
-2654
-2093
-2228
-2692

Environmental Programs A.L. Taboas
WM/Tech. Devel. Joel C. Haugen
Envir. Restoration Jeffrey Roberts
Technical Support Antanas Bindokas
IDAHO OPERATIONS OFFICE (ID)

U.S. Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, ID 83401-1562

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Fax: 5406

Manager: John M. Wilcynski
Deputy Manager: Delores J. Ferri (A)
Executive Assistant: Donald W. MacDonald
Program Execution: Thomas F. Burns, Jr.
SF Program: Brian Edgerton
R&D: Neil S. Burrell
Environmental Restoration: Lisa A. Green
Waste Management: Joel T. Case

NEVADA OPERATIONS OFFICE (NV)

U.S. Department of Energy
Nevada Operations Office
P.O. Box 98518
Las Vegas, NV 89193-8518

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Fax: 702-285-1371
Verif: -1369

Manager: Terry Baeth (A)
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WM Division Director: Frank DiSanza (A)

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P.O. Box 2001
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Verif: -1058

Manager: Jim Hall
Assistant Manager: Edward G. Cumesty
Dir., Energy Programs: Thomas Jelinek
Dep. AM Energy R&D: Ronald Hultgren
Laboratory EPD: Thomas Jelinek

(contd next page)
UNITED STATES

OAK RIDGE OPERATIONS OFFICE (OR) (contd)

Fusion/Nuclear Tech.  Martha J. Kass -0717
Environmental Mgmt.  Doug Underwood -0728
Dir., WM/Tech. Dev.  Larry Radcliffe -9212

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U.S. Department of Energy
Oakland Operations Office
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Oakland, CA 94612
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Manager  James M. Turner -1800
Envir. Safety & Health Div.  Joe Juelten -1592
Envir. Technical Resources  Edward Ballard -1594
Operational Safety  Ralph Kopenhaver -1597

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Fax: -6540
Verif: -7317

Manager  J. D. Wagoner  509-376-7395
Deputy Manager  R. D. Izatt -6278
Employee Concerns Program  L. G. Musen -0000
Chief Counsel  S. R. Brechbill -7311
Manager, Total Quality  D. Combs -4137
Director, External Affairs  K. K. Randolph -7563
Director, Training  R. P. Saget -1860
Director, Environment, Safety and Health  P. W. Kruger -7387
Director, Performance Assessment  G. M. Bell 373-2656
Director, Quality, Safety and Health Programs  W. B. Scott 376-7461

(contd next page)
RICHLAND (HANFORD) OPERATIONS OFFICE (RL) (contd)

Director, Environmental Assurance, Permits, and Policy  J. E. Rasmussen  -5441
Director, Human Resources  J. D. Bauer  -7217
Director, Human Resource Services  R. Cruz (A)  -6657
Director, Procurement Services  A. R. Valdez  -7271
Director, Business Management  R. J. Light  372-3241
Assistant Manager, Office of Tank Waste Remed. System  J. E. Kinzer  376-7591
Senior Lead Advisor  D. Wodrich  -5237
Senior Technical Advisor  D. L. Vieth, Sr.  -7591
Technical Advisors  C. Sohn  -3591
T. R. Sheridan  -3591
D. Wodrich  -3591
Director, Characterization  S. T. Bumum  -3214
Director, Tank Safety Analysis  R. E. Gerton  -9106
Director, Tank Operations  A. B. Sidpara  372-1507
Deputy Director  A. Hon  -2025
Director, Tank Waste Retrieval, Treatment and Immobilization  W. J. Taylor  376-6406
Deputy  L. Ericksen (A)  -8409
Director, Tank Waste Projects  L. Nicoll (A)  -7391
Director, Program Integration  C. P. Bader  373-9109
Assistant Manager for Waste Management  C. A. Hansen  376-7434
Deputy  P. M. Knollmeyer  372-2610
Fax: 372-2610
Senior Technical Advisor  P. G. Loscoe  376-7434
Director, Waste Programs  T. K. Teynor  -1366
Director, Spent Nuclear Fuels Project  E. D. Sellers  -7465
Director, Waste Operations  F. T. Daniels  373-9317

(contd next page)
<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assistant Manager for Facility Transition</td>
<td>L. Piper</td>
<td>376-7435</td>
</tr>
<tr>
<td>Director, Transition Program</td>
<td>J. E. Mecca</td>
<td>-7471</td>
</tr>
<tr>
<td>Director, Site Operations</td>
<td>K. A. Benguit</td>
<td>-6600</td>
</tr>
<tr>
<td>Director, Site Infrastructure</td>
<td>W. A. Rutherford</td>
<td>-7597</td>
</tr>
<tr>
<td>Director, Project Management</td>
<td>S. H. Wisness</td>
<td>373-9337</td>
</tr>
<tr>
<td>Assistant Manager for Environmental Restoration</td>
<td>L. K. McClain</td>
<td>376-6628</td>
</tr>
<tr>
<td>Director, Restoration Projects</td>
<td>R. A. Holten</td>
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<tr>
<td>Director, Restoration Projects Support</td>
<td>R. D. Freeberg</td>
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<tr>
<td>Assistant Manager for Technology Management</td>
<td>R. M. Rosselli</td>
<td>372-4017</td>
</tr>
<tr>
<td>Deputy</td>
<td>J. W. Wiley</td>
<td>-4005</td>
</tr>
<tr>
<td>Technical Assistant</td>
<td>J. Hennig</td>
<td>-4025</td>
</tr>
<tr>
<td>Director, Technology Development</td>
<td>R. F. Christensen</td>
<td>-4900</td>
</tr>
<tr>
<td>Director, Laboratory Management</td>
<td>D. E. Trader</td>
<td>-4005</td>
</tr>
<tr>
<td>Director, Safeguards and Security</td>
<td>J. L. Spracklen</td>
<td>376-7441</td>
</tr>
<tr>
<td>Chief Financial Officer</td>
<td>A. Q. Murphy</td>
<td>-6657</td>
</tr>
<tr>
<td>Director, Budget</td>
<td>A. E. Lorenz</td>
<td>-8669</td>
</tr>
<tr>
<td>Director, Contract Finance and Review</td>
<td>D. A. O'Toole</td>
<td>373-3352</td>
</tr>
<tr>
<td>Director, Planning and Integration</td>
<td>E. W. Higgins</td>
<td>372-2500</td>
</tr>
<tr>
<td>Director, Financial Management</td>
<td>J. K. Absher</td>
<td>376-2901</td>
</tr>
</tbody>
</table>
Fuel Cycle and Waste Management Activities: Remedial action for formerly used AEC sites (FUSRAP) and for surplus facilities management program (SFMP); D&D of ANL-East (Argonne, IL) contaminated facilities; mixed waste treatment and disposal; groundwater treatment; LLW/TRU waste technologies; TRUEX process development; pyrometallurgical and pyrochemical fuel reprocessing; electrorefining; Environmental Restoration and Waste Management support for DOE; applied R&D program (contd next page)
support for DOE/EM; SARP review; Civilian Radioactive Waste Program: socioeconomic impact assessment, transportation planning, spent fuel and waste glass performance, interaction of waste package with repository environment; instrumentation development and characterization.

Major Facilities

**ANL-East (Argonne, IL):** High-Level Hot-Cell Facilities; Large Gamma Radiation Facility, Alpha-Gamma Hot-Cell Facility (AGHCF).

**ANL-West (Idaho Falls, ID):** Experimental Breeder Reactor No. 2 (EBR-II); Zero Power Physics Reactor (ZPPR); Transient Reactor Test Facility (TREAT); Hot Fuel Examination Facility (HFEF); Radioactive Scrap and Waste Facility; Sodium Process Facility (SPF); Radioactive Liquid Waste Treatment Facility (RLWTF); Fuel Cycle Facility (FCF).

**BCO**

Battelle - Columbus Operations  
505 King Avenue  
Columbus, OH 43201  
Tel: 614-424-6424  
Fax: 5601

Environmental Systems and Technology Division

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Phone</th>
<th>Ext</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Manager</td>
<td>B. G. Maiden</td>
<td>-4822</td>
<td></td>
</tr>
<tr>
<td>Deputy General Manager</td>
<td>G. J. Kovacs</td>
<td>-7937</td>
<td></td>
</tr>
<tr>
<td>Mgr., ER</td>
<td>J. Means</td>
<td>614-424-5442</td>
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</tr>
<tr>
<td>Mgr. WM/Pollution Prevention</td>
<td>C. MacDonald</td>
<td></td>
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<tr>
<td>Strategic ES&amp;H Mgr.</td>
<td>W. Simmons</td>
<td>-3242</td>
<td></td>
</tr>
<tr>
<td>Nuclear Facilities Safety</td>
<td>D. Robinson</td>
<td>513-648-6768</td>
<td></td>
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<tr>
<td>Integrated Risk Mgmt.</td>
<td>S. Unwin</td>
<td>-5216</td>
<td></td>
</tr>
<tr>
<td>Strategic Planning and Resource Alignment</td>
<td>D. Moul</td>
<td>-6523</td>
<td></td>
</tr>
<tr>
<td>Albuquerque Office</td>
<td>G. Hanson</td>
<td>505-224-8022</td>
<td></td>
</tr>
</tbody>
</table>

(Contd next page)
Fuel Cycle and Waste Management Activities: Site survey/characterization; waste packaging; disposal technology; transportation; performance assessment; safety analysis reports; environmental/socioeconomic assessments; decontamination and decommissioning; systems integration; quality assurance; licensing; nuclear engineering/technology; policy support; institutional interactions; communications and outreach; safety and training; regulatory compliance.

Hazardous Chemical and Mixed Waste Activities: Transportation; risk assessment; modeling; regulation; waste management; policy support; regulatory compliance.

Brookhaven National Laboratory
Associated Universities, Inc.
Upton, NY 11973

Director
Environmental & Waste Technology Center
N. P. Samios
Paul Moskowitz

Fuel Cycle and Waste Management Activities: Waste stabilization/solidification processes; mixed waste form performance criteria and testing protocol; subterranean waste confinement barriers; performance and risk assessment; geochemistry of contaminated soils and sediments; materials characterization and evaluation.

Major Facilities: Hot and Cold Development Laboratories: Cobalt-60 Gamma Irradiation Facility; National Synchrotron Light Source; Alternating Gradient Synchrotron; High Flux Beam Reactor; Scanning Transmission Electron Microscope.
Fuel Cycle and Waste Management Activities: D&D of structures (test reactors and hot cells) and open sites; D&D technology development; liquid metal (sodium and NaK) waste destruction; characterization and final remediation surveys; pathway analysis models; statistical treatment of survey data for regulatory compliance; statistical/computational code for estimating and displaying spatial contaminant distribution.

Major Facilities: Radioactive Materials Disposal Facility (RMDF)

Fuel Cycle and Waste Management Activities: National LLW technology; D&D operation of SWEPP for TRU waste; LLW disposal operation; cask systems development; SF cask transport and testing; treatment and disposal of hazardous and mixed wastes; pollution prevention; WIPP support activities; remediation and treatment of buried TRU waste.
Major Facilities: Radioactive Waste Management Complex (RWMC); Waste Experimental Reduction Facility (WERF); Stored Waste Examination Pilot Plant (SWEPP) for TRU wastes; Test Area North Spent Fuel Storage Area (TAN); Advanced Test Reactor (ATR); Transuranic Storage Area; Idaho Chemical Processing Plant (CPP).

LMIT

Lockheed Martin Idaho Technologies Co.
P.O. Box 4000
Idaho Falls, ID 83415

President
W. John Denson
526-4600

VP/Director, Applied Technology
Bart Krwetz
526-4661

VP/Manager Operations
Henry B. Barron
526-4437

Fuel Cycle and Waste Management Activities: Receive and store spent nuclear fuel from Navy and other DOE sources, including characterization and technology development for final disposal; manage and process liquid and solid LLW and HLW (including necessary technology development) for final disposal.

Major Facilities: Fluorine and Storage Facility (FAST), New Waste Calcining Facility (NWCF), Liquid Effluent Treatment and Disposal (LET&D) facility, Remote Analytical Laboratory (RAL), Idaho Research Center (IRC), and Fuel Processing Facility (FPF) - not yet complete.
Fuel Cycle and Waste Management Activities: Fundamental studies of waste materials (BES); migration from LLW (BES); D&D of various site facilities; HLW disposal site characterization (RW).

Major Facilities: Waste Disposal Field Experimental Facility; Controlled Air Incinerator Facility; Size Reduction Facility; TRU Waste Assay Systems; Advanced Testing Line for Actinide Separations (ATLAS).

Fuel Cycle and Waste Management Activities: SNM disposition; waste form characterization; near-field environment characterization (geochemistry, geohydrology, geomechanics); engineered barrier system (EBS) concept development; scientific bases for waste package design; EBS (contd next page)
LLNL (contd)

materials selection and characterization; EBS performance analysis; international programs (spent fuel, introduced materials, natural analogs).

**Major Facility:** Large Block Test at Fran Ridge-Yucca Mountain, Nevada.

**MOUND**

EG&G Mound Applied Technologies
P.O. Box 3000
Miamisburg, OH 45343-3000

Tel: 513-865-4020
Fax: 3742
Verif: 3575

General Manager: Earl N. Fray
Tritium Technology: Ken Armstrong
Environmental Restoration: Monte Williams
Waste Management: Raymond J. Finney

Fuel Cycle and Waste Management Activities: Mixed waste treatment with glass melter; TRU waste technology/record systems; tritium recovery from scrap; D&D of 238Pu facilities.

**Major Facilities:** Glass Melter; Liquid Radioactive Waste Treatment Facility; Combined Electrolysis Catalytic Exchange System (CECE); Tritium Effluent Recovery System (ERS); Hydrogen Isotope (Cryogenic Distillation) Separation System (HISS); Tritium Aqueous Waste Recovery System (TAWRS).
UNITED STATES

Oak Ridge National Laboratory
Martin Marietta Energy Systems, Inc.
P.O. Box 2008
Oak Ridge, TN 37831

Tel: 615-576-5454
Fax: -2912
Verif: -6068

Director
Alvin Trivelpiece 576-2900

Dir., WM/Remedial Action
Bob Mason 574-1365

Dir., Robotics/Process Systems
Joe Herndon -7065

Dir., OCRWM Programs
Ronald Pope -6461

Dir., Env. Tech. Devel.
Tony Malinauskas 576-1092

Waste Management Activities: Operate waste management facilities, including disposal; develop LLW and TRU waste treatment technology, including assay and package certification; hazardous waste remedial actions; waste operations control center; UMTRA radiological survey; environmental restoration and facilities upgrade; waste management R&D.

Major Facilities: LLW disposal/storage facilities; Waste Examination Assay Facility (WEAF); Tower Shielding Facility (fuel/waste cask drop tests); TRU storage/certification facilities; liquid LLW processing/storage; waste processing/disposal; Tumulus LLW Disposal Facility; Non-Radiological Wastewater Treatment Plant; Hazardous Waste Storage and Packaging Facility.

Fuel Cycle and Reprocessing Activities: Develop reprocessing, remote systems, safeguards technologies, and facilities design optimizations.

Major Facilities: Integrated Equipment Test Facility, including fuel element disassembly and shearing systems; Continuous Rotary Dissolver; Chemical Rack Systems; Advanced Integrated Maintenance System; and Environmental Test Chamber.
Fuel Cycle and Waste Management Activities: Waste storage and transportation; LLW, HLW, mixed, and TRU waste characterization and treatment; waste tank remediation; international program support in waste management/environmental remediation; radioisotope separation and use; damaged spent fuel stabilization; in situ treatment and barriers for contaminated sites; disposal performance assessment; reactor safety and advanced design; integration of geologic disposal systems; management of surplus plutonium; D&D planning and technologies; assessment of past radioactive releases; environmental information systems; public involvement processes; risk management tools and health effects; analysis of environmental regulations; and integrated environmental planning and management approaches.

(cont'd next page)
PNNL (contd)

**Major Facilities:** Hot and cold analysis laboratories and development laboratories; hot cells for pilot scale programs; facilities for large-scale demonstrations and major basic science research.

**Kaiser-Hill Rocky Flats, Inc.**
Rocky Mountain Remediation Services
P.O. Box 464
Golden, CO 80402-0464
Tel: 303-966-7000
Fax: 4092
Verif: -2719

General Manager: Jim McAnally
Waste Operations: Andy Power
Waste Minimization: Lavelle Knight
Technology Development: Thomas L. Rising

**Fuel Cycle and Waste Management Activities:** Defense TRU waste technology; LLW technology development; waste treatment facilities operations; TRU/LLW minimization technology.

**Major Facilities:** Solid Waste Reduction Facility; Advanced Size Reduction Facility; TRU Waste Supercompaction; TRU Waste Assay; Liquid Waste Treatment and Fixation Facilities; Microwave Melting of Liquid Waste Treatment Sludges.

**Sandia National Laboratory**
P.O. Box 5800
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Fax: 505-844-1068
Verif: -8917

President: Al Narath
VP, Energy & Environment: Dan Hartley
Energy & Environment: Thomas O. Hunter
Envir. & Transportation: Jim Rice
Nuclear Waste Mgmt.: Felton Birghan (A)
Nuclear Energy Technology: Nestor Ortiz

(contd next page)

US-24
Fuel Cycle and Waste Management Activities: ER/WM technology development, radioactive waste management (Yucca Mountain, WIPP, Greater Confinement Disposal, LLW), waste management strategic planning, reactor safety, new production reactor, reactor engineering technology.

Major Facilities: Research reactors and numerous test facilities.

SRS

Westinghouse Savannah River Company (WSRC)
Savannah River, SC
P.O. Box 616
Aiken, SC 29802

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Fax: 803-725-1660
803-725-2978
803-725-5331

VP/Gen. Mgr. Norm F. Boyter 952-6818
Deputy General Manager Gale K. Hovey 952-6824
Solid Waste J.W. French 557-6305
Environmental Restoration A.M. (Sam) Schwartzman 952-6828
Program Management Clay B. Jones 644-4902

VP/Gen. Man. Austin B. Scott 725-2585
HLW Tech. Dir., HLW Harry D. Harmon 725-3887
HL Liquid Waste G. Todd Wright 208-1527
DWPF David B. Amerine 208-6060

Fuel Cycle and Waste Management Activities: Operate fuel reprocessing facilities and associated spent fuel storage, HLLW tank storage, and treatment facilities for defense waste; operate LLW shallow-land burial grounds; start up and operate DWPF; store mixed waste; site remediation.

US-25
SRS (contd)

**Major Facilities (existing and planned):** Defense Reprocessing Plants; Canyon Mockup Shop; LLW Incinerator, HLW Tank Farm; Defense Waste Processing Facility (DWPF); Hazardous Waste/Mixed Waste Processing Facility; Consolidated Incinerator Facility (Hazardous, LLW, and Mixed Waste); Transuranic Waste Facility; LLW Preparation Facility.

**Savannah River Technology Center**
Westinghouse Savannah River Company (WSRC)
Aiken, SC 29808
Tel: 803-725-6211 Fax: 803-725-1660 Verif: -2304

VP/Dir. SRTC
Susan Wood 725-3994
WM/Environ. Tech.
Lucien M. Padouchado -3701
Mgr. Focus Area Programs
John L. Steele -1830
Inter. Prog. Coord.
Gayle Baumgarner -4602

**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; mixed/hazardous waste technology development; groundwater remediation technology development.

**Major Facilities:** HLW Vitrification Pilot Plant; HLW Tank Mockup; HLW Caves for Process Development; Groundwater Remediation Demonstration; Bioremediation Demonstration; MLLW Vitrification.

**TRW**
TRW Environmental Safety Systems Inc.
2650 Park Tower Drive
Vienna, VA 22180
Tel: 703-204-8500 Fax: 703-204-8580

President/General Mgr.
Roland L. Robertson 204-8600
Colin Heath 204-8563

( contd next page)
Function: Management and Operating Contractor (M&O) for the DOE Office of Civilian Radioactive Waste Management (OCRWM); supports OCRWM through systems engineering, design, development, and technical direction of the Civilian Radioactive Waste Management System. The OCRWM mission is permanent disposal of the nation's spent nuclear fuel and HLW in a manner that protects the health and safety of the public and the quality of the environment.

WHC

Westinghouse Hanford Company
P.O. Box 1970
Richland, WA 99352

President: A. LaMar Trego
Dir., President's Office: Ronald E. Lerch
Exec. VP, TWRS: William T. Alumkal
VP, Transition Projects: Ronald J. Bliss
VP, Solid Waste: Henry E. McGuire
Dir., Spent Fuel: John C. Fulton

Tel: 509-376-7411
Fax: 509-376-4668
Verif: 509-376-5777

Fuel Cycle and Waste Management Activities: Hanford Site operating contractor; HLW tank storage; Cs/Sr recovery and encapsulation; HLW concentration and solidification; liquid LLW treatment and fixation; TRU waste assay; Hanford waste disposal; breeder fuel development and fabrication; spent fuel storage; solid waste disposal operations.

Major Facilities: Plutonium Finishing Plant; Fast Flux Test Facility; Fuel Development Laboratories; PUREX Plant (shut down 1992); UO$_3$ Plant; B Plant; Tank Farms.
UN IT E D 

St A T E S

West Valley Nuclear Services Co., Inc.
P.O. Box 191
10282 Rock Springs Road
West Valley, NY 14171-0191

President
William G. Poulsom
Tel: 716-942-3235
Fax: 716-942-4376

Exec. VP/Deputy Project Mgr.
James L. Little
Tel: 942-4344
Fax: 942-4750

Fuel Cycle and Waste Management Activities: Demonstration of HLW vitrification; supernatant treatment by ion exchange; LLW treatment using cement solidification.

Major Facilities: HLW Vitrification Facility; Integrated Radioactive Treatment System (supernatant processing, evaporation, remote cementation facility, product storage).

OTHER U.S. ORGANIZATIONS

EPA

Environmental Protection Agency
401 M Street S.W.
Washington, DC 20460

Tel: 202-260-2090
Fax: 202-260-7883
Verif: 202-260-2078

International Activities
Assistant Administrator
William A. Nitze
Tel: 260-4870

Multilat. Staff Dir.
Paul Cough (A)
Tel: 260-4875

Radiation Programs
Director
E. Ramona Trovato
Tel: 233-9320

Criteria Snds.
Lawrence Weinstock
Tel: 233-9290

Waste Management
Albert Colli
Tel: 233-9310

Solid Waste
Director
Elliott P. Laws
Tel: 260-4610

Dep. Dir., State Programs
Matthew Hale, Jr.
Tel: 703-308-8404

(contd next page)

US-28
Function: Establish and enforce standards for protection related to radioactive and hazardous waste.

**EPRI**

Electric Power Research Institute  
3412 Hillview Avenue  
P.O. Box 10412  
Palo Alto, CA 94303

President: Richard Balzhiser  
855-2141  
VP/Director, Nuc. Power: Robin Jones  
855-2790  
Fuel Performance Storage/Disposal: Rosa Yang  
855-2481  
Low-Level Waste: Carol Hornbrook  
855-2022  
Fuel Cycle: Rosa Yang  
855-2481  
HLW Repository: John Kessler  
855-2069  
Performance Assessment

**Fuel Cycle and Waste Management Activities:** Dry and wet storage technology development, design and demonstration of spent fuel transfer facility; conceptual designs for LLW disposal sites; spent fuel transportation technology; fuel failures, fuel cladding corrosion, high-temperature operation, and extended burnup; fuel performance computer models; HLW repository performance assessment.

**NRC**

U.S. Nuclear Regulatory Commission  
Washington, DC 20555

Chairman: Shirley A. Jackson  
415-1759  
Commissioner: Kenneth C. Rogers  
415-1855

(Contd next page)
UNITED STATES

NRC (contd)

Office of International Programs (OIP)
Director Carlton R. Stoiber 415-1780
Bilat. Cooperation/Asst. James R. Shea 415-2336
Non-Prolif./Exp./ Multilat. Rel. Ronald D. Hauber 415-2344

Office of Nuclear Material Safety and Safeguards (NMSS)
Director Carl J. Papierello 415-7800
Fuel Cycle Safety/Safeguards Elizabeth Q. Ten Eyck 415-7213
Indust./Medical Nuc. Safety Donald A. Cool 415-7197
Waste Management John T. Greaves 415-7437

Office of Nuclear Reactor Regulation (NRR)
Director William Russell -1270
Reactor Projects I/II Steven A. Varga -1403
Reactor Projects III/IV/V Jack W. Roe -1354
Adv. Reactors/ License Renewal Dennis M. Crutchfield -1199
Project Support Brian K. Grimes -1163
Systems Safety/Analysis Gary M. Holahan -2884
Inspection and Support Frank P. Gillespie -1275
Programs
Reactor Controls/Human Bruce A. Boger -1004
Factors Engineering Brian W. Sheron -2722
Technical Support R. Lee Spessard -2903

Office of Nuclear Regulatory Research (RES)
Director David L. Morrison -6641
Engineering Technology Lawrence C. Shao -5678
Systems Technology M. Wayne Hodges -5728
Regulatory Applications Bill M. Morris -6207

Regional Offices
Philadelphia-Region I Thomas T. Martin 610-337-5299
Atlanta-Region II Stewart D. Ebner 404-331-5500

(und next page)
NRC (contd)

Chicago-Region III
John B. Martin 708-829-9657
Dallas-Region IV Leonard J. Callan 817-860-8225

Function: Issue regulations and licenses and enforce them for commercial nuclear activities and disposal of spent fuel and HLW, in compliance with general environmental standards issued by the EPA; carry out R&D to support regulatory function.

NWTRB

U.S. Nuclear Waste Technical Review Board
1100 Wilson Boulevard, Suite 910
Arlington, VA 22209

Chairman
John E. Cantlon
Executive Director
William D. Barnard
Dir., External Affairs
Paula N. Alford

Function: Established by Congress in the Nuclear Waste Policy Amendments Act of 1987 to provide independent review of DOE's technical and scientific program for disposal of commercial spent nuclear fuel and defense HLW. At full complement, eleven members serve on the Board; all are appointed by the President.

USGS

U.S. Geological Survey
106 National Center
12201 Sunrise Valley Drive
Reston, VA 22092

Director
Gordon P. Eaton 648-7411
Senior Advisor for Science Applications
James F. Devine 648-4423
Toxic Waste
David Morganwalp (A) 648-5720
YMP TPO (Denver Office)
Larry R. Hayes 303-776-0516

(contd next page)
Fuel Cycle and Waste Management Activities: Basic/applied research on hydrogeologic processes relevant to radioactive and toxic waste disposal; geologic/hydrologic investigations to determine suitability of potential HLW repository site at Yucca Mountain; site investigations/research at DOE and DOD installations and EPA Superfund sites; consultant for EPA, DOE, DOD, Dept. of Agriculture (DOA), Bureaus of Land Management (BLM), Mines (BOM), and Reclamation (BOR), and state agencies.
INTERNATIONAL AGENCIES
Commission of the European Communities
200 Rue de la Loi
1049 Brussels, Belgium

Commissioner for Science, Research and Development, Joint Research Centres
Director-General, Science/R&D
Director-General, JRCs, Deputy
Director-General, Science/R&D
Director, Energy R&T

Division, Fuel Cycle & Safety
R&D Program RWM
Safety Studies
Waste Form R&D
Disposal Studies
URLs
R&D Program D&D Nuc. Inst.

Radiological Protection Division
Director-General, Environment, Nuclear Safety & Civil Protection
Director, Envir. Monitoring
Director, Euratom Safeguards
Dir. Gen., Euratom Supply Agency

INTERNATIONAL

Edith Cresson
Paulo Fasella
Hendrik Tent
Ezio Andretta
Werner Balz (A)
Rainer Simon
Henning von Maravic
Michel Hugon
Henning von Maravic
Bertus Haijting
Rainer Simon
Jaak Sinnavee
Marius Enthoven
George Fraser
Wilhelm Gmelin
Michael Goppel

MEMBER STATES - EUROPEAN COMMUNITY (EC)

Belgium Greece Netherlands Austria
Denmark Italy Portugal Finland
France Ireland Spain Sweden
Germany Luxembourg United Kingdom

INTL-1
INTERNATIONAL FUNCTION

Executive body for the European Communities (combined Euratom, Coal and Steel, Common Market).

FUEL CYCLE PROGRAM ADMINISTRATION

R&D Programs

- **Direct action** - fully funded by CEC (through tax on member states); conducted by Joint Research Centre establishments at Ispra (Italy) and Karlsruhe (Germany).

- **Shared-cost action** - coordinated and partly (50%) funded by CEC HQ under cost-sharing contracts; conducted by research centers, universities, and industries in the member states:
  - Radioactive waste management and disposal, including decommissioning
  - Nuclear reactor safety
  - Radiation protection.

Cooperation Programs

Participation/support in joint projects with various nations and/or other international organizations.

**DOE/CEC AGREEMENT FOR WASTE MANAGEMENT TECHNOLOGY EXCHANGE**

Term: 10-6-82 to 10-6-92

Scope: Characterization of waste forms; disposal in geologic formations; emphasis on R&D.

**CEC-JRC: ISPRA**

CEC Joint Research Center
Ispra Establishment
21020 Ispra (Varese) Italy
Tel: 39-332-78-9111
Fax: 39-332-78-9045

(contd next page)
CEC-JRC: ISPRA (contd)

Location: Northern Italy; may be reached by air to Milan, ground transport to Ispra, about 50 km.

Safety Technology
Nuclear Fuel Cycle R&D

Waste Management R&D: R&D in treatment and storage of radioactive wastes; volume reduction and conditioning TRU wastes; nuclide assay in wastes.

CEC-JRC: KARLSRUHE

Karlsruhe Joint Research Centre
(European Institute for Transuranium Elements)
Postfach 2266
76125 Karlsruhe
Federal Republic of Germany

Director
Jacques van Geel

Location: On the site of the German Nuclear Research Center, KfK, in Linkenheim, near Karlsruhe.

Function: Basic research in the transuranium elements, especially plutonium; reactor fuels development; R&D on actinide partitioning and transmutation.

Fuel Cycle R&D: Plutonium conversion and plutonium fuels.

Waste Management R&D: Characterization of vitreous HLW forms and SF when considered waste.

Safeguards R&D: Fissile material solution analyses.
Autonomous intergovernmental organization established in 1957 in accordance with a decision of the General Assembly of the United Nations, authorized to foster research and development in the peaceful uses of nuclear energy and exchange of scientific and technical information, establish and administer safeguards against the diversion to military purposes of nuclear materials intended for use in civil nuclear programs, and to establish or administer health and safety standards.

WASTE MANAGEMENT ACTIVITIES

- Collect, prepare, review, and disseminate technical and scientific information on
- planning waste management systems and programs
- handling, treatment, storage, and conditioning of waste, including uranium mill tailings
- disposal of waste
- assessment of the radiological and environmental consequences of waste management
- decontamination and decommissioning of nuclear facilities
- environmental restoration.

- Develop and promote international consensus documents (safety fundamentals, standards, guidelines, and practices) in all areas of radioactive waste management, implemented through the Radioactive Waste Safety Standards Program (RADWASS).

- Provide direct assistance to member states through the
  - Waste Management Advisory Program (WAMAP), focused on developing nuclear programs
  - Waste Management Assessment and Technical Review Program (WATRP), an international peer review service for developed programs

- Serve as scientific and technical body for international conventions (e.g., London Convention) and multinational projects (i.e., International Arctic Seas Assessment Program (IASAP)).

- Assist in and facilitate international/multinational projects (e.g., UNDP and UNEP)

- Promote and sponsor research work and development of data and technologies through technical assistance projects and coordinated research projects.
## PARTIAL IAEA ORGANIZATION

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
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<tbody>
<tr>
<td>Director General</td>
<td>Hans Blix</td>
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<tr>
<td>Dep. Dir. Gen. Safeguards</td>
<td>Bruno Pellaud</td>
</tr>
<tr>
<td>Dep. Dir. Gen. Research/Isotopes</td>
<td>Sueo Machi</td>
</tr>
<tr>
<td>Dir., Nuclear Fuel Cycle/WM</td>
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<tr>
<td>Waste Management</td>
<td>Donald E. Saire</td>
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<tr>
<td>Predisposal</td>
<td>Vladimir Tsyplenkov</td>
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<tr>
<td>Disposal</td>
<td>Arnold Bonne</td>
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<tr>
<td>D&amp;D</td>
<td>Mike Laraia</td>
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<td>Rad./Env. Effects</td>
<td>Gordon Linsley</td>
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<tr>
<td>RADWASS/WATRP</td>
<td>Ernst Warnecke</td>
</tr>
<tr>
<td>Nuc. Mtl. FC Tech.</td>
<td>Nohoru Oi</td>
</tr>
<tr>
<td>Raw Materials</td>
<td>Mohamad Tachid</td>
</tr>
<tr>
<td>Fuel Tech/Perform.</td>
<td>Georgi Sukhanov</td>
</tr>
<tr>
<td>SF Management</td>
<td>Feree Takats</td>
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<tr>
<td>Dir., Nuclear Safety</td>
<td>Morris Rosen</td>
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<tr>
<td>Dir., Nuclear Power</td>
<td>Poong-Eil Juhn</td>
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<tr>
<td>Dir., Sci/Tech Information</td>
<td>Joyce Amenta</td>
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</tbody>
</table>
IAEA (contd)

U.S. Mission to IAEA (UNVIE)
Obersteiner Gasse 11
1190 Vienna, Austria

Nuclear Policy
Nuclear Technology
Safeguards
Science Attaché

ICRP

International Commission on Radiological Protection
Clifton Avenue
Sutton, Surrey SM2 5PU
United Kingdom

Chairman, Main Commission
Scientific Secretary

FUNCTION

Provide principles of radiation protection as a basis for each country to use in establishing technical codes of practice.

OECD

Organisation for Economic Cooperation and Development
2, Rue André-Pascal
F-75775 Paris Cedex 16, France

Secretary General
Dep. Secretary General
Dep. Secretary General

(contd next page)
## OECD (contd)

**U.S. OECD Mission**  
19 Rue Franqueville  
75016 Paris, France  
Tel: 33-1-45-24-74-77  
Fax: 33-1-45-24-74-80  
DOE Representative  
Carol Lee  
33-1-45-24-74-24

**OECD/NEA**  
OECD Nuclear Energy Agency  
le Seine Saint Germain  
12 Boulevard des Isles  
92130 Issy-les-Moulineaux, France  
Tel: 33-1-45-24-11-12  
Fax: 33-1-45-24-11-10

**Director General**  
Kunihiko Uematsu  
33-1-4524-1000

**Directors**  
Samuel Thompson  
33-1-4524-1002  
Makoto Takahashi  
33-1-4524-1004  
Philippe Savelli  
33-1-4524-1006

**Radiation Protection/Waste Mgmt.**  
Jean-Pierre Olivier  
33-1-4524-1040

**Nuclear Safety**  
Giani Frescura  
33-1-4524-1040

**NEA Data Bank**  
Nigel Tubbs  
33-1-4524-1070

**Nuclear Development**  
Geoffrey Stevens  
33-1-45-24-10-60

## MEMBER STATES

<table>
<thead>
<tr>
<th>Australia</th>
<th>Austria</th>
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<td>Denmark</td>
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<td>Switzerland</td>
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<td>U.K.</td>
<td>U.S.</td>
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FUNCTION

Promote orderly development of peaceful uses of nuclear energy through cooperation among member states. Initiate, encourage, and coordinate cooperative work in reactor and nuclear fuel cycle studies, radiation protection and waste management, nuclear safety, regulatory matters, and nuclear data collection.

ACTIVITIES

- Workshops, technical meetings, symposia, and publications
- Joint R&D programs
- Data bank.

U.S. PARTICIPATION IN WASTE MANAGEMENT ACTIVITIES

- **Radioactive Waste Management Committee (RWMC)** - Established in 1975; composed of senior experts and government representatives from member countries; responsible for national policy, regulation, and program development/implementation; information exchange and discussion forum on waste management policy, regulations, technical, and scientific issues; participation of CEC and IAEA.

- **Performance Assessment Advisory Group (PAAG)** - Initiated in 1985 to provide a broad forum for discussion of performance assessment and to advise the RWMC on technical aspects of system performance assessments.

- **Coordinating Group on Site Evaluation and Design of Experiments for Radioactive Waste Disposal (SEDE)** - Established in 1990, forum for discussions of site characterization issues and promotion of specific studies in this area.

(contd next page)
- **Liaison Committee for Cooperative Program on Decommissioning**
  
  **Participants:** Belgium, Canada, France, Germany, Italy, Japan, Spain, Sweden, U.K., U.S.
  
  **Term:** 1990-1995 (Phase 2).
  
  **Scope:** Exchange of scientific and technical information as nuclear installation decommissioning projects.

- **Committee on Radiation Protection and Public Health (CRPPH)**

  - **Coordinated Research and Environmental Surveillance Program (CRESP)** - Related to sea disposal of radioactive waste.
    
    **Participants:** Belgium, Canada, Denmark, France, FRG, Italy, Japan, Netherlands, Portugal, Spain, Sweden, Switzerland, U.K., U.S., IAEA; IMO is an associate member.
    
    **Term:** 1981-1995.
    
    **Scope:** Investigate oceanographic and biological characteristics of the northeast Atlantic disposal site and perform related scientific work; as of 1987, extended to cover land-based discharges.

- **Committee for Tech./Econ. Studies on Nuclear Energy Development and Fuel Cycle (NDC)**

  - Assess, review, and evaluate technical and economic implications related to the nuclear fuel cycle.
    
    **Participants:** Open to NEA members, IEA, IAEA, CEC.
    
    **Term:** 10-26-77 - unspecified.
    
    **Scope:** Provide governments and scientific communities with competent and reliable information, based on a very wide field of expertise and matured in international debate, to assist in policy discussions.
PARTIAL NEA ORGANIZATION

Director General
Kunihiko Uematsu

Dep. Dir. General
Samuel Thompson

Safety and Regulation

- Radiation Protection/Waste Management
  Jean-Pierre Olivier
  Oswaldo Ilari
  Bertrand Ruegger
  Edward Lazo
  Edward Patera
  Claudio Pescatore
  - CRPPH - Committee for Radiation Protection/Public Health
  - RWMC - Radioactive Waste Management Committee

- Nuclear Safety
  Giani Frescura
  Jacques Royen
  - CSNI - Committee for Safety of Nuclear Installations
  - CNRA - Committee for Nuclear Regulatory Activities

Nuclear Development

Geoffrey Stevens
  James Joosten
  Pierre Girouard
  - NDC - Committee for Technical/Economic Studies on Nuclear Energy Development/Fuel Cycle

Science and Information Processing

Philippe Savelli
  Nigel Tubbs
  - NSC - Nuclear Science Committee
NUCLEAR SOCIETIES

AUSTRALIA

Australian Nuclear Association (ANA)
P.O. Box 445
Sutherland, N.S.W. 2232
Australia
Tel: 61-2-528-8529
Fax: 61-2-543-9263

BELGIUM

Forum Nucléaire Belge (ASBL)
Avenue Lloyd George 7
1050 Brussels, Belgium
Tel: 32-2-647-22-92
Fax: 32-2-647-04-54

Belgian Nuclear Society (BNS)
Ravensteinstreet 3
1000 Brussels, Belgium
Tel: 32-2-774-0511
Fax: 32-774-0547

CANADA

Canadian Nuclear Association (CNA)
144 Front St. West, Suite 725
Toronto, Ontario M5J 2L7
Canada
Tel: 416-977-6152
Fax: 416-979-8356

Canadian Nuclear Society (CNS)
144 Front St. West, Suite 725
Toronto, Ontario M5J 2L7
Canada
Tel: 416-977-7620
Fax: 416-979-8356

CHINA

Chinese Nuclear Society (CNS)
P.O. Box 2125
Beijing 100822, China/PR
Tel: 86-1-801-2211
Fax: 86-1-857-188
INTERNATIONAL

Société Française d'Energie Nucléaire (SFEN)
48, rue de la Procession
75015 Paris, France
Tel: 33-1-44-49-60-00
Fax: 33-1-44-49-60-11

World Association of Nuclear Operators (WANO)
39, Avenue de Friedland
75008 Paris, France
Tel: 33-1-40-42-30-78
Fax: 33-1-40-42-92-77

GERMANY

Deutsches Atomforum e.V. (DAfF)
Heussallee 10
53113 Bonn 1, Germany
Tel: 49-228-507-0
Fax: 49-228-507-219

Kerntechnische Gesellschaft e.V. (KTG)
Heussallee 10
53113 Bonn 1, Germany
Tel: 49-228-50-7259
Fax: 49-228-50-7219

ITALY

ANS Sezione Locale Italiana
c/o Ansaldo S.p.A.
C.so Perrone 25
16161 Geno, Italy
Tel: 39-10-655-8505
Fax: 39-10-655-8816

Forum Italiano dell’Energia Nuclare (FIEN)
Palazzo Taverna
Via di Monte Giordano, 36
00186 Rome, Italy
Tel: 39-6-689-3091
Fax: 39-6-8528-2591

Società Nucleare Italiana (SNI)
Facolta di Ingegneria
Viale Risorgimento 2
40136 Bologna, Italy
Tel: 39-51-644-3400
Fax: 39-51-644-3411
PNL-9450-2

JAPAN

Atomic Energy Society of Japan (AESJ)
1-1-13, Shimbashi
Minato-ku, Tokyo 105, Japan
Tel: 81-3-508-1261
Fax: 81-3-581-6128

Japan Atomic Industrial Forum (JAIF)
6th Floor, Toshin Bldg.
1-13, Shimbashi
Minato-ku, Tokyo 105, Japan
Tel: 81-3-508-2411
Fax: 81-3-508-2094

World Association of Nuclear Operators (WANO)
c/o Komae Institute, CRIEPI
2-11-1 Iwato-Kita
Komae-shi, Tokyo, Japan
Tel: 81-3-480-4809
Fax: 81-3-480-5379

KOREA

Korea Atomic Industrial Forum, Inc. (KAIF)
Yeouedo P.O. Box 1021
Seoul 150-610, Korea
Tel: 82-2-785-2570
Fax: 82-2-785-3975

Korean Nuclear Society (KNS)
No. 21, Yeouedo-dong
Youngdungpo-Ku Box 109
Seoul 150-610, Korea
Tel: 82-2-786-5975
Fax: 82-2-786-5975

NETHERLANDS

Nederlands Atoomforum
P.O. Box 1
1775 ZG Petten, Netherlands
Tel: 31-2246-4082
Fax: 31-2246-3490

Netherlands Nuclear Society
c/o N.V. Kern
Utrechtsweg 310
6812 AR Arnhem, Netherlands
Tel: 31-85-56-2491
Fax: 31-85-45-8279
INTERNATIONAL FORUM ATOMICO ESPAÑOL
Boix y Morer, 6
28003 Madrid, Spain

SOCIEDAD NUCLEAR ESPAÑOLA (SNE)
Campoamor 17
28004 Madrid, Spain

SWEDEN

SWEDISH ATOMIC FORUM (SAFO)
Box 1704
111 87 Stockholm, Sweden

FORENINGEN KÄRNTEN (FK)
Box 1419
111 84 Stockholm, Sweden

SWITZERLAND

SCHWEIZERISCHE VEREINIGUNG FÜR ATOMENERGIE (SVA)
Postfach 5032
3001 Bern, Switzerland

SCHWEIZERISCHE GESellschaft DER KERNFACHLEUTE (SGK)
c/o Paul Scherrer Institute
5232 Villigen-PSI, Switzerland

UNITED KINGDOM

BRITISH NUCLEAR ENERGY SOCIETY (BNES)
1-7 Great George Street
London SW1P 3AA, U.K.
PNL-9450-2

British Nuclear Forum (BNF)
22 Buckingham Gate
London SW1E 6LB, U.K.
Tel: 44-71-828-0116
Fax: 44-71-828-0110

Institution of Nuclear Engineers (INuE)
Allan House
1 Fenerley Road, Catford
London SE6 2LQ, U.K.
Tel: 44-81-698-1500
Fax: 44-81-695-6409

World Association of Nuclear Operators (WANO)
Chelsea Chambers
262a Fulham Rd.
London SW10 9EL, U.K.
Tel: 44-71-352-3617
Fax: 44-71-351-9678

UNITED STATES

American Nuclear Society (ANS)
555 North Kensington Avenue
La Grange Park, IL 60525
Tel: 312-708-6611
Fax: 312-708-0499

Nuclear Energy Institute
Suite 400, 1776 I Street NW
Washington, DC 20006-2495
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Fax: 202-785-1898

World Association of Nuclear Operators (WANO)
Suite 1500
1100 Circle 75 Parkway
Atlanta, GA 30339-3064
Tel: 404-953-7602
Fax: 404-953-7549

YUGOSLAVIA

Professional Section of ETAN for Nuclear Technique and Technology (ETAN-NDE)
c/o Institut Joze Stefan
Jamova 39
61000 Ljubljana, Yugoslavia
Tel: 38-61-371-321
Fax: 38-61-219-365

INTL-17
## ORGANIZATIONS AND FACILITIES

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US-10
US-II

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Department of Interior . . ........ . ... .
Department of Transportation .... . ... .
Waste disposal facility ......... . ... .

INTL-2
INTL-8
UK-12

US-S
US-S
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UK-II
DWK

DWPF

Deutsche Gesellschaft filr
Wiederaufarbeitung von
Kembrennstoffen ............. . ... .

GE-6
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GE-lS
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Defense Waste Processmg Facility .....

US-2S

Enlwlced Actinide Removal Plant .... .
European Conununity .............. .

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FR-3

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IT-I
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**Additional Codes:**

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- **JA-11**: JA-11
- **JA-21**: JA-22
- **FR-14**: FR-14
- **FR-1**: FR-4
- **INTL-16**: IN-10
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## TECHNICAL AND OTHER TERMS

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<td>advanced gas-cooled reactor</td>
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<td>at-reactor</td>
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<td>advanced thermal reactor</td>
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<td>BWR</td>
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<td>gas-cooled, graphite moderated reactor</td>
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<tr>
<td>ILW</td>
<td>intermediate-level waste</td>
</tr>
<tr>
<td>kg/hr</td>
<td>kilograms per hour</td>
</tr>
<tr>
<td>kgHM</td>
<td>kilograms heavy metal</td>
</tr>
<tr>
<td>kgU</td>
<td>kilograms uranium</td>
</tr>
<tr>
<td>kPa</td>
<td>kilopascal</td>
</tr>
<tr>
<td>kW</td>
<td>kilowatt</td>
</tr>
<tr>
<td>L/hr</td>
<td>liters per hour</td>
</tr>
<tr>
<td>LEU</td>
<td>low enriched uranium</td>
</tr>
<tr>
<td>LGR</td>
<td>light-water cooled, graphite moderated reactor</td>
</tr>
<tr>
<td>LHGW</td>
<td>low heat generating waste</td>
</tr>
<tr>
<td>LLLW</td>
<td>low-level liquid waste</td>
</tr>
<tr>
<td>LLW</td>
<td>low-level waste</td>
</tr>
<tr>
<td>LTR</td>
<td>low-temperature district heating reactor</td>
</tr>
<tr>
<td>LMFBR</td>
<td>liquid metal fast breeder reactor</td>
</tr>
<tr>
<td>LWCHW</td>
<td>light-water-cooled heavy-water-moderated reactor (same as HWLWR)</td>
</tr>
<tr>
<td>LWR</td>
<td>light water reactor</td>
</tr>
<tr>
<td>m</td>
<td>meter</td>
</tr>
<tr>
<td>MEV</td>
<td>million electron volts</td>
</tr>
<tr>
<td>MLW</td>
<td>medium-level waste (same as intermediate-level)</td>
</tr>
<tr>
<td>MOX</td>
<td>mixed (plutonium/uranium) oxide</td>
</tr>
<tr>
<td>MTR</td>
<td>materials test reactor</td>
</tr>
<tr>
<td>MTIHM</td>
<td>metric tons initial heavy metal</td>
</tr>
<tr>
<td>MTU</td>
<td>mega tons uranium</td>
</tr>
<tr>
<td>MW</td>
<td>megawatts</td>
</tr>
<tr>
<td>MWd/t</td>
<td>megawatt days per ton</td>
</tr>
<tr>
<td>MWe</td>
<td>megawatts electric</td>
</tr>
<tr>
<td>MWt</td>
<td>megawatts thermal</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
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<tr>
<td>NPT</td>
<td>Non-Proliferation Treaty</td>
</tr>
<tr>
<td>OTD</td>
<td>Office of Technical Development</td>
</tr>
<tr>
<td>PFR</td>
<td>prototype fast reactor</td>
</tr>
<tr>
<td>PHWR</td>
<td>pressurized heavy water reactor</td>
</tr>
<tr>
<td>PLWR</td>
<td>pressurized light water reactor</td>
</tr>
<tr>
<td>PM</td>
<td>program manager</td>
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<tr>
<td>Pu</td>
<td>plutonium</td>
</tr>
<tr>
<td>PUREX</td>
<td>Pu/U redox extraction process</td>
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<tr>
<td>PWR</td>
<td>pressurized water reactor</td>
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<tr>
<td>QUAD</td>
<td>$10^{15}$ Btu</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>research and development</td>
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<tr>
<td>SBR</td>
<td>fast breeder reactor (European acronym)</td>
</tr>
<tr>
<td>SF</td>
<td>spent fuel</td>
</tr>
<tr>
<td>SS</td>
<td>stainless steel</td>
</tr>
<tr>
<td>SWU</td>
<td>separative work (U enrichment)</td>
</tr>
<tr>
<td>SYNROC</td>
<td>synthetic rock (for waste immobilization)</td>
</tr>
<tr>
<td>t</td>
<td>metric ton</td>
</tr>
<tr>
<td>TD</td>
<td>technical development</td>
</tr>
<tr>
<td>Th/U</td>
<td>thorium/uranium</td>
</tr>
<tr>
<td>THTR</td>
<td>thorium high-temperature reactor</td>
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<tr>
<td>TFO</td>
<td>technical program officer</td>
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<tr>
<td>TRU</td>
<td>transuranic</td>
</tr>
<tr>
<td>TWh</td>
<td>terawatt hour (million megawatt hours)</td>
</tr>
<tr>
<td>U</td>
<td>uranium</td>
</tr>
<tr>
<td>UF$_6$</td>
<td>uranium hexaflouride</td>
</tr>
<tr>
<td>UO$_2$</td>
<td>uranium dioxide</td>
</tr>
<tr>
<td>VOG</td>
<td>vessel off-gas</td>
</tr>
<tr>
<td>yr</td>
<td>year</td>
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