The nuclear fuel cycle information system: NFCIS

IAEA's international directory of nuclear fuel cycle facilities

by Sergio Ajuria

As part of activities for the collection, analysis, organization, and dissemination of information, the Agency currently maintains two computerized databases focusing on the nuclear fuel cycle: The Nuclear Fuel Cycle Information System (NFCIS) and the International Uranium Geology Information System (INTURGEO). A third one, the Waste Management Information System (WAMIS), now is being considered. All are intended to provide a comprehensive and authoritative source of information on their respective topics.

This article briefly describes NFCIS, which is an international directory of nuclear fuel cycle facilities.

Scope of the system

The current version of NFCIS covers 272 facilities in 32 countries, distributed as follows:

- Uranium ore processing: 66 operational (O); 49 non-operational (NO)
- Uranium refining and conversion: 15 (O); 3 (NO)
- Uranium enrichment: 14 (O); 4 (NO)
- Fuel fabrication: 34 (O); 4 (NO)
- Away-from-reactor storage of spent fuel: 10 (O); 5 (NO)
- Spent-fuel reprocessing: 17 (O); 10 (NO)
- Production of heavy water: 12 (O); 4 (NO)
- Production of zirconium metal: 5 (O); 5 (NO)
- Production of Zircaloy tubing: 14 (O); 1 (NO)

Non-operational facilities include those planned or under construction, and those that are closed or on stand-by.

A large proportion of the production capability is concentrated in relatively few facilities, particularly in activities other than uranium ore processing. However, for the purposes of NFCIS it is important to include the smaller installations as well.

The purpose of NFCIS is to identify existing and planned nuclear fuel cycle facilities throughout the world and to indicate their main parameters. It thus provides an overview of the worldwide situation in this field.

For NFCIS purposes, the nuclear fuel cycle has been broadly defined as the set of processes and operations needed to manufacture nuclear fuels and to treat them after irradiation. Not included in NFCIS are nuclear power reactors (they are covered in other Agency systems and publications; for example, PRIS, the Power Reactor Information System) or at-reactor storage of spent fuel (much information is not readily available). Production of heavy water has been included because it is essential for the operation of several types of reactors. Information on waste management facilities will be included later.

This listing of fuel fabrication facilities is just one sample adapted from the NFCIS, which contains more complete descriptions. In a typical NFCIS data sheet, for example, descriptive information also includes the owner or operator of the facility; type of facility in operation; and the reference number documenting the information.

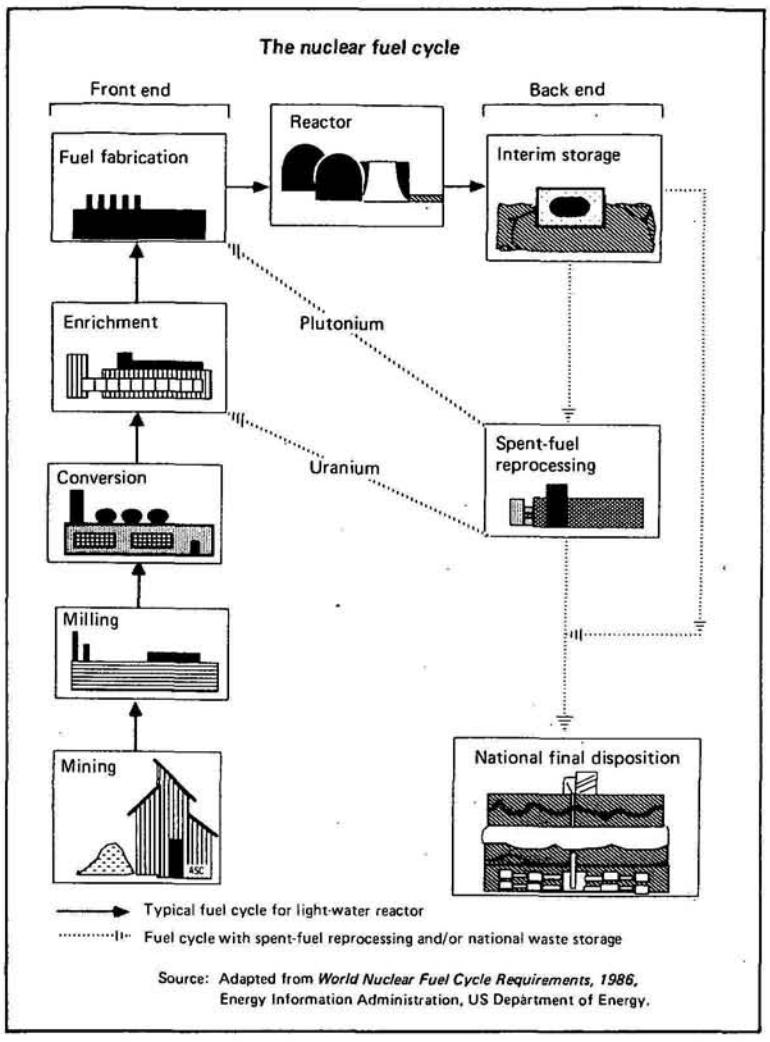
Fuel fabrication facilities

Country	Facility	Capacity*	Year**	Status
Argentina	Ezeiza	300	1985	Planned
Belgium	Dessel-BN	45	1983	Operation
	Dessel-FBFC	400	1982	Operation
Brazil	Resende	100	1983	Operation
		(400 after	1990)	Planned
Canada	GEC	600	1982R	Operation
	Monctun	200	1982	Operation
	Varennes (HWR)	500	1982	Operation
France	Cadarache	25	1986R	Operation
	Pierrelatte	500	1984	Operation
	Romans	700	1986R	Operation
	Romans-sur-Isère	700	1983	Operation
Germany,Fed.Rep.of	Hanau	600	1985	Operation
	Karlstein	250	1982	Operation
	Lingen	300	1986	Operation
India	Hyderabad	250	1986R	Operation
Italy	AGIP	200	1986R	Operation
	Bosco-Marengo	200	1986R	Operation
	Saluggia	60	1986R	Operation
Japan	Kumatori	125	1982R	Operation
	Tokai-Mura	460	1982	Operation
	Yokosuka	480	1983R	Operation
Korea, Republic of	Taejon	200	1989	Planned
Spain	Juzbado	200	1985	Operation
Sweden	Vasteras	400	1982	Operation
United Kingdom	Springfields	650	1986R	Operation
	Windscale	600	1986R	Operation
United States	Apollo	360	1986R	Operation
	Columbia	1200	1986R	Operation
	Hematite	500	1986R	Operation
	Lynchburg	375	1982R	Operation
	Richland	700	1986R	Operation
	Wilmington	1100	1982R	Operation
	Windsor	150	1986R	Operation
USSR	Atommash	700	1982R	Operation

* Capacity is expressed in metric tonnes of heavy metal per year.
** An "R" indicates the year when the data was reported.

Notes: HWR = Heavy-water reactor.

Mr Ajuria is a staff member in the Agency's Division of Nuclear Fuel Cycle, which maintains and operates NFCIS and INTURGEO as part of its activities.



Source: Adapted from *World Nuclear Fuel Cycle Requirements, 1986*, Energy Information Administration, US Department of Energy.

Background of the project

A first survey of nuclear fuel cycle facilities in Member States was prepared in 1978 for the International Nuclear Fuel Cycle Evaluation (INFCE), which was conducted from November 1978 to February 1980. The final reports of the INFCE were published by the IAEA in March 1980. They include summaries on facilities for the production of heavy water, uranium enrichment, and spent-fuel storage (at-reactor and away-from-reactor). In November 1980, the IAEA began a comprehensive survey of the status of nuclear facilities used in the peaceful nuclear fuel cycle in Member States. Questionnaires were sent to each country requesting information on facilities for uranium refining, conversion, and enrichment; production of heavy water; fuel fabrication and reprocessing; and spent-fuel storage.

In a parallel effort, but separate from the INFCE, the Agency has sponsored two surveys of uranium ore processing facilities. It also has co-sponsored two others with the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (NEA/OECD). The first survey included 42 facilities and was published in 1976 in *Uranium ore processing.** The second survey, including 76 facilities, was published in 1980 as part of *Significance of mineralogy in the development of flowsheets for processing uranium ores.*** The third one includes approximately 80 facilities and was published as Part IV of *Uranium extraction technology*, issued jointly with the OECD in 1983. The fourth survey is conducted regularly every two years for the publication of the OECD/IAEA report on *Uranium, resources, production and demand* (commonly called the "Red Book").

An internal report ("Availability of nuclear fuel and materials") was prepared in March 1983, based primarily on information collected through questionnaires sent in 1980. From 1983-86 this database was re-organized, updated, and expanded with information obtained from the specialized literature to constitute the present NFCIS. This will be prepared as an IAEA technical document (TECDOC). Both it and a new questionnaire will be sent to Member States early in 1987 for their review and comments. With their co-operation, a revised TECDOC on NFCIS is planned for publication the same year.

Organization of the system

NFCIS is arranged in four parts:

- ***Part 1:*** Directory of facilities by type, with separate sections for 1) uranium ore processing, 2) uranium refining and conversion, 3) uranium enrichment, 4) fuel fabrication, 5) away-from-reactor storage of spent fuel, 6) spent fuel reprocessing, 7) production of heavy water, 8) production of nuclear-grade zirconium metal and 9) fabrication of Zircaloy tubing.
- ***Part 2:*** Directory of nuclear fuel cycle facilities by country, in alphabetical order, and lists of facilities of the nine types included in Part 1.
- ***Part 3:*** Summary of nuclear fuel cycle facilities by country.
- ***Part 4:*** Directory of facilities, including the addresses and main parameters of each facility (such as the type of process or processes used, the type of products made, current and projected capacities) and a summary description and bibliographic references.

The first three parts, plus the bibliography, will be published as a technical document. Part 4, which extends to more than 300 pages, is not yet complete. It may be published in microfiche form at a later date.

* IAEA STI/PUB/453.

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A primary feature of NFCIS is full documentation. This means that the information presented should be supported by published reports or by official reports from the Government or organization concerned. In the current NFCIS, 93% of facilities reported are so documented through 140 bibliographic references.

End uses of NFCIS

NFCIS will be used as a source of information within the Agency to maintain an awareness of nuclear fuel cycle activities in Member States and to assist in the implementation of technical co-operaton programmes. In addition, Member States may use NFCIS to:

- Assess current production capabilities of the nuclear fuel cycle industry
- Make projections of future production capabilities
- Identify suppliers or potential suppliers of nuclear fuel, related materials, and nuclear fuel services
- Assess future needs for nuclear fuel cycle facilities.

Future NFCIS activities

The Nuclear Fuel Cycle Information System will be continuously updated, both by monitoring specialized literature and by questionnaires sent every few years to Member States. It is currently planned to publish revised editions of NFCIS every 2 years.

INTURGEO: An overview

The International Uranium Geology Information System (INTURGEO) was established to provide Member States with a comprehensive source of information about the geology of uranium deposits and occurrences. Analysis of deposit characteristics from the system may provide more accurate geological recognition criteria to aid in both exploration and speculative resource assessment. Another important objective is the publication of a world atlas of uranium deposits and occurrences.

Toward the aim of better assisting geologists in identifying additional uranium resources, data is being analysed from numerous examples to develop more representative and diagnostic recognition criteria, as well as a classification scheme. From data collected so far, a trend toward more complete and accurate descriptions of occurrences from developing countries has emerged. Data from the developed countries, although more voluminous, is far less detailed. Much of the data acquired has been the result of IAEA contacts in developing countries who see a need to have a similar capacity for inventorying minerals.

As a result of efforts in system design and programming, the Agency now has available the software to establish data centres in Member States so that information may be exchanged in a more effective way. Brazil is actively engaged in a project to establish a national uranium geology information system, for example.

Currently, more than 5000 entries are described in INTURGEO. These will be presented in a world atlas to be prepared as an IAEA technical document. The atlas will have detailed maps and brief descriptions of uranium occurrences and will also include microfiche records of the full database.

Japan's Tokai reprocessing plant. (Credit: PNC)