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Plutonium *Investigation*

"Key words in the Dutch energy policy are 'reliable, affordable and clean'. At the moment, [our] main attention is given to energy conservation, renewable energy and the liberalisation of both the electricity market and the market for natural gas". In his statement before the General Conference of the International Atomic Energy Agency (IAEA) in September 1998, Ambassador Hans Forster, Head of the delegation of Netherlands, implicitly mentioned the nuclear phase-out which his country is enacting. Currently, the main (remaining) objective of the Dutch nuclear industry is the safe management of nuclear waste.

Two nuclear power plants have been operated in the Netherlands, of which one was definitely shut down in 1997, officially for economic reasons.

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The only operating plant is planned to be shut down at the end of 2003. On its own, it generated 3.6 TWh in 1998, which corresponds to about 4% of the total electricity generated in the Netherlands.

The Dutch nuclear industry has also collaborated with the European plutonium industry - operating reprocessing plants, MOX (plutonium fuel) fabrication plants and fast-breeder reactors. Dutch electricity utilities have had spent fuel reprocessed in France, the UK, and in Belgium. The Dutch company SEP (Samenwerkende Elektriciteits-Produktiebedrijven) has had shares in the European fast-breeder reactor programmes, the centrepiece of which was the French Superphénix fast-breeder reactor. However, in contrast to all the other countries which have been engaged in the plutonium industry, the Netherlands did not plan any use -outside the breeder programme - for plutonium which was produced through the reprocessing of their spent nuclear fuel. The current situation of the nuclear industry in Europe, in which most utilities are disengaging themselves from reprocessing and plutonium fuel programmes, therefore tends to confirm the interpretation that reprocessing was chosen solely as a temporary solution for the spent fuel. After spending several hundred million Dutch guilders for the foreign reprocessing of its spent fuel, the Netherlands are now faced with managing reprocessing waste, of which the most important is plutonium.

Nuclear Power

The only operating nuclear power plant is the 450 MWe Borssele PWR which has been running since 1973 operated by EPZ. According to a 25 November 1994 resolution from the Tweede Kamer, the lower house of the Dutch Parliament, its operating license is only valid until 31 December 2003. The parliamentary vote was passed by a margin of 77-73 votes only. However, an opinion poll conducted at the time showed 80% of the Dutch population was opposed to nuclear power. During 1997, the plant was subject to an intensive overhaul which comprised the complete rebuilding of parts of the facility. EPZ is not willing to shut down the plant and has initiated an administrative court case against the decision in 1997. Typically, such administrative cases last four to six years, and thus a decision on the validity of the end of the operating license could precede or even follow the currently planned shut-down of the plant.

The only other nuclear power plant in the Netherlands is the 60 MWe boiling-water reactor (BWR) which was operated by GKN at Dodewaard. This plant generated 11.5 TWh from 1968 to 1997.

Dutch research and development has contributed to the development of enrichment capability based on centrifuge technology, through the trilateral (Netherlands - Germany - UK) URENCO partnership company, established by the 1970 Treaty of Almelo. The company started up in August 1971, using previous secret research from the three countries which was pooled. The enrichment plant at Almelo began active operations in 1972.

Management of Nuclear Waste

As in all countries using nuclear power, no definitive solution has yet been chosen for nuclear wastes. COVRA, the waste management authority, has just received the operating license for an intermediate level radioactive waste (ILW) and high-level radioactive waste (HLW) interim storage facility called HABOG, located at Borssele. This facility is designed to store the waste for some hundred years. The HLW part of the facility is designed to enable the storage of spent fuel from both commercial Dodewaard and Borssele reactors, which has not been reprocessed, as well as spent fuel from research reactors - the much smaller Petten research reactor and the Delft pool reactor. SGN, the engineering subsidiary of COGEMA, is a contractor on HABOG. SGN signed a 90 million Dutch guilders contract for the design and the construction of the facility. A license was issued on 29 June 1998 by the Government under the responsibility of the Ministry of Economic Affairs. However, Greenpeace and five other groups objected to the licensing of the facility. An administrative court dismissed the case and confirmed the license on 8 January 1999. COVRA is now authorised to build the HLW interim storage facility as well as to operate the ILW facility.

COVRA has been authorised to use the HABOG ILW interim storage facility to temporarily store spent fuel from the research reactor at Petten which is owned by the European Commission but operated by ECN - the Netherlands Energy Research Foundation - and is a supplier of medical radio-pharmaceuticals. The reactor has up to now only used highly-enriched uranium (HEU) which was supplied by the USA. The US Administration recently lobbyied in favor of a conversion of the reactor from HEU to low enriched uranium (LEU), for non-nuclear proliferation purposes, as part of a diplomatic push for conversion of other European research reactors. ECN's management was divided into on the one hand favoring converting to LEU, with which the US would be co-operative - and would accept taking back the spent HEU fuel already produced - and on the other hand not converting to LEU, for which the US would not accept back the spent HEU fuel, which would therefore require a shut-down of the reactor, because of the lack of storage for the HEU spent fuel. The possibility of storing the spent fuel in shielded 'Castor' casks at the COVRA's ILW facility helped ECN out of this delicate situation.

The spent fuel from the Petten research reactor was planned to be transferred for storage at HABOG during February 1999.

Reprocessing Policy: No Use for Plutonium

Both Dutch utilities operating nuclear power plants have had reprocessing programmes for their spent fuel, to be carried out in Belgium, France and the UK.

At first, the Netherlands actively participated in the Eurochemic reprocessing programme, for the operation of a plant at Dessel/Mol in Belgium, which started operation in 1957 and ended in 1974 when the plant was mothballed. The process of decommissioning the plant began in 1990 and is planned to last until 2005. It is not clear yet how the plutonium contaminated materials (PCM) will be managed in Belgium, or whether this waste will be sent back to the Dutch contractors. The electricity utility GKN, which operated the Dodewaard reactor until its shut-down, had 8.5 tonnes of spent fuel reprocessed in the plant.

GKN also signed a 53-tonnes-reprocessing contract with the British BNFL for other Dodewaard spent fuel. BNFL's THORP plant at Sellafield, which is planned to reprocess the fuel, has started operations in 1994 but has not yet reached nominal annual throughput. The Dutch contract amounts to only 1% of THORP's 'base-load' capacity. The plant has been shut down temporarily on numerous occasions since decommissionng, most recently in December 1998. The future reprocessing plans for different batches of foreign spent fuel at THORP is thus unclear. The future parliamentary debate is planned to decide on the approval of an extending of the THORP contract for a further 4.5 tonnes of spent fuel.

Starting in the 1970s, the electricity utility EPZ, formerly called PZEM, which operates the Borssele reactor, signed three reprocessing contracts with the French company COGEMA which operates the La Hague (Normandy) reprocessing plants. The first contract concerns spent fuel which was reprocessed at the UP2 reprocessing plant before 1990. This contract corresponds to 85 tonnes of spent fuel, which produced 620 kg of plutonium (the contract originally concerned only 79 tonnes but 6 tonnes of 'defective' fuel were reprocessed because it was difficult to manage). The second and third contracts concern fuel to be reprocessed at the UP3 plant. The second contract was also originally signed in the 1970s and corresponds to 140 tonnes of spent fuel which were reprocessed at the UP3 plant at La Hague from 1990 to 1998. According to WISE-Paris estimates, this produced about one tonne of separated plutonium. The third contract corresponds to 156 tonnes of spent fuel. According to the agreement, this spent fuel should be reprocessed during the 2000-2010 period. WISE-Paris estimates that this spent fuel should produce close to 1.1 tonnes plutonium if reprocessed. EPZ has signed this contract in order to have reprocessing contracts covering all the spent fuel due to be discharged by the plant until its final shut-down.

Due to actions by environmental groups in the Netherlands, spent fuel transports from Borssele to La Hague were postponed in November 1996. More recently, some Belgian cities objected to have the transports pass by on their roads. In 1998, the contamination scandal of spent fuel transports in Europe (See **Plutonium *Investigation*** N^{o}. 6-7) perpetuated the postponement of the spent fuel transport. Therefore it is highly probable that the spent fuel corresponding to the third reprocessing contract with COGEMA (156 tonnes to be reprocessed at the UP3 plant during the 2000-2010 period) is still at the Borssele plant. Some of it is and will also still being used in the reactor core since the reactor has not yet been shut down.

Of the other countries which have had their spent fuel reprocessed, only a few are planning a continued use for the corresponding plutonium which is separated. Different countries, among which is France, are currently using MOX fuel - a mixture of plutonium and uranium oxides - in a tentative way to slow down the increase, and later (hopefully) diminish, their plutonium stockpiles. However, because of costs and proliferation considerations, MOX fuel is not economic and is not largely used. MOX use is the only non-military use for the plutonium, and the only justification to the continuation of reprocessing. The Netherlands however as a result of its imminent plan to shut down its only operating reactor, will never therefore use MOX fuel. The costly reprocessing of Dutch spent fuel has generated a stockpile of separated plutonium, which no other country will want to put to use. The only possible management strategy for this plutonium is to store it, which needs to take into consideration the related nuclear proliferation risks: for long term storage, the nuclear industry is thinking mixing the plutonium with high-level radioactive waste. This is a bit like putting back together the different components of the spent fuel, or reprocessing in reverse, "anti-reprocessing", as it was called by Frank von Hippel, a US analyst from Princeton University or "détraitement" ("deprocessing"), a name given by Daniel Cohn-Bendit.

The Government of the Netherlands have published some figures on the Dutch plutonium stockpile. A WISE-Paris estimate of the plutonium inventory in the Figures of the Month section (see p.7) shows that the Netherlands have had separated at least 1,670 kg plutonium, of which 670 kg have already been used to fabricate nuclear fuel for

European fast-breeder reactors.

The figures leave many questions unanswered. WISE-Paris has not been able to discover much information on the state of this material. It is unclear whether it has been irradiated, or if it will be reprocessed. France plans that COGEMA will reprocess the nuclear fuel, both irradiated and fresh fuel, from Superphénix. What would be done with separated plutonium recovered, inluding that of Dutch ownership and origin, is open to speculation. Why would the Netherland's nuclear industry and Government prefer the spent fuel to be reprocessed, which would separate out plutonium and which would be more difficult and costly to manage than the spent fuel itself in the first place? This is an issue that is certain to engage Dutch Parliamentarians in the upcoming debate. They could ensure the avoidance of the unnecessary reprocessing of the 156 tonnes, the 53 to 57.5 tonnes of spent fuel which are still to be reprocessed respectively at the COGEMA La Hague and BNFL THORP plants and try to prevent breeder fuel processing.

NUCLEAR PROLIFERATION AND DUAL-USE TECHNOLOGY

Even though there is no (known) nuclear weapons programme in the Netherlands, the Dutch nuclear industry has somehow contributed to the development of nuclear weapons in other countries, in at least three ways.

First, the participation in reprocessing programmes in France and in the UK have induced commercial contracts with the same companies which have supplied plutonium to the military programmes, notably COGEMA in France. In Britain, it is clear that the commercial company BNFL has benefited from subsidies and the R&D carried out for the weapons plutonium user, the Atomic Weapons Establishment.

Secondly, when one looks at the legal aspects, according to the European nuclear community agreements (Euratom), special fissile materials in the European Union are the property of Euratom. However, Euratom lets each member country manage its own fissile materials. The Netherlands has sent its spent nuclear fuel - which contains uranium and other radionuclides, including plutonium - to France and to the UK. Both these countries have developed such an intricate industry that nuclear materials for civil and military uses are in some conditions mixed together. For instance, plutonium from the La Hague reprocessing plant; which has processed spent fuel from commercial reactors in Europe and in Japan, has been used for the French fast-breeder reactor programme. Fast-breeder reactors in France (Phénix and Superphénix) have generated plutonium with characteristics to be used in the military programme. The French Atomic Energy Commission (CEA) has admitted that the Phénix reactor has not been subject to international nuclear safeguards verifications because it has been used for defense purposes. There is no legal constraint, no bilateral or multilateral agreement, nor any technical constraint which could have forbidden or prevented the use of Dutch materials in the French nuclear weapons programme. Admitting this fact for Dutch authorities was an implicit participation in the French nuclear weapons programme. The situation is similar in the UK although it has no operating fast reactor to convert plutonium.

Thirdly, the Dutch-British-German company URENCO, which operates a uranium enrichment plant at Almelo, has acted as a covert conduit of weapons useable nuclear technology know-how. Blueprints for centrifuge technology to enrich uranium - which can be used to generate highly enriched uranium for military programmes - has been obtained illegally by both the military programmes in Iraq and in Pakistan. For instance, in April 1979, the US Government terminated military aid to Pakistan after it emerged in 1978 that the Pakistani uranium enrichment centrifuge technology had been illegally and clandestinely obtained from a spy, Dr. Abdul Qadeer Khan, based at the URENCO plant in Almelo. Dr. Khan is now considered the father of the Pakistani nuclear weapons programme, which was made public with the nuclear testing in Pakistan at the end of May 1998. Also, a now retired German born engineer, Bruno Stemmler, five years ago admitted that in 1988-89 he had assisted the Iraqi uranium enrichment programme, using knowledge he had gained first during 1969-72, part of which he worked at the early MAN-URENCO centrifuge project at Almelo.

COVRA

The Centrale Organisatie voor Radioactief Afval NV (COVRA) is the national radioactive waste management organisation. It is partly owned by the State (10%) and mostly by private waste management companies, including both nuclear plant operators.

POSTBUS 202 - NL-4380 AE VLISSINGEN
TEL: +31 113 613900 - FAX: +31 113 613950

Nuclear Safety and Safeguards division

The Nuclear Safety and Safeguards division of the Ministry of Economic Affairs is the regulatory and inspection body for safety and physical protection.

POSTBUS 19266 - NL-3501 UTRECHT
TEL: +31 30 284 8990 - FAX: +31 30 280 1539

Netherlands Energy Research Foundation (ECN)

The Netherlands Energy Research Foundation (ECN) operates the Petten High-Flux reactor, which is a reactor owned by the European Commission. ECN currently produces radioisotopes for radiotherapy.

POSTBUS 1 - NL - 1755 ZG PETTEN
TEL: +31 224 564949 - FAX: +31 224 564480
Information: verkroost@ecn.nl

EPZ

The NV Elektriciteits-Produktiemaatschappij Zuid-Nederland (EPZ) is the operator of the only operating nuclear power plant in the Netherlands, the 450 MWe pressurised water reactor (PWR) at Borssele. EPZ also operates conventional thermal power plants and has a total of 3,900 MWe power generation output.

POSTBUS 711 - NL-5600 AS EINDHOVEN
TEL: +31 40 250 3200 - FAX: +31 40 257 2200

GKN

The NV Gemeenschappelijke Kernenergiecentrale Nederland (GKN) was the operator of the Dodewaard 60 MWe boiling water reactor (BWR) which was operated from 1968 to 1997.

POSTBUS 40 - NL-6669 ZG DODEWAARD
TEL: +31 488 418811 - FAX: +31 488 412188

URENCO-Nederland

URENCO-Nederland is the Dutch part of the trilateral (Netherlands - Germany - UK) URENCO partnership company. URENCO has currently more than 10% of the world enrichment market.

PLANTHOFSWEG 77 - POSTBUS 158 - NL-7600 AD ALMELO
TEL: +31 54 654 5454 - FAX: +31 54 681 8296
Business information: h.rakhorst@urenco.nl

IRI

The Interfaculty Reactor Institute (IRI) of the Delft University of Technology is a 2 MWth pool reactor with a 3 MV pulsed electron-accelerator facility. The reactor is used both for theoretical as well as applied research.

MEKELWEG 15 - NL-2629 JB DELFT
TEL: +31 15 278 5052 - FAX: +31 15 278 6422

Greenpeace

Greenpeace is very active on both the plutonium/reprocessing and the nuclear transports issues in the Netherlands. Greenpeace has organised actions highlighting safety problems of nuclear transports and has contributed to the current de-facto moratorium on spent fuel transports to France and the UK prior to reprocessing since 1994.

DIEDERIK SAMSOM
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<http://www.greenpeace.org/>

LAKA/WISE-Amsterdam

LAKA, a foundation which has collected a significant documentation on nuclear issues and WISE-Amsterdam share office and staff. LAKA/WISE-Amsterdam is planning activities against future nuclear transports, spent fuel to be sent from Borssele to La Hague in France, from Dodewaard to Sellafield in the UK, and from the Petten research reactor to the HABOG interim storage facility.

[NOTE: WISE-Paris is entirely independent of WISE-Amsterdam. The original organisational link, WISE-International, has been legally dissolved.]

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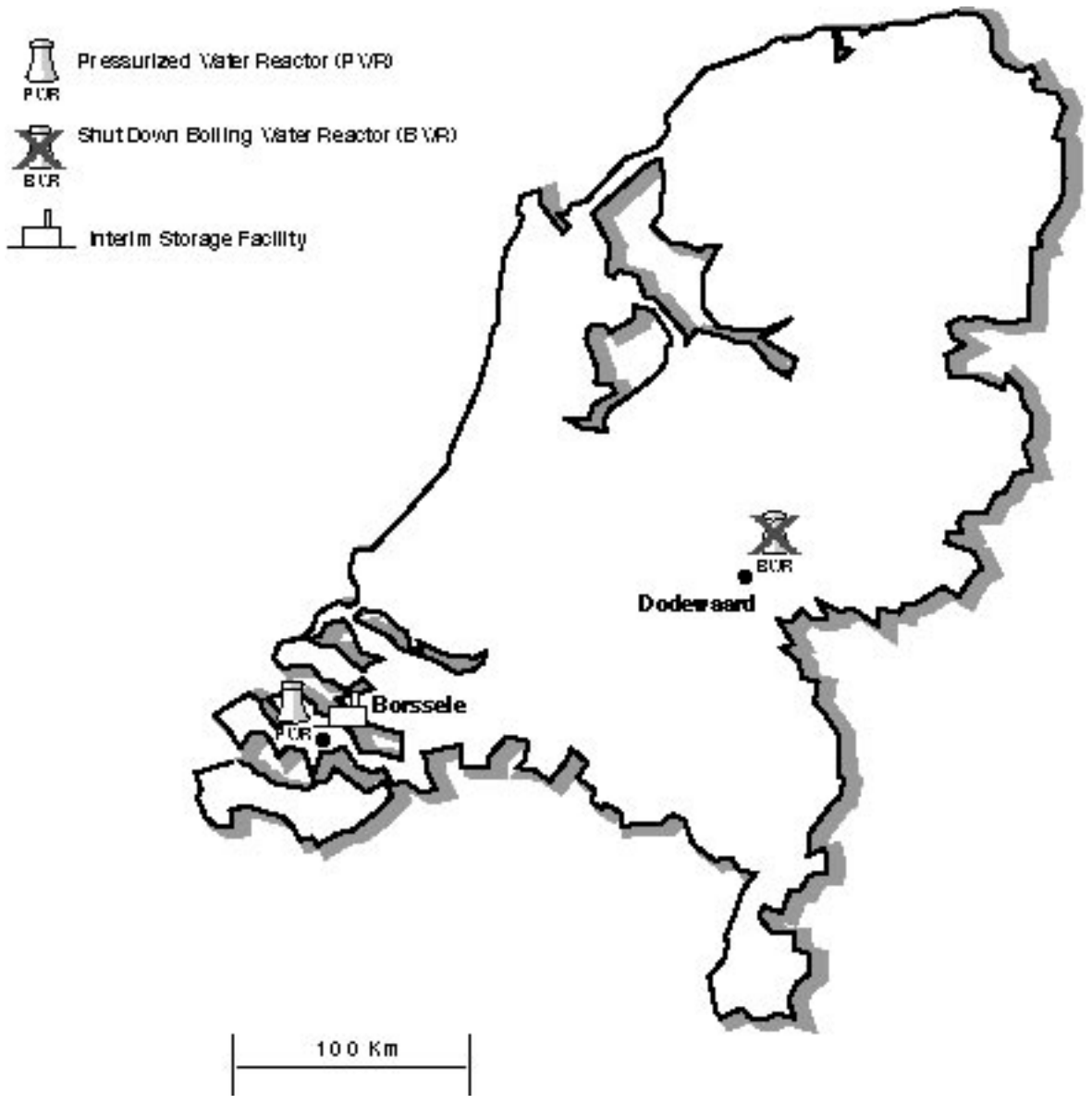
<http://antenna.nl/~wise/>



1 OPERATING NUCLEAR POWER PLANT
- 1 operating pressurised water reactor (PWR), not licensed to use MOX fuel.

1 SHUT DOWN NUCLEAR POWER PLANT
- 1 boiling water reactor (BWR), which was shut down in 1997.

1 INTERIM STORAGE FACILITY
- 1 interim storage facility for nuclear waste and for spent fuel (HABOG)

FIGURES OF THE MONTH

Following are two tables which give a WISE-Paris estimate for the inventory of separated plutonium and the inventory of plutonium in spent fuel for the Netherlands, as of 1 January 1999.

Production and Inventory of Separated Plutonium (kg)

Plant and Operator	Reprocessing Plant and End Use for the Plutonium
Dodewaard (GKN)	- 8.5 tonnes reprocessed at Eurochemic, which generated **47,4 kg plutonium (used for testing and FBR programme)**
Borssele (EPZ)	- 85 tonnes reprocessed at COGEMA's UP2 plant, which generated **620 kg plutonium (used for the FBR programmes)** - 140 tonnes reprocessed at COGEMA's UP3 plant, which generated **at least 1,000 kg plutonium (not used, stored at La Hague)**
TOTAL	**233.5 tonnes reprocessed, which generated at least 1,670 kg plutonium**

(Source: Tweede Kamer 1985, COGEMA, WISE-Paris)

Spent Fuel to be Reprocessed and Plutonium Content

Plant and Operator	Reprocessing Plant
Dodewaard (GKN)	- 53 tonnes to be reprocessed at BNLFL's THORP plant, which should generate **at least 300 kg plutonium**
Borssele (EPZ)	- 156 tonnes to be reprocessed at COGEMA's UP3 plant, which should generate **at least 1,100 kg plutonium**
TOTAL	**209 tonnes to be reprocessed, which should generate at least 1,400 kg plutonium**

(Source: COGEMA, WISE-Paris)

The two Dutch utilities have to manage at least 1,670 kg plutonium which has been separated from their spent fuel. A large share of this plutonium is stored at the La Hague plants with no planned end-use. Further reprocessing of spent fuel according to existing contracts with BNFL and COGEMA would generate at least 1,400 kg plutonium - for which there can be found no planned end use neither.

One French Franc for Superphénix
- at least NLG 45 million for the Dutch utilities

The Superphénix fast-breeder reactor, which has generated costs of about 60 billion French francs according to the French national accounting organisation (1996 figure), has been sold to the French electricity utility EDF for one symbolic French franc, at the end of 1998. According to an EDF spokesperson in a telephone interview with WISE-Paris at the beginning of February 1999, the company NERSA, which owned the reactor, was dismantled and absorbed by EDF after the sale. NERSA was a consortium with participations from EDF (51%), the Italian ENEL (33%) and SBK (16%). SBK is another consortium with participations from Germany, Belgium and the Netherlands through the Dutch SEP (15%). The Dutch participation in NERSA was therefore about 2%.

EDF inherits of the larger economic consequences. Apart from NERSA debts and the reprocessing of the nuclear fuel which all former participants share, EDF is now responsible for the decommissioning and dismantling of the reactor.

According to the EDF representative, Superphénix debts amount to FRF 4.1 billion and the planned reprocessing of the nuclear fuel (one core which was used and the other one which was not) will cost FRF 2.7 billion. The Dutch participation in NERSA will therefore cost SEP FRF 136 million (NLG 45 million) not covered by the 1 FRF deal.

Questioned on the fissile materials resulting from the reprocessing, the EDF representative said that the former participants to NERSA will be responsible for their share. "EDF is not interested" in recuperating the plutonium from other participants (which is a confirmation that the French plutonium stockpile is not an asset). Managing plutonium from Superphénix will cost a lot to the Netherlands. Previous and future costs together with current debts have made Superphénix a very costly enterprise for the Dutch utilities.

WORDS OF THE MONTH

"Today the nuclear community in the Netherlands is small but beautiful."

This sentence is the beginning of the editorial of "Holland Nuclear Profile", a short document prepared by the Netherlands Nuclear Society and the Netherlands Foreign Trade Agency to present the exhibitors of the Holland Pavilion at the ENC'98 International Nuclear Congress and the World Nuclear Expo in Nice, France, 25-28 October 1998.

"Reprocessing makes no sense at all - unless you want to make bombs."

Conclusion by Alex Kirby, environment correspondent, BBC Business of his piece (1/ 99) Sellafield: The product of the quest for military nuclear power ?

WORTH READING

Offshore Wind Energy is Far More Economical Than Plutonium for Japan

A new report issued last month by the Institute for Energy and Environmental Research (IEER) in Washington DC makes some interesting comparisons between the plutonium and wind energy potential for Japan "The worldwide potential of wind energy and recent advances in technology, such as larger, more reliable turbines and offshore wind power platforms, have made electricity from wind far more economical in the near-term and much more promising in the long-term than plutonium," said Marc Fioravanti, author of the report and a consulting engineer with IEER. He asserts that the situation for plutonium in Japan relative to wind power is about as favorable as it can be since Japan has a limited land area on which wind power development is possible. "It is time to leave plutonium behind in the century in which it was created and stop throwing good money after the enormous amount of public resources that have already been wasted on it. "said Dr.Arjun Makhijani, president of IEER. "Japan has spent huge sums of money on developing plutonium as an energy source - $11 billion on the Rokkasho reprocessing plant alone [Planned cost] - in the name of energy self-sufficiency. But development of wind power is far better economically, environmentally, and for promoting non-proliferation." The report's analysis shows that costs of electricity from plutonium-based fuel (known as MOX) in present-day commercial nuclear reactors are about 40% greater than offshore wind electricity. According to the report, the development of economical wind power has been held back by poor public policy decisions, such as a focus on tax incentives for capital investment that have encouraged high initial construction costs along with inadequate attention to long-term performance.

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e-mail: ieer@ieer.org - <http://www.ieer.org>

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*NOTE: This issue of **Plutonium Investigation** is partly based on two earlier reports by WISE-Paris: "Dutch Plutonium and the French Nuclear Weapon Program", January 1996, and "The Dutch Plutonium Dead-End", September 1997.*

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❑ "La France Nucléaire 1997", Mary Byrd Davis, WISE-Paris, 256 pages; 120 FRF + 25 FRF for postage

❑ "Comprehensive Impact Assessment of the Use of MOX Fuel in Light Water Reactors", Jinzaburo Takagi, et al., CNIC, Tokyo, 335 pages; 400 FRF (NGOs 160 FRF) + 60 FRF postage + VAT for Europe (contact CNIC for US and Asia, fax: 81-3-53 30 95 30).

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