International Atomic Energy Agency
INFORMATION CIRCULAR
(Unofficial electronic edition)

INF

INFCIRC/549/Add. 8
31 March 1998

GENERAL Distr.
Original: ENGLISH

Communication Received from Certain Member States Concerning their Policies Regarding the Management of Plutonium

1. The Director General has received notes verbales, dated 5 December 1997 and 4 March 1998, from the Permanent Mission to the IAEA of the United Kingdom of Great Britain and Northern Ireland. In keeping with the United Kingdom's commitment under the Guidelines for the Management of Plutonium (contained in INFCIRC/549 of 16 March 1998 and hereinafter referred to as the "Guidelines"), the government of the United Kingdom, in the enclosure of the note verbale of 5 December 1997, makes available information on its national holdings of plutonium, as at 31 December 1996, in accordance with Annexes B and C of the Guidelines. In the enclosure of the note verbale of 4 March 1998, the government of the United Kingdom, in accordance with its commitment under the Guidelines, makes available a statement explaining its national strategy for nuclear power and the nuclear fuel cycle.

2. In light of the request expressed by the United Kingdom in its note verbale of 1 December 1997 concerning its policies regarding the management of plutonium (INFCIRC/549 of 16 March 1998), the texts of the enclosures of the notes verbales of 5 December 1997 and of 4 March 1998 are attached for the information of all Member States.

ANNEX B

United Kingdom

Annual Figures for Holdings of Civil Unirradiated Plutonium

National Totals	as of 31 Dec 1996 (Previous year's figures in brackets) Rounded to 100 kg plutonium with quantities less than 50 kg reported as such (Tonnes)	
1. Unirradiated separated plutonium in product stores at reprocessing plants.	52.1	( )
2. Unirradiated separated plutonium in the course of manufacture or fabrication and plutonium contained in unirradiated semi-fabricated or unfinished products at fuel or other fabricating plants or elsewhere.	0.5	( )
3. Plutonium contained in unirradiated MOX fuel or other fabricated products at reactor sites or elsewhere.	2.2	( )
4. Unirradiated separated plutonium held elsewhere.	0	( )
Note:		
(i) Plutonium included in lines 1-4 above belonging to foreign bodies.	3.8	( )
(ii) Plutonium in any of the forms in lines 1-4 above held in locations in other countries and therefore not included above.	0.9	( )
(iii) Plutonium included in lines 1-4 above which is in international shipment prior to its arrival in the recipient State.	0	( )

ANNEX C

United Kingdom

Estimated Amounts of Plutonium contained in Spent Civil Reactor Fuel

National Totals

		as of 31 Dec 1996 (Previous year's figures in brackets) Rounded to 1000 kg plutonium with quantities less than 500 kg reported as such (Tonnes)	
1.	Plutonium contained in spent fuel at civil reactor sites.	4.3	( )
2.	Plutonium contained in spent fuel at reprocessing plants.	43.0	( )
3.	Plutonium contained in spent fuel held elsewhere.	0.1	( )

Note:

(i) The treatment of material sent for direct disposal will need further consideration when specific plans for direct disposal have taken concrete form.

(ii) Definitions:

Line 1: covers estimated amounts of plutonium contained in fuel discharged from civil reactors;

Line 2: covers estimated amounts of plutonium contained in fuel received at reprocessing plants but not yet reprocessed.

United Kingdom Civil Nuclear Policy including Plutonium

1. Nuclear Generation

Background

The UK civil nuclear industry has its origin in the military programme of the 1940's and 1950's. The UK became the first country in the world to adopt nuclear power on an industrial and commercial scale when Calder Hall was commissioned by the United Kingdom Atomic Energy Authority (UKAEA) in 1956. Since then, a total of nineteen nuclear power stations, comprising forty-one reactors, are currently fully operational, and three stations, each with two reactors, have been closed down and are being decommissioned. The first generation stations were called magnox reactors (after the magnesium alloy used to make the fuel can containing the uranium fuel elements). The magnox reactors were followed by a series of Advanced Gas Cooled Reactors (AGR) which were commissioned between 1976 and 1988. A Pressurised Water Reactor (PWR) station (The UK's first, Sizewell B) was commissioned in February 1995).

Existing Nuclear Generating Capacity

Nuclear power stations in the UK are operated by Nuclear Electric Ltd. (NEL), Scottish Nuclear Ltd. (SNL), Magnox Electric plc (Magnox) and by British Nuclear Fuels plc (BNFL). NEL and SNL are wholly owned subsidiaries of British Energy plc, which was privatised in July 1996. Magnox and BNFL are wholly owned by the Government, which is currently working to merge the two companies with the aim of improving the arrangements for managing Magnox generation and the associated reprocessing and waste management liabilities.

NEL operates five AGRs and one PWR (total capacity of 7.2 Gwe). SNL operates two AGR stations, each with two reactors (2.4 Gwe). Magnox currently operates six magnox stations (2.9 Gwe). BNFL operates two Magnox stations (0.4 Gwe) at Calder Hall on the Sellafield site and at Chapelcross, both of which supply approximately 1% of total generating capacity to the National Grid. The UK nuclear power stations currently generate about 25% of the UK power demand. Additionally, 17 TWh of nuclear electricity is imported each year from France via the cross-channel interconnector (2.0 Gwe).

Further Nuclear Generating Capacity

Building of new nuclear power stations in the UK is not economically competitive for electricity generation and it is not therefore expected that new nuclear plant will be developed. However past nuclear power station construction has resulted in a stock of nuclear capacity which substantially contributes to electricity generation.

British Energy, the privatised nuclear generating company, reported in its first Annual Report and Accounts since privatisation that long term it is looking to broaden its fuel and plant mix in the UK. British Energy retains access to modern technology through Sizewell B and through overseas projects.

2. Government's Energy Policy

General

The Government's energy strategy is based on the need for secure, diverse and sustainable energy supplies at competitive prices and it is working to establish a level playing field both in the UK and Europe.

Since 1990, the UK electricity market has been undergoing a transition from domination by State-owned monopolies towards a more competitive environment. The entire supply market should be open to competition during 1998.

Nuclear Power

In 1995, the then Government announced that no new nuclear power stations would be built with public sector funding. The present Government sees no economic case at present for building any new nuclear power stations. A key determinant of nuclear power's role will be its ability to compete with generation based on other fuels. The nuclear generators have made significant production and efficiency improvements in the last five years, and there is less uncertainty now about the costs of nuclear power. The forthcoming integration of Magnox Electric with BNFL should yield further savings both in operational costs and in the costs of managing future nuclear liabilities in the years to come.

3. Nuclear Fuel Cycle

BNFL is a public limited Company wholly owned by the Government. BNFL provides the full range of nuclear fuel cycle services to the UK and international markets, including enrichment (through its associated Company, Urenco Ltd.), uranium hexafluoride production, fuel manufacture, reprocessing and waste management. BNFL also provides world-wide nuclear fuel transport services, runs a power generation business and an engineering business. BNFL is also committed to research and development in order to support and develop its business.

4. Current Fuel Cycle Policy

Reprocessing

The UK Government believes that the question of whether to reprocess (and if so when), or to seek alternative spent fuel management options should be a matter for the commercial judgement of the owners of the spent fuel, subject to meeting the necessary regulatory requirements.

Reprocessing extracts reusable uranium and plutonium from the irradiated fuel and is a technology operated by a number of countries with a consistent approach to both process and management of the resulting wastes. Reprocessing is carried out in the UK by BNFL at its Sellafield site in Cumbria. Reprocessing of fast reactor and materials testing, and research reactor fuels, is undertaken on a smaller scale by the UKAEA at its Dounreay site in Scotland.

Siting of Dry Stores

An alternative to early reprocessing of spent oxide fuel is its long-term storage for direct disposal or reprocessing at same time in the future. On February 21 1995, the previous UK Government announced the outcome of its review of radioactive waste management policy about the siting of dry stores for spent nuclear fuel. It concluded that decisions on the siting of dry stores for spent nuclear fuel are a rnatter for the commercial judgement of the operators, subject to the necessary planning and regulatory requirements being satisfied.

Waste from Reprocessing

As well as contracts for reprocessing spent fuel belonging to NE and SNL, BNFL also has contracts with a number of overseas utilities. Since 1976 such contracts have included options for the waste arising from reprocessing to be returned to the country of origin and the UK Government requires these options to be exercised.

Plutonium

All civil plutonium in the UK (whether separated or in spent fuel) is stored safely and securely under relevant national and international regulations including inspection by international safeguards authorities. It has been UK Government policy for the past 11 years or so to publish statistics on plutonium movements, production and stocks. In addition to data on internal movements, information has also been published on exports and imports of unseparated plutonium in irradiated fuel and separated plutonium products, including mixed oxide fuels. The UK will in future be publishing information on its holdings of plutonium in conformity with the format in Appendices B and C of the guidelines for the management of plutonium. This would facilitate comparisons with other participating countries' holdings of plutonium.

5. Spent Fuel Management - Current Practices

Magnox

Magnox fuel (uranium metal/magnesium alloy cladding) must be reprocessed for technical reasons. All Magnox fuel will continue to be despatched to BNFL's Magnox reprocessing facility at Sellafield which on current station lifetime assumptions will be required until at least 2005/2006, but it is capable of continuing safely well beyond this date if reactor lives are extended.

AGR

BNFL has contracted with NE and SNL to reprocess or store all AGR lifetime fuel arisings. Nuclear Electric has contracted to reprocess in BNFL's THORP facility, some 3000tU, the arising from its AGR stations up to about the year 2005. NE retains the option of early reprocessing or of storing subsequent arisings of fuel from these stations. SNL has contracted with BNFL for THORP reprocessing of some 1700 tU, the arisings from the AGRs up to about 2006/2007. The remaining lifetime arisings of SNL AGR spent fuel will be sent for storage at SeIlafield with the option to reprocess or condition for direct disposal.

PWR

No decisions have yet been taken on the long-term management of spent fuel from the Sizewell B PWR station. The Sizewell B design provides for 18 years of at-reactor wet storage, which leaves open for future decision the possibilities of reprocessing or further storage and direct disposal

Prototype Fast Reactor

Fuel from the UK's Prototype Fast Reactor (PFR) is being reprocessed by the UKAEA at Dounreay in a purpose-built reprocessing plant. This programme of reprocessing is expected to run until the early years of next century. The plutonium recovered from the reprocessing of the fast breeder fuel is transported by road, sea and rail to Sellafield for storage.

6. Transport

Attention to safety is a key feature of all operations and is reflected by the excellent safety record which has been achieved over many years. The transport of nuclear products is carefully monitored by the regulatory authorities and is carried out in strict accordance with the International Atomic Energy Agency regulations.

UK companies provide a comprehensive integrated transport service for the movement of materials from all stages of the nuclear fuel cycle. BNFL has experience of transporting by air, road and sea and since the 1960's has transported some 12,000 tonnes of irradiated fuel covering many millions of miles without any incident involving a breach of containment.

7. UK Stocks of Safeguarded Plutonium

Currently there arc some 50 t of separated safeguarded UK plutonium in stock at Sellafield and there are cxpected to be further arisings of some 15 t from the UK Magnox programme. Contracted reprocessing of AGR fuel in THORP together with the UKAEA's WAGR and SGHWR fuel, will separate approximately 15 t. Fast reactor reprocessing will produce between 1 - 2 t of plutonium. The utilisation of these stocks in MOX fuel is currently being considered (see below)

As stated earlier all civil plutonium at Sellafield (whether separated or in spent fuel) is stored safely and securily under relevant national and international regulations including inspection by international safeguards authorities. The timing of reprocessing and separation is an operational matter determined by the most cost-effective use of plant.

8. Plutonium Utilisation in Particular as Mox Fuel

Fast Reactor

Historically, UK policy on plutonium utilisation was largely based on the early commercial exploitation of fast reactors. In July 1988 the then UK Government announced that its funding of Fast Reactor research programme would cease in March 1994. A review carried out by government indicated that the commercial deployment of fast reactors in the UK would not be required for 30 to 40 years.

Utilisation of MOX

It is feasible to recycle plutonium as MOX in both PWRs and AGRs. In the UK, NE are known to be investigating the use of MOX in Sizewell B. Elsewhere, around 400 tonnes of MOX have been utilised in various countries, including Germany and Switzerland. A number of other countries, who have opted for reprocessing, such as Japan., France and Belgium have programmes for use of MOX fuel assemblies.

MOX Fuel Manufacture in the UK

BNFL has designed and manufactured MOX fuel for around 20 years. It currently operates a prototype MOX Demonstration Facility (MDF) at Sellafield which has delivered fuel assemblies to Swiss and German utilities. The capacity of the MDF is fully contracted until around 2001. A large scale commercial MOX plant (SMP) is undergoing commissioning trials. SMP has been designed to produce fuel assemblies for a wide range of PWR and BWR power station designs and to deal with material of a wide isotopic range. SMP potentially has the capacity to accept the expected annual arisings of plutonium from THORP reprocessing. The plant is situated adjacent toTHORP.

There is potential for reduction of military plutonium stockpiles by the recycling of plutonium, for peaceful use, within the safeguarded civil nuclear fuel cycle, as MOX fuel.

9. Safeguards, Control and Transparency

All civil nuclear facilities and all civil nuclear material in the UK are subject to Euratom safeguards. The UK is one or the original depository powers of the Non-Proliferation Treaty (NPTI') and was the first nuclear weapons state to make available for IAEA inspection all of its civil nuclear facilities. Certain installations at the Capenhurst and Sellafteld sites are designated for inspection by the 1AEA. The UK has also given a commitment to accept new safeguards measures which will contribute to increasing the 1AEA's capability to detect undeclared nuclear activities in non-nuclear weapon states, or improve the effectiveness or efficiency of 1AEA safeguards at facilities in the UK designated for inspection.

In order to provide assurance on matters of material accountancy and control, BNFL, UKAEA and Urenco (Capenhurst) Ltd. publish annual figures for Materials Unaccounted for (MUF) for all civil categories of nuclear material at each of their operating sites.

The UK and the governments of all its reprocessing customers observe the IAEA guidelines and the provisions of the Convention on the Physical protection of Nuclear Materials. Under these, plutonium will be. subject to adequate physical protection measures in the UK, during international transport to reprocessing customers and when in the possession of reprocessing customers.

As a condition of exporting civil plutonium the UK Govcrriment requires an assurance from the recipient state that it will apply the appropriate physical protection measures. It also requires assurances as to the non-explosive use of plutonium, the application of safeguards and retransfer of the material to third parties. Assurance on these measures, and on physical protection are set out in relevant Nuclear Co-operation Agreements and exchanges of notes.

The countries which are members of the Zangger Committee and Nuclear Suppliers Group (NSG), which include the UK, have adopted guidelines similar to those described above. These countries have agreed a "trigger list" of items for which assurances are required before any transfers from the United Kingdom can take place.

10. Plutonium Management Policy

Spent fuel and plutonium have to be managed, whether there is reprocessing or not. The UK Government believes that it is for the owners of the spent fuel and plutonium, subject to their meeting the appropriate safety, security and international safeguards requirements, to choose their preferred management option, including whether or not their spent fuel should be reprocessed. As stated in section 5, spent fuel from all Magnox reactors will be reprocessed.

Concerns have been raised about world-wide holdings of separated plutonium. In considering the validity of these concerns in relation to the stocks of plutonium held by the UK, it is important to distinguish between stocks held on behalf of foreign customers and those held on behalf of UK nuclear generators and other UK companies

With regard to stocks held on behalf of foreign customers, this is material owned by BNFL's customers and held by BNFL to their order. All reprocessing customers arc contractually required to demonstrate an acceptable end use before delivery of plutonium. The customers may opt to store the plutonium for a period of time or to convert it to MOX fuel. However, the plutonium remains the property of BNFL's customers, and so the UK Government considers that these customers (or in the last resort, their Governments) bear ultimate responsibility for the plutonium.

In the case of plutonium owned by UK nuclear generators, the UK Government believes that it is a matter for these operators to choose the fuel cycle arrangements which best suit their requirements, within established regulatory frameworks to ensure safety and protection of the environment. British Energy recently signed fixed price long-term contracts with BNFL for further reprocessing of spent fuel. In addition, SNL has also contracted for BNFL to provide storage facilities for additional spent fuel arisings potentially until the year 2086.

11. Conclusion

To summarise, stocks of plutonium, whether separated or not, civil or military, all need to be safely and securely stored and used, subject to arrangements designed to ensure that the material would only be available for a proper purpose. The effectiveness of these arrangements is generally not affected by the specific level of stocks being stored.

In accordance with its international obligations on non-proliferation, the UK Government applies stringent measures to all grades of civil reprocessed plutonium. These measures are designed to prevent the two potential risks which could apply to plutonium, namely attempts by an outside group to steal and/or misuse the material (theft or sabotage) or attempted misuse of the material by the authorities in a non-nuclear weapon state holding it (diversion). The UK remains sa6sfied as to the intentions of the Governments of customer countries and considers that any potential proliferation risks associated with the operation of THORP arc satisfactorily met by arrangements to prevent theft, sabotage and diversion.

November 1997

ANNEX I

Enrichment at Capenhurst, Nr Chester, Cheshire

Uranium has been enriched at the Capenhurst site for some 40 years. Since 1977, BNFL has operated the most modern gas centrifuge enrichment technology at Capenhurst, as a partner in the tripartite international organisation Urenco. The other two partners being commercial companies from the Netherlands and Germany. The enriched uranium produced by this process is used to manufacture the fuel supplied to nuclear power stations such as Advanced Gas-cooled Reactors (AGRs) and Pressurised and Boiling Water Reactors (PWRs and BWRs).

In 1993 BNFL merged its civil enrichment business fully with its Dutch and German partners. BNFL is now a one third shareholder in the restructured Urenco Limited. As a result the civil enrichment business at Capenhurst is now operated by Urenco, with other activities on the site being underttakcn by BNFL.

Fuel Manufacture at Springfields, Nr Preston, Lancashire

BNFLs Fuel Division manufactures nuclear fuel at Springfields. Several thousand tonnes of uranium are processed each year to produce fuel for nuclear power stations worldwide. Fuel can be manufactured for all major designs of nuclear reactors and there arc also facilities to manufacture materials for experimental and prototype reactors.

In over 40 years of operation, Springfields have produced more than seven million fuel elements and pins have been produced (equivalent to 700 million tonnes of coal). Products and services have been supplied to some 140 reactors in more than 12 countries.

In 1993, a replacement plant was commissioned to manufacture uranium hexafluoride, the basic component used to manufacture fuel for modern nuclear power stations such as AGRs and PWRs. This and other intermediate fuel products and services have been marketed very successfully overseas. In Western Europe, a partnership with Westinghouse of the USA and ENUSA of Spain, the European Fuel Group (EFG) has won contracts for the manufacture of PWR fuel for utilities in France, Belgium and Sweden.

Production of fuel elements for the UK's first PWR power station at Sizewell has marked the start of a new fuel manufacturing era era at Springfields. The assembly of the fuel is taking place in the New Oxide Fuels Complex (NOFC) which became fully operational in 1995. This highly automated facility carries out both AGR and PWR fuel production and will lead to further improvements in productivity.

Reprocessing at Sellafield, Cumbria

Used nuclear fuel has been reprocessed at Sellafield since 1952. The current plants designed to reprocess fuel from Magnox power stations began operating at Sellaficld in 1964. Over 35,000 tonnes of nuclear fuel have been reprocessed at Sellafield and more than 15,000 tonnes of the recovered uranium has been recycled for use in AGRs, in the UK.

The Thermal Oxide Reprocessing Plant (THORP) utilises the very latest fuel reprocessing technology. The plant will reprocess fuel from AGRs, PWRs and BWRs. THORP's capacity is fully booked during its first 10 years of operation when it will reprocess some 7000 tonnes of fuel. To date, about 60% of the plant's capacity has been reserved for the second 10 years of operation.

Some 50% of THORP's order book is with overseas utilities; there are 34 utilities in 9 countries which currently have contracts to reprocess irradiated nuclear fuel at THORP.

MOX Fuel Production at Sellafield, Cumbria

At Sellafield, BNFL has developed technology to manufacture mixed plutonium-uranium oxide fuel (MOX). A facility with a capacity of 8 tonnes p.a. is already in operation and a full scale commercial plant is undergoing commissioning trials with a capacity of 120 tonnes p.a. MOX fuel is already used routinely in thermal reactors in several countries, and its use worldwide will increase significantly over the next few years. BNFL has already delivered MOX fuel to customers in Switzerland and Germany.

Waste Management at Sellafield, Cumbria

BNFL has developed at SeIlafield extensive facilities for the safe and effective treatment, encapsulation and storage of all categories of radioactive waste,

HLW

BNFL has extensive experience in the storage of liquid high level wastes arising from the reprocessing of spent fuel. It also operates a major plant, the Windscale Vitrification Plant, for the conversion of such liquid wastes into a vitrified form for long-term storage. A purpose-built storage facility, cooled by natural convection, has been constructed for this duty. A third line to the Vitrification Plant is currently being built and should come on stream by the year 2000. Current UK Government policy is that vitrified HLW should be stored for at least 50 years to allow for cooling, followed by disposal in a deep geological repository.

ILW

A major investment has taken place over the last decade to provide plants for the treatment and storage of intermediate level wastes arising on the SeIlafield site, including those arising from plants developed to minimise the activity in wastes streams discharged from the site. The facilities include plants for the sorting and segregation of wastes, for encapsulation of appropriate wastes in cement and for the super compaction of appropriate waste streams. Purpose built stores have been constructed for the products from these facilities. Disposal of these wastes is expected to be to a deep geological repository.

LLW

Solid low level waste arising at the Sellafield site is disposed of to the near-surfacc facility operated by BNFL at Drigg. Facilities have been developed for the sorting, containerisation and supercompaction of wastes prior to despatch to Dnigg. At Drigg, containers are grouted with cement before emplacement in the disposal vaults. The Drigg site has sufficient capacity to accept UK arisings of solid LLW until the middle of the next century.