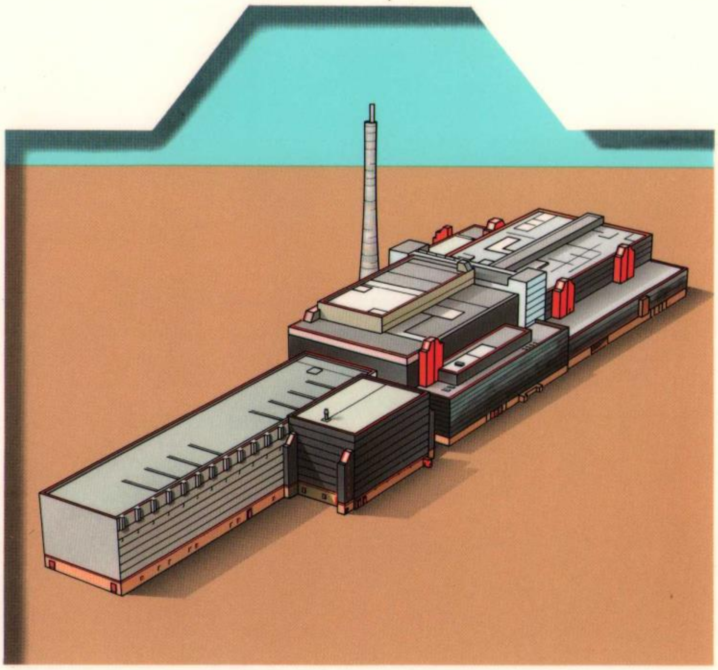
BRITISH NUCLEAR FUELS PLC



The Thermal Oxide Reprocessing Plant

THORP

BNFL

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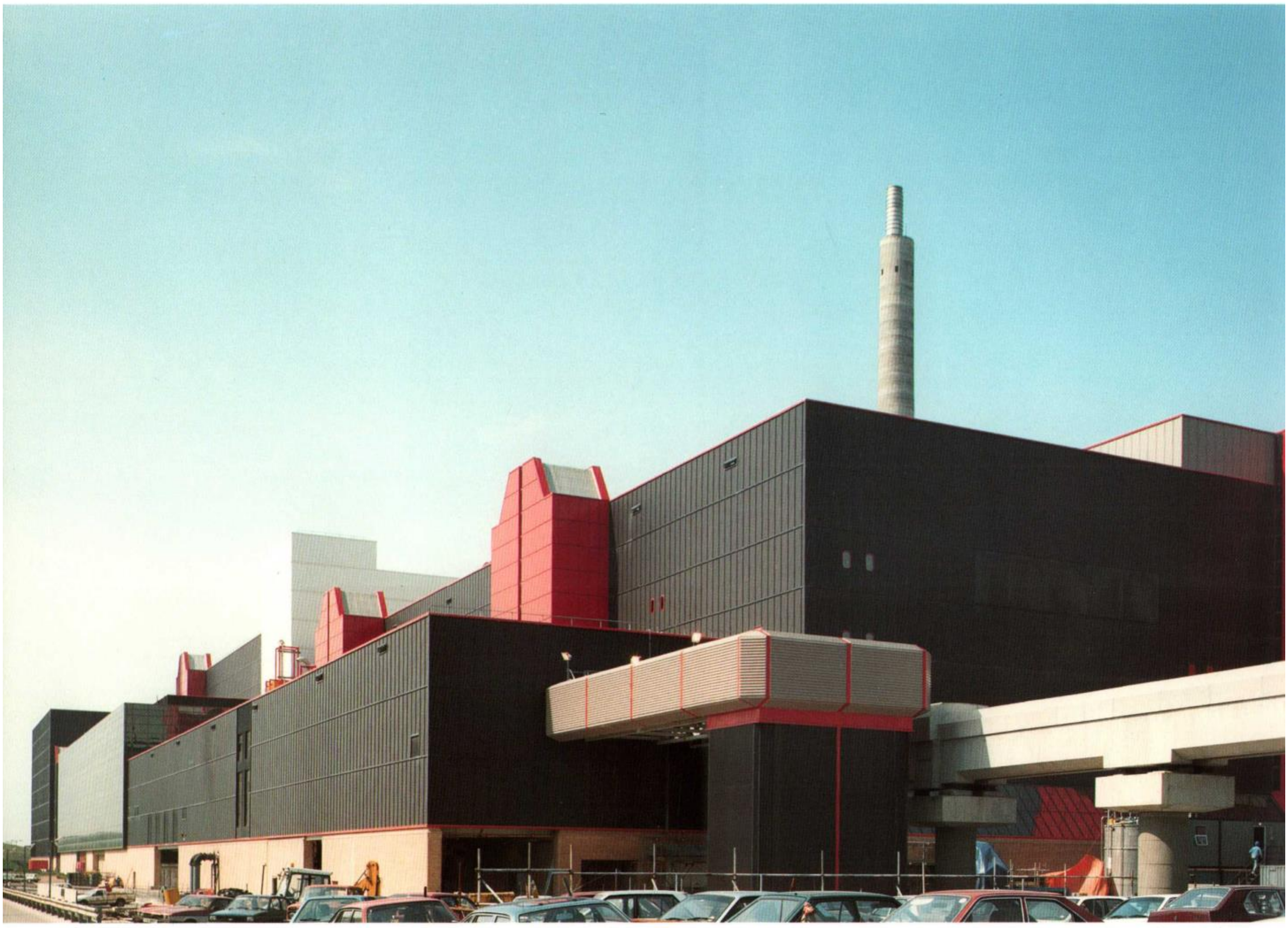
British Nuclear Fuels has been reprocessing Magnox fuel at Sellafield for more than 40 years. The Thermal Oxide Reprocessing Plant (THORP) will enable the Company to reprocess fuel from the more modern reactors such as Britain's Advanced Gas-cooled Reactors and Light Water Reactors.

THORP is one of Europe's largest and most complex engineering projects. The cost of the plant, together with its share of supporting facilities amounts to £2.8 billion.

THORP combines all the facilities necessary for reprocessing nuclear fuel in one plant, enabling the fuel to be received at one end, and the recycled uranium and plutonium to be supplied at the other. The plant is fully integrated with Sellafield's waste treatment plants, and routes incorporated in the design allow the transfer of each class of waste from THORP to the relevant treatment plant.

The Thermal Oxide Reprocessing Plant at Sellafield.



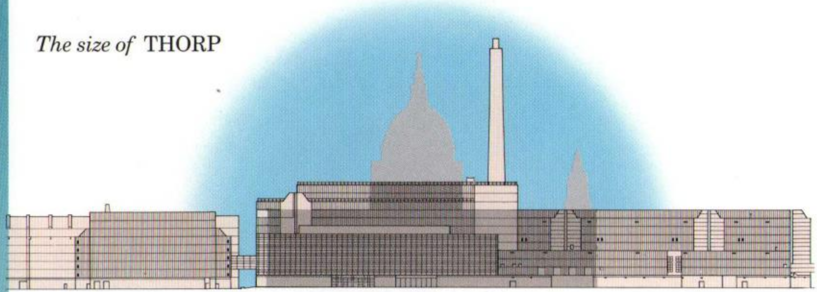
THORP contains enough concrete to fill a queue of concrete mixers reaching from London to Manchester.

The pipework used in the plant would stretch in a line from Sellafield to London.

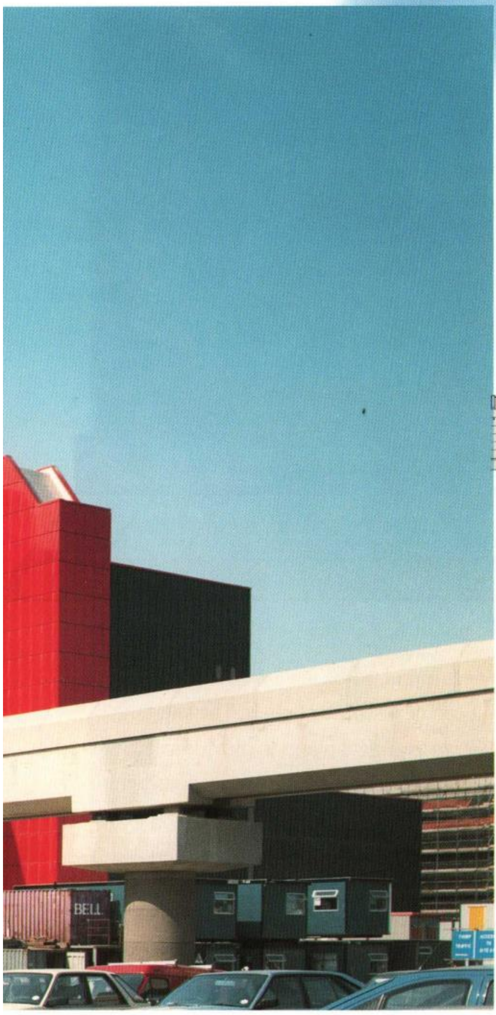
The 500-metres long plant contains 220,000 cubic metres of concrete, 20,000 tonnes of mainframe steelwork and over 40,000 tonnes of reinforcement steelwork. The pipework used within the plant could stretch in a line from Sellafield to London.

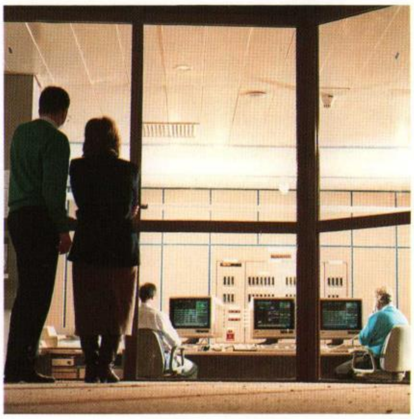
THORP incorporates one of the largest single control systems ever developed in the world. The system is highly computerised and will control all operations to a high degree of safety and reliability. Over 2,000 kilometres of electrical and instrument cabling provide power and monitor the plant, using 15 main computers in THORP's management centre. As well as computer suites, the management centre provides office accommodation, a medical centre, restaurant, changerooms and general facilities to support the operation of the THORP complex.

The size of THORP



Side elevation of St. Paul's Cathedral.

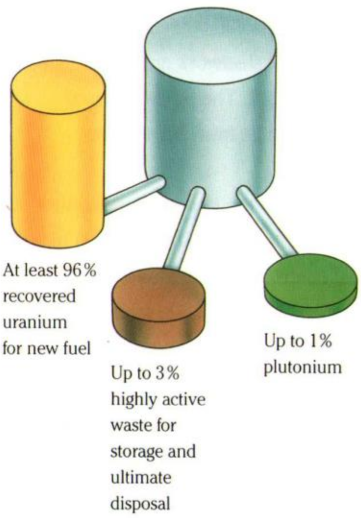




The Thermal Oxide Reprocessing Plant Control Room.

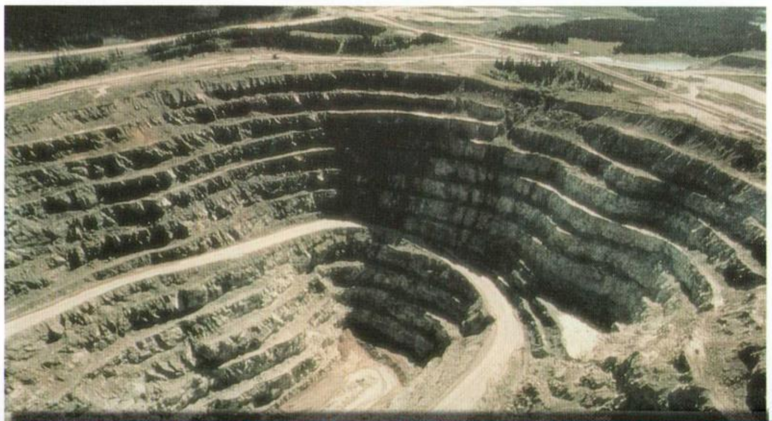
Reasons for Reprocessing

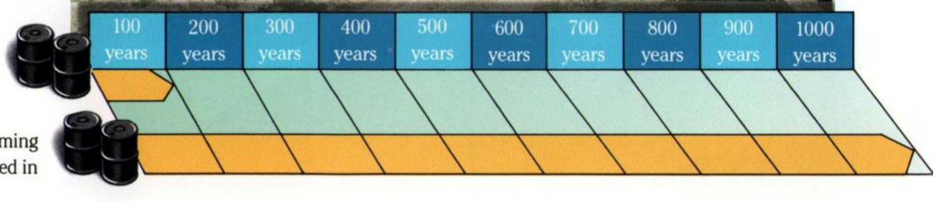
The proportion of products produced by reprocessing at Sellafield (by weight).



After several years in a nuclear reactor, the fuel becomes less efficient and is replaced with fresh fuel. The fuel which is removed can be reprocessed to reclaim the valuable re-usable uranium and plutonium. These make up 97% of the irradiated fuel, leaving only 3% as waste. More than 35,000 tonnes of Magnox fuel has been reprocessed at Sellafield during the past 40 years and more than 15,000 tonnes of the uranium recovered has been recycled for use in Britain's Advanced Gas-cooled Reactors. Plutonium is also a valuable fuel which can be used in both thermal and fast reactors.

Reprocessing nuclear fuel optimises the energy potential from uranium, conserving supplies of natural uranium ore. As supplies of ore have a finite life, reprocessing allows nuclear energy to remain an option in the world's long-term energy policies. Without reprocessing, natural reserves of uranium would last about 100 years, depending on growth in nuclear energy output. With reprocessing, and if the recovered uranium and plutonium were used in fast reactors, electricity supplies could be guaranteed for the next 1,000 years.



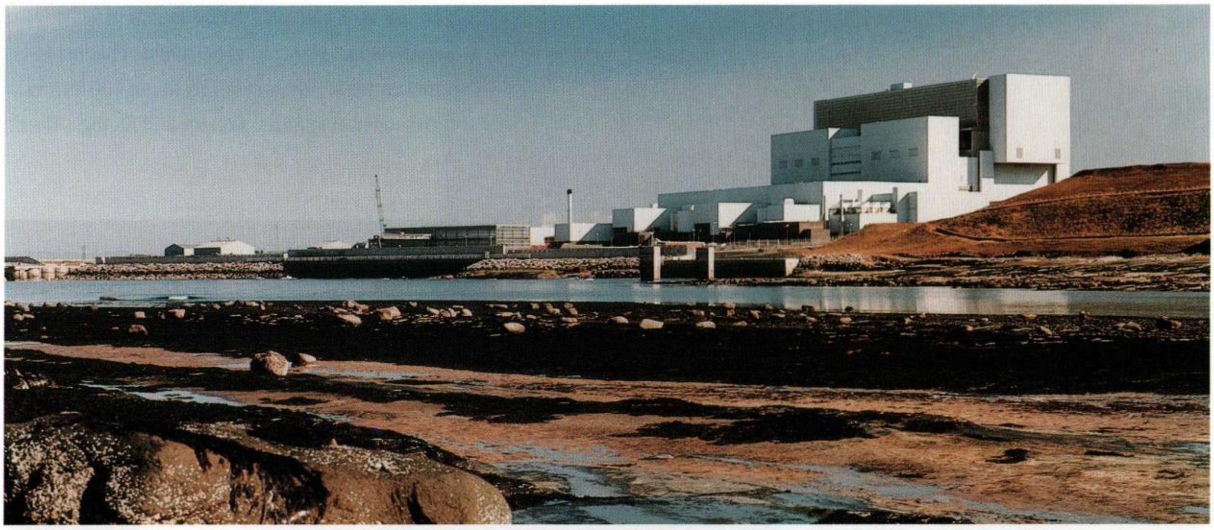


Natural reserves of uranium (without reprocessing).

Uranium reserves (with reprocessing and assuming the recovered uranium and plutonium are used in fast reactors).

Reprocessing also assists in the management of waste. It allows the waste to be separated and conditioned into forms which can be disposed of safely. The latest technology has been used in the Sellafield waste treatment plants to provide safe solutions to the treatment of all types of radioactive waste resulting from reprocessing operations.

If nuclear fuel is not reprocessed, it will need to be disposed of. The technology for conditioning the irradiated fuel to enable it to be disposed of directly is not as advanced as that for dealing with the wastes arising from reprocessing.

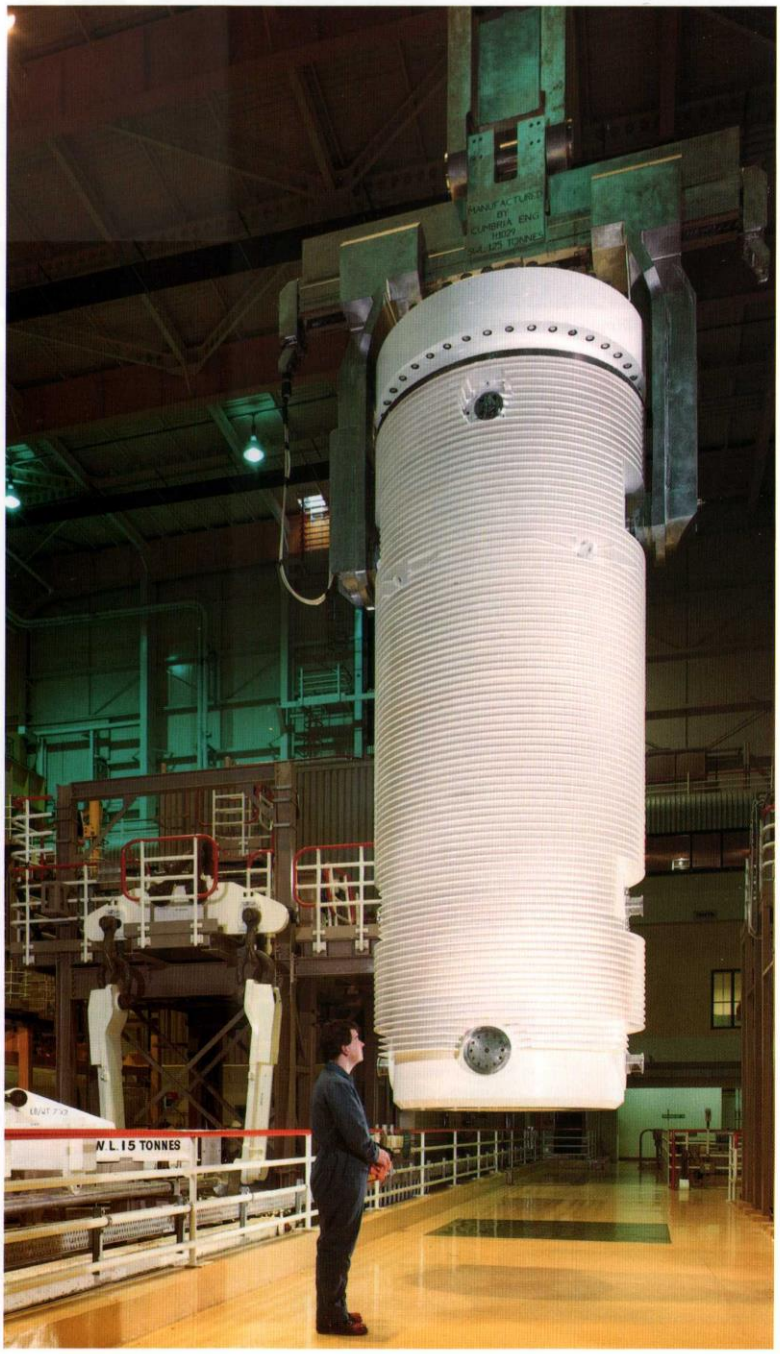


Torness Advanced Gas-cooled Reactor. Uranium recovered through reprocessing has been recycled for use in Britain's AGRs.

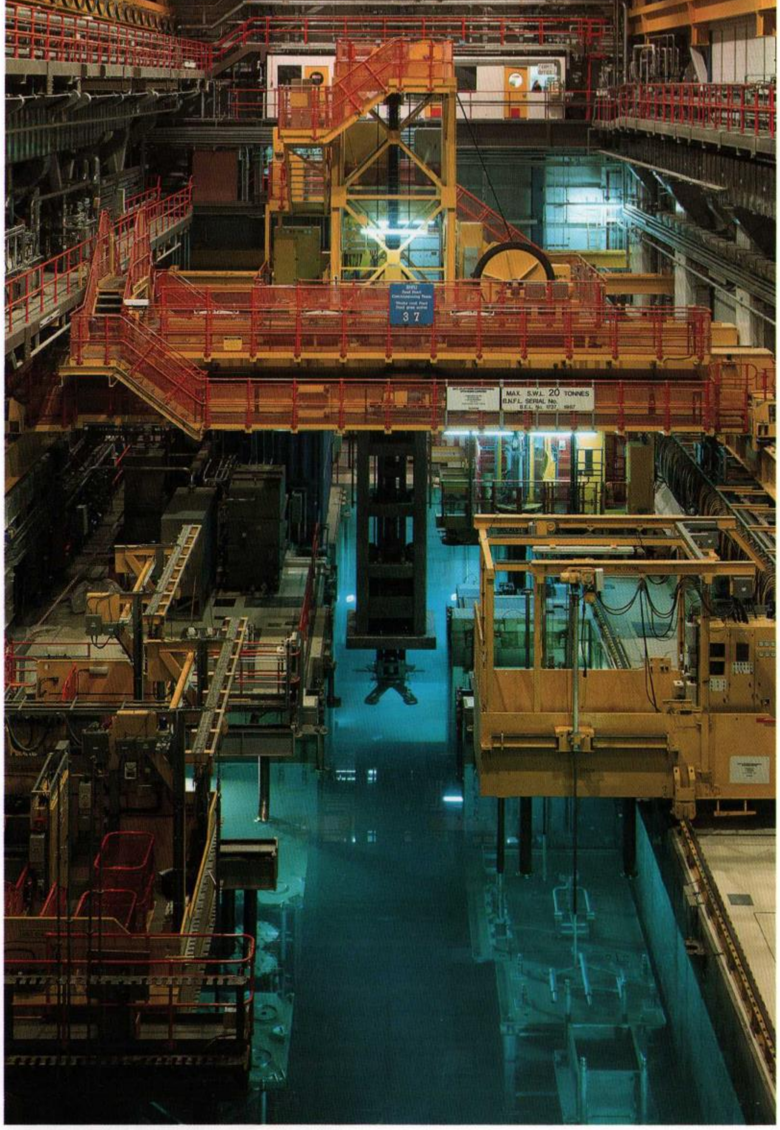
High-level waste arising from reprocessing is stored as glass blocks in Sellafield's Vitrified Product Store.

THORP *Technology*

Fuel from overseas arrives in purpose-built ships at BNFL's own marine terminal at Barrow-in-Furness. It is then transported by rail to Sellafield. The fuel is contained in massive flasks made of steel and lead, each weighing about 100 tonnes. The THORP complex is divided into three operating areas: Receipt and Storage, Head End and Chemical Separation.



Handling a transport flask of irradiated fuel from overseas in THORP's receipt and storage area.



The Fuel Preparation Area and Fuel Removal Pond.

The hydraulically operated shear machine in THORP is designed to cut fuel into pieces.

Reprocessing in THORP begins with the receipt of the fuel at Sellafield where it is stored and cooled in water for several years to allow short-lived highly radioactive isotopes to decay. After this period, the fuel is transferred to the Head End Plant where it is chopped into small pieces. The chopped fuel falls down a chute into a basket suspended in nitric acid. The acid dissolves the fuel, leaving the undissolved residues, consisting mainly of fuel cladding, in the basket.

The dissolved fuel is then transferred to the Chemical Separation Plant. Here, a series of physical and chemical processes separates the uranium and plutonium from the waste. The uranium and plutonium are then separated from each other, purified and converted to a solid form for storage and eventual re-use.

Waste from THORP

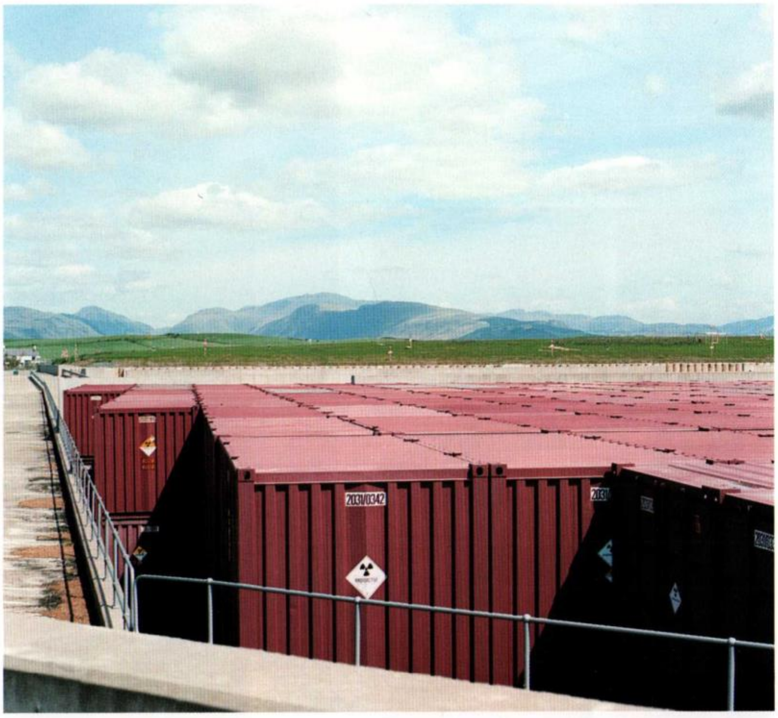
A number of plants have been designed to treat the various wastes arising from Sellafield operations, including those from THORP.

The sections of cladding material which are left after the fuel has been dissolved are classed as intermediate-level waste and are fed to one of the encapsulation plants. Here the waste is safely contained in cement inside steel drums which are placed in a purpose-built store, awaiting the construction of an underground repository.

High-level liquid waste resulting from reprocessing is transferred via a shielded pipebridge to the Vitrification Plant where it is converted into a solid glass-like form.

Immobilisation of the highly active liquid waste into a solid form has several advantages: it greatly reduces the long-term potential for escape of radioactivity; it reduces the volume of highly active material to one-third of its original volume; safe supervision is easier and cheaper; and it is more suitable for returning to overseas customers and for eventual disposal.

Solid intermediate-level waste from THORP is fed in controlled quantities into a drum before being encapsulated in concrete.

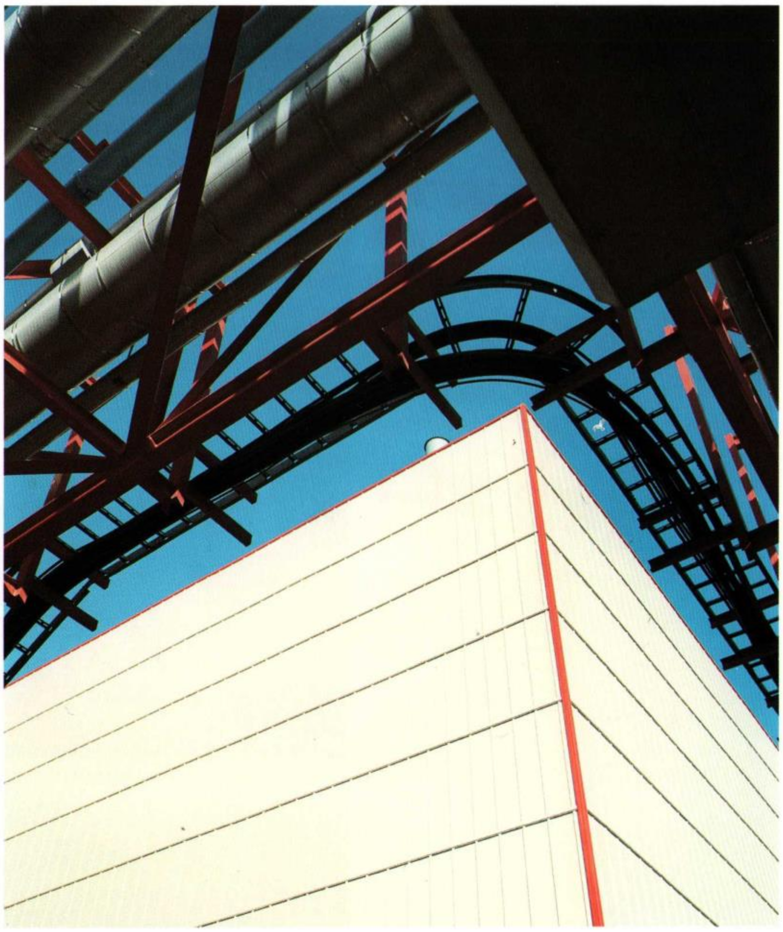


Low-level solid waste is disposed of at Drigg near Sellafield.

Low-level waste such as paper towels, plastic sheeting and protective clothing, which may be contaminated with low levels of radiation, are contained and disposed of at Drigg, BNFL's disposal site about six kilometres south east of Sellafield.

A new plant which will compact this waste and extend the life of Drigg well into the 21st century is under construction at Sellafield.

Waste gases arising from the THORP process are passed through a complex and sophisticated gas clean-up process consisting of various scrubber and filtration



The Enhanced Actinide Removal Plant (EARP) has been designed to remove radioactivity from low-level effluents.

systems. This removes harmful chemicals and radioactive material before the gaseous discharges are monitored and released to the atmosphere.

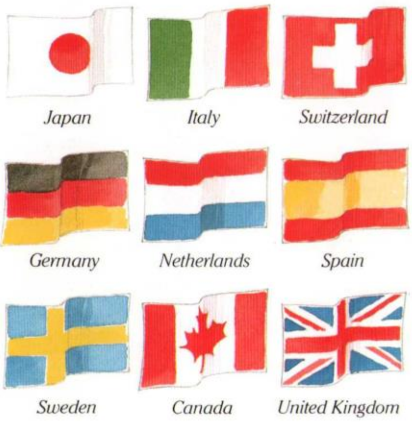
Low-level liquid waste is treated and monitored before being discharged to sea. The Site Ion Exchange Effluent Plant (SIXEP), costing some £200 million, has dramatically reduced the radioactivity of the low-level discharges to the sea. A further £500 million has recently been invested in additional effluent treatment plants. All discharges from THORP are subject to strict rules set down by the Government Authorising Departments.

The waste arising from the reprocessing of fuel from overseas will be treated in exactly the same way as waste arising from UK fuel. However, there are clauses in all overseas contracts signed since 1976 which allow BNFL to return the waste to the country of origin.

Radioactive discharges reaching the environment are minimised through THORP's extensive treatment and monitoring facilities. The plant has been designed and constructed to keep radiation doses to BNFL's workforce and the general public to a minimum level and a small percentage of the authorised limits. Radiation doses to the workforce will be well below the NRPB's recommended limit of 15 mSv per year.

Economic impact of THORP

Thirty customers in nine countries have signed contracts for reprocessing in THORP over its first ten years of operation. The order book is approximately split equally amongst the UK, Mainland Europe and Japan. The business, which makes BNFL one of the UK's biggest earners of Japanese yen, contributes positively to the nation's Balance of Payments.



Flasks of irradiated fuel arriving at Barrow-in-Furness.

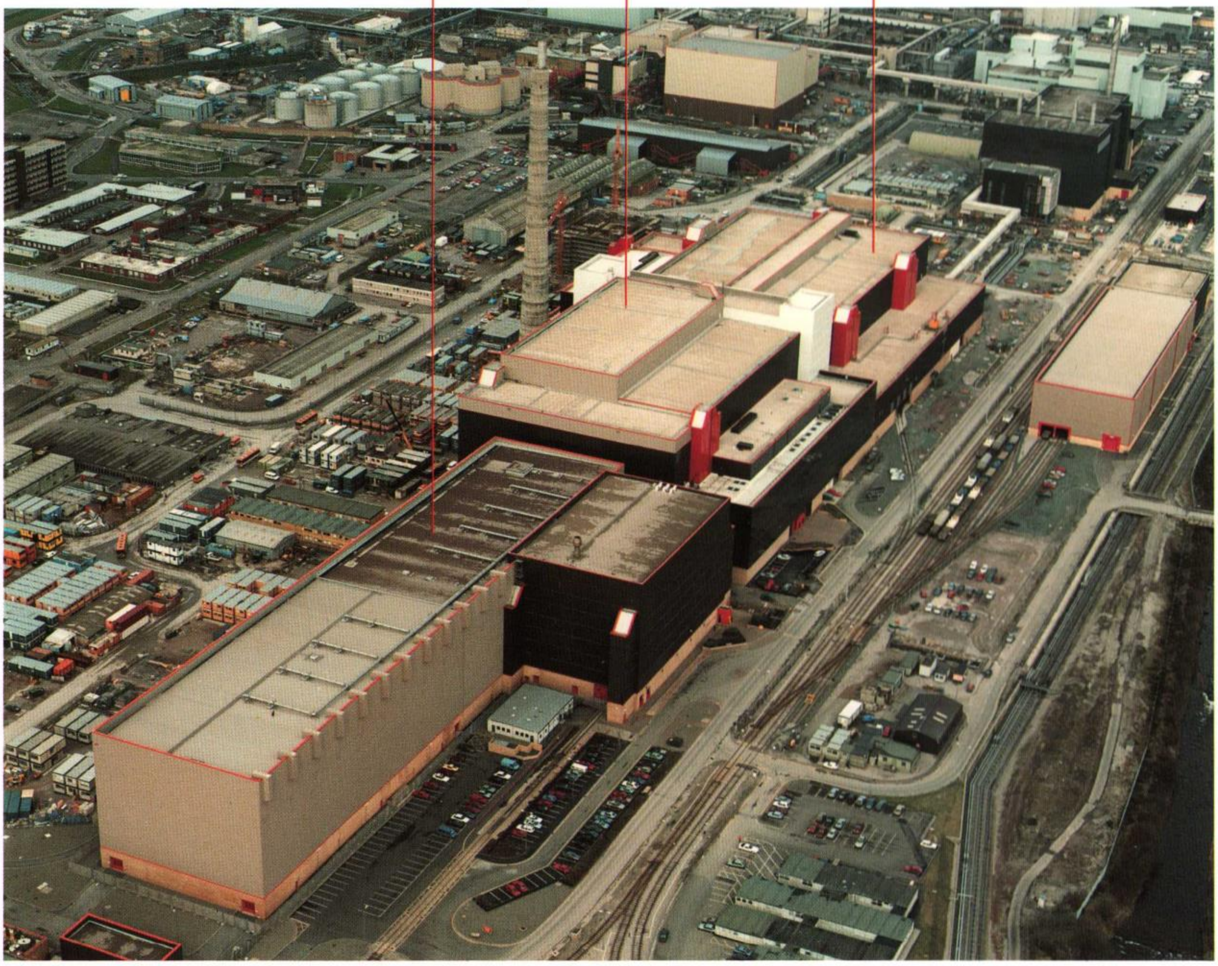
THORP management centre reception.

In addition agreements have been reached with UK and German utilities for some 3,400 tonnes of business in the second decade of THORP operations, bringing the total amount of fuel committed for reprocessing in THORP to over 10,000 tonnes and the total order book to £9,000 million in 1992 money values.

Receipt and Storage

Head End Plant

Chemical Separation Plant



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