



## Supporters of Nuclear Energy

# Newsletter

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### SELLAFIELD'S OTHER LEGACIES

We might not have a United Kingdom or be preparing to vote on whether to stay in the European Community if it was not for the Sellafield nuclear site in West Cumbria. I know that is a huge claim but I intend to try to justify it this month instead of mulling over the Hinkley project's myriad technical, financial and political problems yet again.

It is fairly easy for me to take a break from the Hinkley fiasco anyway as not much has changed. "Plus ça change, plus c'est la même chose" as EDF and its French Government owners might say. At the end of this month Vincent de Riva, EDF's chief executive, told the Commons Select Committee on Energy and Climate Change that the Hinkley project would "clearly and categorically go ahead with an actual investment decision" early in May. I do hope so.

As it is we are still waiting for a firm investment decision, still trying to read the runes about the reactor design and any changes which might still be needed, affecting costs, and still worrying about the impact which the interminable delay is having on investment confidence in the UK's other planned nuclear energy projects. In summary, the more EDF's position changes the more it stays the same.

I was prompted to consider the importance of Sellafield by a statement from the Nuclear Decommissioning Authority this month that "the most significant stride ever" has been made in dealing with the legacy of decades of old and crumbling radioactive wastes stored at the site. The UK seems to be better at knocking things down and then clearing up the mess than building (or having built) the new nuclear electricity power stations which are so badly needed.

The impression which this gives is that this generation of scientists and engineers has been left with nothing but problems by the early nuclear pioneers when the fact is that without their achievements we might well have become a satellite of the Russians, like so many other European countries, at the end of the Second World War. That is another of Sellafield's legacies and it is an important one.

We were saved from the terrifying prospect of Russian domination during the Cold War years of the 1940s and 1950 by the development of an atomic bomb which was designed in Britain, without the help sought from the Americans, using plutonium separated out at Windscale, the early name for Sellafield, using barely understood science and technology.

## **THE LEGACY TODAY**

The latest stage in the Sellafield decommissioning story has involved the removal of the last batch of bulk metal fuel from the 68-year old Pile Storage Pond still in use at Sellafield and its removal to safer, more modern storage, reducing radiation levels in and around the pond substantially.

The material removed from the pond consists of used fuel rods from the early Magnox power stations and rods associated with the production of weapons grade plutonium, both separated from spent fuel using reprocessing technology developed in the UK. The Pond also contained rods deposited there after the 1957 Windscale Fire, the world's first major nuclear accident, the effects of which are still debated.

Moving this old material has been an impressive achievement by the NDA and Sellafield Limited, which it owns. Using remote control processes the Sellafield decommissioning team removed corroded fuel rods which are decades old from a storage pond which is itself something of a museum piece, built in 1948.

The team had to retro-fit an export process and then use it in one of the most challenging environments imaginable. Operators removed the fuel from 40 feet away, working behind radiation shields and using cameras and well-rehearsed procedures.

Paul Foster, managing director of Sellafield Limited, described the exercise as "a truly landmark moment" in the decommissioning of Sellafield, requiring a step change in thinking at the site as it necessitated bringing fuel skips up and out of the water, where it had no shielding for a time. The success of the operation means that radiation levels in and around the Pile Pond have been reduced by 70 per cent, vastly reducing the risk to the workforce and the environment.

Welcoming what it called a decommissioning milestone the Office for Nuclear Regulation said that attention must now be paid to the task of dealing with the remaining solids and sludge in the Pile Pond, including any residual fuel. This would be exported elsewhere "in due course."

## **WHY TAKE SO LONG?**

There are several reasons why it has taken so long to get this far in dealing with this particular feature of the Sellafield legacy, a legacy which in total is expected to take at least another 100 years to completely eradicate. Initially, derelict military reprocessing and storage plants and the buildings containing the spent fuel residues of Magnox fuel reprocessing were mothballed. The argument was that this allowed the radioactive materials in them to decay, making them easier to handle later. Doing not very much also didn't cost much.

With time, however, the materials disintegrated into crumbling pieces of metal and sludge, making it more difficult to handle, putting up costs.. There is an optimum time for dealing with the legacy material and it is now long past.

Another reason for the delay was that there were constant arguments between Government departments and the electricity utilities, all of them State owned at the time, about who should pay for the work. With the Government's belated support for a nuclear reactor construction programme finance is now available. It has finally to recognised that problems with legacy materials at Sellafield could affect public support, scuppering that programme.

While I was with British Nuclear Fuels (BNFL) Board visits were paid to several of the abandoned facilities associated with the Windscale Ponds complex and the early military and civil reprocessing plants.

The visit which worried me most was one to a storage pond containing about 15 tons of the fuel recovered from the 1957 Windscale fire. A retaining wall was clearly bulging and I found myself involved in a serious discussion with colleagues about what would happen if it collapsed. The consensus was that if the wall did give way there would be a release of radioactive water and sludge from the pond which would cause serious difficulties on the Sellafield site.

Much of the site would have to be evacuated and all work halted. A major off-site problem was considered unlikely although it was thought that there might be some disruption in the local community.

Shortly after our visit barriers were installed in the water ducts of the Piles complex pond, which was subsequently refurbished. I believe that this is the pond which is now being emptied, work which was expected to be completed by the year 2004. Clearing up a radioactive legacy - and getting the money to do it - has never been easy.

## **A BRIEF HISTORY**

The pressurised campaign get Britain's own atomic bomb developed as quickly as possible wasn't easy either. Far from it. It was carried out by a

small team of pure scientists, designers and engineers put together by the team leader, Christopher Hinton, later Baron Hinton of Bankside. Virtually all of them were new to the concept of nuclear energy and radiation.

I am sure that if someone had said to Hinton: "We want you to produce the plutonium needed for an atomic bomb in plants which will be easy to decontaminate and decommission when they are no longer needed" they would have received a short, sharp answer.

Speed was of the essence with the Russians breathing down our necks. The first of the two production pile reactors at Windscale began to operate in October 1950, only three years and one month after the first sod had been cut on site. By March 1952 the first piece of weapons grade plutonium made in Britain had been separated out. The whole project had taken five years from start to finish and included the processes needed to isolate weapons grade plutonium in a chemical separation plant, also designed by British scientists and engineers.

When uranium is burnt it consists of the plutonium formed by doing so, unused uranium and the fission products which are the true wastes of the nuclear process. All three are extracted during the chemical separation process. The first two - the plutonium and unused uranium - can be used in the generation of electricity as well as the manufacture of bombs. Something has to be done with the waste. The options are storage, disposal or incineration in plutonium-fuelled reactors.

In practical terms there are two different kinds of plutonium to be considered - reactor grade and weapons grade. It was the weapons grade plutonium which was most interest initially. This is recovered from uranium fuel that has been irradiated, or burnt, for only two to three months in plutonium production reactors such as the Windscale Piles. The reactor grade plutonium is recovered as a by-product of used fuel burnt for about three years.

## **THE START OF REPROCESSING**

The beginning of reprocessing at Sellafield was solely driven by the need to separate weapons grade plutonium from spent nuclear fuel for the Ministry of Defence but it soon became apparent that countries developing their own civil nuclear energy facilities, as the UK was, had another need. They had to do something with the spent fuel when it was discharged from their reactors and one answer was separating out its three main constituents. It was a commercial opportunity which BNFL, which then owned Sellafield, exploited by providing reprocessing services to overseas customers as well as the UK's electricity utilities.

Fuel used in the early Magnox power stations was reprocessed in one plant and fuel used in the later Advanced Gas Reactors (AGR) and Pressurised Water Reactors (PWR) went into a Thermal Oxide Reprocessing Plant (THORP) built after I joined the company. THORP, which is to be shut down in 2018, has had its problems but it is currently operating well and there are those, including some SONE members, who would like to see it operate well past that date. They argue that one of THORP's principal customers over the years, the Japanese, might welcome the breathing space offered by THORP while they decide whether to go ahead with plans to build their own reprocessing facility.

Last month the Japanese Cabinet approved a Bill aimed at “taking measures necessary to the steady implementation of the reprocessing of used nuclear fuel.” The Bill creates a new entity responsible for reprocessing and introduces a new system for funding it. This confirms that reprocessing and use of MOX fuel are still regarded in Japan as key parts of its Basic Energy Plan, although there is plenty of opposition to it.

The Japanese Government is also trying to develop a prototype commercial fast reactor, but there is opposition to this plan, too. In fact considerable uncertainty surrounds pretty well every aspect of Japan's nuclear programme in the wake of the Fukushima incident. China is interested in getting involved in reprocessing, too, but again there are doubts over whether this will actually happen.

Plans for the use of plutonium for electricity generation, on its own or in Mixed Oxide Fuel (MOX) have been developed and dismissed for decades. Nevertheless, there is now a resurgent interest in them, however tentative, driven as much as anything by applications which could lead not only to electricity generation but the destruction of unwanted weapons grade plutonium and radioactive wastes.

## **THE BEAR AND THE BALD EAGLE**

Russia and America have an agreement to reduce their stockpiles of weapons grade plutonium. Until now it has been assumed that they would turn the material into MOX fuel which could be used in commercial reactors, burning up the plutonium. This plan is in disarray, however.

US President Barack Obama has called for the termination of the MOX project under way at the Savannah River site in South Carolina, even though it is said to be 70 percent complete. This has infuriated local politicians, who want to see the project completed, and seems to have annoyed the Russian, too, although that is surprisingly muted.

Instead of proceeding with the MOX plant President Obama wants to see “a change in plutonium disposition.” He has asked the US Department of Energy “to complete a pre-conceptual design for a system of down-blending.” Down-blending apparently means that instead of transforming plutonium into nuclear fuel the Savannah River facility would be used to dilute and dispose of it at a Waste Isolation Pilot Plant in Carlsbad, New Mexico.

This is simply not good enough, according to Tim Scott, the Republican senator for South Carolina. “The United States cannot just terminate the MOX project and walk away from our long-standing international agreement with Russia to dispose of a total of 68 metric tons of weapons grade nuclear material,” Senator Scott has said. Areva, the French company involved in the project is saying much the same thing.

It is easy to understand President Obama's frustration. Work started on the MOX fuel fabrication facility at Savannah River nine years ago and the plant was meant to start operating this year. Although based on France's Melox MOX facility, with an Areva involvement, the US project has had problems associated with “first of a kind issues,” rather like the Hinkley Point C power station project in the UK, in which Areva has also been involved. As a result the US Government Accountability Office said the Savannah River MOX project was unlikely to be completed before 2019 and was likely to cost at least \$7.7 billion, well beyond the original estimate of \$4.9 billion.

Despite this Areva is arguing that the US cannot walk away from the project. It insists that according to the Plutonium Management and Disposition Agreement signed by the US and Russia both countries must change their surplus weapons grade plutonium at the isotopic level to render the nuclear material unattractive for weapons use.

“Although considerations have been raised about pursuing other non-proliferation options, none of the other methods change the plutonium's isotopic structure so would require renegotiations with the Russians,” Areva has said. So far the Russians seem to be enjoying the situation and have responded to what is happening by having a gentle dig at those involved in the Savannah River scheme.

Sergey Kirienko, director general of Rosatom, the Russian state nuclear corporation, announced last September that his organisation had started producing MOX fuel in a plant which took only two and a half years to build and cost \$136 million. The Russian plant produced some 20 MOX fuel assemblies last year and aims to get this figure up to 400 by the end of next year.

These will go into the BN-800 fast neutron reactor at the Beloyarsk nuclear power plant in the Sverdlovsk district, which completed tests under its first power programme this month, at 50 percent of its nominal capacity over 72 hours. Rosatom expects to apply to the Russian regulator shortly for permission to go ahead with the next stage of the reactor's programme, during which the unit will be brought to 10 percent capacity and enter commercial operation.

Rosatom's provocative references to the Savannah River scheme were clearly intended to be mischievous and I will now be a little cheeky, too. Maybe the UK, alongside the US and France should seek advice from the Russians on how to build and operate MOX plants successfully, possibly even using the fuel in fast reactors.

That is not as far-fetched as it may sound. The European Council of Ministers is expected to decide shortly to extend the European Atomic Energy Community's (Euratom's) participation in the Generation IV International Forum (GIF) for a further 10 years. GIF, formed 15 years ago, is an international organisation representing the governments of 13 countries where nuclear energy is significant now and seen as vital for the future. Most are committed to the joint development of the next generation of nuclear technology.

The GIF's 13 countries are the United States, Russia, the United Kingdom, France, Argentina, Brazil, Canada, China, Japan, South Korea, South Africa, Switzerland and the European Union (through Euratom). The GIF has said that the advanced nuclear power systems most likely to be deployed first are the sodium-cooled fast reactor, the lead-cooled fast reactor, the very high temperature reactor and the gas-cooled fast reactor.

## **FINALLY A COMMUNITY LEGACY**

Sellafield Limited touched on another legacy this month when it announced that it has arranged £500 million of socioeconomic investment, mainly centred on Cumbria. The investment, known as the Decommissioning Partnership includes jobs, apprenticeships and work for small and medium-sized businesses.

The Partnership arrangement is described by Sellafield Limited as “possibly the UK’s first ever public procurement that guarantees benefits for the community.” I am not sure what that means.

Sellafield has in fact had an impact on most aspects of economic, social and political life in West Cumbria - including everything Sellafield Limited is claiming as a first, for getting on for 40 years . The present management

benefits from the goodwill - the legacy if you will - which has been built up as a result.

As long ago as the mid-1980s my predecessor, Arthur Scott, and I persuaded the BNFL Board to invest in a comprehensive programme of community support. Some aspects of what we started then are still in place today.

The so-called planning gain assistance associated with the construction of the Therman Oxide Reprocessing Plant (THORP), completed in 1994, was itself worth £22 million. It included improvements to the centre of Whitehaven, through the renovation of 60 Georgian properties which had fallen into disrepair, landscaping at Sellafield, the construction of a new training centre for apprentices and a small grant to the Copeland local authority for recreational facilities.

Another £3 million was spent on community projects between 1984 and 1988 and around that time BNFL agreed to provide up to £1 million a year for ten years towards a newly created West Cumbria Development Fund and an executive arm of the initiative, the West Cumbria Development Agency. The two were later amalgamated and the new organisation was known as the West Cumbria Partnership.

As far as procurement is concerned, at the peak in the early 1990s Sellafield was buying £70 million worth of goods and services locally each year. It seems to me that there is an element of “plus ça change plus c’est la meme chose” about the claim by Sellafield Limited that what it is starting is “possibly the UK’s first ever public procurement that guarantees benefits for the community!

HAROLD BOLTER  
SONE SECRETARY

“NUCLEAR ISSUES” IS A MUCH APPRECIATED FEATURE, TRADITIONALLY CIRCULATED WITH THE NEWSLETTER. THE AUTHOR, GEOFFREY GREENHALGH, NOW FINDS IT IMPOSSIBLE TO SUSTAIN A MONTHLY COLUMN, ALTHOUGH HE WOULD SHARE THE TASK. IF ANYONE IS INTERESTED PLEASE INFORM THE SECRETARY OR DISCUSS WHAT IS INVOLVED WITH GEOFFREY.

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