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Briefing

Towards a Safer Cumbria

How government, regulators and the Nuclear Decommissioning Authority have neglected nuclear waste in Cumbria

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Background

This study was undertaken with the aim of investigating how hazardous nuclear waste at Sellafield has been stored and handled over the past 13 years, via three case studies:

- THORP Reprocessing and Plutonium separation Plant
- High Level Liquid Waste Treatment Facilities
- The Treatment of Solid Wastes

The study took place within the context of implementing the first three stages of the Government's 2008 Managing Radioactive Waste Safely White Paper (1) in West Cumbria. The initial stages were instigated through expressions of interest by Cumbria County Council and the western Boroughs of Copeland and Allerdale in 2008/9 in 'volunteering' to take part in the search for a site for a £12bn deep Geological Disposal Facility (GDF) for the UK's higher activity radioactive wastes in West Cumbria. The third stage of the process, funded by the Department of Energy and Climate Change, was managed by a Partnership (2) which incorporated public participation and consultation. The results of the Partnership's deliberations were reported in August 2012 (3) and the three Councils then took decisions over whether to take part in a fourth stage.

On 30th January 2013 Cumbria County Council's Cabinet voted 7-3 against taking forward a search for a GDF in Allerdale and Copeland. The County and the two Boroughs were the only local authorities in the UK which had made 'expressions of interest' and although the two Boroughs voted in favour, the Department of Energy and Climate Change required all tiers of government to support any move forward (4), and the process therefore came to a halt.

One of the critiques of the process's Terms of Reference was that it concentrated on the GDF to the exclusion of other aspects of nuclear waste management (5). This was brought into sharp focus by a National Audit Office report published in November 2012 on managing risk reduction at Sellafield which clearly demonstrated the need for immediate improvements in the management of major projects at the site. The report criticised the site for posing a "*significant risk to people and the environment*" because of the deteriorating conditions of radioactive waste storage facilities (6). The lack of progress exposed in the NAO report prompted Rt. Hon. Margaret Hodge MP, chair of the Public Accounts Committee (PAC) to state that Sellafield posed an *"intolerable risk"* (7).

In voting to reject the GDF proposal, the County Cabinet recognised the wider issues by agreeing to:

"*encourage the Government to make the necessary investment to improve the existing surface storage facilities at Sellafield so that there is a more robust surface storage arrangement in the decades to come while the Government finds a permanent solution for the country's higher activity radioactive waste*" (8).[1]

Less than a week after the County Council's decision, the House of Commons Public Accounts Committee (PAC) published a report on the Nuclear Decommissioning Authority (NDA) and its management of risk at Sellafield (9). The report, which in many ways reconfirmed Cumbria Council's own concerns, described Sellafield as:

"*…an extraordinary accumulation of hazardous waste, much of it stored in outdated nuclear facilities*". [2]

Chair of the Committee Margaret Hodge MP, was quoted as saying: *"It is essential that the Authority brings a real sense of urgency to its oversight of Sellafield so that the timetable for reducing risks does not slip further and costs do not continue to escalate year on year."* (10)

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1 Councillor Stewart Young, Deputy Leader of Cumbria County Council and leader of the Council's Labour Group, said:

"*The case for investment in Sellafield is now more pressing than ever. We had always raised concerns over the lack of any 'plan B' from Government and the fact that West Cumbria was the only area to express an interest in the process left the Government with few options if we decided not to proceed. It is now time for the Government to secure the long-term future of the nuclear industry and put in place robust storage arrangements at Sellafield while it decides how to continue the search for a repository elsewhere in the UK*." (See Ref 5)

The leader of the Council, Conservative councillor Eddie Martin, said:

"*I especially favour … the enhanced storage and the ability to retrieve the nuclear waste rather than its disposal … West Cumbria is not immune to considerations of rejuvenation by means other than through, or in addition to, the nuclear industry… and, in any case, Sellafield, in one form or another, is going to be there for a very long time to come… even after the closure of the Thorp plant*." (See Ref 1)

2 These problems are not peculiar to Sellafield, so none of this should be taken as a reflection on the Sellafield workforce - it is more to do with the difficulties involved in managing such a hazardous waste. In the Unites States the management of radioactive waste at Hanford, a similar plant in Washington State has been marred by problems and cost overruns for more than two decades. A new report by the Government Accountability Office (GAO) released in February said: "*By just about any definition Hanford has not been a well-planned, well-managed or well-executed major capital construction project*." The GAO warns that delays, escalating costs and daunting technical challenges "*raise troubling questions as to whether this project can be constructed and operated successfully*". It presents a long list of concerns about the operation, from a negligent safety culture onsite to ineffective monetary incentives for progress (11).

Indeed, the PAC's findings could only reflect the fact that over several decades, successive governments have failed to tackle issues on the site in allowing an enormous nuclear waste 'legacy' to build up: leading Sellafield to be one of the most hazardous nuclear installations on the planet in terms of the amount of radioactivity contained its waste stockpile. Deadlines for cleaning up Sellafield have been missed, while total lifetime costs for dealing with the waste and decommissioning the site continue to rise each year and now stand at £67.5 billion. An enormous amount of public money—some £1.6 billion—is spent at Sellafield each year (12).

The NDA claims it now has a credible plan for decommissioning Sellafield, but given its track record - with only 2 of the NDA's 14 major projects being delivered on or ahead of schedule in 2011-12 – it is small wonder the MPs on the PAC remain to be convinced that sufficient progress is actually being made.

A further piece of work by Cumbrians Opposed to a Radioactive Environment (CORE), an environment group with over 30 years experience in examining Sellafield's operations, noted that the site's commercial operations were not part of the NAO report's remit. CORE undertook its own detailed investigation into how Sellafield's operations had performed against annual targets and against original plant design specifications. The results of their investigation reveal that in the 13-year period between financial years 2000/01 and 2012/13 the site missed 83% of commercial targets and that, since the NDA took ownership of Sellafield in 2005, the failure rate has risen to 94% (13).

The MRWS process, the search for a dump site, was moving ahead with little regard for current problems at the Sellafield site. Its Terms of Reference, restricted as they were to the GDF, meant it had no regard for some key recommendations on how the waste management process itself should proceed. The Committee on Radioactive Waste Management's (CoRWM) 2006 landmark report to Government, made clear its recommendations were interdependent and had to be adopted and acted on as a package. It stressed the significant role that storage needed to play in future waste management, but the Government largely ignored CoRWM's view that:

"The uncertainties surrounding the implementation of geological disposal, including social and ethical concerns, lead CoRWM to recommend a continued commitment to the safe and secure management of wastes that is robust against the risk of delay or failure in the repository programme." (14)

Cumbria County Council's decision to withdraw from the MRWS process and to press for safer storage now represents a better reflection of this and offers a new start for a comprehensive waste management strategy.

Three Case Studies

The purpose of this document is to analyse in great depth the problems associated with certain key NDA projects.

The three Case Studies considered are:

1. The 'THORP' Plutonium Separation Plant
2. The High Level Waste Treatment Facilities – particularly 'Evaporator D'
3. The Treatment of Solid Wastes

These projects are overseen by the NDA which was established as a non-departmental public body in 2005 with a mandate to:

- decommission and clean up designated civil nuclear facilities;
- ensure that all the waste products, both radioactive and non-radioactive, are safely managed; and
- implement Government policy on the long-term management of nuclear waste

It replaced the widely discredited British Nuclear Fuels (BNFL) which ran the Sellafield site and Nirex – (originally the Nuclear Industry Radioactive Waste Executive) – which was responsible for developing "*safe and environmentally sound options for dealing with radioactive waste in the long term*"(16) (17).

What Sellafield Does

Sellafield is a large and complex nuclear chemical facility in West Cumbria which was originally a military site set up immediately post-war to provide plutonium for nuclear bombs (18). The plutonium is obtained by chemically separating it from spent – or waste - nuclear fuel rods using '*solvent extraction*' in a process called 'reprocessing' (19). In order to reprocess waste spent fuel, the solid metallic rods are converted to liquid by dissolving them in acid. As a result a number of different forms of radioactive wastes are left over after plutonium and uranium extraction. Sellafield continues to separate plutonium from other nuclear wastes even though the military requirement has been met (20).

Spent nuclear fuel contains about 1% plutonium by volume and about 96% uranium, and the remaining 3% contains highly radioactive products of the nuclear reaction. (21) Once the plutonium and uranium have been separated out in the reprocessing process, the remainder consists of Liquid High Level Waste' (or Liquid HLW) which contains 97% of the radioactivity. Other wastes, including marine and aerial discharges, and solid low and intermediate level wastes, also contain varying degrees of radioactivity. Overall,

reprocessing can increase the overall volume of waste - over that of the original spent fuel rod – by some 160 fold. (22)

Sellafield is the site of two reprocessing plants. The first, B205, which opened in 1964, is used to reprocess waste fuel from Britain's oldest reactors, known as Magnox reactors. Most of these have now closed. Reactor 1 at Wylfa is the last remaining operating Magnox reactor. It is expected to close on 30th September 2014. The NDA expects the Magnox reprocessing plant to complete the reprocessing of waste spent fuel from these reactors anytime between 2017 and 2028 depending on how well it operates (23).

The second reprocessing plant - THORP (the Thermal Oxide Reprocessing Plant) opened in 1994 to reprocess spent fuel from the UK's newer Advanced Gas-cooled Reactors (AGRs) and overseas Light Water Reactors.

The Liquid HLW produced by reprocessing generates its own heat, so it has to be stored in special tanks which keep it cool. It has to be reduced in volume by evaporation and is then transferred to the Waste Vitrification Plant which solidifies the liquid into glass blocks.

CASE STUDY ONE

THORP REPROCESSING AND PLUTONIUM SEPARATION PLANT

THORP was conceived in the 1970s, expecting to capitalise on the then projected worldwide expansion of nuclear power. It had a dual purpose, to recover uranium from waste spent fuel because there were then concerns that a massive worldwide nuclear programme would severely deplete known reserves of natural uranium and to provide plutonium as a fuel for a new type of reactor known as the fast breeder. The proposal was put to a Public Inquiry in 1977 (the Windscale Inquiry) and received Government approval the following year, by which time the site operators BNFL had pre-emptively signed several waste fuel reprocessing contracts with overseas customers.

By 1992 the original rationale for THORP had all but disappeared so the Government decided to commission the consulting firm Touche Ross to examine the financial implications of THORP's operation or abandonment. It concluded that the economic benefit of operating THORP versus not operating it were £1.81bn for BNFL and £950m for the UK (24). In 1994, after a long and agonised debate, the Government decided to allow the plant to operate and the first waste spent fuel was 'sheared' - the outer cladding taken off - as the first step in the reprocessing process, in March of that year (25).

THORP was expected to reprocess 7,000 tonnes of waste fuel in its first ten years of operation – two thirds of which would be from overseas customers. But its throughput was never reliable, nor to specification.

In its first 5 years THORP reprocessed 1900 tonnes of spent fuel or about 28% of the first decade's anticipated throughput. Technical problems of two kinds were encountered: radioactive tritium discharges had been miscalculated, requiring the rate of reprocessing to be slowed to avoid breaching the discharge allowance; and pipes in THORP suffered blockages due to the build-up of residues. THORP was closed for most of the year from spring 1998 to spring 1999 while solutions were sought (26).

Instead THORP only managed 5000 tonnes in its first decade of operation due to a range of equipment failures and accidents including acid spills, pipe leaks and blockages and problems with the plant's sole high-level waste evaporator (27). In April 2005 it was discovered that 22 tonnes of dissolved fuel and nitric acid (18,000 litres - around 83m^3) had leaked from a fractured pipe inside the plant over the previous 9-months. Although the liquid

had leaked into a purpose built, thick walled concrete cell lined with stainless steel this still had significant implications for the plant's future viability. That resulted in a damning internal report and a legal action against BNFL by the Nuclear Installations Inspectorate (NII).[3] The accident forced the permanent isolation of part of the accident damaged cell thus reducing the design specification of THORP by 50%, so its throughput was reduced to a maximum of around 600 tonnes per year.

Engineering modifications needed to be carried out which meant that THORP was closed for almost 2 years. Although regulatory consent for THORP's phased re-start was given in January 2007 only 33 tonnes were reprocessed over the next year. There was a mechanical failure of the elevator system that lifts fuel out of the spent-fuel feed pond in January 2008, so it was not until March 2008 that a slow return to operation was begun. Returning to full operation had to be delayed again over the next few years because of a lack of high-level waste evaporative capacity (28).

The NDA's role in THORP's mismanagement

Despite the fact that the original White Paper about establishing the NDA said the Authority's focus should be "squarely on the nuclear legacy" (29), when the NDA started operation it decided to continue the commercial operations which BNFL had been undertaking, even though these would create yet more volumes of waste which would have to be dealt with. At the time the NDA was formed THORP was expected to complete its reprocessing contracts by 2010: these contracts are not now expected to be completed until 2018. In November 2011 the NDA reported there was still just over 2,000 tonnes of waste spent fuel from UK AGR reactors and 400 tonnes of overseas waste spent fuel which it was contractually committed to reprocessing. The NDA also expects more than 4,000 tonnes of waste spent fuel to arise over the remaining lifetime of the AGRs which could either be reprocessed or stored at the NDA's discretion (30).

In June 2012 the NDA announced that it would only reprocess the waste spent fuel it was contracted to reprocess – in other words it would not attempt to reprocess AGR waste spent fuel for which the contracts allowed for storage or reprocessing.[4] Yet THORP is still scheduled to remain open until 2018. This means the plant will be limping along with a low throughput of around 350 tonnes per year until it closes – less than half the throughput rate it was originally expected to achieve (31).

[3] The full Court Case Transcript can be found here: http://www.greenpeace.org.uk/media/reports/british-nuclear-group-court-case-transcript-and-sentence

[4] Under an international convention to which the UK is a signatory, any waste spent fuel for which no further use is foreseen should be re-classified as high level waste. See http://www.iaea.org/Publications/Documents/Infcircs/1997/infcirc546.pdf Article 2, Clause H.

One of the reasons why THORP's throughput is expected to be so poor over the next five years is because the availability of evaporators – vital equipment in the waste solidification process - is limited, until a new evaporator can be built or the capability of the current evaporators is improved. A new evaporator is not expected to be available until 2016 (see below).

Economics of THORP

The cost of building THORP steadily rose from £300m at the time of the public inquiry in 1977 to £1.8bn on completion in 1992. With the additional cost of associated facilities this figure rose to £2.8bn. BNFL received advance payments from its customers of £1.6bn which largely covered the construction costs. The net result, according to BNFL was that over the first ten years the income would not only cover all building operating and future decommissioning costs, but would produce a profit of £500m. One economic analysis in 1993 pointed out that at a projected profit of only £50m per year, the economics of the project looked extremely vulnerable to unforeseen events, and British electricity consumers would be paying £1.7bn more than necessary to have British waste fuel reprocessed at THORP (32).

This analysis turned out to be prophetic - there have certainly been plenty of unforeseen events since 1994. With THORP now operating at about 8 years behind schedule, any notional profit originally expected must have long since been completely wiped out.

Economics of MoX

With the rationale for separating plutonium disappearing as fast reactor programmes around the world failed, BNFL decided to build a plant to convert the plutonium into a fuel, known as MoX (Mixed Oxide), for use in conventional reactors. A report for the Government by management consultants Arthur D Little predicted in 2001 that the Sellafield Mox Plant would earn the UK more than £200m in foreign currency by exporting Mox fuel to Japan and several other countries. After the plant opened it was plagued by production problems due to its faulty design and layout. Instead of producing 120 tonnes of Mox a year, it managed less than 14 tonnes in eight years. The plant is thought to have cost British taxpayers about £1.34bn in capital and operating costs since it was built (33).

Even with a number of orders having to be sub-contracted to rival fabricators in Europe because of its poor performance, the NDA and Government continued to attempt to keep the MoX Plant open. In 2010 the NDA signed a deal with Japanese utilities to rescue the plant, which involved the Japanese funding a refurbishment. But this deal was never realised due to the Fukushima catastrophe (34).

CASE STUDY TWO

HIGH LEVEL LIQUID WASTE TREATMENT FACILITIES

As discussed above, when plutonium is chemically separated from waste spent fuel rods during 'reprocessing' the radioactive wastes left over are intensely radioactive liquids known as Liquid HLW.

These liquids, which because they are incredibly radioactive generate their own heat, are stored at Sellafield in special cooling tanks. They need to be constantly cooled otherwise they would start to boil. If this happened then radioactivity would escape and contaminate the surrounding environment. The consequences of a prolonged cooling failure could be 'very severe' leading to boiling after 12 hours, and to the tanks drying out after three days. Consequently the HLW facility at Sellafield is probably one of the most dangerous nuclear facilities in the world with the potential to at least force the evacuation of much of northern England and southern Scotland, and cause long lasting contamination well beyond the UK (35).

Nuclear Installations Inspectorate warnings – tanks need to be emptied asap.

Thirteen years ago the Nuclear Installations Inspectorate (NII) warned that the High Level Liquid Waste storage tanks at Sellafield needed to be emptied and the waste solidified "*as soon as reasonably practicable*", and levels must be reduced to a buffer level by 2015. Any shortfall would be "*publicly unacceptable*" (36).

In January 2001, the NII issued BNFL with a legal requirement to reduce the level of dangerous, heat-generating, HLW stored on site at Sellafield down to a residual or buffer stock by 2015 (37). Stocks needed to be reduced from approximately 1600m^3 at the time to a buffer stock of 200m^3 by 2015.

Following the 9/11 terrorist attacks in 2001 a review was undertaken of the impact of similar attacks on vulnerable UK facilities. It found that a terrorist attack on the tanks could require the evacuation of an area between Glasgow and Liverpool, and cause around 2 million fatalities (38). The Massachusetts-based Institute for Resource and Security Studies (IRSS) reported that highly radioactive liquid stored in tanks contained around 2,400 kilograms (kg) of Caesium-137 compared with the 30 kg released during the Chernobyl accident (39).

By 2011 the Office for Nuclear Regulation (ONR) (which now incorporates the NII) said stocks of HLW in liquid form had been reduced significantly and were at their lowest levels since the 1980s, and well within current legal limits (40) even though stocks had only been reduced to 900m^3. The ONR pointed out that these low levels were partly due to the technical problems at the two reprocessing plants and associated facilities that have reduced throughput, so levels might rise again over the next few years (41).

Worse still, following requests by Sellafield Ltd. – the company that operates Sellafield on behalf of the NDA – the ONR decided to increase the permitted level of highly active liquid stocks to almost three times the limits defined under the earlier legal requirement. (42). This increase to the 'buffer level' is to provide Sellafield with "*the flexibility to accelerate the hazard reduction*". Part of the explanation given for this is that the original legal requirement was set at a time when reprocessing was expected to have been completed by about 2015, at which time a minimal working "buffer stock" level would have been reached. But reprocessing operations have been plagued with problems and are now expected to continue until 2018 or beyond; perhaps as late as 2028 (43). Another reason given is that washing out the storage tanks can produce relatively high volumes of liquid which is much more dilute than ordinary Highly Active Liquid.

The ONR appears to have sanctioned something which twelve years ago it deemed "*publicly unacceptable*", because it is not prepared to use its regulatory powers to end reprocessing early.

Liquid HLW Storage Tanks – failures to act and links to reprocessing

In 1998 the extremely dangerous Liquid HLW was stored in 21 stainless steel tanks, the 8 oldest of which were built between 1955 and 1968. Even the 13 newest tanks were causing concern because of leaks in the cooling system which meant they might need to be taken out of service and replaced. Although the Waste Vitrification Plant (WVP), which was designed to incorporate this liquid waste into glass blocks and then place it in stainless steel containers, began operating at Sellafield in 1991, IRSS estimated that the backlog would not be completed until 2020, and, worryingly, it might not be possible to decommission the 8 oldest tanks until 2012 (44).

In 2008 the NII declared that Sellafield needed new Liquid HLW storage tanks "*with utmost urgency*" (45). By then the NDA had already initiated a project to build six new replacement tanks. The initial estimated cost was £83m and delivery was expected in March 2013. But by 2011 the cost had shot up to £474m and delivery was not expected until March 2018. A year later the delivery date slipped yet again to 2019 (46).

In 2010 a contract to design the replacement tanks was awarded to the Halef Partnership, which is made up of Amec, Areva and Balfour Beatty. But on 7th June 2012 the NDA declared that there was no safety, operational or strategic requirement to replace the existing tanks because it had decided that THORP would probably close in 2018 (47).

According to the NAO, abandoning the project to build up to six highly active (liquid) storage tanks will save around £400m. The ONR simply said the information it had been given suggests that replacement tanks "*may no longer represent the 'as low as reasonably practicable' position with regard to hazard reduction activities on the site*" (48).

So ONR is prepared to give up on a project which five years ago it deemed to be required "*with utmost urgency*". Failure by the NDA and its private partner companies has been responded to by the ONR changing its recommendations, rather than using its regulatory powers to ensure action. ONR appears to be sanctioning a cost cutting exercise rather than insisting on maximum safety.

Vitrification

Reducing the backlog of liquid waste to a buffer level requires vitrification to turn the liquid into glass blocks, at a faster rate than new liquids are generated. The previous plant operator – BNFL - struggled to achieve the reductions of liquid stocks. Its ability to do this was almost wholly dependent on whether its operation of the WVP was successful, but in 2001 the plant had an extremely poor operational record. It had two production lines each of which was expected to produce around 300 canisters of vitrified high level waste annually, but they were only meeting about 50% of the target. An additional third production line did help towards meeting NII's target of reducing stocks to a buffer level by 2015 (49). But the vitrification plant's poor performance has resulted in several temporary closures of THORP to reduce the amount of new liquid waste going into the tanks.

The recent analysis by CORE shows that since the NDA took ownership of Sellafield in 2005, the Waste Vitirification Plant has failed to reach its target every year (50).

The Evaporator Debacle

The highly active liquid wastes that come out of the two plutonium separation plants operating at Sellafield are evaporated to reduce their bulk.[5] A range of problems with the Evaporation facility at Sellafield over the years has meant that plans to reduce Liquid HLW

[5] It is important to realise that the Evaporator will only serve to steam water off of the wastes, which will reduce their bulk but not the amount of radioactivity they contain. This means that the wastes will become more concentrated and so more dangerous.

stocks, whilst continuing with reprocessing and plutonium separation operations which produce the waste have not gone according to plan.

There are three evaporators at Sellafield, A, B and C. Problems with these meant a fourth evaporator was being planned from about 2005 when the NDA approved work to start developing plans. Two of the existing three evaporators were approaching the end of their lives and a new evaporator was needed to avoid a build-up of stocks of highly active liquid and to ensure that Sellafield could meet contractual commitments to continue plutonium separation.

By 2006 the NII said there is "*enough uncertainty in the ongoing operation of the existing evaporators that it would be prudent to consider building a second new evaporator (Evaporator E)*" (51).

In 2008 the NII reported that a pre-construction safety report for a fourth evaporator (Evaporator D) was expected towards the end of that year, but the regulator was working to accelerate the plans, and Sellafield was also considering the need for a fifth evaporator. (Evaporator E) (52).

In September 2008, the NII wrote to the NDA to express "*surprise and concern*" that recent funding decisions had delayed the construction of new evaporators and new tanks. (53) In October 2008, the NII, referring to Evaporator D, told *The Whitehaven News*: "*Further evaporator capacity at Sellafield is essential for the longer term safe management of highly active liquor.*" The newspaper reported that both the NII and the Environment Agency had expressed concern that "funding shortfalls" for the operation of Sellafield could undermine regulatory standards (54).

The NDA gave approval for the construction of Evaporator D to start in 2009. (55) The construction project is the biggest single nuclear project in the UK. It was originally estimated to cost £90m and was due to be completed as early as 2010 (56). By February 2012 the NDA said the cost had jumped to £400m, and would probably end up costing £100m more (57). At that time although it was scheduled for active commissioning in December 2015, the NDA admitted that date was unlikely to be met. It is now targeted for delivery in February 2016 - a little more than two years before THORP is due to close - and is expected to cost as much as £673 million (58).

Even if – and it is questionable - the 2016 date for completing the assembly of the Evaporator is met, it will then have to undergo inactive commissioning to test plumbing, electrics and so on before active commissioning can begin. The active commissioning itself

is put optimistically at 18 – 24 months and, whilst it will be evaporating some Liquid HLW, the moment it starts active commissioning it will take some time before it gets up to speed. In other words it is unlikely to be fully operational by 2018 when THORP closes.

Despite not being available until the end of the operating life of Sellafield's two reprocessing plants, the Evaporator D project is not as easy to abandon as the high level waste storage tanks. The NDA says the three existing evaporators will not have the capability to support the post operational clean out of the facilities that have managed Highly Active Liquors over fifty years (59).

According to the NAO, the NDA gave permission for the construction of Evaporator D to start before design issues were resolved, which contributed to cost escalation and delays (60). The NDA estimates that £50 million of the £244 million increase in the cost of evaporator D and part of the 18-month delay since 2009 is because the subcontractor lacked experience in welding to the necessary nuclear quality standards. (61) This is an important consideration for New Build – particularly given the EdF experience in Finland and France (62).

ONR Lowering Safety Standards

Clearly the ONR feels that, because of technical problems and delays at the two reprocessing plants and associated facilities it cannot impose its strict steady state limit on Highly Active Liquid stocks because this could 'force' the cessation (or significant curtailment) of reprocessing. It claims that there is currently no viable alternative to the reprocessing of existing stocks of waste Magnox or AGR fuel within reasonable timescales, so it is in the best interests of safety to relax the limits. If the regulator had announced plans to impose strict regulatory standards when some of these concerns were first being raised at the end of the 1990s, Sellafield would now be in a much stronger position with adequate storage capacity for waste AGR fuel and a long-term storage technique developed for waste Magnox fuel.

Instead the ONR is now in the awkward position where it feels it has to accept that Highly Active Liquid stocks may in fact have to increase over the remaining lifetime of the reprocessing plants as THORP's throughput is ramped up, prior to closure in 2018.

CASE STUDY THREE

THE TREATMENT OF SOLID WASTES

In 2002 *The Observer*, reporting on a document from Nirex, declared that "*almost 90 per cent of Britain's hazardous nuclear waste stockpile is so badly stored it could explode or leak with devastating results at any time*" (63).

The Nirex document was the company's submission to a joint investigation by two government advisory committees which no longer exist - the Radioactive Waste Management Advisory Committee (RWMAC) and the Nuclear Safety Advisory Committee (NuSAC). The final report, published in June 2002, looked at arrangements for the storage, conditioning and packaging of Intermediate Level Waste (ILW). The report said that by 1998 only 12% of existing ILW had been conditioned, and that some historic wastes:

"… *may be poorly characterised. Physically and chemically degraded and held in old facilities subject to deterioration. Considerable effort is often needed to find suitable means of retrieving, conditioning and storing these wastes. Attention has also been drawn to other challenging wastes, including material where effective immobilisation is difficult, and materials with inherent hazards (such as reactive metals and high fissile content)*."(64)

Today, a decade later, the description by the NAO makes the situation sound very similar:

"Some of the older facilities at Sellafield containing highly hazardous radioactive waste have deteriorated so much that their contents pose significant risks to people and the environment. The highest risks are posed by the ponds and silos built during the 1950s and 1960s to store fuel for early reprocessing operations and radioactive waste … the exact quantity and type of hazardous material on the site had yet to be fully investigated." (65)

The recent NAO report says a quarter of Sellafield Limited's annual spending - £381m in 2011-12 - is on waste retrieval and clean-up of high hazard legacy ponds and silos containing waste spent fuel and ILW sludges and spent waste fuel cladding etc. But limited progress has been made on starting some key waste retrieval projects, and completing waste retrieval from legacy ponds and silos has been postponed by seven years until 2036.

A series of regulatory specifications on intermediate-level waste in legacy ponds and silos were set by the NII in 2000. For example, at least 80 per cent of intermediate-level waste sludges originating prior to 1 August 2000 should be stored in a safe passive form by 2020. Although these specifications are still in force the NII was forced to recognise in 2008 that they would not be achieved. This particular specification on ILW sludges is now not expected to be completed until 2031 (66).

As part of a project to retrieve corroding radioactive metal cladding stored under water in silos after being stripped off waste fuel before reprocessing (the magnox swarf storage silos retrievals project) (67), remotely controlled devices had to be designed and built. Construction of the silo-emptying machines started in the late 1990s, but there have been protracted delays and cost escalations since. Work was suspended from 2002 to 2007 because of the risk of a hydrogen explosion. Work restarted in 2007 but was delayed again because of worries about the waste catching fire. Since April 2007, the estimated lifetime cost of this project has increased by £52 million and the schedule has slipped by eight years, including cost increases of £23 million since April 2010 (68).

After this waste is retrieved it has to be treated and packaged, so plans were developed in the early 1990s to build a new treatment plant (the silos direct encapsulation plant). Although the characteristics of the waste and therefore design requirements were uncertain, construction of the facility proceeded. Between 1994 and 2002 some £400 million was spent on building a plant which then had to be abandoned. A further £128 million was spent between 2006 and 2008 but this was put on hold in 2008 because it was found the design could not deal with the waste safely. Sellafield Ltd's current plan is estimated to cost nearly £1.3 billion in addition to the £528 million already spent (69).

Although the NDA inherited a legacy of poor planning, neglect and gaps in information associated with these legacy ponds and silos projects when it took ownership of Sellafield in April 2005, mistakes and cost escalations have continued since then.

Conclusions

Despite a focus which should have been “squarely on the nuclear legacy” the NDA, since taking over Sellafield in 2005, has continued with operations which produce yet more waste because of short-term income generation. Environment groups warned of the potential problems arising from the NDA's 'dual role' when the legislation to form the Authority was still at the Committee stage. Government cannot say it was not warned of these problems in advance. The THORP plant which cost £1.8bn in 1992 has been a financial disaster for taxpayers. It should have completed its commercial contracts in 2010 at the latest, but this task will now take eight years longer than expected. If the NDA had called a halt in 2005, we would now be eight years into the process of cleaning up the mistakes made by industry and government in the 1970s and with less highly dangerous liquid waste to deal with.

Instead we are now told it is too late to come up with an alternative used waste fuel management process and THORP must limp on another five years before decommissioning can begin.

Between 2000 and 2008 we were told by the nuclear regulator that the Liquid HLW needed to be solidified “*as soon as reasonably practicable*”, and that new storage tanks “*should be progressed with the utmost urgency”* and further evaporator capacity was “*essential for the longer term safe management of highly active liquor”.*

The essential Evaporator D construction project originally expected to cost £90m, should have been completed in 2010 – in plenty of time to help solidify Liquid HLW while Sellafield completed its reprocessing contracts. Instead the cost multiplied by seven and a half times with completion not expected until February 2016, too late to make a significant contribution to reducing the risks flagged up in 1998. All talk of building a fifth evaporator has now quietly been dropped.

Similarly the replacement High Level Waste Tanks, which according to the regulator were required with the “*utmost urgency*”, escalated in cost from £83m to £474m – almost a six fold increase. But the delivery date had disappeared into the future – 2019 – making the exercise of building them almost completely pointless, so the project has now been dropped.

Sellafield and the NDA have been carrying out an expensive and dangerous balancing act in order to complete its reprocessing contracts. Despite the failure to urgently replace old tanks containing highly radioactive liquid waste and build new evaporator capacity to reduce the bulk of dangerous liquid waste as quickly as possible, reprocessing has continued – not just of overseas spent fuel, which the NDA has claimed it is legally bound to reprocess, but

mainly of AGR waste spent fuel – perhaps to free up space so that EdF Energy can extend the life of its ageing AGR reactors, and avoid the cost of new spent fuel storage facilities.

Despite the efforts of the nuclear regulator to push the NDA and Sellafield operators to build replacement plant, it is now too late for new plant to make much of a difference. But because the nuclear regulator refuses to countenance ordering an end to reprocessing we remain at risk.

Warnings about the state of solid waste at Sellafield have been raised for at least the last decade, yet little progress seems to have been made. At least £528m has been spent on projects which have come to nought and the UK taxpayer is still left with wastes which "*pose significant risks to people and the environment".*

Recommendations

There is no doubt Cumbria County Council's decision was the right one and it is quite proper that the Council has resisted calls to reverse its decision. It would be wholly inappropriate for Copeland and Allerdale Borough Councils to be allowed 'to go it alone' in continuing the search for a nuclear dump while major problems remain on site at Sellafield. Both Councils should make every effort now to work towards reducing, as far as possible, the risks at Sellafield. Moreover, national government has to work with Cumbria to ensure the NDA is 'fit for purpose' and is working to achieve the goal of hazard reduction at the site.

In the meantime the UK needs to stop adding to the problem by creating yet more waste and the NDA needs to focus anew on its original remit of clean-up and decommissioning.

(1) Cumbria County Council should continue pressing for urgent action to tackle these '*intolerable risks*', and the Boroughs should do so too.

(2) While the waste already generated is in such a parlous state Cumbria should refrain from supporting any more nuclear facilities which produce yet more radioactive waste.

(3) The NDA should halt reprocessing as soon as possible, even if this requires contracts to be broken. Reprocessing is adding to the waste mountain. Arrangements should be made as quickly as possible for Sellafield to stop accepting waste, including spent waste fuel from other UK nuclear facilities. Sellafield should be completely focussed on clearing up its mess not engaging in commercial operations. Plutonium on the site should be immobilised as a waste and plans for a new MoX facility, which would further exacerbate the waste problem, should be dropped.

(4) Evaporator D should be pursued with vigour so as to solidify the liquid high level waste as fast as possible. The NDA and ONR should urgently re-visit the idea of building new waste storage tanks and a new vitrification line. If either of these projects can add to safety in the time available they should go ahead.

(5) Cumbria County Council should take on a lead role in the creation on an independent Overseeing Body as recommended by the original CoRWM to carry forward a "staged process" – in other words a body which supervises the safe storage of waste that currently poses an "intolerable risk". With such little progress over the past decade it is time for a wider discussion over whether the NDA is fit for purpose. The Overseeing Body would design the best institutional arrangements – technical, social and environmental - to speed up the clean-up at Sellafield. Any review must include a

fair representation of stakeholder bodies, with hands-off funding from Government to allow for independent critique of any proposals put forward.

(6) The NDA and its predecessor organisations have failed to make adequate progress, on time and budget, with regard to managing the UK's most dangerous radioactive waste for over the past decade. Is it really the right body to be searching for a nuclear waste disposal site? According to international principles, as a waste producer the NDA should play no part in being a waste dumper because of the vested interests involved.

(7) Unfortunately, the MRWS process as outlined in the White Paper depends heavily on the NDA and on the regulatory bodies to ensure that plans meet safety and security requirements (70). This report shows that the ONR has failed to do so over highly dangerous waste at Sellafield. The fitness of the NDA to take a leading role and ONR as guarantor of safety and security within any future implementation of MRWS must therefore also be questioned.

References

(1) Managing Radioactive Waste Safely – a framework for implementing Geological Disposal, DEFRA, BERR and the devolved administrations for Wales & Northern Ireland, June 2008 Cm 7386 http://mrws.decc.gov.uk/assets/decc/mrws/white-paper-final.pdf
(2) West Cumbria Managing Radioactive Waste Safely Partnership http://www.westcumbriamrws.org.uk/
(3) West Cumbria Managing Radioactive Waste Safely Partnership Final Report, August 2012 http://www.westcumbriamrws.org.uk/documents/306The_Partnership's_Final_Report_August_2012.pdf
(4) Letter from Energy Minister Charles Hendry to Councillor Alan Smith, Leader of Allerdale Borough Council 7th Nov 2011 http://www.westcumbriamrws.org.uk/documents/240-Letter_from_DECC_regarding_DtP_and_RoW_7_Nov_2011.pdf
(5) Briefing by Ruth Balogh on Radwaste Disposal and Storage Policy Issues with special reference to the GDF proposals presented to DECC / NGO Forum Oct 17th 2012 http://forum.foe.co.uk/campaignhubs/index.php?action=media;sa=item;in=994
(6) Managing Risk Reduction at Sellafield, National Audit Office, November 2012. http://www.nao.org.uk/publications/1213/sellafield_risk_reduction.aspx
(7) BBC 7th November 2013 http://www.bbc.co.uk/news/uk-england-cumbria-20228176
(8) Cumbria County Council Press Release 30th January 2013 http://www.cumbria.gov.uk/news/2013/January/30_01_2013-150007.asp
(9) Nuclear Decommissioning Authority: Managing risk at Sellafield, Public Accounts Committee 4th Feb 2013 http://www.publications.parliament.uk/pa/cm201213/cmselect/cmpubacc/746/746.pdf
(10) ITV Border 4th Feb 2013 http://www.itv.com/news/border/2013-02-04/urgent-action-needed-over-critical-nuclear-waste-problem/
(11) New York Times 5th Feb 2013 http://green.blogs.nytimes.com/2013/02/05/study-slams-nuclear-waste-practices-at-hanford/
(12) Nuclear Decommissioning Authority: Managing risk at Sellafield, Public Accounts Committee 4th Feb 2013, page 3. http://www.publications.parliament.uk/pa/cm201213/cmselect/cmpubacc/746/746.pdf
(13) CORE 3rd February 2013 http://www.corecumbria.co.uk/newsapp/pressreleases/pressmain.asp?StrNewsID=313
(14) Managing our radioactive waste safely; CoRWM's recommendations to Government, July 2006. http://corwm.decc.gov.uk/assets/corwm/post-nov%2007%20doc%20store/documents/reports%20to%20government/nov%20and%20dec%202007/700%20-%20corwm%20july%202006%20recommendations%20to%20government.pdf
(15) NDA website (accessed 23rd January 2013) http://www.nda.gov.uk/aboutus/
(16) Miliband announces radioactive waste plan, DEFRA news release 26th October 2006 http://webarchive.nationalarchives.gov.uk/20070101084426/http://defra.gov.uk/news/2006/061025b.htm
(17) Nirex Annual Report and Financial Statements 2004-05.
(18) Margaret Gowing and Lorna Arnold – "*Independence and Deterrence – Britain and Atomic Energy, (1945-1952) – Volume I Policy Making*" pp 166-8, p144 (A volume commissioned by the United Kingdom Atomic Energy Authority – as part of the Historical Account of the UK Nuclear Weapon Project)
(19) For a more complete description of reprocessing see Patterson, P (1986) Nuclear Power, Penguin (pp 64-67) available online at http://www.waltpatterson.org/nppenguin.pdf
(20) Historical Accounting of Plutonium: A Summary Report by The Ministry of Defence on the Role of Historical Accounting for Fissile Material in the Nuclear Disarmament Process, and on Plutonium for the United Kingdom's Defence Nuclear Programme. MoD 2000 http://www.fas.org/news/uk/000414-uk3.htm
(21) See HKNIC website (accessed 20th February 2013) https://www.hknuclear.com/nuclear/power/spentfuel/spentfuelreprocessing%20and%20direct/pages/spentfuelreprocessinganddirectdisposal.aspx
(22) Union of Concerned Scientists website (accessed 20th February 2013) http://www.ucsusa.org/nuclear_weapons_and_global_security/nuclear_terrorism/technical_issues/reprocessing-and-nuclear.html
(23) The Magnox Operating Programme MOP9, NDA 2012. http://www.nda.gov.uk/documents/upload/The-Magnox-Operating-Programme-MOP9.pdf Page 3 suggests Magnox reprocessing might not be completed until around 2028.
(24) Walker, W. Nuclear Entrapment: THORP and the politics of commitment, IPPR, 1999, page 87.
(25) Forwood, M. The Legacy of Reprocessing in the United Kingdom, International Panel on Fissile Materials, July 2008 http://fissilematerials.org/library/rr05.pdf
(26) Walker, W. Nuclear Entrapment: THORP and the politics of commitment, IPPR, 1999, page 117.
(27) Forwood, M. The Legacy of Reprocessing in the United Kingdom, International Panel on Fissile Materials, July 2008 http://fissilematerials.org/library/rr05.pdf
(28) Ibid

(29) Managing the Nuclear Legacy: a strategy for action, DTI, July 2002 http://webarchive.nationalarchives.gov.uk/+/http://www.dti.gov.uk/energy/nuclear/announce_pubs/conspubs/nuclear_legacy/whitepaper.pdf
(30) Oxide Fuels: Credible Options, November 2011 http://www.nda.gov.uk/documents/upload/Oxide-Fuels-Credible-Options-November-2011.pdf
(31) Oxide Fuels: Preferred Option, NDA June 2012 http://www.nda.gov.uk/documents/upload/Oxide-Fuels-Preferred-Options-June-2012.pdf
(32) Aubrey, C. THORP: The Whitehall Nightmare, Jon Carpenter 1993
(33) Independent 31st October 2011 http://www.independent.co.uk/news/uk/home-news/sellafield-waste-plant-closure-could-cost-taxpayer-100m-6255007.html
(34) See CORE Press Releases 13th May 2010 http://www.corecumbria.co.uk/newsapp/pressreleases/pressmain.asp?StrNewsID=280 and 9th May 2011 http://www.corecumbria.co.uk/newsapp/pressreleases/pressmain.asp?StrNewsID=288
(35) Consequences in Norway after a hypothetical accident at Sellafield, Norwegian Radiation Protection Authority, 25th January 2011 http://www.nrpa.no/eway/default.aspx?pid=240&trg=Center_6352&Center_6352=6401:88342::0:6371:1:::0:0
(36) The Storage of Liquid High Level Waste at BNFL Sellafield, HSE February 2000. http://pdf.edocr.com/09fa7e8e81f2c1a45b6430bfc45c5c33706b9fc6.pdf
(37) Progress on BNFL's Response to the three reports issued by HSE on 18 February 2000, HSE, February 2001 http://www.hse.gov.uk/nuclear/bnflprog01.pdf
(38) Assessing the risk of terrorist attacks on nuclear facilities, POST Report 222, July 2004. p81 http://www.parliament.uk/briefing-papers/POST-Report-8.pdf
(39) Civilian Nuclear Facilities as Weapons for an Energy, A submission to the House of Commons Defence Committee, Institute for Resource and Security Studies, 3rd January 2002 http://www.irss-usa.org/pages/documents/UKDefCttee01_02_000.pdf
(40) The Storage of Liquid High Level Waste at Sellafield: Revised Regulatory Strategy, ONR 29th May 2012 http://www.hse.gov.uk/nuclear/halstock-sellafield-public.pdf
(41) The Storage of Liquid High Level Waste at Sellafield: Revised Regulatory Strategy, ONR 29th May 2012 http://www.hse.gov.uk/nuclear/halstock-sellafield-public.pdf
(42) ONR Project Assessment Report, ONR 2011, http://www.hse.gov.uk/nuclear/halstock-sellafield-par.pdf
(43) The Magnox Operating Programme MOP9, NDA 2012 http://www.nda.gov.uk/documents/upload/The-Magnox-Operating-Programme-MOP9.pdf Page 3 suggests Magnox reprocessing might not be completed until around 2028
(44) High Level Radioactive Liquid Waste at Sellafield, by Gordon Thompson, IRSS, June 1998 http://www.irss-usa.org/pages/documents/Completew-oapp.pdf
(45) HSE Nuclear Newsletter No.43 July 2008 page 16. http://pdf.edocr.com/d807427c6372ac346c0959e35030ca0dbc44b8a9.pdf
(46) Managing Risk Reduction at Sellafield, National Audit Office, November 2012, page 30 http://www.nao.org.uk/publications/1213/sellafield_risk_reduction.aspx
(47) NDA Press Release 7th June 2012 http://www.nda.gov.uk/news/oxide-fuels-preferred-option.cfm
(48) i-Nuclear 16th May 2012 http://www.i-nuclear.com/2012/05/16/hast-tank-project-may-be-abandonedas-sellafield-reviews-thorp-evap-d-future/ (password protected) see also i-Nuclear Monthly June 2012
(49) CORE Briefing 4th January 2001 http://www.corecumbria.co.uk/newsapp/briefings/briefsmain.asp?StrNewsID=109
(50) CORE Press Release 3rd February 2013 http://www.corecumbria.co.uk/newsapp/pressreleases/pressmain.asp?StrNewsID=313
(51) HM NII BNGSL Sellafield and Drigg, and UKAEA Windscale, West Cumbria Sites Stakeholder Group, Quarterly Site Report for 1st April to 30th June 2006, http://www.wcssg.co.uk/documentstore/nii%20report%202006%20quarter%202.pdf
(52) HSE Nuclear Newsletter No.43 July 2008 pp16 -17 http://pdf.edocr.com/d807427c6372ac346c0959e35030ca0dbc44b8a9.pdf
(53) Letter from Mike Weightman Chief Inspector to Richard Waite, NDA Acting CEO, 26th September 2008.
(54) Irving, A. Multi-million pound bill for Sellafield, Whitehaven News 8th October 2008. http://www.whitehaven-news.co.uk/news/1.251885
(55) Managing Risk Reduction at Sellafield, National Audit Office, November 2012, page 9 http://www.nao.org.uk/publications/1213/sellafield_risk_reduction.aspx
(56) CORE Press Release 5th Jan 2012 http://www.corecumbria.co.uk/newsapp/pressreleases/pressmain.asp?StrNewsID=299
(57) i-Nuclear 7th February 2012 http://www.i-nuclear.com/2012/02/07/sellafields-evaporator-d-to-comeinat-well-below-1-billion-following-2009-redesign/ or i-Nuclear Monthly March 2012
(58) i-Nuclear 16th May 2012 http://www.i-nuclear.com/2012/05/16/hast-tank-project-may-be-abandonedas-sellafield-reviews-thorp-evap-d-future/ (password protected) see also i-Nuclear Monthly June 2012. See also Independent 30th May 2012 http://www.independent.co.uk/news/uk/home-news/sellafield-needs-

extra-276-million-of-taxpayers-money-to-complete-uks-biggest-nuclear-construction-project-7804779.html
(59) Oxide Fuels: Preferred Option. NDA June 2012, http://www.nda.gov.uk/documents/upload/Oxide-Fuels-Preferred-Options-June-2012.pdf
(60) Managing Risk Reduction at Sellafield, National Audit Office, November 2012, page 9 http://www.nao.org.uk/publications/1213/sellafield_risk_reduction.aspx
(61) Managing Risk Reduction at Sellafield, National Audit Office, November 2012, page 38 http://www.nao.org.uk/publications/1213/sellafield_risk_reduction.aspx
(62) See for example Greenpeace International Press Release 13th August 2008 http://www.greenpeace.org/international/en/press/releases/confidential-documents-reveal/ And 26th June 2008 http://www.greenpeace.org/international/en/news/features/greenpeace-activists-block-french-nuclear-reactor260608/
(63) Townsend, M, Nuclear stores on verge of exploding, Observer, 30th June 2002 http://www.guardian.co.uk/politics/2002/jun/30/uk.nuclear?INTCMP=SRCH
(64) "Current arrangements and requirements for the conditioning, packaging, and storage of Intermediate Level Radioactive Waste", RWMAC and NuSAC June 2002. http://collections.europarchive.org/tna/20080727101330/http:/defra.gov.uk/rwmac/reports/interwaste/index.htm
(65) Managing Risk Reduction at Sellafield, National Audit Office, November 2012, para 1.10 http://www.nao.org.uk/publications/1213/sellafield_risk_reduction.aspx
(66) Managing Risk Reduction at Sellafield, National Audit Office, November 2012, pp22-23 http://www.nao.org.uk/publications/1213/sellafield_risk_reduction.aspx
(67) Magnox Swarf is the magnesium metal cladding which is stripped off the waste fuel from Britain's first generation Magnox reactors before it is reprocessed. See "Magnox Swarf Storage Silos" Sellafield Ltd. (Accessed 25th January 2013) http://www.sellafieldsites.com/solution/risk-hazard-reduction/magnox-swarf-storage-silos/
(68) Managing Risk Reduction at Sellafield, National Audit Office, November 2012, p39 http://www.nao.org.uk/publications/1213/sellafield_risk_reduction.aspx
(69) Managing Risk Reduction at Sellafield, National Audit Office, November 2012, p40 http://www.nao.org.uk/publications/1213/sellafield_risk_reduction.aspx
(70) Managing Radioactive Waste Safely: A framework for implementing geological disposal, DEFRA June 2008 http://mrws.decc.gov.uk/assets/decc/mrws/white-paper-final.pdf

Glossary of Organisations

British Nuclear Fuels Limited (BNFL) was a nuclear fuel cycle services company wholly owned by the UK Government. It was set up in 1971when it became the operator of Sellafield (formerly called Windscale) and some other nuclear facilities. In 2005, it transferred all of its nuclear sites to the Nuclear Decommissioning Authority. It then sold its Westinghouse Electric Company subsidiary in February 2006. Later, BNFL sold the separate companies that made up its major subsidiary, British Nuclear Group. By May 2009, BNFL had completed the sales of all its assets and had no remaining operational activities or businesses. BNFL continued to exist only as a legal entity to meet all pension liabilities and any obligations arising from disposal programmes. However, on 14 October 2010, the Government announced that BNFL would be abolished.

Nirex was a body set up in 1982 by the UK nuclear industry to research options for the disposal of low and intermediate-level radioactive waste. Originally known as the Nuclear Industry Radioactive Waste Executive, it became the limited company United Kingdom Nirex Limited in 1985. Nirex gained widespread notoriety during the 1980s as the focus for widespread public opposition to the burying of nuclear waste in the UK. Nirex announced plans in October 1992 to build a “Rock Characterisation Facility” or RCF at Sellafield. In 1997, following a five month local planning inquiry, the Secretary of State for the Environment rejected Nirex's case. The ownership of Nirex was transferred from the nuclear industry to the UK Government departments DEFRA and DTI in April 2005, and then to the UK's Nuclear Decommissioning Authority (NDA) in November 2006. Nirex's staff and functions were integrated into the NDA in April 2007, at which point Nirex ceased trading as a separate entity. Nirex's role continues through the activities of the Radioactive Waste Management Directorate of the NDA.

The **Nuclear Decommissioning Authority** (**NDA**) is a non-departmental public body established by the Energy Act 2004. It came into existence in late 2004, and took on its main functions on 1 April 2005. Its purpose is to deliver the decommissioning and clean-up of the UK’s civil nuclear legacy in a safe and cost-effective manner, and where possible to accelerate programmes of work that reduce hazard. NDA does not directly manage the UK's nuclear sites. It oversees the work through contracts with specially designed companies known as site licence companies. NDA determines the overall strategy and priorities for managing decommissioning. Although the NDA itself only employs 300 staff, its annual budget is £2.2 billion.

The **Nuclear Installations Inspectorate (NII)** was part of the Nuclear Directorate of the Health and Safety Executive until 1 April 2011 when it became one of the bodies merged into the Office for Nuclear Regulation. Its function was to regulate nuclear safety and radioactive waste management at civilian and defence sites.

The **Office for Nuclear Regulation** (ONR) is the regulator for the civil nuclear industry in the UK. Created on 1 April 2011, the ONR is formed from the merger of the Health and Safety Executive's Nuclear Directorate (the Nuclear Installations Inspectorate, **Office for Civil Nuclear Security**, and the UK Safeguards Office) and, from 1 June 2011, the Department for Transport's Radioactive Materials Transport Team. The change follows the recommendations of a review conducted on behalf of the Government in 2008. The ONR

was initially created as a non-statutory body and an agency of the Health and Safety Executive, however the Government has announced its intention to put the ONR on a statutory basis once the appropriate legislations has been passed, outside of the HSE to regulate the nuclear power industry.

The **Public Accounts Committee (PAC)** or Committee of Public Accounts is appointed by the House of Commons to examine "the accounts showing the appropriation of the sums granted to Parliament to meet the public expenditure, and of such other accounts laid before Parliament as the Committee may think fit". The Committee does **not** consider the formulation or merits of policy (which fall within the scope of departmental select committees); rather it focuses on value-for-money criteria which are based on economy, effectiveness and efficiency.

The **National Audit Office (NAO)** scrutinises public spending on behalf of Parliament. By reporting the results of audits to Parliament, NAO holds government departments and public bodies to account for the way they use public money, thereby safeguarding the interests of taxpayers. In addition, NAO's work aims to help public service managers improve performance and service delivery.

Sellafield Ltd is the company responsible for safely delivering decommissioning, reprocessing and nuclear waste management activities on behalf of the Nuclear Decommissioning Authority. The shares in Sellafield Ltd are currently held Nuclear Management Partners Ltd which is a consortium comprising URS, Amec and Areva.