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Nuclear Decommissioning Authority

INSIGHT

into nuclear decommissioning

Delivering progress across the UK

Contents

Front cover: Asbestos stripping requires complete protection for workers, page 18-19

Welcome to the autumn 2012 edition of Insight, the news magazine where we aim to provide a snapshot of some of the developments across the NDA estate.

If you have any comments, please contact the editor Deborah Ward on 01925 832280 or **deborah.ward@nda.gov.uk**

£4-5 billion competition under way

The formal process is now under way to appoint a new Parent Body Organisation for the two companies that operate 12 of the NDA's historic nuclear sites.

Valued at £4-5 billion over the next seven years, the contract represents one of the UK's largest public procurement exercises and will see ownership of Magnox Ltd and Research Sites Restoration Ltd transfer to a new organisation with the skills and experience to take decommissioning forward.

Following a bidders' conference in Manchester for interested organisations and the submission of pre-qualification questionnaires, the next step in the two-year process will be an invitation to take part in a period of dialogue with the NDA.

Competition is central to the NDA's strategy for securing world-class experience. The new PBO will oversee management of decommissioning activities, taking ownership of shares in the two SLCs for the period of the contract, and key PBO staff will be seconded in to provide business leadership, innovation and ensure value for money.

Nine of the Magnox sites are in various stages of decommissioning, while Wylfa on Anglesey, is still generating electricity but is expected to cease generation by 2014. Magnox Ltd is currently owned by EnergySolutions.

The two RSRL sites at Harwell and Winfrith are former research centres that housed some of the UK's earliest experimental reactors but are well advanced in their decommissioning programmes. RSRL is currently owned by Babcock International Group.

Steve Dixon, the NDA's Competition Manager, said: "The Magnox and RSRL sites played a unique role in the UK's pioneering nuclear past and we are seeking to ensure they continue to forge an important path in demonstrating the very best in decommissioning practice."

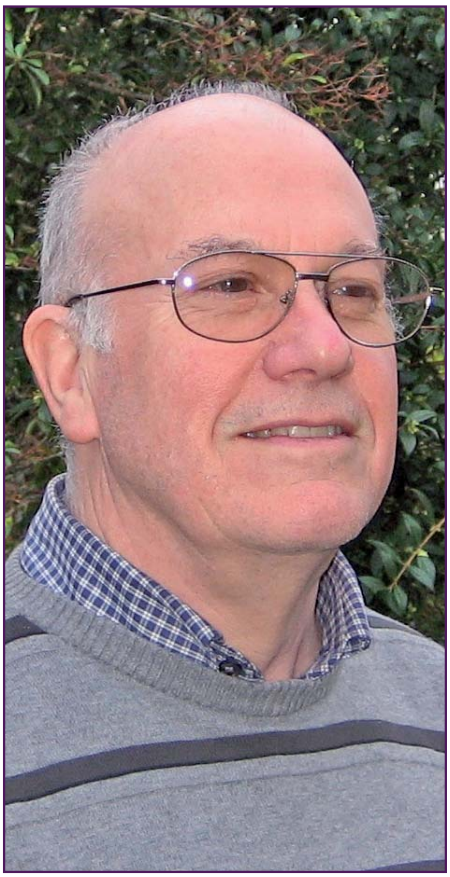
Earlier this year, ownership of Dounreay Site Restoration Limited which operates the NDA's Dounreay site in Caithness was transferred to a specially created private-sector consortium, Babcock Dounreay Partnership. The new contract has created the opportunity to secure savings of more than £1 billion for the UK taxpayer and cut up to 16 years off decommissioning timeframes.

Photograph: Head of Competition Graeme Rankin addresses the bidders' conference.

Last year, Stan Gordelier, former Head of the Nuclear Development Division of The Organisation for Economic Co-operation and Development Nuclear Energy Agency, became the first independent Chair of the NDA's restructured Research Board. He has more than 40 years experience in the nuclear sector and is a specialist in waste management and decommissioning.

Research is vital – and we need more of it

Let me start with a little personal reflection. I started my professional career with 10 years nuclear energy research. Many years and roles later I spent 15 years in senior positions in waste management and decommissioning. So for me it was a great pleasure to be invited to chair the NDA's Research Board, allowing me to bring these two career ends together. Not only that, of course, but R&D in this area is so important.



Stan Gordelier, former Head of the Nuclear Development Division of the OECD Nuclear Energy Agency

Given the scale of UK liabilities (NDA liabilities alone are currently estimated at around £50 billion in discounted terms), anything that can be done to improve safety and environmental performance and reduce costs is extremely beneficial.

Research and Development is the key to improvement in each of these areas, and this impacts far more than just clearing up the past. If the UK is to achieve its objective of a significant nuclear contribution to the nation's energy mix again, we must demonstrate effective management capability for the new liabilities that will arise.

In this context it is important to emphasise that the Research Board, while focused on the NDA mission, now also takes a wider view across the UK as a whole to help ensure alignment. Our responsibilities cover the legacy facilities that form the core of the NDA's mission, together with the current fleet of still-generating plants and defence-related facilities. Our interests also extend to decommissioning the next generation of nuclear plants that support the Government's long-term vision for UK energy provision.

Our intent is to ensure that the right work is carried out, with funding focused on areas of greatest priority, bringing together the diverse but individual strands of research that have hitherto been conducted independently.

When, after my second period on the UKAEA Board, I left the UK to work with the OECD Nuclear Energy Agency in Paris, there was no such linkage. On my return, it is a great pleasure to see how this has been immensely improved by the Board and the work of the Nuclear Waste Research Forum.

This new approach for the UK is in line with the conclusions of last year's hard-hitting House of Lords report, which recommended that more must be done to develop a long-term strategy for nuclear R&D, including a roadmap to close research gaps and re-establish the UK's international credentials.

The report noted that the UK's existing strengths were based on past investments that would soon be depleted as many experts reach the end of their careers. We are fully aware of this and are keen to inspire new blood into R&D, building a generation of experts who will play an important role in ensuring that the UK remains a vital player in the global nuclear industry, supporting job creation and reducing our reliance on imported technology.

The Board, originally formed in 2006, was restructured in 2011 to include representatives from all across the UK nuclear sector and the international community, in recognition of its much strengthened remit. It is a measure of its important role, and the high reputation of the NDA, that all of those invited to be members accepted the invitation. Let me finish by expressing my sincere thanks to those members for their help and support in this important work.

"Building a generation of experts who will play an important role in ensuring that the UK remains a vital player in the global nuclear industry"

Sellafield excited by remote possibilities

The challenges at Sellafield are numerous, complex and hazardous, with environments that often rule out sending in a human taskforce.

Instead, solutions must be developed that allow machines to do the dirty work and ensure workers remain safe. Wherever possible, the approach is to use tried and tested technology adapted from other industries, rather then bespoke equipment which is expensive and takes time to develop.

Many innovations involve robotics, or remote technologies, which are successfully used in both production plants and decommissioning operations. Typical examples include remotely operated vehicles for surveying work, master-slave manipulators (hand-like mechanisms controlled by an operator) working in enclosed cells, remote diggers for demolition and robots used more commonly in car manufacturing.

Dr Melanie Brownridge, NDA Head of R&D, said: "These examples demonstrate the importance of robust technical underpinning to deliver decommissioning. Sellafield R&D spans early academic research through to development in adapting novel technologies to the nuclear market and technology transfer from other industries."

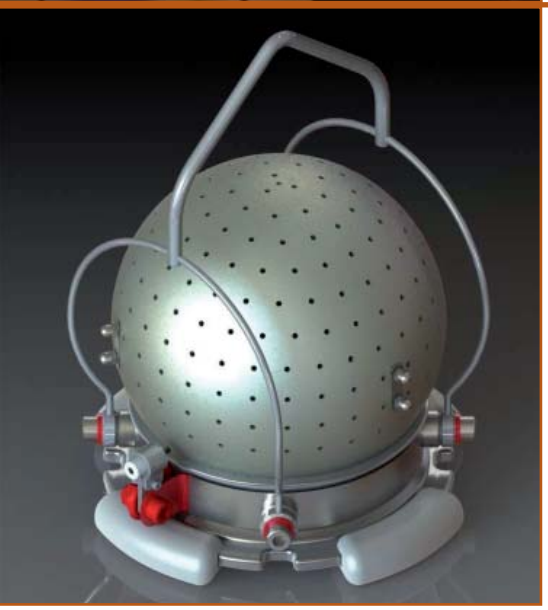
Among the ongoing projects being developed are four promising applications that have the potential to support work in high-radiation areas.

Welcome to a virtual world

Off-the-shelf gaming technology is being used to help decommission redundant facilities. Virtual environments that replicate a number of Sellafield plants have already been constructed. These enable a user to simulate plant walkthroughs from their own PC, similar to a conventional computer game – but without the monsters!

Steve Hepworth, Decommissioning Technical Manager, said: "We've built virtual environments using gaming software to which we've attached plant data, photographs and plant items. This offers Sellafield the ability to build a walkthrough of any plant.

"The potential applications are huge; in particular it's an effective means of providing plant familiarisation, operator training and job planning. All of this can be done safely in front of a computer screen, which is particularly valuable where the reality would be to visit a high-radiation area."



Roundabout way to track radiation

A new radiation detection device has also been trialled at Sellafield which shows tremendous promise. The UK's National Nuclear Laboratory (NNL) developed the RadBall® which uses innovative radiation-sensitive materials to identify radiation sources.

Phil Reeve, Head of Decommissioning Technical, said: "The RadBall® trial results at Sellafield have already demonstrated that it could be valuable help in our mission to clean up the site. It could be used to identify radiation hazards in enclosed cells, nuclear stores, gloveboxes and hard-to-access facilities undergoing decommissioning."

The RadBall® is a passive device needing no power source and can be deployed into a high-radiation area by a robot or manually in a lower-activity area. It is about the size of a grapefruit and contains layers of radiation-sensitive films which change to a rather fetching green opaque colour when exposed to radiation. The opaque tracks on the film are used to measure the direction and intensity of the radiation.

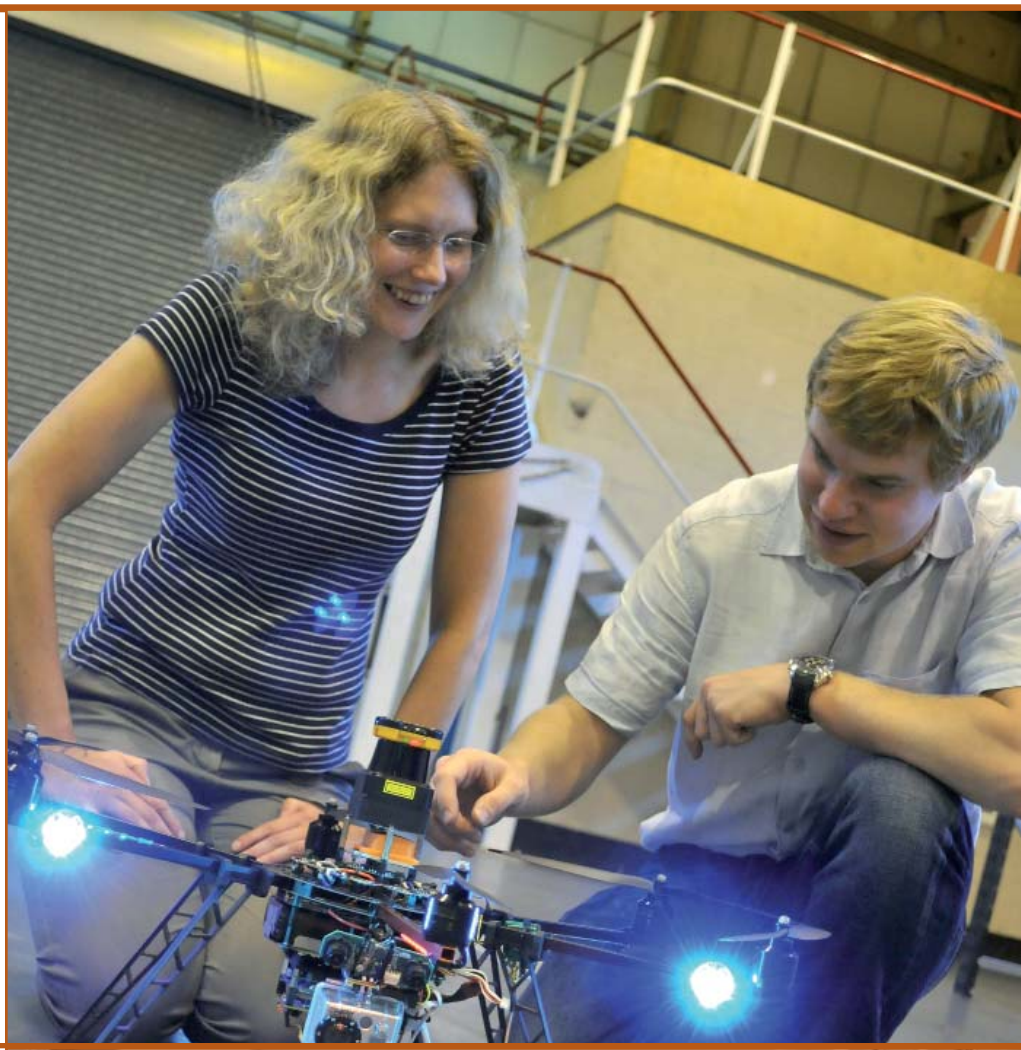
Photographs: Above, Steve Hepworth uses gaming software to create a virtual Sellafield world. Below, the radiation-detecting Radball is around the size of a grapefruit.

Mini high-flier

In addition, Sellafield Ltd is sponsoring a PhD student at the University of Warwick's Mobile Robotics Department to develop the first remotely operated flying vehicle with the capability to map its surroundings.

It's known as a hexacopter, is less than a metre wide and is small enough to be flown into many of the huge nuclear buildings at Sellafield. It has six separate rotors on the end of six arms, which makes the hexacopter extremely manoeuvrable. The flying robot can effectively scan the inside of a building and be used to detect radiation levels. This visual inspection information can then be used to plan how best to decommission and dismantle redundant nuclear facilities.

A commercially available hexacopter was adapted to enable it to be flown out of direct line of sight of the operator through the use of a stereo camera visor – the robot's eyes. The hexacopter has a sort of 3D compass to determine its position in space using its on-board laser scanning sensors to continually create a map of its surrounding environment.



Positively climbing the wall

And a new breed of wall-climbing robots could form part of the toolkit for overcoming decommissioning challenges. The WallRover™ has a unique wall-climbing ability and significant payload capacity, which makes it extremely useful for remote inspection and characterisation duties.

The current demonstrator model, developed by Smith Engineering of Maryport, is equipped with a video camera and miniature gamma spectrometer and can access difficult-to-reach places. In theory any equipment could be mounted and remotely deployed via a WallRover™ unit, provided it weighs less than 5kg.

Alex Jenkins, Decontamination Centre of Expertise, said: "The time and cost savings associated with not having to scaffold and platform areas requiring survey are significant and of course this technology will greatly reduce, or even avoid completely, the worker dose uptake associated with these activities."

Photographs: Above, hexacopter with Stefan Winkvist and tutor Emma Rushforth. Below, Sylvain du Tremblay and Alex Jenkins with the wall-climbing robot.

Cumbrian councils say more work needed before nuclear waste decision

Three Cumbrian councils are asking the Government for further information before deciding whether to move to the next phase in a search for a site that could potentially host a repository for the country's higher activity radioactive waste.

Allerdale Borough Council, Copeland Borough Council and Cumbria County Council were expected to make a decision this month on whether to allow detailed studies and investigations to take place in Allerdale or Copeland, but have opted for a deferral until January 2013. During this time they will be seeking clarification from the Department of Energy and Climate Change (DECC) on a number of issues.

In a letter to Baroness Verma, Parliamentary Under Secretary at DECC, the Councils cited community benefits, the right of withdrawal and suitable geology as the key issues for which further information was required.

The councils, along with other Cumbrian organisations, have been involved in the West Cumbria Managing Radioactive Waste Safely (MRWS) Partnership to consider whether to enter the siting process for a Geological Disposal Facility. The Councils started the early stages of this conversation with Government because a large amount of the country's radioactive waste is already stored at Sellafield.

In addition to an extensive communications and engagement programme, the Partnership has spent more than three years considering reports, hearing from experts, commissioning independent research and inviting reviews by independent experts. A final report in July 2012 set out its opinions and advice on issues involved in taking part in the search for a site. However, the Partnership did not make a recommendation about whether the councils should take part in that process.

For further information, visit **www.westcumbriamrws.org.uk**

The Government remains keen to talk to any local authority that wants to find out more about the benefits of hosting a repository for higher activity radioactive waste.

North Wales MP visits Trawsfynydd

Hywel Williams, Plaid Cymru MP for the Westminster constituency of Arfon, recently made his second visit to the Trawsfynydd site.

Although Trawsfynydd lies outside Arfon, a number of employees working on the site live in Hywel's constituency.

The seat is situated between the two constituencies that are home to Wylfa (Ynys Mon) and Trawsfynydd (Dwyfor Meirionnydd).

Hywel is a member of the House of Commons Science and Technology Select Committee.

His first viewing of the site took place when he was a schoolboy more than 40 years ago.

After visiting the ILW processing plants and one of the safestore buildings, Hywel said: "Trawsfynydd has been part of our landscape for decades and one tends to pass it without a thought.

"Indeed, the very long-term nature of the project tends to mask the extensive work that is continuingly going on there.

"On my visit I was impressed by the care and inventiveness of the work being done at the site, and the obvious commitment of the workforce.

"Part of the task appears just to be straightforward construction and demolition. However this is combined with novel work requiring the utmost delicacy and attention to detail.

"I am very glad to have had the opportunity to revisit Trawsfynydd after all these years!"

The visit was hosted by Site Director Dave Wilson and joined by Interim Chair of the Snowdonia Enterprise Zone John Idris Jones.

Photograph: Outside the waste store are, from the left, Site Director Dave Wilson, Dave Cabrera, John Idris Jones, MP Hywel Williams and Robbie Huston from the NDA

Visiting team in at the deep end

Rob Whittleston, Research Manager – Geosciences, is one of many new recruits to join the NDA's Radioactive Waste Management Directorate (RWMD). At 26, Rob recently obtained a PhD in biogeochemistry and, as part of his new role, joined colleagues to tour a unique Swedish facility.

A small group of staff from our Radioactive Waste Management Directorate including Neil Smart, Director of Science; Jon Martin, Head of Research; Steve Reece, Head of Design; Alex Carter, Post Closure Safety Specialist; Amy Young, Specification Manager, and myself recently travelled to the Äspö underground research laboratory in Sweden.

Designed and built by the Swedish Nuclear Fuel and Waste Management Company (SKB) in 1995, projects at the laboratory contribute to SKB leading the field in implementing the disposal of spent fuel. The research facility is designed to test "different technical solutions to geological disposal of radioactive waste in a real environment, on a full scale."

The visit was organised to mark the Radioactive Waste Management Directorate joining the Äspö General Agreement – an international agreement enabling access to scientific and technical information and results from experiments run by SKB at the laboratory. The agreement also provides access to international networks through regular technical information meetings, an ideal forum to discuss research findings globally with sister organisations from France, Finland, Japan and Canada.

Travelling by elevator to a depth of nearly 500 metres, our group, hosted by representatives from SKB, viewed numerous experiments designed to investigate the many different components of a geological disposal facility. From small-scale testing of the chemical properties of the host rock, concrete and clay barriers, to a full-scale prototype repository, the experiments run at Äspö provide an impressive insight into SKB's progress in tackling many of the technical and engineering challenges surrounding geological disposal.

Returning to SKB headquarters at Stockholm, the visit concluded with enthusiastic discussions on increased collaboration for the future.

RWMD Science Director Neil Smart said: "The visit was highly beneficial to us and the SKB team made us feel very welcome. We discussed the potential opportunity for RWMD staff to be seconded to Äspö. This would be an important method of developing our skills and experience in anticipation of UK-based underground operations."

The visit highlighted the advantages of conducting experiments to test concepts on an environmentally relevant scale, which have already produced many innovative solutions to meet the challenges facing the Swedish programme. Access to the Äspö site therefore raises the exciting prospect of RWMD leading UK-specific research programmes within the facility itself.

This represents a significant development in RWMD's key mission to advance research and development supporting the needs of the UK disposal programme.

Further information: www.skb.se

Photograph: The RWMD team are shown the underground facility.

spotlight on
Dounreay

Rail terminal improvement could cut lorryloads

Following a £multi-million refurbishment, the siding at Georgemas Junction in Caithness could become an important regional rail freight hub for the north of Scotland.

The new railhead, completed earlier this year, has been vital to enable nuclear materials to be moved by road from Dounreay and transferred by train to Sellafield, however, it will also be made available for commercial freight movements.

The North Highland rail line runs from Inverness to Wick and Thurso where it terminates.

The NDA's Head of Programme at Dounreay, Nigel Lowe, said: "The NDA recognised that the local community had been lobbying for a rail freight terminal for many years because of the sustainable economic development potential associated with such a facility. We hope it will be a good example of gaining maximum impact from our investment in the clean-up of the Dounreay site."

The NDA's subsidiary Direct Rail Services (DRS) looked at three sites in Caithness before concluding that Georgemas was the most viable, and the construction work was carried out between March and July this year.

DRS Communications Manager Austen Skinner said: "We have already met business and community leaders, including representatives from Caithness Transport Forum, Caithness Chamber of Commerce, Dounreay site stakeholders group and Orkney Islands Council to explore the possibilities for commercial traffic."

John Green, Chairman of Caithness Transport Forum added: "We welcome the investment that has been made at Georgemas and look forward to seeing long-term local benefits from its commercialisation.

"I understand that DRS is talking to a diverse range of businesses about taking freight into the north of Scotland, but also there is now huge potential for using rail to export goods from the region to other parts of the UK and onward into Europe."

He said that the increased use of rail would help to relieve pressure on the busy A9 trunk road.

Georgemas is approximately 15 miles from Dounreay and just eight miles from Scrabster Harbour, which is currently undergoing an NDA-funded major redevelopment programme that will have the capacity to support oil and gas developments in the Pentland Firth, as well as the marine renewables industry.

The Georgemas railhead upgrade includes the installation of a fixed crane capable of lifting more than 100 tonnes, a new concrete platform and welfare facilities.

DRS, based in Carlisle, specialises in moving nuclear material and has clocked up more than 12 million miles moving nuclear fuel safely across the UK. The freight specialist also moves millions of tonnes of non-nuclear freight, including consumer goods and high-value products.

According to the Rail Freight Operators Association, each train would remove up to 70 lorries from the roads, while reducing congestion and cutting carbon dioxide emissions.

Photograph: A flask arrives by road for loading at the railhead.

Transport plays vital role in site closure

The removal of nuclear fuel and foreign radioactive waste is a small but important part of the work needed to close Dounreay.

When the NDA took over the Scottish site from the UK Atomic Energy Authority in 2005, it inherited approximately 100 tonnes of nuclear fuel, plus contractual obligations to return several hundred tonnes of waste to former customers who had sent their fuel to Dounreay in the 1990s.

Different parts of the NDA estate have been working together on the carefully planned removal of materials.

NDA led a consultation and public engagement around its strategy of co-location for the nuclear fuels it inherited.

Following a public engagement programme, a decision was taken in late 2011 to begin removing almost half the inventory – the breeder produced in the Dounreay Fast Reactor – and transfer it to Sellafield for reprocessing. A decision on the remaining fuel is due later this year.

Sending the breeder to Sellafield requires close collaboration between the SLCs, Dounreay Site Restoration Ltd and Sellafield Sites Ltd, as well as the train operator DRS and Magnox Sites Ltd for use of the transport containers.

The newly completed Georgemas freight terminal was constructed to enable the transfer.

Another close collaboration is between DRSL and INS, a subsidiary of the NDA, to enable foreign reactor operators to collect their waste from reprocessing carried out historically at the site.

The first of 123 drums destined for Belgium was delivered safely by INS at the end of August.

INS is in discussion with other operators in Australia, Netherlands and Germany who also sent fuel to Dounreay historically for reprocessing. These contracts require the waste to be returned in accordance with UK Government undertakings.

Nigel Lowe, the NDA's Head of Programme at Dounreay, said: "We're working closely with the site, the former customers and a variety of government bodies to ensure these contracts are closed out satisfactorily and the return-of-waste obligations are met."

Photographs:

Top left, a flask arrives by road for loading at the railhead.
Top right, a drum of the kind used for delivering waste to Belgium.

Overseas contracts

Part of Dounreay once used to supply and recycle specialist nuclear fuel.

A series of chemical plants serviced the three reactors, as well as research reactors in the UK and more than a dozen countries world-wide.

These plants recycled used fuel, dissolving the elements in acid and separating the re-usable nuclear materials from the radioactive waste.

Between 1958 and 1996, the materials test reactor reprocessing plant alone dissolved almost 13,000 fuel elements, including 4,000 from Africa, Asia, Australia and Europe.

By 1996, when one of the plants broke down, more than 800 elements from overseas had been reprocessed, with less than a tonne of spent fuel from Belgium, Denmark, Germany, the Netherlands, Spain and France still to be done.

In 2001, the UK Government decided not to repair the reprocessing plant.

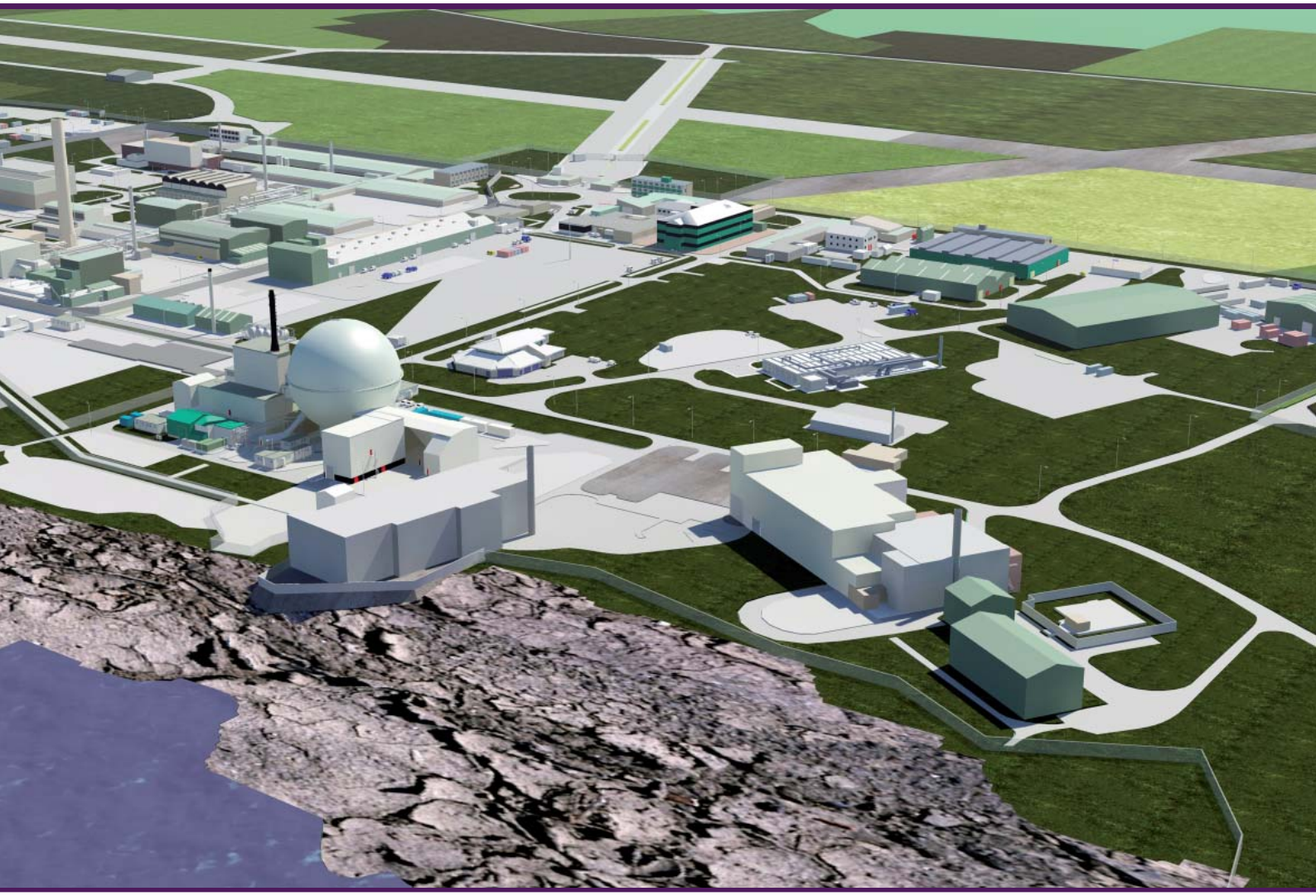
Today, a small but important part of the closure programme is reaching agreements with historic customers to close their contracts.

Dounreay no longer has plants to recycle the remaining spent fuel and the contracts do not allow it to be returned untreated.

INS, an NDA subsidiary, is now responsible for concluding these contracts. The waste associated with the contracts represents two per cent of all the higher activity waste at Dounreay.

In 2012, the Scottish and UK Governments decided INS could offer waste substitution in its negotiations to close out these contracts.

Customers will be sent an amount of new fuel and waste from UK stocks, equivalent to what would have been produced if the fuel had been reprocessed, with the UK retaining the spent fuel.



Plans take shape for world's deepest nuclear clean-up

Plans for the world's deepest nuclear clean-up have been on public display ahead of an application for permission to start construction work next year.

The plans show how radioactive waste is to be removed from two underground facilities – a vertical shaft 65 metres deep and a nearby vault set nine metres into the ground – as part of the closure of the Dounreay site.

The water-filled shaft and silo were once used for radioactive waste from some of Britain's earliest experiments with nuclear energy.

Their clean-out is a key part of the site closure contract awarded by the NDA to the Babcock Dounreay Partnership (BDP) earlier this year.

The aim is to complete both facilities by 2021, several years earlier than previous forecasts and using innovation in areas such as waste packaging to reduce costs.

An estimated 1,500 tonnes of radioactive waste was consigned to the two facilities between 1957 and 1998.

Radiation levels are too high for man-entry to either facility, so robotic equipment will be used to retrieve, analyse, shred and package the waste.

Separate headworks and waste-processing facilities will be built above each facility.

A 60-strong team is now working on the project, with employment levels expected to peak at about 200 during the construction phase in 2013-16.

The project team is looking wherever possible to use technology already proven elsewhere such as remote vehicles, cranes, shredders, remotely-operated grabs, water treatment, analysis and monitoring.

They will solidify the processed waste in a type of container that is new to Dounreay but proven by the nuclear industry in other parts of the world.

The use of boxes made from steel, lead and concrete will provide shielding from harmful radiation and remove the need to build a heavily shielded store for the previous design of containers. This will save tens of millions of pounds in design and build costs.

Image: The shaft and silo are located just in front of the sphere.

About 20 companies are likely to be involved in contracts ranging from the design and build of mechanical systems such as cranes to the procurement of robotics capable of operating in high radiation zones, major construction, plant decommissioning and back-filling of the shaft and silo.

The project is being managed for the NDA by Dounreay Site Restoration Ltd, the site licence company acquired by BDP.

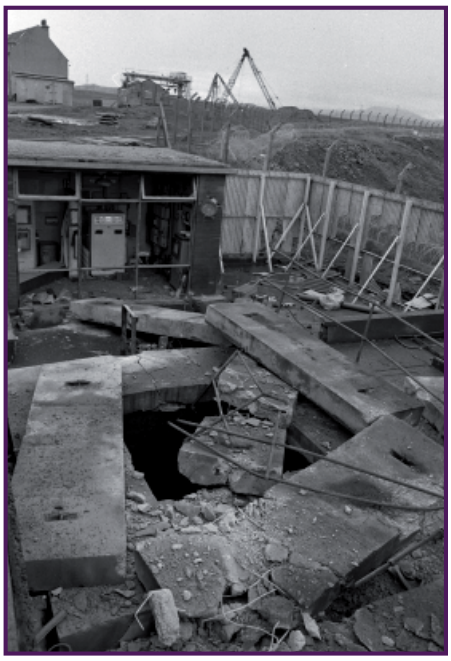
Project director Bo Wier said: “Emptying the shaft and silo at Dounreay is one of the biggest clean-up challenges in Europe and one of the priorities for the NDA in the UK.

“We believe we can deliver the decommissioning on an earlier timescale and at lower cost than previously thought by combining proven, off-the-shelf technology with innovation in design.

“By 2021, we aim to have all the waste safely packaged for long-term storage above ground and both facilities left in a condition that do not pose a hazard to future generations. This is significantly earlier than previous estimates and offers substantial cost savings to the NDA.”

DSRL put the plans on display in neighbouring village Reay and in the Thurso information office during September, to seek feedback from the community, before making a formal application to the Highland Council at the end of October.

Subject to consent, construction is scheduled to begin in the second half of 2013 and take up to three years. Once emptied, both facilities will then be back-filled.



Shaft used for waste

The shaft was sunk to enable the building of a tunnel, through which low-active radioactive effluent would be discharged.

The shaft was used to transfer excavation equipment in and out of the tunnel, for removing spoil and for pumping out groundwater.

A concrete plug separates the tunnel from the shaft, which is mostly unlined.

In 1958, the shaft was licensed to take radioactive waste and was routinely used for unconditioned intermediate level waste.

The wet silo - an engineered, concrete-lined bunker - was brought into use as an ILW store in 1971 to allow the shaft to be taken out of routine service.

All consignments to the shaft halted in 1977 following an explosion.

A decision to empty both facilities was taken by the UK Government in 1998.

To prevent groundwater seeping in as waste is retrieved, and becoming contaminated, the surrounding rock was grouted.

Specialist grout from Sweden was ground down until it was finer than toothpaste, injected through boreholes and squeezed into the fissures around the shaft where it hardened.

The project, completed in 2008, won a number of industry awards. Further work was carried out to prepare for the retrievals phase.

Photographs:

Top, waste has accumulated in the shaft

Centre, an explosion ended the shaft’s use as a waste facility

Left, the silo was also used for unconditioned ILW

Marine energy set to flow

The re-developed Scrabster Harbour will play a key role in Scotland's first marine energy park, launched earlier this year by the Energy and Climate Change Minister Greg Barker.

The Pentland Firth and Orkney Waters Marine Energy Park is intended to enhance the development of renewables, already well established in the region.

According to the Department of Energy and Climate Change (DECC), the powerful tides and waves racing through the Firth have the potential to provide up to 27GW of power in the UK alone by 2050, equivalent to the output from eight coal-fired power stations.

Mr Barker made the announcement at the end of July during a visit to Caithness when he visited Scrabster and the new Energy, Technology and Engineering Centre (ETEC) at North Highland College in Thurso.

Scrabster harbour has been upgraded in a £21.5 million scheme, supported by £2 million from the NDA's socio-economic budget, to bring a deep-water channel to a new multi-functional pier, additional lay-down areas at the quayside with heavy lifting facilities and an improved range of services, including fuel and water at each berth.

The facilities will help to support the continued growth of marine energy industries as well as positioning Scrabster as the most northerly mainland port supporting the oil and gas fields that are opening up in the Atlantic and North Sea.

Designation as a marine energy park is intended to raise the region's international profile and its reputation as a world leader in the field. The park also includes the world-leading European Marine Energy Centre (EMEC) in Orkney, which attracts developers from across the world and where testing of a range of wave and tidal energy devices is already well under way.

A range of public and private-sector organisations are involved in collaborative partnerships to develop the park, including Scottish Government, the NDA, the Orkney Islands and Highland Councils, and the Highlands and Islands Enterprise.

Photographs:

Top, from the left, Caithness and North Sutherland Regeneration Partnership Chairman Sir Anthony Cleaver, Caithness businessman William Calder, Greg Barker, NDA Director of Communications Jon Phillips and MP John Thurso.

Above, Scrabster Harbour will support the marine energy industries, as well as oil and gas developments in the Pentland Firth.

Industry Guidance set for launch

Three years of collaborative work across the nuclear industry have led to the compilation of a comprehensive set of guidelines on the interim storage of Higher Activity Waste (HAW) packages.

Aimed at all organisations and businesses involved in nuclear operations and decommissioning, the Industry Guidance for Interim Storage of HAW Packages addresses wide-ranging technical issues associated with both storing the packages and the stores. Currently in the final stages of preparation, the documents will be available on the NDA's website following publication towards the end of November 2012.

At a recent seminar for store operators in Penrith, representatives from the industry, Government, the Regulators and the International Atomic Energy Authority discussed practical implementation of the Guidance, including monitoring temperature and humidity in stores, preventing package corrosion, store design, record-keeping and emerging monitoring technologies.

Work on the Guidance brought together, for the first time, store operators from the public and private sectors, as well as defence, to share differing experiences, explore good practice and pinpoint areas for further research. Technical aspects of the Guidance were supported by substantial underpinning research, primarily funded by the NDA's Direct Research Portfolio.

James McKinney, NDA's Head of Integrated Waste Management, said: "Many people have so far been involved in compiling the Guidance over three years and feedback from the grassroots indicates that it is already providing a valuable toolkit."

The Guidance takes account of the need for waste packages to remain safe and secure until they can be transferred to a permanent disposal facility. In England and Wales, final disposal will be to the Geological Disposal Facility (GDF). Scottish Government policy is for long-term management in near-surface facilities.

The focus is on ILW which arises at most nuclear sites rather than HLW, which is stored only at Sellafield. However, the principles apply to all conditioned wastes in long-term storage. Around 60,000 packages are currently stored on NDA sites, with tens of thousands more anticipated as operational power stations close down and legacy facilities are decommissioned.

As the location and timeframe for the GDF are still subject to future decision-making, waste from dismantled facilities and those currently undergoing decommissioning, must be kept in robust, corrosion-resistant packages over the decades until disposal becomes available. In line with UK and Scottish Policies and recommendations by the Government's Committee on Radioactive Waste Management (CoRWM), the storage arrangements will need to remain effective for a period of at least 100 years.

The Guidance represents an integrated approach to storage with toolkits to assist future store designs and improve existing store operations, including package performance criteria, monitoring technologies and maintaining disposability.

Development of the Guidance arose from a CoRWM recommendation for better strategic co-ordination across all UK nuclear industry organisations and for additional work to demonstrate the robustness of interim storage arrangements in the light of the disposal uncertainties. The NDA's 2009 UK Higher Radioactivity Wastes Storage Review also recognised the importance of an integrated, standard approach to storage.

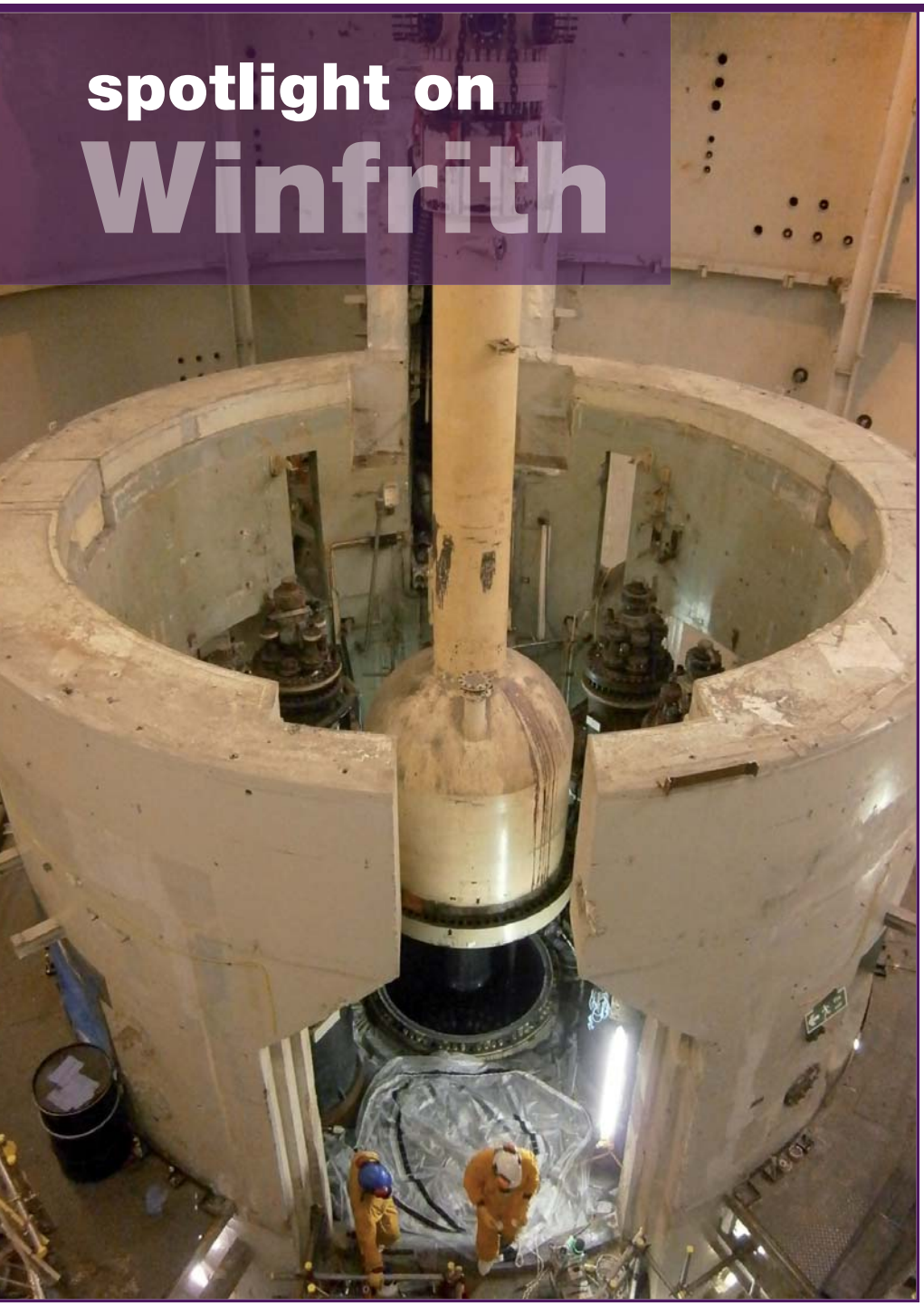
The NDA subsequently set up a cross-industry Integrated Project Team (IPT) comprising representatives from all the current SLCs and the wider nuclear industry, with support from the regulators, to deliver the Guidance which has undergone a programme of 'road-testing' and independent peer review over the last 12 months.

The cross-industry Store Operations Forum, set up to assist in developing the Guidance, continues to meet with the intention of updating and refining the contents to take account of new developments.

Dave Stretton, IPT Lead, added: "Keeping the Guidance live and relevant will ensure it remains fit-for-purpose. We are very grateful for all the contributions that have enabled us to compile the integrated approach, and will continue to welcome feedback."

Photograph: An interim storage facility on the Sellafield site

spotlight on
Winfrith



Challenges overcome as Dragon work restarts

Work has restarted on taking apart one of Winfrith's most iconic features, the unique Dragon high temperature gas cooled reactor.

Decommissioning first began in 2005, then halted in 2007 and restarted in October 2011.

The first phase, now under way, will see the decommissioning and removal of all plant and ancillary equipment, except the reactor itself.

The programme is progressing well, meeting targets for time, quality, cost and – most importantly – safety. "We've so far clocked up 45,000 hours without a single lost-time incident," said Tony Smith, Project Manager for Research Sites Restoration Ltd.

"Our main challenge lies in the uniqueness of the reactor," Tony said. "There's no decommissioning manual applicable to Dragon, and there's no other reactor exactly like it in the world to benchmark from."

Tony's team have had to come up with innovative solutions for removing each piece of plant and equipment.

"We were amazed at how radiologically clean it was. After almost half a century, there were still contamination and activation products, but not as much as originally anticipated. It was a reminder to us of just how well Dragon had been engineered and how advanced its design was, for its time," he added.

Recently, the helium clean-up plant has been removed. The plant was used to clean impurities and fission products from the helium coolant, a process which took seven months.

The plant consisted of three hot plants and three cold plants, plus other parts and a myriad of pipework – all inside a space measuring just nine square metres and12 metres deep.

Working in such a confined area was just one of the challenges, as Tony explained. "First, the floor beams that covered the plant were lifted. This involved the removal of lead and steel shot used as shielding. The three hot plants were the first out – where we encountered an unexpected hazard: asbestos. This had to be removed by a specialist contractor and the plant size-reduced ready for disposal.

"Next, each of the three cold plants were removed and reduced in size. Here we came across another challenge: powdery perlite insulation material. This was particularly difficult, requiring the innovative use of a huge industrial vacuum cleaner system."

As well as the helium clean-up plant removal, a number of significant decommissioning tasks have taken place, mostly items within the bio-shield including, the 6 primary gas circulators, the fuel transfer flask, canning facility and the fuel charge machine which formed the top of the reactor pressure vessel.

The second phase will involve decommissioning of the reactor core and pressure vessel.

Background

The Dragon complex operated successfully from 1964-1976.

It was widely regarded as one of Europe's most successful collaborations in applied science, and the most important multi-national technical collaboration in nuclear energy.

Cooled by the inert gas helium, the experimental reactor was a forerunner of many of today's gas turbine-modular helium reactors. Developed from technology pioneered by Dragon, modern reactors are highly efficient and reliable, with little waste compared with other forms of generation.

There are around 10 High Temperature Gas Cooled Reactors around the world, most are in a state of care and maintenance but a number are planned or are in construction particularly in Russia, China and South Africa.

Removed....

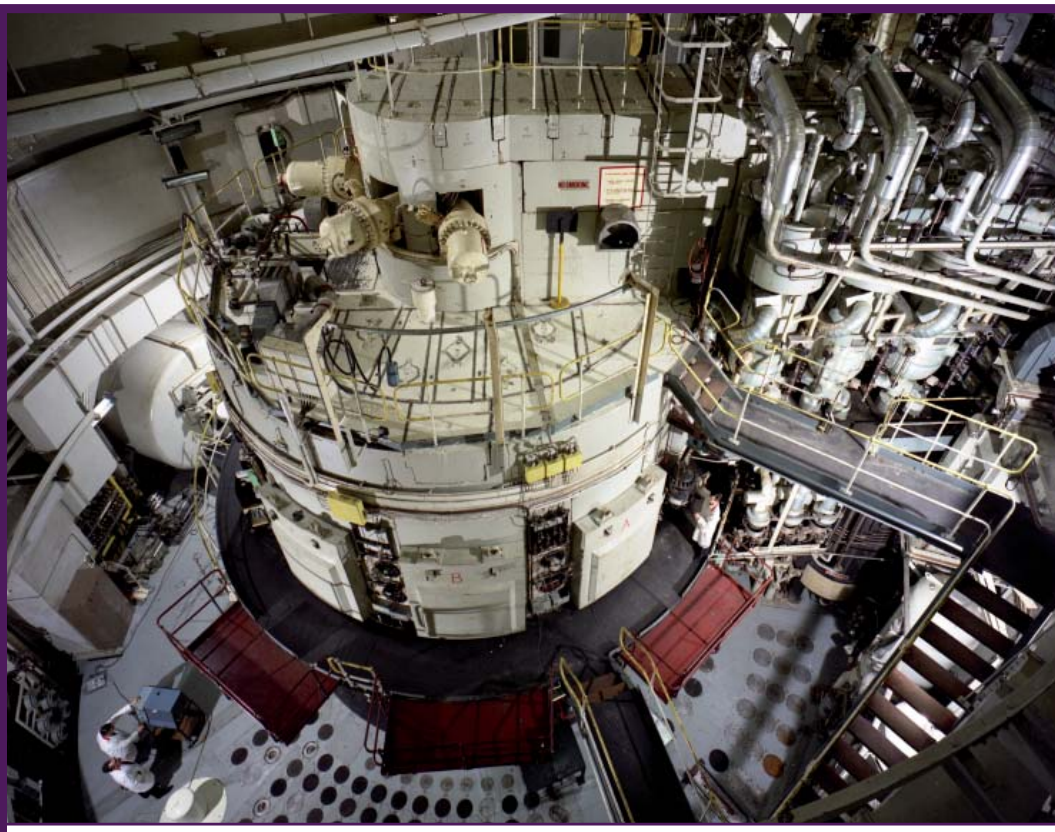
- 10 tonnes of lead
- 25 cubic metres of asbestos
- 140 cubic metres of perlite
- 83 tonnes of steel
- 80% of the steel removed was suitable for reuse or recycling

Photographs:

Top left, the pressure vessel is taken apart

Top right, Dragon was a unique research reactor

Right, Winfrith is being gradually restored



Winfrith delicensing

A large part of the Winfrith site - equivalent to 10 rugby pitches - has now been released from the nuclear licence.

The 10 hectares of land, representing 12% of the site, were delicensed by the Office for Nuclear Regulation last month (September), an achievement that marks many years of clean-up work. Signs marking the site boundary have now been moved.

Over the years, a number of research facilities plus other buildings were decommissioned and demolished, including the zero energy reactor halls and fissile material store. 'Zero energy' reactors were designed only for research into areas such as core design and refuelling, and produced no power. Grass now grows over the land.

The final piece in the site restoration jigsaw will be the lifting of the directions giving the NDA responsibility for the site, which must be issued by the Secretary of State, and will allow the land to be transferred to another business operator and brought back into use for a different purpose.

Now, with more than 30% of the Winfrith clean-up programme complete, around half of the original area has already been released for commercial use.

spotlight on
Magnox

Wylfa keeps the lights on

Wylfa has been given the go-ahead to transfer fuel between its reactors, enabling electricity generation to continue until September 2014, almost four years past its original closure date of December 2010.

The move could potentially generate an additional 4.6TWh and approximately £200 million gross income to the UK taxpayer, supporting the NDA's decommissioning mission.

The Anglesey power station was permitted to continue using one reactor, transferring partially used fuel from Reactor 2 to Reactor 1, following several independent reviews. Reactor 2 closed in April after operating for 41 years.

Magnox fuel is no longer manufactured, so the transfer of still-useable fuel from one reactor to another has been important in allowing generation to continue. The technique was first used at Oldbury, which closed in February, and adapted at Wylfa. Transfer of fuel, or Inter-Reactor Transfer (IRX) has continued during the recent outage, when the plant was taken off-line for technical reasons.

Stuart Law, Wylfa Site Director, said: "It is a credit to the staff who have supported Wylfa throughout its 41 years of generation and I look forward to working with them through the final phase of generation – the IRX phase."

To date, 204 fuel channels (1,224 fuel elements) have been transferred from Reactor 2 into one of the site's dry fuel stores before being moved to refuel Reactor 1. The whole process requires comprehensive checks and safeguards, together with a full programme of training for staff and changes to operating procedures.

Fuel in the closed reactor also needs to be maintained in a safe state.

A shut-down reactor still requires appropriate cooling, due to the heat produced by the decaying fission products from the nuclear reaction when it was operating at power (referred to as decay heat).

This decay heat significantly reduces once a reactor has been closed for more than a few days. However the cooling requirements for Reactor 2 will be kept the same as an operational reactor that is shut down for maintenance.

Photograph: A fuelling machine is carefully manoeuvred into place.

Check them out

Barcodes are a background feature of modern life, quietly appearing everywhere from supermarket goods and airport luggage tags to theatre tickets and, now, nuclear waste.

The recent introduction of barcode technology has enabled Magnox to pioneer an innovative tracking system at all sites that, for the first time, provides immediate access to comprehensive up-to-date information on waste streams.

The 'cradle to grave' system, means all waste can be tracked as it progresses through treatment and disposal routes, while also providing confidence to the regulator that waste packaging labels accurately describe the contents. The system also supports sites' emergency scheme arrangements allowing instant analysis of records in the event of a site incident.

The barcode technology involves scanning waste packages for an instant electronic report detailing contents, which saves significant amounts of time and effort. Hinkley has been leading on introduction of the system, and is sharing the experience with both EdF and the Low Level Waste Repository (LLWR), who are investigating its potential for use at their own sites.

Paul Mountford-Lister, Magnox Environment Agency Lead, said: "A waste tracking/accountancy system is an essential element of a management system designed to ensure that the application of the waste management hierarchy can be simply, consistently and effectively demonstrated.

"We are pleased to see the implementation of the system on Magnox sites and encourage its further development to deliver a consistent approach to the categorisation, control and reporting of radioactive, hazardous and controlled wastes. Implementation of the system across 10 sites will enable Magnox to efficiently report how it is optimising its waste processing systems across the fleet to maximise their financial and environmental impact."

John Collinson, Magnox Waste Director, added: "The development of the system is ongoing and work is in progress to fully integrate records for GNS yellow boxes and their contents. This will provide detailed information to the Radioactive Waste Management Directorate and aids their plans for a geological deep disposal facility."

Photograph: Barcodes give instant access to information.

Are you nuts?

Picture courtesy of npmimages.com

It sounds nutty but the removal of contaminated walnut shells has helped to reduce the amount of Intermediate Level Waste (ILW) being stored at the Trawsfynydd site.

The shells are commonly used as a soft abrasive because they can remove paint, grease and other debris without damaging the surface underneath.

During the 1990s, the procedure was used to clean eight steel sections of the site's former fuelling machine rings, each weighing 60-80kgs, which were subsequently categorised as ILW.

However, a 'kernel of an idea' led to the careful removal and vacuuming of the radioactively contaminated walnut shell debris, allowing the rings to be re-categorised as Low Level Waste. This highly successful process enables the metal to be recycled and means Magnox don't have to shell out on ILW processing and long-term on-site storage costs.

Vic Belshaw, Programme Delivery Manager at Trawsfynydd Site, said: "Our initial tests showed the steel was not as radiologically active as first predicted and it was in fact walnut debris inside the rings which was the main source of the higher levels of radiation.

"Removing the debris means we can reduce the amount of waste stored at Trawsfynydd, reducing the long term legacy of the site."

The removed walnut debris can be disposed of through an existing waste stream.

Stripping back to the basics

Around 2,000 tonnes of asbestos cladding have now been removed from structures at Chapelcross site as Phase One of the project comes to a close.

The project is the largest-known asbestos strip in Europe, aiming to remove 3,300 tonnes of asbestos and man-made mineral fibres from the Scottish site.

Since stripping started in 2009, the lagging material has been removed from eight turbines, four dump condensers, 16 heat exchangers, pump houses and a range of associated ducts and pipework. Before the stripping began, two years were spent encasing the heat exchangers in £3 million weatherproof enclosures to contain any fibres and protect from wind and rain.

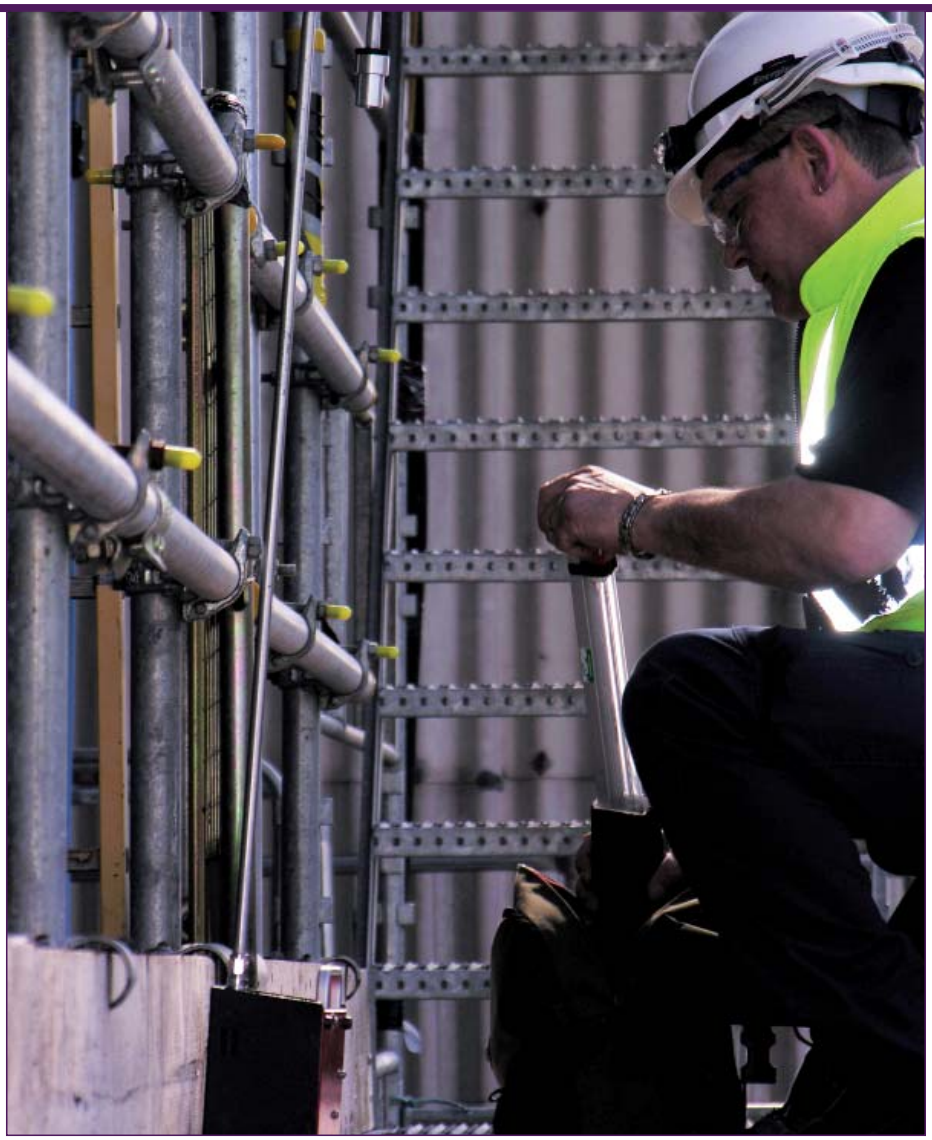
This required more than half a million feet of scaffolding, almost 200,000 fittings, 276 ladders, 24,000 square metre of sheet cladding. Placed end to end, the scaffold boards would stretch from Manchester to Bristol.

Site Director John Grierson said: "This is a tremendous achievement for the site and our contractor Kitsons. The safe, early and cost-efficient delivery is testament to the quality of the personnel working on the project. I look forward to similar excellent performance as we deliver Phase Two."

Once the bulk asbestos is removed, the steelwork left exposed is fine-cleaned by hand, taken back to bare metal and then washed down. Fibre levels within and near the enclosures are monitored constantly.

In all, more than 617,000 man-hours have been spent on the project, 23,000 of them on training to ensure the safety of workers, many of whom have been working at heights of up to 90 feet and in temperatures ranging from 13 degrees below freezing to 28 degrees C.

Starting in autumn, the second phase will remove the remaining bulk asbestos from all four reactor buildings and is scheduled to finish in 2016.



Fact File

- Asbestos was widely used during construction of the Magnox sites.
- In the 1939 film Wizard of Oz, industrial-grade asbestos was used to simulate snow.
- When delivery of the Magnox Optimised Decommissioning Programme (MODP) began last year, almost 25,000 cubic metres of asbestos were present on Magnox sites.
- Under MODP plans, all asbestos will be removed from Magnox sites by around 2025, much earlier than previously planned.
- Sizewell has recently completed removal of asbestos from external steam pipes on the reactor buildings and turbine hall.
- The Chapelcross project is ahead of schedule and due to be completed under budget.
- Approximately 100 staff and contractors are working on the project.
- More than 225,000 bags have been used to package the materials.

Photographs:

Opposite page, more than half a million feet of scaffolding were used to encase the heat exchangers

Top, constant monitoring is one of many precautions required for asbestos work

Left, the turbines are now free from asbestos

A closer look at pond life

Work continues at pace to decommission cooling ponds across a number of the Magnox sites. The aim of the £300 million programme is to reduce the hazards of the highly radioactive facilities, and associated plant, in ways that are safe, cost-effective and comply with regulatory requirements.

Magnox is taking a 'lead and learn' approach across all its work programmes. The Ponds Programme team was fundamental in pioneering this strategy, initially starting with a team at Hinkley who moved on to Bradwell, bringing the learning, innovation and best practice with them to inform the next set of challenges.

Steve Walters, Magnox Ponds Programme Director, said: "Dealing with the ponds legacy is particularly important in realising the benefits from the Magnox Optimised Decommissioning Programme. The programme is active on five sites and the team continuously share learning across these sites to ensure safe, innovative and cost-efficient solutions."

The ponds task isn't a small one: the team will tackle eight Magnox sites (Berkeley's ponds were decommissioned in the 1990's and Wylfa uses a dry store), applying a consistent approach where the ponds are first drained of liquor and then decontaminated to a level that will enable entry to the Care and Maintenance (C&M) phase - facilities remaining on a site are made safe and left passively until final dismantling decades later.

Innovation is vital to overcome challenges, with a focus on adapting technologies and off-the-shelf equipment from outside the nuclear arena rather than developing expensive bespoke solutions. Examples include:

- Replacing the electrical drive system of a mini-digger with water-powered hydraulics, enabling underwater operations to recover, for example, bulk sludge.
- A floating 'pontoon' system (as used in marinas) which forms a working platform on the pond surface, dropping lower as the liquor drains down.
- A freeze-dredge system traditionally used for clearing silt from water channels, but now for retrieving mixed wastes from the Bradwell pond centre bay.

The pontoons were first introduced at Hunterston - which has the largest Magnox pond at around the size of an Olympic swimming pool – for workers using ultra-high pressure jets to remove contamination from the pond walls.

At Bradwell and Chapelcross, individual ponds have been completely drained and stabilised, while the draining of Hinkley Point ponds has recently started. Although the steps are the same at all sites, some bring greater challenges, such as Trawsfynydd, where the ponds walls are being scabbled to remove contaminated surface concrete.

Fact File

- Concrete-lined ponds store irradiated fuel as it is removed from the reactors.
- The fuel is stored in skips.
- Water cools the fuel and acts as a barrier to radiation.
- Spent fuel can be stored in ponds for long periods, sometimes years.
- Ponds also contain various kinds of debris and sludge.
- During 2011, 3,000 cubic metres of pond water were drained from Magnox ponds.
- More than 20,000 cubic metres remain to be drained– the equivalent of more than 50 standard swimming pools.
- By the end of 2015, just over 7,800 cubic metres will remain.
- Hazard will be completely removed by 2020.
- The programme team are currently working at Bradwell, Chapelcross, Hinkley Point, Hunterston A and Trawsfynydd sites.
- The optimised 'lead and learn' approach will save approximately £45 million from the original estimate.

Photograph:

Empty pond at Chapelcross