

ISSUE 22 2017

INSIGHT

into nuclear decommissioning

NDA
Nuclear
Decommissioning
Authority

Delivering progress across the UK



INSIDE:
Five-page
focus on
**NDA Estate
Supply Chain
Event 2016**

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Front cover: *Nucleus (The Nuclear and Caithness Archive)* is set to open its doors - see page 28

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Advertising contracts

Smaller businesses will be able to easily view a wide range of sub-contract opportunities across the NDA Estate when a new 'Publishing' module on the Complete Tender Management (CTM) system launches at the end of January.

Almost 30 major private-sector businesses in the Tier 2 category have agreed to join the NDA led-initiative. They will advertise sub-contracts in CTM, which will be added to the Government's Contracts Finder portal aimed at smaller suppliers in the Tier 3, 4 and Small and Medium-sized Enterprise (SME) community.

More than 60 per cent of the NDA's annual £1.7 billion supply chain spend is with 30-40 Tier 2 businesses or consortia, who place sub-contract requirements for goods and services.

NDA Supply Chain Manager Sam Dancy said: "Our initial aim is to encourage publication of opportunities worth up to £250 million a year and we expect more businesses to join as the scheme gets under way."

Using the CTM portal as a single advertising location supports

the government's drive to boost the economy by increasing the involvement of SMEs in public contracts. Its target is to encourage the top 500 government suppliers to advertise public sector sub-contracts more widely.

Public sector contracts are advertised on the Government's Contracts Finder portal, however, private-sector businesses use a diverse range of electronic and printed formats to advertise sub-contracts.

Businesses interested in viewing the sub-contract opportunities will need to register on CTM to view details of available contracts, relevant buyer contact details and will then be directed to the relevant location for completing paperwork to pre-qualify.

Sam added: "We are committed to helping facilitate wider involvement from SMEs and new participants. Greater levels of awareness of contracting opportunities will also encourage competitiveness, greater capacity and capability, and to fulfil NDA's goal to become the Nuclear Client of Choice."

To register on CTM:

<https://sharedsystems.eu-supply.com/login.asp?B=SELLAFIELD>

Tier 2 businesses and consortia in the scheme

- Cavendish Nuclear
- Nuvia
- Morgan Sindall Arup (ISA)
- AXIOM (Amec, Jacobs, Mott McDonald, Assystem)
- SMF Delivery Team (Silo Maintenance Facility: JV Cavendish Nuclear & Balfour Beatty)
- National Nuclear Laboratory
- Bechtel Cavendish Nuclear Solutions
- Hertel (UK) Ltd
- Costain
- MW High Tech Projects UK Ltd
- Carillion Construction Ltd
- BEP Delivery Team
- Mitie Facility Services
- Ansaldo Nuclear Engineering Services
- ACTiv Nuclear (Atkins, Carillion, Jacobs)
- Shepley Engineers Ltd
- Balfour Beatty Civils
- Interserve
- Cumbria Nuclear Solutions Ltd
- PX Limited
- Doosan Babcock
- Jacobs Stobarts Limited
- Kaefer Ltd
- Jacobs E&C Ltd
- Amec Foster Wheeler Nuclear UK Ltd
- URS E&C UK Ltd
- AECOM Infrastructure
- Graham Construction Ltd
- James Fisher Nuclear



NDA Chief Executive John Clarke opened the event

Record turn-out as supply chain event keeps on growing

A record 1,500-plus visitors enjoyed a day of exhibitions and informal networking at the busiest ever NDA Estate Supply Chain Event.

Businesses from across the UK and overseas were represented at Manchester's EventCity venue, with delegates from as far afield as Canada, the US, Japan, India, Singapore and Europe.

Organised jointly by the NDA and its Site Licence Companies, a key goal is to create greater visibility of opportunities for suppliers and in particular for Small and Medium-sized Enterprises (SMEs). Around half the visitors were from the SME community.

Since launching six years ago, the event has become established as one of the largest nuclear decommissioning supplier days in the world.

The 2016 event day was formally opened by NDA Chief Executive John Clarke, who highlighted the importance of suppliers in providing skills and innovation, together with a new drive to encourage wider advertising of contract opportunities (see page 2).

The main hall featured almost 300 exhibition stands, staffed by technical and service suppliers, alongside information stands representing the NDA, all the SLCs, government bodies and regeneration organisations.

New for 2016 was a Skills Zone where a range of organisations were able to offer guidance, advice and one-to-one discussions.

The ever-popular Innovation Zone, supported by the

government's Innovate UK, hosted more than 40 exhibitor companies, who held demonstrations of leading-edge technologies during the afternoon.

Other government departments attending included:

- The Ministry of Defence's Submarine Enterprise Programme
- Department for International Trade
- Crown Commercial Service
- Welsh Government

Ron Gorham, NDA's Head of Supply Chain Optimisation and SME Champion, said: "The success of our mission depends on vibrant, dynamic businesses providing solutions to the many challenges. We remain committed to working with the supply chain, from the largest to the smallest players, to improve opportunities for involvement in decommissioning.

"The last event was the most successful so far. We know that suppliers value the opportunities for networking with other businesses suppliers and speaking directly to leading figures from across our estate.

The event is part of a series of initiatives developed over recent years to encourage and support the supply chain.

One of the morning highlights was the presentation of the NDA Estate awards: **see pages 4-7.**



Awards recognise vital role of suppliers

The winners of this year's prestigious NDA Estate Supply Chain Awards were announced to a packed audience in Manchester.

The awards recognise the vital contribution of suppliers to the UK's nuclear clean-up and were among the highlights of the NDA Estate Supply Chain Event, held at EventCity. Entries were submitted in six categories including innovation implementation, SME innovation, collaboration and export success. This year, there was also a new award for skills development.



*Photographs:
Top, the trophies
Above, attendees enjoy opportunities for networking
Opposite, everyone seated ready for the award ceremony to begin*

Survey Feedback



NDA
Nuclear Decommissioning Authority

QUOTES

'Brilliant day for business'

'Always a great event'

'Great exhibition!'

'One of the best eight-hour investments you can make'

'Excellent networking opportunities'

FEEDBACK FACTS

96% of respondents rated the event as successful

Almost 90% of respondents made new contacts during the day

19% were new to the nuclear decommissioning market

Almost 60% found the Innovation Zone useful

Award Winners



Enhancing Capability and Capacity

This new award was aimed at suppliers who supported a range of skills programmes and initiatives in their own businesses or supply chain partners.

WINNER

Profile Security Services:

Setting up a partnership with Dounreay and Wick Jobcentre Plus to create 'Return to Work', 'Work Experience' and 'upskilling' opportunities in the security industry for local young people.

HIGHLY COMMENDED

Stainless Metalcraft Ltd:

A project to develop more home-grown talent, culminating in establishing an apprentice Training Academy – the Fenland Engineering Skills Centre. The company is celebrating 100 years of training apprentices on its site.

Technology and Innovation Implementation

This award recognises the innovation and collaboration required to take technology or innovation through to successful implementation at an SLC.

FIRST WINNER

OC Robotics and TWI Ltd, with Sellafield Ltd: An integrated snake-arm robot and laser cutting technology which successfully completed an active in-cell size reduction task at Sellafield, demonstrating versatility for in-situ decommissioning.

SECOND WINNER

NNL and Westinghouse (Fauske & Associates LLC) with Sellafield: Working at the UK's highest hazard facility, the Magnox Swarf Storage Silo, the combined expertise of this group radically improved understanding of the stored waste's chemical behaviour. The results will lead to faster waste retrieval and hazard reduction, plus estimated savings of more than £1 billion.

Innovation by small and medium-sized enterprises (SMEs)

An award for smaller businesses, the innovation can be a new product/process or adaptation of technology from other non-nuclear markets.

WINNER

Omniflex: Working for and with NNL at their active handling facilities at Sellafield, Omniflex designed, built and installed a replacement radiological monitoring system of 130 instruments, to a tight timescale and ensuring 100% plant availability during the works.

HIGHLY COMMENDED

DBD Ltd: The Resilience Project followed Fukushima which prompted fundamental reviews of nuclear power plants worldwide. DBD were tasked by Sellafield to design and implement the Resilience Evaluation Process which examines nuclear facilities, identifies fault pathways and the effectiveness of the emergency response.



Collaboration

This award looked at collaboration in its widest form and was open to suppliers and organisations working within the supply chain.

WINNER

ACKtiv Nuclear with Shepley Engineers and Sellafield: The ACKtiv Nuclear joint venture of Jacobs, Atkins and Carillion is pioneering advances into risk reduction, seeking fit-for-purpose solutions and embracing innovation. The start of bulk sludge transfers from the FGMSF was only possible through the collaboration between ACKtiv Nuclear, Sellafield and the supply chain, particularly Shepley Engineering.

HIGHLY COMMENDED

Nucleargraduates: The success of the *nucleargraduates* scheme comes from the 11 sponsor organisations from nuclear, defence and regulators, as well as the 20 secondment host organisations which includes SMEs, government departments and international hosts.

Export

An award for companies who have successfully exported overseas from concepts, products and services originating in the NDA estate.

WINNER

Nuvia: The Ignalina fuel-handling equipment incorporated Nuvia's accumulated knowledge gained from their combined experience of remote handling equipment, including designs for nuclear fuel grabs, remote cranes and controls as well as safety systems, acquired from years of work on NDA estate projects.

Minister's SME award

This recognises the value, flexibility and innovation that SMEs bring to the mission.

WINNER

Stainless Metalcraft Ltd:

The judges loved the story of 100 years of apprenticeships at an SME that intends to recruit up to 10 apprentices every year until at least 2020. It showed a company determined to supply equipment for high-integrity, mission-critical items well into the future, with its next generation of engineers trained to the highest standards.



"Our suppliers play a critical role in delivering timely, cost-effective decommissioning across our sites, and we are delighted to acknowledge their vital contribution."

Chair of the judging panel Ron Gorham, NDA's Head of Supply Chain Optimisation and SME Champion

*Photographs:
Opposite, EventCity
Above, winners with their awards*

Progress at Sellafield

“Five years ago, we couldn’t have envisaged that we would be looking at bulk retrievals from all four facilities in this decade”

Duncan Thompson



Years of careful planning are now beginning to pay off

Years of careful planning and preparation are paying off at Sellafield’s ageing ponds and silos as huge steps forward are made on removing the long-stored hazardous waste.

All four facilities, collectively known as ‘Legacy Ponds and Silos’ (LP&S), have reached significant milestones during 2016, putting in place the vital building blocks that will speed up progress in dealing with the mixed inventory of highly radioactive material that has been kept in them for decades.

Dating from the earliest days of the UK’s post-war nuclear industry, the LP&S initially provided storage for spent fuel and associated waste from the weapons programme, but have also taken additional spent fuel from the Magnox power stations.

The two ponds and two silos contain waste from different sources, with different characteristics, each

requiring a set of bespoke solutions for both retrievals and treatment. Together, they represent the highest hazards on the NDA’s 17 sites and are the top clean-up priority.

“We have reached a historically significant point in tackling these facilities. Increased focus and investment, together with greater involvement of the regulators through the collaborative G6 forum, are paying real dividends,” said the NDA’s Sellafield Programme Director, Duncan Thompson.

“The teams worked through uncertainties in inventory and technology; they also challenge themselves continuously and seek innovation.”

Sludge removal bulks up

At the First Generation Magnox Storage Pond (FGMSP), new equipment is enabling large quantities of sludge to be removed from the pond floor and transferred to a packaging plant.

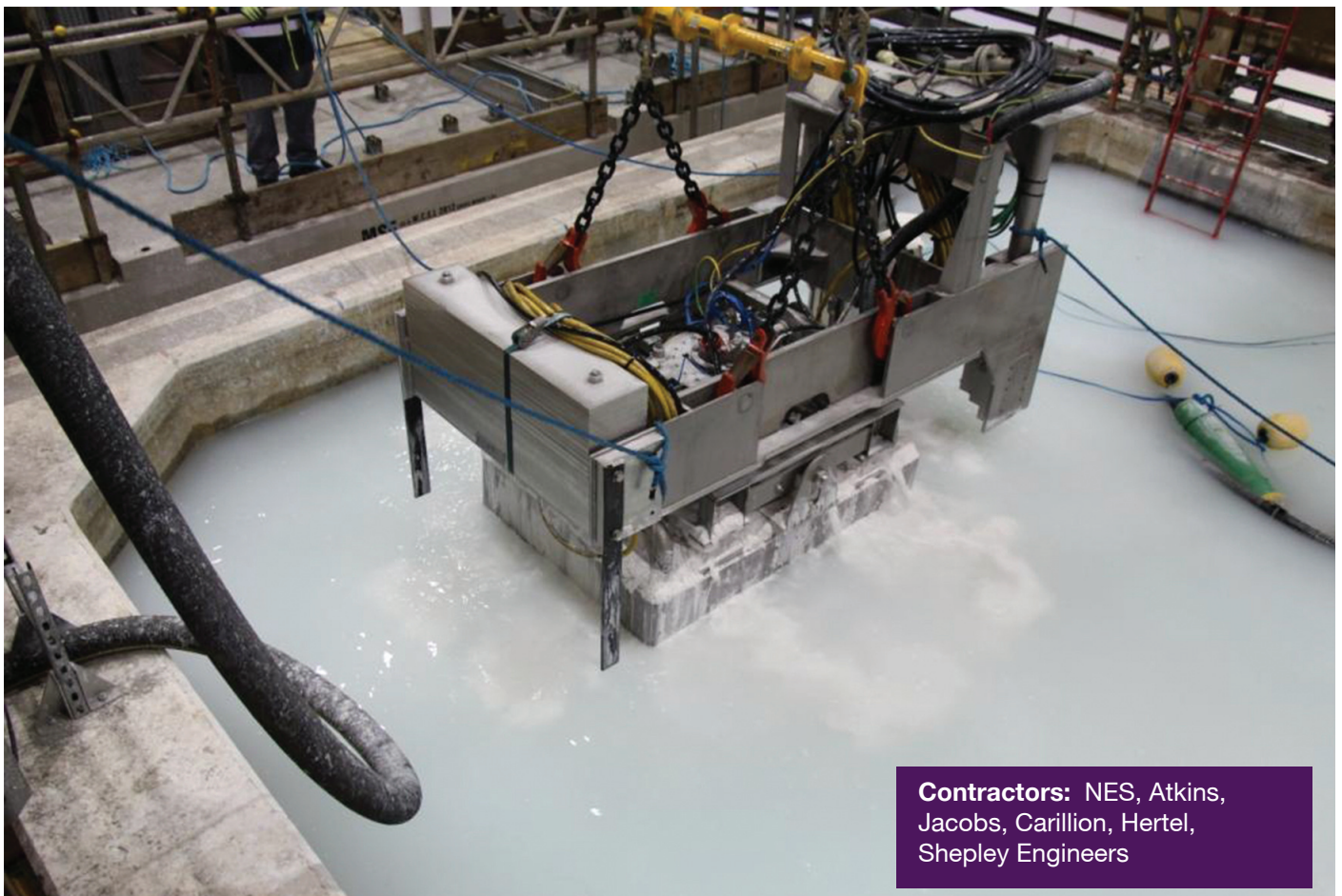
The six-metre deep pond dates from the 1950s and, as well as sludge, holds spent fuel from the Magnox power stations, skips and miscellaneous material. Sludge consists mainly of corroded waste material, as well as organic matter such as algae and wind-blown vegetation. It is highly radioactive and up to one metre thick in places.

The very first sludge removals began on a small scale in 2015, via a newly installed pipe-bridge, while the first skip of fuel was hoisted out in April last year, demonstrating that all the pieces were in place to begin a sustained programme of emptying the pond contents. With the new Bulk Sludge Retrieval Tool in place and working 10 months ahead of schedule, the rate of sludge removal will now increase.

Bulk fuel and sludge exports are expected to be complete by 2022, when risks and hazards associated with the pond will be massively reduced. The retrieved contents will be treated, when appropriate, and packaged for long-term storage.



*Photographs:
Above, an aerial view of FGMSP
Below, bulk sludge retrieval tool being
tried at NES*



Contractors: NES, Atkins, Jacobs, Carillion, Hertel, Shepley Engineers

Pond sludge transferred for the first time

In December 2016, the Pile Fuel Storage Pond saw sludge removed for the very first time and moved to a nearby treatment plant before being put into a 500-litre drum.

The drums are being exported to an encapsulation plant for grouting in cement and then transferred to a storage facility, where they will be kept before final disposal in a Geological Disposal Facility.

The PFSP was built in the 1940s to take irradiated fuel from the Windscale Piles, supporting the UK's military programme, and is the world's largest open-air spent fuel pond as well as the UK's oldest nuclear storage facility. It contained 1,000 different wastes including skips, sludge and redundant equipment.

The sludge removal is expected to be completed by 2022, while the pond will be ready to start de-watering in 2019. This is around 10 years ahead of the original schedule and, at £100 million, half the original estimated cost.

In February 2016, all the bulk metallic fuel was lifted out, marking a 70% reduction in radioactive content. Sludge constitutes around one third of the radioactive material still remaining in the pond.

Contractor: Nuvia, Amec, Hertel and Cavendish



Photographs

Left, the area of the pond where the sludge has been corralled so far
Inset, the Drum Filling Plant, where sludge is put into a drum before transfer to the Waste Encapsulation Plant for grouting

First machine ready for work

The Magnox Swarf Storage Silo (MSSS), which opened in 1964, contains metallic debris produced when the outer cladding was shaved off spent Magnox fuel before being sent for reprocessing. The debris, known as swarf, is stored under water in 22 compartments.

The highly radioactive contents will be scooped out by three 360-tonne machines that are being constructed off site and installed in situ, module by module. The first Silo Emptying Plant machine, SEP2, has now been fully assembled and is ready to undergo the inactive commissioning process before deployment on the swarf.

The final pieces were put together almost one year after the first module was lifted into place in November 2015. Construction involved 100 lifts, to install the 22 modules comprising 13,500 different parts.

Chris Halliwell, Sellafield's Head of MSSS Programme, said: "This tremendous achievement has called upon the skills, expertise and dedication across the programme as well as our colleagues in the supply chain."

Contractor: Ansaldo NES plus Shepley, Amec, Hertel

*Photograph
Below, the first Silo Emptying Plant is installed at the MSSS*



Radioactive waste Study wins top award

A ground-breaking scientific study into how Intermediate Level Waste (ILW) behaves at the MSSS has been recognised in global chemical engineering awards.

The research into waste at Sellafield's most hazardous legacy storage facility won the Process Safety category in the IChemE Global Awards last November.

Sellafield Ltd and National Nuclear Laboratory (NNL) won for their four-year study on the viability and safety of storing MSSS waste in 3m³ boxes. The research centred on the long-term behaviour of the waste and the corrosion of magnesium and uranium.

It confirmed that Sellafield Ltd could move from a 22-step process, which would have required construction of a £multi-million plant, to a simpler and ultimately safer process. This involves placing waste directly in a shielded box for storage before transfer, decades later, to an underground repository. It means waste retrievals at MSSS will be accelerated by around four years.

The research is also paving the way for other nuclear waste material at Sellafield to be managed in this simpler, more fit-for-purpose way.

Progress
at Sellafield



**"Like keyhole surgery
but on an industrial
scale"** Gary Snow



The last door, ready to leave Rosyth where it was constructed

Doors set to open on new era

At the Pile Fuel Cladding Silo (PFCS), the last of six huge stainless steel doors has now been fixed in place, which will be key to gaining access to the building and lifting out the contents.

Each highly engineered door is equivalent in weight to around 150 adult men. Holes will be cut behind the doors enabling remote grabs to reach in, drop down and pull out the waste.

The PFCS is the oldest of the four legacy facilities. It stores cladding removed from the Windscale Pile fuel that helped to create the UK's nuclear deterrent. Material was tipped in from the top and Magnox cladding was later added to the mix.

The air inside the silos was replaced by inert argon gas in 2001 to reduce the risk from fire. Although non-toxic, argon cannot be breathed so all work must be carried out remotely and the atmosphere must be maintained during retrievals.

Meanwhile, engineers are using an innovative water jet to remove plates of steel while maintaining the sensitive inert atmosphere.

The large metal deflector plates were used to properly

direct waste into the chambers from the tunnel that originally ran along the top of the silos, and need to be removed before the contents can be taken out.

Each deflector plate is about the size of a small car and welded firmly in place. After making openings in the walls, engineers are cutting each of the six deflector plates into approximately 150 pieces each. Using water and finely ground stone blasted at the speed of sound prevents sparks from being creating during the cutting.

Gary Snow, Head of the PFCS programme, said: "Removing the plates inside the silo is like keyhole surgery, but on an industrial scale."

The pieces of steel fell into the storage chambers and will be removed along with the cladding when waste retrievals begin, scheduled for 2020.

Contractors: James Fisher Nuclear, Shepley Engineers
Bechtel Cavendish Nuclear Solutions and BMT

Waste returned to overseas customers

Two further shipments of highly active waste have been successfully completed as part of a programme to return foreign-owned material from Sellafield to overseas customers

International Nuclear Services (INS), the NDA's nuclear shipping subsidiary, dispatched the vitrified waste in two separate transports to Japan and Switzerland.

The Pacific Grebe, one of a fleet of specialist nuclear cargo vessels, sailed from the port of Barrow and arrived in Japan at the end of October, carrying 132 canisters of waste.

It was the sixth shipment in the Vitrified Residues Return programme, a key part of the NDA's strategy to clean up the Sellafield site, fulfil contracts with overseas customers and deliver UK Government policy.

Sellafield's THORP plant reprocesses spent fuel from the UK's fleet of

operational nuclear power stations and from overseas customers in Japan, Switzerland, Germany, Italy and the Netherlands.

Following reprocessing, which separates the fuel into components that can be re-used as fuel, the remaining high level waste is converted into a solid glass form that is suitable for permanent disposal.

An earlier shipment of waste, 28 containers, arrived in Switzerland during the same month after being transported by sea to Cherbourg, and then by rail through France. This marks the final delivery to Switzerland.

INS Managing Director Mark Jervis said: "The successful completion

of these shipments is a significant milestone in the UK government's strategy to return highly active waste from Sellafield to overseas customers.

"The way we transport nuclear materials is safe, secure and tried and tested, and we know that with meticulous planning and close working between Sellafield Ltd, INS and our partners, we can continue to deliver good progress in this important programme."

INS has been transporting nuclear materials around the world for 40 years, covering more than five million sea miles, without a single incident resulting in the release of radioactivity.

The Pacific Grebe sailed from the port of Barrow



Bradwell

leads the fleet



Bradwell has been notching up a series of major achievements as the site prepares for the hugely important care and maintenance phase when all near-term decommissioning will be complete.

The most obvious sign of recent change is the new weather-proof aluminum cladding that encases the two reactor buildings, a project that began in 2012. More than 288,000 individual fittings were used on the protective shell, now fully visible after the removal of 690 tonnes of scaffolding and two large tower cranes.

Magnox Closure Director Scott Raish said: “Preparing for an 80-year care and maintenance period often means building things as well as demolishing them. This is the biggest construction project we will undertake and completing it safely is a huge step towards our end goal of closing this phase of decommissioning.”

More than 900 people worked 980,000-plus hours on the project. To cope with the extra workers on site, Magnox operated a park and ride scheme from a local airfield. The volume of traffic on local roads has now eased. Focus now continues on processing waste with the intention of completing the work during 2019.

Another success milestone for the entire Magnox fleet was the emptying of Bradwell’s 18 waste vaults. The underground vaults contained radioactive metal, sand, sludge and other material which had accumulated over the 40-year operational life of the power station. One of the primary aims was to safely recover the material, characterise it and find the most suitable treatment or disposal route. Some metallic waste, the Fuel Element Debris (FED), is being dissolved in a specially designed plant that dramatically reduces its volume, while other types are being conditioned, then packaged, ready for storage until a Geological Disposal Facility is available.

In addition, three vessels, each weighing seven tonnes, were removed and size-reduced while more than 60 waste vault covers were also decontaminated. The vaults clearance means an area equivalent to five tennis courts, or 972 square metres, is decontaminated to a level where it can be covered and left for the C&M phase. Bradwell is the first in the fleet to be completely empty its vaults.

Cladding Contractor:
Vinci Construction

Pond decontamination marks another important step forward

At Bradwell's ponds complex, meanwhile, four years of hard work have resulted in the successful decontamination of more than 10,000 square metres of walls, floors and ceiling – equivalent in area to a rugby pitch.

The pond, once used to store spent fuel before transfer to Sellafield for reprocessing, were drained and stabilised in 2012.

Since then, work has been carried out to remove redundant equipment and decontaminate the rest of the buildings and infrastructure. More than 2.5km of pipework was removed and 120-plus tonnes of metal waste recovered and appropriately disposed of.

One of the next phases of work will be to demolish the redundant ponds building and remaining ancillary structures, followed by installation of weatherproof cladding over the remaining buildings.

Scott Raish added: "The learning gained from reaching these milestones is invaluable as we move into our next phases of work on site and take another important step towards care and maintenance."

Care and Maintenance

By 2019, only the two reactor buildings, the weather-proofed pond structures and the ILW store will be left. Security staff will patrol the silent site, with just repairs and maintenance activities taking place for the decades ahead.

Eventually, natural radioactive decay will enable the remaining structures to be safely dismantled and the waste transferred to the UK's Geological Disposal Facility. The land will then be available for development.

Bradwell will be the UK's first Magnox site to reach this state – the rest will follow over successive years until the last one falls silent in just over 10 years' time.

Contractors: Magnox workforce with support from Squibb Group, Trant Engineering and Vinci Construction

*Photographs:
Opposite page, the new cladding
Below, cutting up the last delay
monitoring tanks at the pond*



Progress at Dungeness



Divers plumb the depths

Specialised divers are descending into ponds containing spent nuclear fuel, where they have been cutting up containers and helping to clean up sludge.

The team working at Dungeness A are highly specialised professional divers brought over from the US, where the practice is more widely used in the nuclear industry.

Water in the ponds provides radiation shielding, enabling the divers to work near empty fuel storage skips, sludge and other submerged equipment, and to gain access to awkward or cluttered areas.

Wearing full protective gear and breathing apparatus, the divers are guided carefully while below the surface, and subject to rigorous monitoring when they emerge.

Preparatory measures includes installation of a platform with ladders, electrical arrangements, cranes to receive and move retrieved packages, dose monitoring equipment, as well as extensive engagement with the Office for Nuclear Regulation.

The conventional UK approach to ponds clearance is based on remotely

operated equipment, used to hoist skips intact from the water and then cut them up in air, a slow process that potentially exposes workers to higher doses.

The trial has demonstrated that diving reduces dosage to workers while enabling faster, more efficient removal of pond contents. Subject to agreement from the regulators, it is planned to use divers at Sizewell A and Oldbury, benefitting from the learning at Dungeness A.

During electricity generation, the ponds stored used fuel in skips before it was sent for reprocessing. The site has been fuel free for more than four years but the skips, classed as Intermediate Level Waste, need to be safely disposed of.

Once cut up, the skips will be stored in waste containers inside a shielded storage area on site before being packaged for interim storage.



Contractor: Underwater Construction Corporation UK Ltd

*Photographs:
Top, preparing to dive
Above, a diver undergoing checks*



Reactor dismantling work steams ahead

One more piece of a complex engineering jigsaw is now being put in place, finally allowing the core of an iconic experimental reactor to be removed.

Work will soon be complete on isolating the reactor from all the plant and equipment that allowed it to operate.

This involves removing 1.5km of highly irradiated stainless steel pipework which fed water through the reactor, producing steam to drive the turbine and then re-circulating the condensed water.

The complexity meant months of planning and preparation, including creating full-scale plant mock-ups.

At minimal risk, staff were able to rehearse the work in detail, learning valuable lessons in the process. Once the pipework – the steam

risers and feeders – is removed, access to the reactor core for decommissioning will be possible.

Kevin McIntyre, Reactors Programme Manager, said: “The removal of the steam risers and feeders represent the culmination of many years of precursor work.

“This led to the eventual safe removal of the reactor core, demolition of the SGHWR complex and eventually returning the land to heathland.”

Over the last two years, major items have already been removed from the reactor, including the heavy water circuits, cooling water circuits,

pumps and pressure relief valves, which paved the way to access the steam feeders and risers.

John Clarke, NDA Chief Executive, said: “This milestone at Winfrith is an important step forward. With a project as demanding and complex as this, it is important to consider the options carefully. The Magnox Ltd programme team have been thorough in exploring the safest and most cost-effective approach to this project as it moves towards completion next year.”

Contractor: James Fisher Nuclear and Kaefer

FACT FILE

Winfrith’s former Steam Generating Heavy Water Reactor (SGHWR) was the largest of nine reactors at the Dorset site, and one of only two now remaining – Dragon is also being decommissioned.

Producing enough power for a small town, the SGHWR opened in 1967 and operated for 23 years. It used ordinary water as a coolant and supported a major experimental programme which provided information and experience on water-cooled reactors.

After closure, extensive decommissioning began immediately and is still under way.



Highly irradiated pipework is being removed



spotlight on Dounreay

We've got the NaK of destroying hazards

A highly radioactive liquid metal coolant used in one of Dounreay's experimental reactors, has been completely destroyed, removing one of the major hazards in the NDA estate.

Over a 10-year period, around 68 tonnes of the sodium and potassium blend, known as NaK, was removed from the Dounreay Fast Reactor (DFR). This required a specially built plant and removal system, then safe conversion to hydrogen gas and salt water.

The NaK was used to remove heat from the reactor's nuclear fuel.

Handling NaK is a particularly complex technical challenge as it reacts vigorously when exposed to air or water, eventually catching fire. This meant that it had to be kept under a nitrogen gas blanket to prevent reactions.

Reactors Director Ken Heider said: "The Dounreay team, in partnership with our supply chain, worked extremely hard over a long time to remove and convert the highly radioactive NaK into safe products."

Nigel Lowe, the NDA's Programme Director, Dounreay and Magnox, added: "This was one of the highest radiological hazards in the NDA estate, as well as a significant conventional safety hazard."

The bulk removal of NaK was completed in 2012 and, since then, work has been under way to remove the last of the coolant from the pipework and base of the structure. This final stage was extremely challenging because the hazardous material was difficult to access.

Detailed technical solutions, including remotely drilling through parts of the reactor, had to be developed. The team also had to work with outdated original drawings which, as the reactor had been modified over several decades, did not give a full reflection of the plant.

Focus now turns to the removal of around 1,000 breeder elements still in the DFR reactor vessel. This must be completed before cleaning and removing the reactor and its nine kilometres of cooling pipework.

Photographs:

*Above, Dounreay site, with the steel sphere of the DFR
Right, the NaK has finally been destroyed*



On target for liquid hazard reduction

Meanwhile, the last of the higher activity liquid waste produced during DFR fuel reprocessing has been made safe.

The 232 cubic metres of liquor, known as raffinate, have been encapsulated, with the material grouted in 875 drums and now suitable for long-term storage or disposal.

It is an important milestone in the immobilisation of all the liquid created by reprocessing undertaken during the operation of the three Dounreay reactors.

Batches of raffinate were remotely transferred from underground tanks to a cementation plant. Here it was neutralised and mixed with cement powder inside the 500-litre drums.

The cementation plant will now be modified and enhanced before the workforce begin to immobilise raffinate from the Prototype Fast Reactor (PFR).

“The difficulty of this task can’t be understated, and I welcome the news that this work is complete. Everyone involved should be proud of this achievement.”

Nigel Lowe





A great idea ... and as usual it's Calder's!

Calder Bain started working at Dounreay in the year that JFK was elected US president, Coronation Street was aired on TV for the first time and the farthing (worth 0.25p) was still in circulation.

Aged 15, the school-leaver signed up as an apprentice turner/fitter at the remote Scottish site near his home. It wasn't long after the old RAF airfield had been converted into a research site and construction activity was everywhere.

He watched many facilities being built, including the Prototype Fast Reactor (PFR), one of the pioneering experiments in fast breeder technology that promised to produce new fuel as a by-product of generating electricity, an approach abandoned in the 1980s

Now aged 71, he is incredibly still working. The emphasis, however, has switched to dismantling those ground-breaking plants as the site heads towards closure.

Bargain camera looks inside reactor

One of Calder's ideas was to use a £50 off-the-shelf CCTV camera, which is providing crystal clear images (right) from deep within Dounreay's Prototype Fast Reactor (PFR).

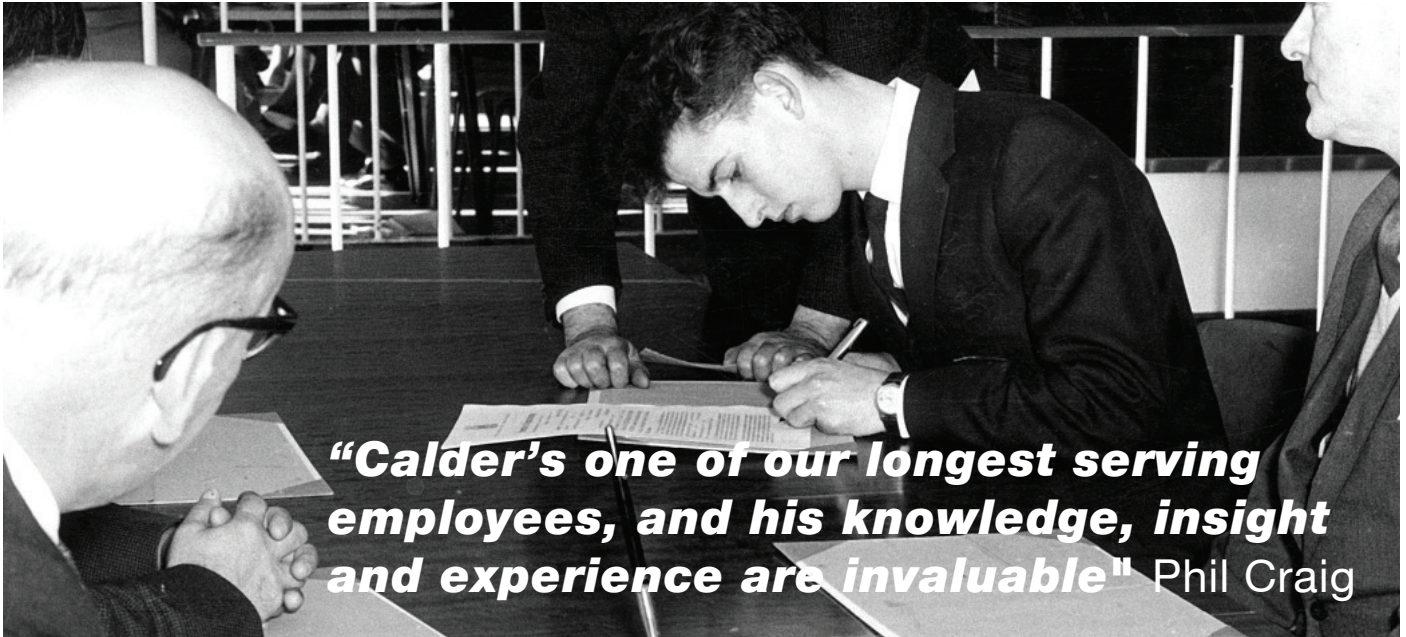
The reactor decommissioning team are viewing footage that will enable them to pull apart the innards of the second and last fast reactor built in the UK.

The camera will provide information to help dismantle the plant.

Calder said: "There is a continual requirement for inventive methods to dismantle a complex nuclear reactor."

Ken Heider, Project Director for Reactors, said: "We need to use lateral thinking and unique ideas to design and build the necessary equipment to safely take apart the plant and remove the reactor vessel. The use of simple off-the-shelf equipment like this is a credit to all DSRL staff and contractors involved."





“Calder’s one of our longest serving employees, and his knowledge, insight and experience are invaluable” Phil Craig

Calder became a draughtsman and then a senior design engineer. He was also the assistant plant manager of the fuel fabrication plant for eight years. Although he’s officially retired and has been working just three days a week for the last few years, now down to one day, his accumulated decades of knowledge and hands-on experience are proving indispensable.

He’s been helping to decommission the PFR since 2004 and has often been the brains behind some of the imaginative robotic tools that are being sent in remotely operated as radiation levels are too high for worker access.

The task is immense. Dounreay’s reactors are unique, developed by some of the country’s finest scientists who were totally absorbed by the challenge of making the complex technology work. There is no handy manual on how to safely dismantle contaminated, hazardous ageing nuclear reactors.

Led by Calder, a team of engineers has developed a series of individually designed tools to reach in, grab, cut, slice and lift hundreds of components out of the redundant reactor core that sits 40ft below ground level.

Sometimes the solutions are simple: like the piece of Blu-Tack on a long flexible pole, lowered into the reactor to pick up samples of metal particles for radiation checks. Calder has a lathe at home to work on some of his ideas. Once, back in 2010, he

took the castors off his sofa to fix on a device for probing radioactivity levels and shooting video footage inside pipe-work that had held liquid sodium coolant. The castors prevented the device from toppling over while rounding a bend.

“The best ideas come in the middle of the night and sometimes wake me up,” he explained. “I’d gone to sleep thinking about the camera in the sodium pipes and suddenly realised that castors would work.”

Many of the high-tech in-house solutions are manufactured locally, by small businesses that can respond quickly and readily to the adjustments required as a concept is gradually translated into functioning components.

It’s a system built on solid business relationships and personal involvement from the Dounreay team at every stage. Difficulties can be ironed out before they become insurmountable problems and new thoughts can be progressively taken into account.

A full-size test facility has been built right next to the reactor itself, allowing the equipment to be thoroughly trialled, and refined if necessary, before deployment.

“There’s a continual requirement for inventive methods to dismantle a complex reactor like the PFR. It will take three-four years to remove all the items from the core; it’s a meticulous task and we need to know equipment will work before it

goes into the reactor. We design, commission, refine, test, fine-tune and deploy, and are involved with the manufacturer at every stage.”

The process is saving millions of pounds: eight tools have cost just £100,000 including design and manufacture, while the ingeniously simple ideas require even less expense.

Now, his vast reservoir of knowledge is being passed on to protégé Chris Irwin, also a design engineer who has been shadowing Calder for two years, and others in the PFR team.

“Chris and the team will be at the forefront of the final stages of the reactor dismantling, and I’m proud to be sharing my experience with them,” Calder said.

Phil Craig, Dounreay’s Managing Director, said: “Calder’s one of our longest serving employees, and his knowledge, insight and experience are invaluable.

“The reactor dismantling project is critical to the decommissioning of PFR. To safely take apart the plant, we need to inspect all the areas in the reactor before we can begin the final phase to remove the reactor vessel itself. The design of such purpose-built equipment is fundamental.”

Will Calder ever retire? Probably not.

*Photographs:
Above, young Calder signs his indentures.
Opposite page, outside the PFR*



Research and
Development

Date	Event	Venue
14 February	Briefing	Digital Catapult, London
28 February	Brokering	The Oil & Gas Technology Centre, Aberdeen
2 March	Brokering	etc.venues Maple House, Birmingham
7 March	Brokering	Rheged, Penrith
9 March	Brokering	Armada House, Bristol



“We know the decommissioning challenges will be significant and are aiming to encourage early technology solutions.”

Melanie Brownridge

Innovate, integrate and demonstrate – the race starts now

Funding totalling £3 million is being offered to develop and demonstrate technologies that can help resolve some of the challenges associated with dismantling facilities at Sellafield.

Reprocessing of spent fuel is due to end by 2020, when the site will shift to full-scale decommissioning and waste management. The THORP and Magnox reprocessing facilities are unique, extremely hazardous and expected to present major decommissioning challenges, with opportunity for robots and remotely operated equipment to play a significant role in addressing those challenges.

Since 2013, the NDA and Innovate UK have collaborated successfully with a range of other public bodies to encourage innovative R&D projects across the whole nuclear industry. The total investment, including support from the private sector, has reached more than £50 million.

Building on this success, the NDA and Innovate UK are investing at least £3 million, this time in partnership with Sellafield Ltd, in projects that could deliver solutions to decommissioning challenges at the site. The aim is to reduce risk to workers, increase productivity, optimise waste routing, reduce timescales and cut costs.

Another important goal will be to encourage collaborative proposals from organisations of all sizes, especially Small and Medium-sized Enterprises (SMEs) both from within the sector and other industries.

The competition, named Integrated Innovation in Nuclear Decommissioning, will be split into stages. Initial funding will be available to develop a business case, followed by the second stage leading to demonstrations in a non-radioactive environment.

If this demonstration is successful, there is the potential for progress to deployment and demonstration in a radioactive facility at Sellafield.

Although the focus is on Sellafield, it is anticipated that emerging technologies will also be of interest to the wider estate, the nuclear sector and industries operating in hazardous environments, such as oil and gas or defence.

The competition opened officially on 30 January 2017 and will be followed by a briefing event for interested organisations on 14 February at the Digital Catapult in London. Applications must be received by 26 April.

A series of regional brokering sessions will take place during February and March 2017, providing further opportunities for organisations to understand the scope and link up with prospective collaborative partners. A table of events is summarised on the opposite page.

The NDA's Head of Technology Melanie Brownridge said: “We're particularly interested in robotics, other autonomous systems, sensors and detectors, imaging, virtual reality simulation – that can ensure a safer working environment that can provide a step change in approach.

“On this occasion, we are working closely with Sellafield, the potential end-user, so the technologies developed will be aligned with their requirements with the potential to test solutions at the Sellafield site.”

For further information, visit: www.gov.uk/government/organisations/innovate-uk

*Photograph:
Opposite, robotic technology will be needed for some of the major decommissioning challenges*



When playing a game is a serious business

A fun board game about asset management may sound pretty much like a contradiction.

Synergy however, is a board game where teams spend Sellafield-minted money worth £millions on a range of facilities and infrastructure.

The real aim, though, is to bring asset management alive for members of the workforce who need to understand its vital role in managing a large and complex site.

It has just won the innovation category in the international Institute of Asset Management awards in London and was runner-up, along with Russia's Rosatom, to EDF in the Knowledge Management category at the World Nuclear Exhibition in Paris.

Unlike some traditional board games, the goal of Synergy is not to amass a fortune but to invest with care, weighing up risks against possible performance improvements.

Teamwork is an integral part of the game, players quickly realise that they need increasing levels of collaboration to play successfully. In other words, they must take a pragmatic approach based on sound Asset Management principles and value optimisation.

Martin Grey, the NDA's National Programme Delivery Manager Assurance, said: "Asset management (AM) can be rather a dry, abstract subject for many people, often difficult to understand.

"But it is critical that the estate's assets – buildings, infrastructure, IT systems, equipment, vehicles and much more – are maintained cost-effectively and to a level that is appropriate for their present and future function.

"Is it, for example, sensible to spend large amounts of money on buildings that are ultimately scheduled for



demolition? The answer is that it depends on a wide range of factors linked to its current condition, hazards, performance, risks, opportunistic reuse and more.

Asset managers need to understand all the issues but critically, so do many other members of the workforce who are involved in decision-making."

Synergy was designed for Sellafield by Vulcain Engineering Ltd supported by its strategic partner Oxand, and is based one of their existing business board games. Synergy is used in AM workshops that aim to develop asset management understanding. The NDA has supported development of the game where Sellafield was not only the customer but were actively involved in the design and development process.

Vulcain Engineering Principal Consultant Simon Spencer, an asset management specialist who previously worked at Sellafield, led the project. He said: "The question is how do you make the fundamentals of asset management interesting and enjoyable to learn?"

"In a PowerPoint presentation, on

average you will only take in about six per cent of the information on the screen; in a face-to-face conversation, it's about 20 per cent, but with a simulation or an activity based tool like this, it will be up to 75 per cent. Oxand's existing AM board game wasn't created for the nuclear industry or for Sellafield, so we adapted it to better reflect the operational challenges and decision-making processes of a live site. It is about ensuring that an understanding of the reality of managing assets is embedded across all levels of the workforce.

"Synergy brings to life the processes needed for anticipating problems, allocating the right budget, reducing costs where possible, understanding the impact on performance as well as collaborative and integrated working, but also recognises that compromises are necessary."

Interestingly, there's no winner in Synergy, but there is the satisfaction of a job well done.

*Photograph:
Above, colleagues playing the game*



Communities take centre stage

Plans to permanently dispose of the UK's most radioactive waste are continuing to make progress.

Radioactive Waste Management Limited (RWM), a subsidiary of NDA, is responsible for delivering a geological disposal facility (GDF). This will see the UK's higher activity radioactive waste placed in engineered chambers deep underground so that no harmful quantities of radioactivity can reach people and the surface environment.

Since publishing its 2014 White Paper on geological disposal, the government has committed to working in partnership with interested communities to find a suitable site for a GDF. This is now a major focus for RWM's work as it prepares for the launch of the GDF siting process during 2017.

Events such as the Local Government Association's annual conference held in July allow RWM to discuss geological disposal with local authorities and other bodies. This is an opportunity to listen to views, gauge current levels of awareness and understand what further information might be needed.

In October, RWM held a conference in Manchester to bring together a wide range of stakeholders including government, regulators, industry and academia. The 80+ attendees heard about the next steps in the GDF project and discussed the challenges and opportunities going forward.

RWM is also meeting with Site Stakeholder Groups (SSGs) for nuclear sites around the country, as a way of updating nuclear communities on the GDF project and ensuring their views help shape future activity. There will be further opportunities to engage in the GDF project in early 2017, when the government looks set to launch its consultation on a proposed framework for working with communities



interested in hosting a GDF. This will include a series of regional events aimed not only at the nuclear industry but broader society- including non-profit organisations, conservation groups, academics and faith groups. A separate consultation and programme of events is due to take place in Wales.

Communities stand at the very heart of plans for a GDF; their support is vital not only to identify a site but also to ensure the long-term success of the project. RWM's diverse stakeholders – especially within the nuclear industry – are also a critical part of that journey. They need to feel confident about geological disposal so that they can be advocates for the GDF project; however strong, RWM cannot do this on its own.

RWM looks forward to engaging with a wide range of interested parties to ensure that plans for a GDF are informed when the siting process is launched.

Photographs:
Above, RWM is engaging with stakeholders to inform its work



Stephen Henwood is preparing to step down as NDA Chairman after nine years and three full terms of office.

He became involved with the NDA in 2008, when it was a relatively new organisation setting out to address the challenge of dismantling 17 historic nuclear sites and dealing with large quantities of radioactive waste.

“The challenge was huge and it was important to break down the numerous tasks, understand them separately, then begin to build an overall plan. We set a planning framework and put together a corporate plan and operating plan, in addition to the statutory requirement for a strategy and annual business plan. These were all extremely valuable in providing a solid structure and targets.”

During his first year, Stephen made sure to visit every site, building a picture of the wide range of complexities. This set a baseline for subsequent visits, and understanding the reality of progress achieved. “Plants were being kept safe and secure but Sellafield, for instance, was more of an operational facility while Magnox was effectively a fleet

Pieces now in place to achieve major progress

of independent stations. There were few common techniques or shared tools. We have made tremendous strides since then.”

The development of a single coherent strategy on decommissioning nuclear facilities was new for the UK, where the old state-owned sites had historically operated as separate entities.

Another significant achievement was defining how the diverse range of sites should be managed, and awarding a series of fixed-term ownership contracts to enhance the role of the private sector.

The aim is to accelerate progress while prioritising safety and cost-effectiveness through competitive markets, which have introduced global expertise and innovation. Each major contract was shaped differently, modified according to circumstances and experience.

The Low Level Waste Repository was opened to a bid process and, eventually, handed the task of defining a LLW strategy for the whole UK. “This worked extremely

well and has produced a high level of waste diversion away from the repository, saved many £millions and extended the life of the facility significantly,” said Stephen.

The Springfields and Capenhurst fuel plants were transferred to the private sector on long-term leases while Sellafield, Dounreay, the Magnox sites and the Harwell and Winfrith research sites were also subject to a competitive process. The Sellafield contract was subsequently replaced and the Site Licence Company became a wholly owned NDA subsidiary.

“The Sellafield model change was an important milestone. We were fortunate to have good Non-Executive Directors who worked well together and with the executive team – it was a good outcome,” he continued..

Photographs: Top, Stephen, inset and centre, with Non-Executive Directors Ken McCallum and Tom Smith, on a 2013 visit to Dounreay Opposite page, new Chairman Tom Smith

"However, the model change is the start of a the model change is the start of a journey to improved performance and greater efficiencies."

Emerging relatively intact from several government spending rounds was also an achievement, a tribute to many months of hard collaborative work between the NDA, the SLCs and regulators.

"Our response to the requirement for savings was positive: we embraced the process and examined our options. We worked with DECC/BEIS, UKGI, our SLCs and the regulators - and the Treasury appreciated that we were willing to address the challenges."

He has taken personal satisfaction from on-the-ground progress across the estate but particularly at the most hazardous Sellafield plants, where bulk waste retrievals are now under way. The disposal of surplus assets, including large tracts land adjoining NDA sites, via an electronic auction was another highlight, securing hundreds of millions of pounds and freeing up land for new build developers.

He is also proud that the NDA recognises its responsibility to communities, especially where its sites have been the dominant employer and is supporting regeneration initiatives.

In 2013, Stephen was made a Commander of the Order of the British Empire (CBE) in the New Year Honours list, in recognition of his services to the nuclear industry and to charity.

As he departs, the clean-up challenge remains substantial, stretching well into the next century, but he is confident the pieces are now in place to drive forward major progress. Hazards are being reduced and every pound spent is aimed at providing the taxpayer with value.

NDA welcomes Tom Smith as new Chairman

The NDA's new chairman has been named as Tom Smith, who will take over from Stephen Henwood in March.

Tom, an Oxford chemistry graduate, former diplomat and Member of the Institute of Directors, has been an NDA Non-Executive Director since 2013. His appointment was announced in December by Energy Minister Baroness Neville-Rolfe.

He said: "It is a privilege to be taking up this post with the NDA, which through a highly skilled workforce, cutting-edge innovation and strong utilisation of the UK supply chain, is making good progress on delivering its exceptionally challenging mission.

Tom's diplomatic career included postings in London, Hong Kong and Beijing. He was part of the team that negotiated the 1984 Hong Kong treaty with China.

He also spent 10 years at the Go-Ahead Group plc, becoming Managing Director Rail Development and was Chairman of the Association of Train



Operating Companies from 2009 until 2013.

Before his rail industry career, he was Managing Director of Midland Expressway, the company that developed and operates the M6 Toll.

He is also Chairman of Angel Trains Group, the rolling stock leasing company, and has served as a non-executive director of Highways England.

"Tom Smith has a strong track record in delivering infrastructure projects and complex commercial contracts between the public and private sectors, and since 2013 he has been an invaluable asset to the NDA Board. I have no doubt that the NDA will greatly benefit from his knowledge, experience and dedication."

Stephen Henwood

Sites welcome new ground force

A new NDA team is working on the ground across 14 of the estate's sites to build a comprehensive and accurate understanding of performance.

The Site Assessment Group has embarked on a rolling 12-month programme of visits that aims to overcome one of the challenges facing the NDA: with the exception of Dounreay, staff work remotely from the sites and the Site Facing Teams are relatively small in relation to the work they're contractually responsible for.

Now, as part of the NDA's commitment to continuously challenge its own approach, the five-strong group has been assembled to focus exclusively on developing a much more detailed understanding of progress.

Covering Dounreay, the Magnox sites and the NDA's archive in Wick, the group, part of the Dounreay-Magnox Site Facing team, will visit each site over a rolling 12-month programme.

They will work closely with the on-site management to carry out a detailed analysis of agreed topics, building a clear picture of progress. The aim is to pinpoint and address any areas of joint concern, ensure accurate reporting and refine details of the waste inventories.

The Dounreay and Magnox sites are driving ahead on decommissioning in line with the target-cost contracts awarded in 2012 and 2014 respectively, where work activities are aligned to a series of milestones and performance incentives.

Accurate reporting is key to meeting



the detailed requirements in the contracts. This is in turn based on in-depth understanding and agreement between the NDA and the Site Licence Company (SLC).

The team, all experienced professionals with different specialisms, began with a familiarisation visit to Dounreay, followed by the inaugural site assessment at Berkeley.

In advance of the visits, team members will agree areas of focus with the site, analyse support information and propose topics for detailed inspection. The Site Assessment Group's detailed follow-up report forms the basis for sharing learning and improving delivery where appropriate. In all, the process for each site is expected to take around three weeks.

Nigel Lowe, NDA Head of Programme Dounreay and Magnox, said: "Every year we release millions of pounds of taxpayer's money based on SLC performance.

"It's vital we can demonstrate that we are releasing such funds against demonstrable progress.

"We cannot be on every site every day, so the rolling 12-month cycle will enable us to build confidence in the activities reported to us."

David Edwards, Site Assessment Group Leader, added: "The formation of this dedicated team provides an excellent opportunity to assess the decommissioning progress in detail on the ground. This allows a more informed view of the SLC reporting and accuracy of forecasts.

"We're confident that by working in conjunction with the SLC, these site assessments will add value to the NDA, Magnox Ltd and Dounreay Site Restoration Ltd, supporting progress and improving performance."

Photograph:
Above, from the left, group members Adrian Jones, Gill Thomas, Laura Baker and David Edwards

Nuclear archive set to open its doors for business

The doors of Nucleus (The Nuclear and Caithness Archives) are opening for business in February. Located next to Wick Airport, the dramatic triangular building is now complete. An official ceremony will take place in summer.

The £20 million facility, developed by NDA Properties Ltd, will house plans, photographs, records, plus other data from the beginnings of the UK nuclear industry. It will also store the local Caithness archives.

To ensure safe preservation, the material will be stored in a series of secure pods and much of it will gradually be converted to digital format. Dounreay's records will be the first nuclear consignment, followed by other collections from the rest of the estate.

An important role will be to store waste records over hundreds of years for the Geological Disposal Facility being developed by NDA subsidiary Radioactive Waste Management.