DOUNREAY – SHAPING FOR THE FUTURE

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BACKGROUND

Dounreay was the site of the UK’s fast reactor development programme from the 1950’s until a Government decision was taken to cease funding for further development work and the Prototype Fast Reactor (PFR) was shut down in 1994. During this time the site undertook pioneering research and development work, culminating in the completion of the nuclear fuel cycle when plutonium recovered from reprocessing at Dounreay was manufactured into assemblies and used to fuel PFR.

As facilities across the UKAEA sites started to close from the late 1980’s the cost of the company’s government-funded decommissioning programme increased sharply and it was realised that this trend would continue. It was also recognised that undertaking decommissioning work using solely in-house resources could lead to conflicting pressures between the need to ensure value-for-money for the taxpayer and UKAEA’s other commercial business objectives. For this reason in 1991 UKAEA established a separate unit, the Corporate DRAWMOPS (Decommissioning and Radioactive Waste Management Operations) Directorate, to manage the company’s decommissioning programme. DRAWMOPS was set the objective of obtaining value for money for Government by seeking to compete as much of the decommissioning work as possible.

Around the same time the commercial part of UKAEA was established as a separate business arm, AEA Technology, which was eventually privatized in 1996. The facilities service arm of UKAEA was sold to the private sector and several other parts of the business were also divested. From this point UKAEA’s remaining mission was to manage its nuclear sites in a safe and cost-effective manner and to assume responsibility for the UK fusion programme.

The 1990’s was a time of great change at Dounreay. There was a loss of scientific, engineering and skilled craft staff as the pace of the fast reactor R&D programme slowed before it eventually came to a close. A programme of diversification was initiated, with commercial reprocessing and fuel fabrication work sought to replace some of the government funded R&D work. In 1996 a Management Support Contract was placed to bring private sector disciplines and project management skills to support the site’s decommissioning programme, which was a departure from the way that the UK’s civil nuclear sites were traditionally managed. However by this time the Fuel Cycle Area (FCA) plants were approaching the end of their lifetime and the Nuclear Installations Inspectorate (NII) became increasingly concerned over their material condition and also on the level of in-house competence of the licensee to manage safety. This came to a head in 1998 when, following a high-profile loss of electrical power incident, NII brought forward a planned safety audit of the site and issued a “Direction” that halted all operations in the Fuel Cycle Area pending completion of the audit recommendations.
DOUNREAY – THE WAY AHEAD

Following from the NII safety audit a decision was taken to cease further commercial reprocessing work at Dounreay and to focus on decommissioning the site. An action plan entitled “Dounreay – The Way Ahead” was developed to address the shortcomings identified during this audit, and for the next three years this became the focus of the site’s activities. During this period of consolidation additional engineers, safety case writers and project managers were recruited to strengthen the site’s technical base and the Management Support Contract was terminated.

A major review of the site’s long-term strategy was undertaken that resulted in the production of the Dounreay Site Restoration Plan (DSRP). This defined an integrated strategy for decommissioning the site and managing the associated fuels and wastes. At that time it was envisaged that the site would be fully decommissioned by around 2060, with most of the work being done by around 2035. This was the first time in the UK that an integrated, costed closure plan had been produced for a complex nuclear site.

A large number of engineering upgrades that were necessary precursors to the resumption of FCA decommissioning were completed, the safety management arrangements were strengthened, and new safety cases were produced for the site’s waste storage and treatment plants. Operational staff underwent a programme of refresher training, housekeeping in plants was improved, backlogs of maintenance were cleared, new personnel monitoring equipment was installed and a limited programme of decommissioning was permitted.

In the period immediately following the issuing of the NII Direction morale on the site was very low. This started to improve as the site rose to the challenge of addressing the audit recommendations and understanding the new challenges presented by the decommissioning programme. At the start of 2001 NII gave consent for a progressive resumption of the waste treatment plants and decommissioning of the fuel plants resumed, which further boosted morale.

MANAGING THE NUCLEAR LEGACY – A NEW WAY FORWARD

In November 2001 the UK Government announced its’ intention to radically change the way that the country’s government-funded nuclear clean-up work on UKAEA’s and BNFL’s sites was managed. In July 2002 a policy paper entitled “Managing the Nuclear Legacy” was put to Parliament setting out how this would operate in practice. The key elements were:

- A declared intention, through competition, to ensure that the best practices from private and public sectors are used to undertake the clean-up work;
- A commitment to ensure that clean-up was carried out safely, securely, cost-effectively, in a way that protects the environment;
- A commitment to transparent management to command public confidence.

The Government established a Liabilities Management Unit (LMU) to prepare for the creation of a separate Government Agency to manage the national civil decommissioning programme. The LMU was staffed by a mix of private and public sector employees, with the majority being seconded from UKAEA and BNFL. A support
contract was placed with Bechtel to draw on experience from managing the American clean-up programme. An early task for the LMU was to introduce common project controls systems across the UK’s 20 civil nuclear sites and produce costed closure plans for each site.

Dounreay was reasonably well placed at that time as there was already had a single mission to close the site and the DSRP represented a good starting point. The drive towards future competition of the site provided a stimulus to accelerate the pace of the site’s decommissioning programme.

CREATION OF THE NUCLEAR DECOMMISSIONING AGENCY

The Government passed the Energy Act in 2004 and in March 2005 the Nuclear Decommissioning Agency (NDA) was established as a non-departmental government body to take forward the work started by the LMU. Competition was a key element of the NDA’s strategy and it soon became evident that Dounreay was targeted as one of the first of the 20 NDA sites to be competed, with a target date of 2008/09.

UKAEA was given an initial dowry contract to manage the Dounreay site for the period until the site was competed. It was evident that if UKAEA was to be a credible bidder then its’ performance on delivery of decommissioning projects to time/schedule would need to improve at a rapid rate.

IMPACT OF THE DCP INCIDENT

The pace of decommissioning increased during 2005, however the site suffered a setback in September 2005 when an incident occurred at the Dounreay Cementation Plant. A product drum was not raised and secured into its proper position against the face of drum mixing cell, nor was its lid removed, but subsequent operations proceeded on the basis that the drum had been correctly prepared for filling. As a result, 266 litres of conditioned radioactive MTR raffinate was spilled into the process line and sumps, and 300 Kg of dry cement powder was then spilled on top of the product drum, with some over-spilling into adjacent areas. Whilst no-one was hurt and there was no release of radioactivity, the work needed to reinstate the plant was a major task and NDA, as customer, was obviously extremely concerned that it had happened.

The internal Investigation Team concluded that there was no single cause for this incident occurring. Instead, it was caused by a combination of the factors listed below:

- Failure by staff to respond appropriately to abnormal plant conditions;
- Tolerance of defects and the use of workarounds;
- Poor communications between shift and day staff;
- Ambiguity in the management and safety in DCP;
- Over-reliance on automated controls;
- Shortcomings in safety culture;
- Shortcomings in some aspects of the plant design;
- Poor control of temporary modifications;
- Staff training and competency issues.
ORGANISING FOR THE FUTURE

Whilst the DCP incident was highly regrettable, it did serve as a springboard for the site to address the underlying issues and get into shape for competition. The traditional response to such an incident might have been to issue yet more procedures and documentation, but in this instance a much more radical and wide-ranging response was made which covered cultural and attitudinal issues as well as management arrangements, as illustrated in Fig 1, followed by a description of the individual elements.

![Diagram: Culture, Attitudes and Arrangements]

Fig 1: Culture, Attitudes and Arrangements

**Organisation**
At the time of the DCP incident there was matrix-management organisational structure which made it difficult to identify clear lines of responsibility and accountability. Operations and decommissioning were managed by plant managers, maintenance was managed by an engineering function, some projects were managed by another division of UKAEA and there was a large central safety team. In early 2006 the site underwent a major reorganisation to move to a project-based structure, with clearly defined roles and accountabilities. Project managers were made responsible for all aspects of performance in their areas, including safety, delivery and finance. Support staff, including safety, environmental and radiological protection advisers and safety case writers were embedded into the project teams, whilst retaining a link back to their parent function for professional development purposes; a similar arrangement was also applied.
to finance, commercial and personnel management staff. A key feature is that the new structure was intentionally made to be significantly different from its predecessor in order to promote a culture of change. The new structure is shown in Fig 2.

Fig 2: Organisational structure at 1 March 2006

**Partnering**

It was apparent that change could be achieved more rapidly by engaging support from external organisations experienced in project management and decommissioning. After a selection process UKAEA placed contracts with CH2M-Hill and AMEC to provide support through a “partnering contract” which provides for the secondment of experienced staff to support the UKAEA’s sites.

**Leadership Selection**

UKAEA staff from Dounreay and staff put forward by CH2M-Hill and AMEC were invited to apply for management posts in the new organisation; at this stage several of the existing UKAEA senior managers took the opportunity to take voluntary early retirement rather than apply for the new positions.

The first stage of selection was for the senior management positions. Selection was initially done by application, with all applicants including nominees from the partner
organisations being given equal consideration provided that they possessed the necessary level of competence and experience for the post. Chosen applicants attended day-long assessment centres, which were facilitated by an external consultancy. During these they undertook an interview, a role play exercise, a group exercise and a psychometric test and were assessed against the criteria of “SCAN” (the ability to analyse an issue and move it forward), “RELATE” (how they interacted with others) and “ACT” (ability to deliver results and to be held accountable for their actions). The new senior management was then involved in the selection process for the next level of management, again using assessment centres do identify the preferred candidates for each post.

It is notable that seven members of the new senior management team had not previously occupied posts in the “old” organisation, and that four came from the partners. There were also numerous changes at the next level down, including the appointment of three more partners in line management positions as well as several in advisory posts. There were few difficulties in integrating the partners into the new management team, probably because of the high quality of the individuals and the fact that there were a large number of other changes made at the same time.

**Behavioural Safety**
Experience worldwide is that companies with behavioural-based safety programmes in place are amongst the best performers in terms of safety performance. Thus following the reorganisation a site-wide behavioural safety programme, termed “Second Nature”, was rolled out on a phased basis, with the objective of ensuring that all staff were aware of their personal responsibility for safety and instilling positive SHE values, including caring for their colleagues and the environment. People with management and supervisory roles underwent a 1½ day course and all other staff working at Dounreay, including contractors and sub-contractors, attended a half-day course. The course included a role play session to make it interesting and relevant, and feedback from attendees has been extremely positive. The behavioural safety programme had received strong support from the site’s network of trade union appointed Safety Representatives and various local follow-up action has since been taken to ensure that the key messages stick.

**Conduct of Operations**
The DCP investigation showed that some staff had failed to follow procedures and instructions. A set of standards and expectations, termed “Safer by the Dozen”, was therefore introduced across the site to clearly define the key “Do’s and Don’ts” and a “Conduct of Operations” manual was produced to set out in more detail how work was to be done.

**Targeting “Zero Accidents”**
There had previously been an acceptance that Dounreay’s safety performance was good on the basis that its’ accident frequency rate and other SHE metrics compared reasonably well against industry norms. Following DCP it was recognised that in order to achieve a world-class safety performance it is necessary to adopt a different mindset and to target “zero accidents”, and this is now the basis for the site’s SHE metrics. Safety performance against site SHE objectives is also used as the basis for the staff bonus scheme and a range of other rewards and recognition schemes have been introduced to encourage good individual and team SHE performance.
**Socio-economic Considerations**

Dounreay currently injects about £80M per year into the local economy and so its future is of great importance to Caithness and North Sutherland. Around 2000 staff work at Dounreay on a daily basis, which represents around one in five jobs in the area, and it is estimated that a further 2500 jobs are indirectly supported by the presence of Dounreay. The accelerated closure programme has been of great interest to staff, contractors and the wider community, and local stakeholder groups are now beginning to recognise the need to plan for a future without Dounreay. Although the decommissioning programme end date is in the 2020’s, the number of staff employed at Dounreay will start to reduce from around 2012 and a number of schemes have been introduced to ensure that staff are given the opportunity to re-skill and retrain for their future.

**MOVING UP THROUGH THE GEARS**

The NDA has introduced common reporting metrics for industrial safety across their sites using the OSHAS system of TRIR (Total Recordable Injury Rate) and DACR (Days Away Case Rate) and publishes a monthly “league table” based on TRIR performance. Having a customer that takes safety performance so seriously has led to an improvement in performance across all of the NDA sites, including Dounreay. At the start of 2006/07 Dounreay was close to the bottom of this league but there was a steady improvement through the year and by the end the site had reached “mid-table”. Industrial safety performance data for 2006/07 is shown in Fig 3 below:

![DACR & TRIR data for Dounreay Sept’06 – Aug’07 (all staff including contractors)](image)

The “Baker Report” on the accident at Texas City refinery demonstrated that good industrial safety statistics do not necessarily prevent major incidents from occurring. This has served as a strong reminder for the management at Dounreay to maintain a focus on all aspects of SHE performance including maintenance of plant, engineering substantiation, robust safety cases and supporting documentation and compliance with site licence requirements. These are more difficult to measure and Dounreay, in common with the other UK nuclear operators, has been working closely with NII to
develop a set of performance metrics to measure nuclear safety performance and these are being trialled during 2007/08.

It is widely recognised that good safety performance and good business performance go hand-in-hand and during 2006/07 there was an improved performance across the board. The site’s baseline programme of decommissioning work was delivered at 15% below the estimated cost which enabled additional scope to be brought forward from future years. Within the fuel cycle area all of the glove-boxes were removed from the fuel fabrication plant and the materials test reactor pond was cleaned. The pond furniture was also removed from the MTR reprocessing plant and clean-up of the pond liquor commenced. A number of redundant laboratories were decommissioned and the clean-up of cells in the redundant PIE facility continued to programme.

SHAPING UP FOR COMPETITION

The competition process entails establishing the site as a separate stand-alone legal entity, called Dounreay Site Restoration Limited (DSRL) and referred to as a Site License Company (SLC); it is the management of the SLC and the associated work programme for a defined period that is competed. Setting up the SLC is a complex process which, in the case of Dounreay, required further minor changes to the site organisational structure and the creation of a Board of Directors as shown in Fig 4. It is also necessary to obtain a new nuclear site license and to transfer the site’s discharge authorisations to the new company. Both of these activities entail the preparation a large suite of documentation to justify the change and validation audits of the site’s arrangements by the regulators. During the transition there has been considerable discussion between UKAEA, NDA, NII and SEPA over the number of management posts that can be occupied by partners and hence will be subject to possible change when the new management contract is awarded, and agreement on this has now been reached.

The site will shortly commence a period of shadow working with the intention that the new licences come into effect from April 2008. The current expectation is that NDA will start the competition process by issuing invitations to tender during 2008, with the new site management contract being awarded in late 2009.

Figure 4: Dounreay management structure from commencement of “shadow working”
CONCLUSIONS

- The site’s response to the recommendations from the NII’s Audit of Safety in 1998 helped to provide a good base for decommissioning the Dounreay site and the advent of the NDA and the drive to compete the management of the site has helped to stimulate further improvements in both safety and delivery performance;

- The reorganisation of 2006 and the move to a project-based structure with clear lines of responsibility and accountability have proved to be successful. The embedding of specialist support staff into the project teams has proved to be particularly worthwhile by ensuring that safety and environmental knowledge is integrated into all stages of project work;

- The use of partners in senior management positions has helped to stimulate cultural change faster than would otherwise have been the case as well as providing fresh thinking and outside experience;

- Safety performance never stands still, it either gets better or worse. Safety plans need to be kept live and performance has to be actively managed. There have been improvements but Dounreay’s management recognise that we still have some way to go to achieve a world-class level of performance and we are committed to this. A “sustained excellence” safety management plan has been developed to ensure that this is achieved.