

NuSAC Paper

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**NUCLEAR SAFETY ADVISORY COMMITTEE****DOUNREAY – SHAPING FOR THE FUTURE**

A Paper by

**Simon Middlemas, Director, UKAEA Dounreay  
and  
Tony Wratten, Assurance Manager, UKAEA Dounreay**

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**INTRODUCTION**

1 In November 2001 the UK Government announced its' intention to radically change the way that the country's government-funded nuclear clean-up work was managed on the sites operated by UKAEA and BNFL. 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 best practices from the 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.

2 Unlike many other sites, Dounreay was reasonably well positioned as there was already a single mission in place to close the site. The Dounreay Site Restoration Plan, which was produced in response to the NII/SEPA Safety Audit of 1998, provided a good starting point in terms of defining the site's closure strategy. At that time it was anticipated that decommissioning would be complete by around 2060.

3 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 national nuclear decommissioning programme. 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. UKAEA was given an initial dowry contract to manage Dounreay for the period until the site was competed, and given the target of becoming a stand-alone site by March 2008.

It was evident that if UKAEA was to be a credible bidder in the competition to manage the Dounreay site then its' performance on delivering decommissioning projects safely and to time and cost would need to improve at a rapid rate.

## **IMPACT OF THE DCP INCIDENT**

4 The pace of decommissioning increased during the period 2001 to 2005, however the site suffered a major setback in September 2005 when an incident occurred at the Dounreay Cementation Plant (DCP). A product drum was not raised and secured into its proper position against the face of the 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 injured 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.

5 The internal Investigation Team concluded that there was no single cause for this incident occurring. Instead, it had resulted from 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 of 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**

6 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. This covered cultural and attitudinal issues as well as management arrangements, as illustrated in Figure 1. This is followed by a description of the individual elements of the site's improvement programme.

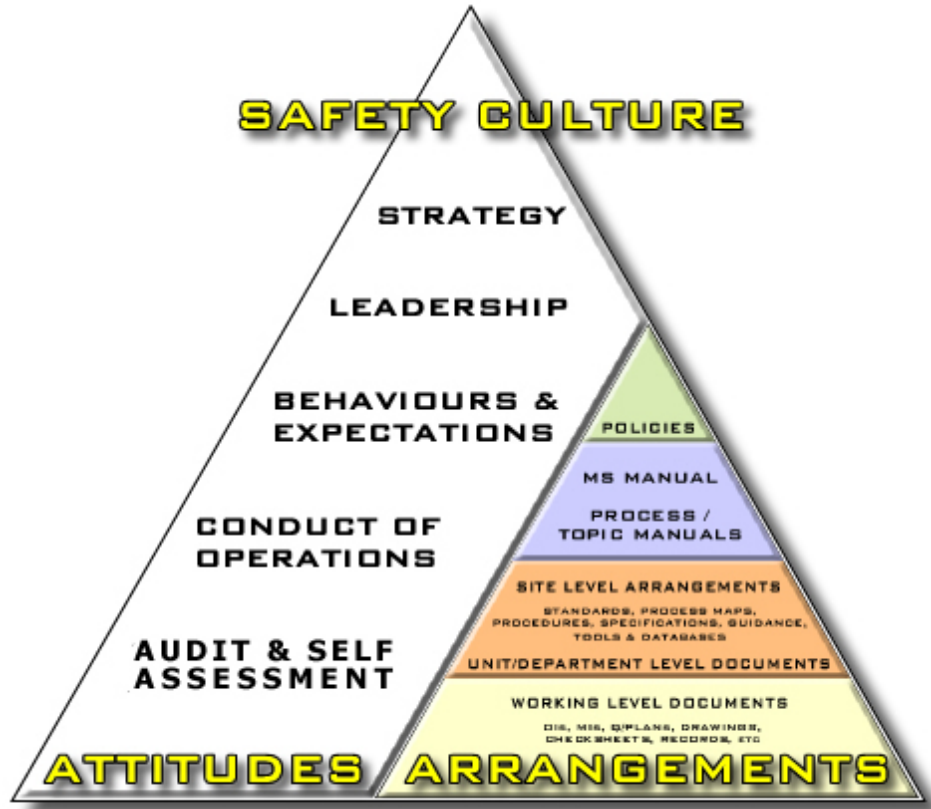


Figure 1: Culture, Attitudes and Arrangements

### **Organisation**

7 At the time of the DCP incident there was a matrix-management organisational structure in place 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 Figure 2.

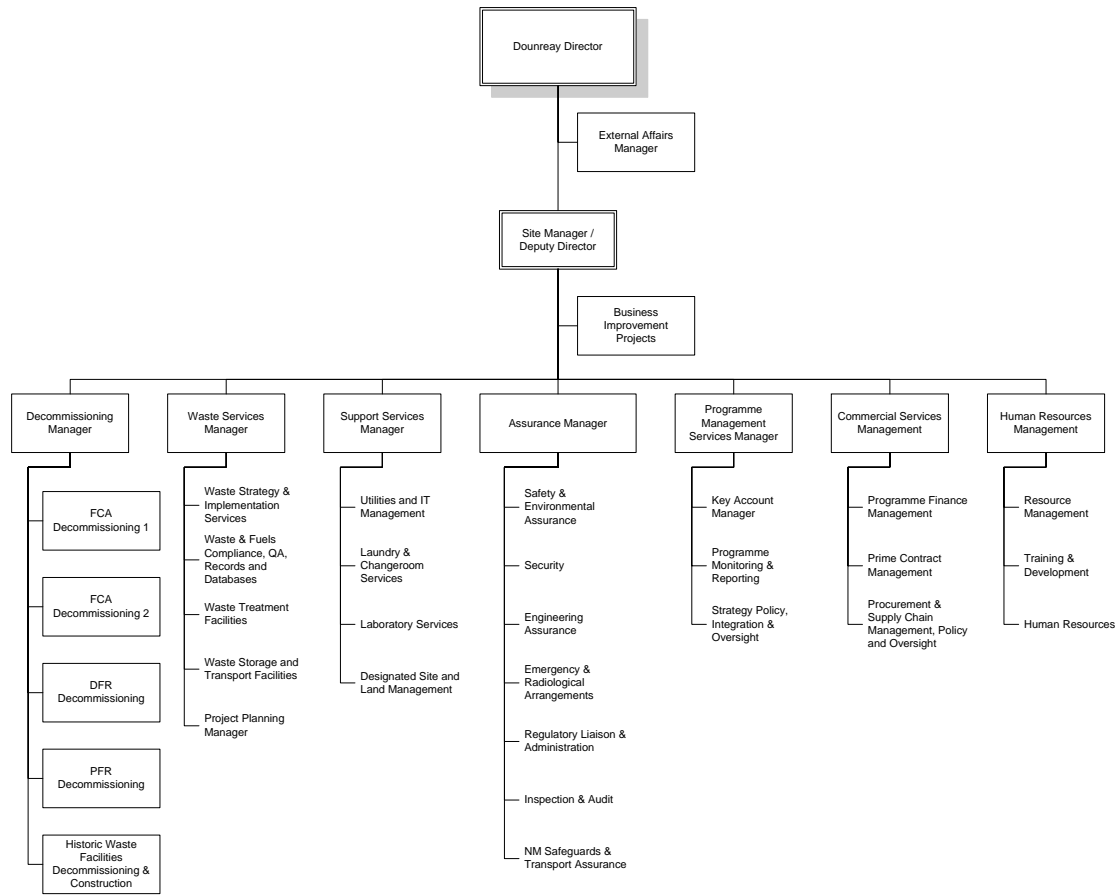


Figure 2: Organisational structure at 1 March 2006

### **Partnering**

8 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 CH2MHill and AMEC to provide support through a “partnering contract” which provides for the secondment of experienced staff to support the UKAEA’s sites, including Dounreay.

### **Leadership Selection**

9 UKAEA staff from Dounreay and staff put forward by CH2MHill 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.

10 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. Short-listed applicants attended day-long assessment centres, which were facilitated by an outside consultancy to ensure objectivity. During these they undertook an interview, a role play

exercise, a group exercise and a psychometric test. They 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 to identify the preferred candidates for each post.

11 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 calibre of the individuals and the fact that there were a large number of other changes made at the same time.

### ***Behavioural Safety***

12 Experience worldwide is that companies with behavioural-based safety programmes in place are amongst the best performers in terms of both safety performance and productivity. Thus following the reorganisation a site-wide behavioural safety programme, termed “*Second Nature*”, was rolled out on a phased basis. The objectives were to ensure that all staff were aware of their personal responsibility for safety and to instil positive SHE values, including caring for 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 courses included a role play session to make them more interesting and relevant, and feedback from attendees has been extremely positive. The behavioural safety programme has received strong support from the site’s network of trade union appointed Safety Representatives and follow-up action at local level has since been taken by management to reinforce the key messages.

### ***Conduct of Operations***

13 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. Follow-up action has been taken by management to promote and reinforce the key messages.

### ***Targeting “Zero Accidents”***

14 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 was 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 now an integral part of

the staff bonus scheme and a range of other rewards and recognition schemes have also been introduced to encourage good individual and team SHE performance.

### ***Raising the profile of Safety***

15 Almost all organisations claim that safety is their highest priority but it is extremely challenging to ensure that this is recognised and embraced throughout the site. This was found to be particularly true in the case of the middle-managers and supervisors who are faced with the demands of achieving performance targets – they need to be given the confidence that they will receive senior management support if they slow or stop work for safety reasons. Various workshops have been held within the project teams involving staff at all levels in order to get this message across.

16 In addition, from January 2007 a daily “Safety and Environmental Assist Meeting” was introduced at the start of each working day. This meeting is chaired by the Head of Assurance with core members being the key accountable project managers, the Site Shift Manager and a TU-appointed Safety Representative; the Director and other members of the site’s senior management team also attend on a regular basis. The meeting, which normally lasts between 15 and 30 minutes, considers all unusual occurrence reports that have been raised over the previous 24 hours to ensure that appropriate follow-up action is taken. It is also used to track the status of investigations and to identify issues that need to be notified to regulators. This meeting has served to encourage better reporting of unusual occurrences, improve the dynamics of follow-up action, ensure that lessons are learned across the site and generally to raise the profile of safety.

17 The site has also put in place a SHEQ (safety, health, environment and quality) improvement programme termed “Sustained Excellence”, the key themes being safety leadership, behavioural change, environmental stewardship, process and systems, assurance and improvement/benchmarking. Performance is monitored at a monthly Accountability Meeting and a performance report to February 2008 is attached as Appendix 1.

## **MOVING PERFORMANCE UP THROUGH THE GEARS**

### ***Industrial Safety Performance***

18 The NDA has introduced common reporting metrics for industrial safety using the OSHA (Occupational Safety & Health Administration) 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 industrial safety 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 has since been a steady improvement and by the end of 2008 the site had reached “mid-table”. Industrial safety performance data for 2007/08 is shown in Figure 3.

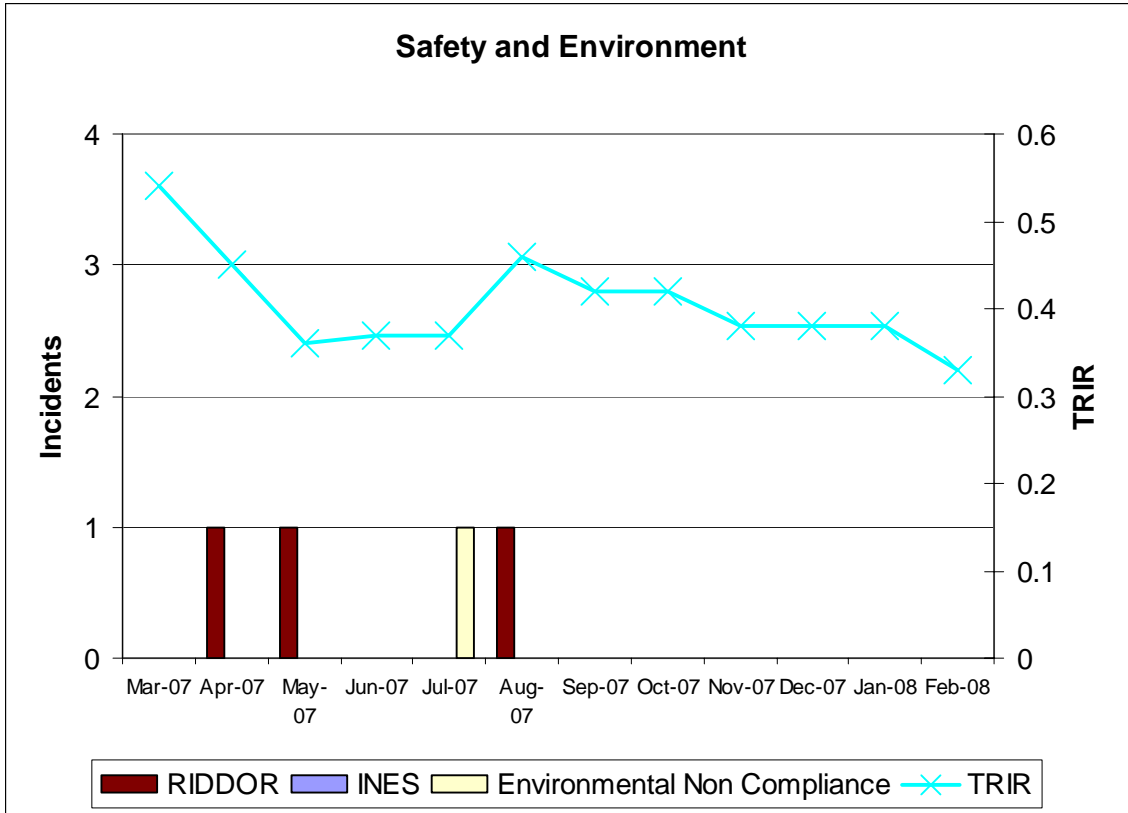


Figure 3: TRIR, RIDDOR and INES data for Dounreay Mar'07 – Feb'08 (all staff including contractors)

**Nuclear Safety Performance**

19 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; these were trialed during 2007/08 and in the light of this experience it is anticipated that some refinements will be made for the coming year.

**Radiological Protection**

20 Decommissioning work involves dismantling contaminated plant and containment systems and as such it is essential that good standards of radiological protection are maintained. Radiological Protection Advisors and Radiological Protection Supervisors are embedded into all of the major decommissioning project teams and are intimately involved in the planning of work to ensure that ALARP considerations are taken into account at a formative stage. The 2007 radiation dose to workers data is shown in Figure 4, with the data for 2006 shown in brackets for comparison:

Radiological Protection Data	Calendar Year 2007, mSv (2006 data in brackets)	
Average individual dose – employees	0.17	(0.06)
Average individual dose – contractors	0.07	(0.07)
Maximum individual dose - employees	4.59	(2.04)
Maximum individual dose – contractors	3.23	(3.56)
Collective dose – employees	147.91	(62.88)
Collective dose – contractors	91.06	(113.01)

Figure 4: Workforce radiation dose data for 2007

21 The collective dose for 2007 is approximately thirty per cent greater than the previous year, with a shift between contractors and UKAEA doses as more hands-on work is currently being performed by UKAEA staff. This is particularly true in respect to remediation of the Dounreay Cementation Plant, where approximately forty per cent of the collective dose has been accrued. It should be noted that the number of airline suit entries has doubled during 2007 as the pace of decommissioning work has increased.

### **Hazard Reduction**

22 It is widely recognised that good safety performance and good business performance go hand-in-hand and over the past three years there has been an improved performance in both. As a result of this the site closure date has progressively been advanced and it now stands at 2024; at this point all facilities will have been decommissioned with the exception of the waste and fuel stores and associated support facilities such as the police command and control building. Good progress has already been made on hazard reduction across a broad front as summarised below, with information on the decommissioning achievements during 2007/08 being given in Appendix 2:

- *PFR*: All of the bulk sodium from the reactor vessel, the primary and the secondary circuits has safely been destroyed via the Sodium Destruction Plant (SDP). Around one tonne of residual sodium remains in the reactor vessel, which will be destroyed using the water-vapour/nitrogen process; this process has already been successfully applied to large parts of the secondary circuits. Large quantities of redundant equipment have been removed. It has been over three years since the last lost-time accident at PFR.
- *DFR*: The NII has recently issued a Licence Instrument enabling active commissioning of the NaK (sodium/potassium) destruction plant and the first batch of NaK was destroyed during February 2008. A new plant to remove and package the breeder elements that are stuck inside the reactor vessel is at an advanced stage of construction. It has been over four years since the last lost-time accident at DFR.

- *DCP*: The contamination that was spread inside the cell line after the “DCP incident” has been safely removed. The plant has been reinstated and recently resumed active operation.
- *D1202*: This former fuel fabrication plant was demolished to ground level in December 2007. This is a major achievement, representing the first completion of decommissioning of a Category 1 plant at Dounreay.
- *D2670 Pulse Column Lab*: Following completion of a programme of improvements to the ventilation system, a Licence Instrument has been received from the NII enabling decommissioning to recommence. Good progress is being made and most of the plutonium-contaminated glass column has now been safely removed.
- *D8550*: Work to declassify the former criticality test facility, which was heavily contaminated with plutonium as a result of an incident in the 1960’s, remains on schedule for completion early in 2008.

## **SHAPING UP FOR COMPETITION**

23 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 Licence 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. It is also necessary to obtain a new nuclear site licence and to transfer the 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 are potentially vulnerable to change when the new management contract is awarded) and agreement on this has now been reached.

24 In October 2007 the site commenced a period of shadow-working to the new arrangements and it remains on programme for the new licence and authorisations to transfer to DSRL on 1 April 2008. The DSRL management structure is shown in Figure 5:

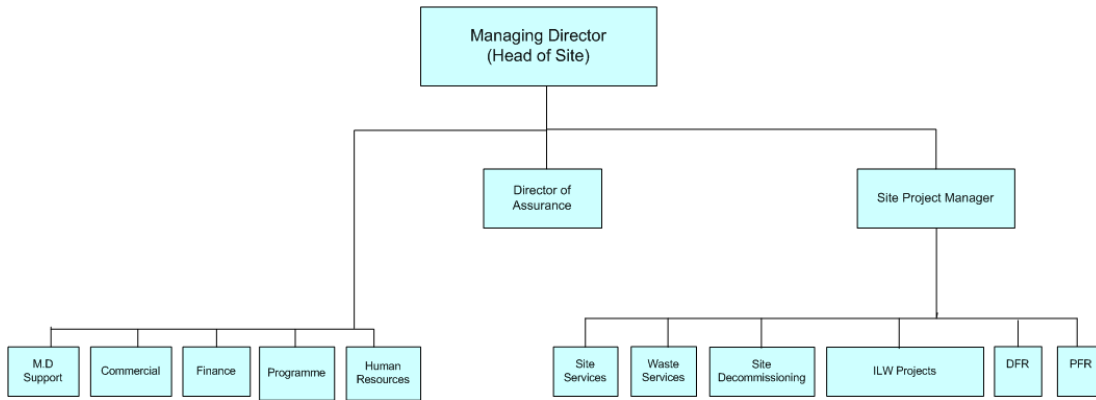


Figure 5: Dounreay management structure from commencement of “shadow working”

## **SOCIO-ECONOMIC CONSIDERATIONS**

25 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. At the time that the DSRP was issued the planned closure date was 2060. Accelerating the decommissioning programme end date to 2024 means that the number of staff employed at Dounreay will start to reduce from around 2012. A number of schemes have been introduced to ensure that staff are given the opportunity to re-skill and retrain for their future. Stability of NDA funding for delivering the LTP programme is essential in order to successfully manage the transition.

## **26 CONCLUSIONS**

- UKAEA's response to the recommendations from the NII/SEPA Audit of Safety in 1998 provided a good base for decommissioning the Dounreay site. 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 which moved the site to a project-based structure with clear lines of responsibility and accountability has proved to be successful. The embedding of specialist support staff into the project teams has proved to be particularly worthwhile, ensuring that safety and environmental knowledge is integrated into all stages of project work;
- The use of staff from partner organisations 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 must be actively managed. Whilst there has been a significant improvement in safety performance over the past three years, Dounreay's senior management recognise that there is still some way to go to achieve a world-class level and we are committed to delivering this. The "Sustained Excellence" safety management plan has been developed to ensure that this is achieved;
- The "Baker Report" on the accident at the Texas City refinery served as a strong reminder of the need 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;

- In order to manage the closure programme for a geographically remote site such as Dounreay it is essential that there is stability of future funding as the local economy cannot accommodate large fluctuations.