

Early Regulatory Engagement for Successful Site Remediation: the UK Experience – 13173

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ABSTRACT

The Office for Nuclear Regulation (ONR) is an independent safety, security and transport regulator of the UK nuclear industry. ONR regulates all civil nuclear reactor power stations, fuel manufacture, enrichment, spent fuel reprocessing, most defence sites and installations that store and process legacy spent fuel and radioactive waste. The responsibility for funding and strategic direction of decommissioning and radioactive waste management of state owned legacy sites has rested solely with the Nuclear Decommissioning Authority (NDA) since 2005. A key component of NDA's mandate was to encourage new strategic approaches and innovation to dealing with the UK's waste legacy and which deliver value-for-money to the UK taxpayer. ONR, as an agency of the Health & Safety Executive, is entirely independent of NDA and regulates all prescribed activities on NDA's sites. NDA's competition of site management and closure contracts has attracted significant international interest and the formation of consortia comprised of major British, US, French and Swedish organizations bidding for those contracts. The prominence of US organizations in each of those consortia reflects the scale and breadth of existing waste management and D&D projects in the US. This paper will articulate, in broad terms, the challenges faced by international organizations seeking to employ 'off-the-shelf' technology and D&D techniques, successfully employed elsewhere, into the UK regulatory context. The predominantly 'goal-setting' regulatory framework in the UK does not generally prescribe a minimum standard to which a licensee must adhere. The legal onus on licensees in the UK is to demonstrate, whatever technology is selected, that in its applications, risks are reduced 'So Far As Is Reasonably Practicable' or 'SFAIRP'.

By the nature of its role, ONR adopts a conservative approach to regulation; however ONR also recognises that in the decommissioning (and ultimately the site closure) domain, it is often necessary to consider and support novel approaches to achieve the nationally desired end-state. Crucial to successful and compliant operation in this regulatory environment is early and sustained engagement of the contractor with the regulator. There must be a 'no-surprises' culture to engender regulatory confidence early in a project. The paper considers some of the challenges facing international prime and lower tier contractors when undertaking D&D contracts in the UK, and emphasizes the importance of constructive and transparent dialogue with all regulators to sustain confidence at all stages of a major decommissioning project. The paper will also articulate ONR's strategy to increase collaboration with the US Department of Energy in light of increasing UK-US synergy in the area of waste management and to benchmark respective regulatory approaches.

INTRODUCTION - THE UK REGULATORY FRAMEWORK

A broad understanding of the regulatory and legislative framework, within which the industry operates, is helpful to contextualize this paper and the messages herein.

Office for Nuclear Regulation

The Office for Nuclear Regulation (ONR) is an independent safety, security and transport regulator of the nuclear industry in Great Britain. ONR regulates all civil nuclear reactor power stations, fuel manufacture, enrichment, spent fuel reprocessing, most defence sites and installations that store and process legacy spent fuel and radioactive waste. Previously known as the Nuclear Installations Inspectorate (NII), ONR was formed as an agency of the Health & Safety Executive (HSE) in April 2011, pending the formation of a statutory corporation that is fully independent and proposed within the 2012 Energy Bill. ONR's current 'agency' status is a transitional phase to enable a systematic organizational transformation whilst the Energy Bill is laid before Parliament.

The need for organizational transformation and the wider legislative reform was driven by the UK government following its announcement in its 2006 'White Paper' that concluded that new nuclear power stations should constitute part of a secure and low carbon energy portfolio for the UK. The UK government commissioned in 2008 a comprehensive review of the Nuclear Installations Inspectorate (the 'Stone Review' [1]) to evaluate the organization's capability and readiness to deliver the necessary regulatory oversight for licensing the construction of new nuclear power stations. The Stone Review made a number of recommendations that were intended to improve ONR's ability to deal with the many challenges associated with the UK government's ambition to make the UK a world leader in the safe, efficient use of nuclear energy, thus demanding a highly efficient and effective regulatory system. The formation of ONR as a statutory body anticipated early 2014, and the implementation of organizational transformation, will enable the UK regulator to operate in a more flexible, open and transparent manner.

Events at Fukushima Dai-ichi in March 2011 and the subsequent investigations undertaken on an international scale emphasized the importance of open and transparent regulatory bodies that are demonstrably independent from the nuclear industries they regulate.

The Legislative and Regulatory Framework

The operators of nuclear facilities in the UK, comparable with their counterparts in other industries and places of work in general, are required to comply with the Health and Safety at Work etc Act 1974 (HASAW Act) [2]. The HSW Act places a fundamental duty on employers to ensure, So Far As Is Reasonably Practicable (herein referred to as

SFAIRP), the health, safety and welfare at work of all their employees. This duty further extends to persons not in their employment (i.e. the public) and provide the basis for regulation by ONR.

To assure the safety of nuclear installations in the UK, ONR works on a system of regulatory control, based on a robust licensing process by which a corporate body is granted a licence to use a site for specified activities. A set of 36 Standard Conditions, covering design, construction, operation and decommissioning, is also attached to each licence which require licensees to implement adequate arrangements to ensure compliance.

ONR verifies that licensees comply with their licence conditions through planned inspections, on a sample basis according to information derived from safety cases and other operational intelligence. ONR also undertakes permissioning of key activities through assessment of licensees' safety cases, on a sample basis according to potential consequences, to ensure that the hazards have been understood and are properly controlled. Where necessary, ONR undertakes the full spectrum of enforcement activities, from the provision of advice through to prosecution, in accordance with HSE's Enforcement Policy Statement and the UK Regulators' Compliance Code.

It is established in UK case law [3] that the fundamental test to determine whether risks have been reduced SFAIRP involves an assessment of the risk to be avoided, the sacrifice (in money, time and trouble) involved in taking measures to avoid that risk, and a comparison of the two. If the sacrifice in implementing further risk reduction measures is grossly disproportionate (and greater) than the risk reduction, then the risks are deemed to be As Low as is Reasonably Practicable (ALARP) . This predominantly 'goal-setting' regulatory framework does not generally prescribe a minimum standard to which a licensee must adhere. The onus on licensees in the UK is to demonstrate that, whatever technology is selected, risks are reduced SFAIRP.

THE CHANGING LANDSCAPE OF INDUSTRY – ACCELERATED HAZARD REDUCTION

Formation of the Nuclear Decommissioning Authority

An increased government focus on the UK's historic nuclear legacy and latterly a recognition that nuclear power constitutes part of the nation's future sustainable energy portfolio have justifiably directed attention to the nuclear regulatory body in its readiness to respond to the shifting industry landscape. The previous section alluded to the specific impact of Stone's review on the organization in the context of readiness for licensing a new reactor fleet. This section and wider report explore how the existing UK's regulatory philosophy can meet the challenges posed by accelerated legacy hazard reduction across the UK's nuclear estate.

The responsibility for funding and strategic direction of decommissioning and radioactive waste management of state owned legacy sites has rested solely with the Nuclear Decommissioning Authority (NDA) since 2005. The management of those sites has been subject to competition during the last 7 years. A key component of NDA's mandate was to encourage new strategic approaches and innovation to dealing with the UK's waste legacy, as well as to secure value for money to the UK taxpayer.

Organizational Transformation

Since the formation of ONR as an interim agency of the Health & Safety Executive in April 2011 (pending legislation that will create an statutory body in 2014), ONR's program of organizational transformation has been comprehensive and wide-ranging:

- A program management structure was introduced in 2011 to align regulatory activities and resources better to industry sectors.
- In April 2013 ONR will implement a fundamental organizational redesign according to a matrix-management structure that will promote a more flexible approach to deploying inspector resource according to the needs of industry regulation.
- An extensive recruitment campaign to ensure organizational readiness and capability
- The development of programs that ensure ONR is more strategically positioned to monitor and respond to international developments in nuclear safety standards.

In line with program working, the formation of a Decommissioning, Fuel and Waste (DFW) program will better equip ONR to regulate more consistently the more active decommissioning program that has ensued since NDA's formation. Its formation will refocus regulatory attention to the significant historic radioactive waste legacy accumulated across the nuclear estate. Central to DFW's remit is the effective influence of government, industry and wider regulatory stakeholders in the definition of end-states, waste management standards and the anticipated construction and licensing of a Geological Disposal Facility.

Contractorized Site Remediation

With the advent of NDA in April 2005 resulting from the 2004 Energy Act, Parent Body Organization (PBO) contracts for state owned nuclear licensed sites have been subject to international competition. To date, Energy Solutions, URS, CH2M Hill and Babcock have successfully formed parent body consortia with other international contracting organizations to successfully bid for M&O and site closure contracts at one or more of the following licensed sites:

- Magnox Reactor Sites (Energy Solutions purchased Magnox Ltd)

- LLWR (URS in partnership with AMEC, Studsvik and Bechtel)
- Sellafield (URS in partnership with AMEC and AREVA)
- Dounreay (CH2M Hill, URS in partnership with Babcock)

Following the announcement of Babcock Dounreay Partnership (BDP) as the preferred bidder to manage the Dounreay site closure project, ONR has been proactive in ensuring lessons learned from early experience at Sellafield with US prime contractors (this experience is considered in the following section). Transatlantic partnering for the wider Magnox Reactor and Research Reactor sites PBO contract (to be awarded by NDA in 2014) is anticipated once again. Experiences to date with PBO contractors from the US indicates a clear need for ONR to better understand the regulatory environment employed on US Department of Energy sites, and vice versa. This is essential as US contractors seek to transpose D&D and waste management approaches in the UK regulatory context.

ADAPTING TO THE UK REGULATORY FRAMEWORK

International Differences - the US as a case study

In the UK Tier 1 contracting framework, the Parent Body Organization deploys personnel from its constituent organizations into the site licence company itself. Those individuals typically adopt senior management (Director or Project Management) positions vacated by previous incumbents. A fundamental challenge faced by the incoming management team, particularly those from outside the UK, is to rapidly develop an appreciation of the UK regulatory framework and the arrangements made by the licensee required under the licence.

The absence of a fully independent nuclear safety regulator of D&D and waste management activities across US DOE sites constitutes a difference that Tier 1 contractors from the US have faced when entering the UK industry. DOE sites are nevertheless heavily regulated by the US Environmental Protection Agency (EPA), often through trilateral arrangements discharged by individual state agencies. Nuclear Safety (in addition to wider chemotoxic and industrial safety) is nonetheless subject to internal DOE Oversight programs that are managed both at a site and Federal level separate to the DOE project delivery functions.

D&D contracts awarded across Department of Energy (DOE) sites in the United States require site Tier 1 contractors to manage nuclear and conventional safety in accordance with DOE Orders and DOE's standardized Integrated Safety Management System (ISMS). ISMS provides a consistent and standardized set of safety management arrangements which site contractors in the US must follow across the large DOE estate. DOE orders and ISMS collectively provide contractors with a transferable basis on which to execute and deliver D&D projects.

However in the UK, licensees are required to undertake site activities in accordance with adequate arrangements according to 36 standard Licence Conditions. This goal-setting framework does not prescribe what those arrangements should be but the regulator does expect good practice methods to be followed (judged by ONR and licensees through proactive benchmarking). Those arrangements provide a framework within which the SLC undertakes its own 'checks & balances' (internal sanction processes and self regulatory systems) during the option selection, design, commissioning and operations of any D&D activity – again in a non-prescribed manner.

These differences in regulatory / safety oversight frameworks between the UK and US inevitably present US contractors a challenge to promptly acquire a comprehensive understanding of the environment with which to deploy preferred technological approaches to D&D that formed the basis of contract bids.

Early challenges to prime contractors for site closure contracts

Hazard reduction at Sellafield will occur over many decades due to the extent, concentration and complexity of legacy wastes and diversity of facilities. On other NDA-owned sites which operate (or will operate) under defined site closure contracts, the societal risk presented by facilities undergoing decommissioning and radioactive waste conditioning are considerably lower than at Sellafield. The majority of facilities on those sites could theoretically remain under extended care & maintenance if justified by a suitable and sufficient safety case and waste management strategy.

Accordingly, the regulatory incentive for accelerated hazard reduction on sites across NDA's estate with lower hazard profiles than Sellafield is much less compelling. Notwithstanding that, ONR has recognised that to bring about site closure on those lower hazard sites inevitably demands short-term increases in worker and public risk to achieve the desired overall safer end-state for future generations.

During the early months following the PBO transition at Dounreay in April 2012, ONR reviewed its experiences gathered from the Sellafield PBO contract (awarded in 2008) to identify any lessons learned. Following the transition at Sellafield, difficulties were encountered by the PBO in translating previously successful decommissioning and waste management techniques into viable safety cases, as required under the UK regulatory framework, within timescales originally anticipated by the PBO.

ONR consciously sought to evaluate possible reasons for a slower than expected pace of hazard reduction, and to secure confidence that the regulatory framework is not misperceived to be an undue barrier.

Dispelling Misconceptions

The following factors are postulated as possible reasons and then considered in-turn:

1. Incoming international secondees to the Site Licence Companies (SLC) have successfully deployed novel techniques within their respective home nations but according to regulatory oversight different in rigour and / or depth to UK regulatory expectations (key differences are articulated in the previous section). Subsequent translation into the UK regulatory context proved challenging because contractors may not have had equitable opportunity during the period of due diligence.
2. A grossly conservative approach to decision making and safety analysis within the incumbent SLC due to lack of UK experience in a particular technique. Inconsistent rigour of conservative analysis when evaluating different options can cultivate a misleading perspective of risk and lead to viable and possibly safer options being discounted prematurely.
3. Overly intrusive regulatory involvement in licensee decision making processes.
4. Misinformed perceptions of regulatory expectations. The licensee may have misinformed perceptions that a particular technique will somehow not be accepted by the regulator and prematurely dismiss those techniques.

The factors above are considered in-turn:

Factor 1 Becoming acquainted with the UK's goal-setting regulatory framework for safety that puts much greater emphasis on the licensee's arrangements in demonstrating compliance with the licence condition framework and wider health & safety law. ONR's benchmarking in the United States has revealed that secondees from organisations operate within safety management systems that are consistent and systemically applied across USDOE's estate. Many aspects of USDOE's regulatory expectations are goal-setting, predicated on nuclear safety standards. Whilst some aspects are prescriptive (such as components of the integrated safety management system) contractors are much less acquainted with sequential safety case hold-point sanction.

Familiarisation with site licence compliance arrangements constitutes a significant challenge to incoming PBOs and should be a cornerstone benchmarking activity for due diligence and in the early months of site closure contracts.

Factor 2 The UK Safety Assessment Principles (SAPs [4]) are used by ONR to help guide regulatory decision making and the need for conservative hazard analysis is a cornerstone of Design Basis Accident (DBA) analysis; conservative deterministic analysis is essential during screening of fault sequences to identify where and the extent to which safety measures should be implemented into the design. Safety analysts can however be tempted to invoke excessively conservative assumptions in an attempt to bound risk, particularly where the extent of fault progression and its consequences has not been fully characterized during the early stages of decision making.

Licensees should also proactively work with incoming PBO secondees to acquire an informed understanding of novel techniques (for which there might be limited direct experience within the UK industry) that have been successfully deployed and characterized internationally. Such experience and capability may be transferable to inform a viable safety case and should not be discounted purely on the basis of novelty.

Risks must be appropriately balanced when comparing one option against another, i.e. process risk versus worker risk. Due cognisance should be given to international experience in techniques which are novel to the UK when undertaking such a risk balance.

Decision making should integrate safety, environmental, cost and other competing factors in an optimized manner, consistent with IAEA Safety Fundamentals.

Factor 3 Regulatory intrusion into licensee decision making can be necessary if ONR believes that due process may not have been followed or an inadequate safety case has been presented. However, it is well documented that ONR's regulatory philosophy in this regard is [5]:

- To adopt an open and effective dialogue with licensees
- To adopt a positive and enabling approach to the permissioning of activity when legal requirements have been met or the risk/compliance gap is such that it would be disproportionate not to grant a permission.

The essence to licensees cultivating regulatory confidence is by demonstrating a systematic, plausible and professional process for balancing risks posed by various design options. The law is not prescriptive in this sense and requires straightforward demonstration that

further risk reduction would invoke grossly disproportionate costs (in terms of time, money and effort) – the foundation of demonstrating that risks are reduced ALARP.

It is not ONR's policy to restrict or unduly direct a licensee towards any particular approach or option.

Factor 4 The licensee may have misinformed perceptions that a particular technique will somehow not be accepted by the regulator and prematurely dismiss those techniques. This perception has been echoed, anecdotally, amongst PBo secondees during regulatory interactions. Licensees can be reluctant to engage early with the regulator particularly where design proposals or safety cases are yet to be fully developed.

The regulatory framework should not be considered by licensees to be burdensome; regulatory expectations enshrined in the Health & Safety at Work Act, and other relevant statutory provisions such as the nuclear site licence conditions are, on balance, goal-setting and not prescriptive. ALARP is founded upon principles of defence-in-depth, relevant good practice and making balanced judgements.

Undertaking early regulatory engagement should not predispose licensees to disproportionate steer from the regulator; rather it promotes mature, open and transparent dialogue that can ultimately de-risk projects at an early stage.

Licensees and lower tier contractors should engage early with the UK regulator to cultivate early and sustained confidence and to eradicate misconceptions that the regulator is a barrier to progress.

CONCLUSIONS

- Significant differences between US DOE and UK nuclear safety regulatory frameworks pose a challenge to US prime contractors to promptly acquire sufficient appreciation of regulatory expectations in order that contract bids can be realised.
- The UK's goal-setting regulatory framework is flexible in allowing novel techniques to be justified by adequate safety cases. Regulatory policy supports, where necessary, temporary increases in risk to achieve an ultimately safer end-state.

- The introduction of novel approaches and challenges to status-quo is a legitimate mandate on PBOs delivering (through the SLC) hazard reduction across the NDA estate. The licensee should undertake balanced decision making that gives equitable consideration to international experience in the absence of previous application in the UK
- Early and transparent dialogue is essential to secure regulatory confidence in novel techniques
- The expansion of the PBO model to other legacy NDA sites has provided ONR with the impetus to:
 - I. Proactively review and benchmark against international regulatory approaches, with much emphasis on empowering licensees to strengthen internal regulatory processes.
 - II. Engage and collaborate with US Department of Energy, France and other nations to better benchmark the UK regulatory perspective on good practice approaches to decommissioning and regulatory oversight.

REFERENCES

1. Observations by Dr Tim Stone for the Secretary of state for Energy & Climate Change; December 2008;
http://www.decc.gov.uk/en/content/cms/meeting_energy/nuclear/new/reg_reform/reg_reform.aspx
2. Health & safety at Work Act et. (1974) <http://www.hse.gov.uk/legislation/hswa.htm>
3. Principles and guidance to assist HSE in its judgements that dutyholders have reduced risks so far as is reasonably practicable;
<http://www.hse.gov.uk/risk/theory/alarp1.htm>
4. Safety Assessment Principles, 2006 <http://www.hse.gov.uk/nuclear/saps/index.htm>
5. ONR guidance for Intervention Planning; G/INS/008;
<http://www.hse.gov.uk/nuclear/operational/inspection/gins008.htm>
6. Guidance on the demonstration of ALARP; T/AST/005
http://www.hse.gov.uk/nuclear/operational/tech_asst_guides/tast005.pdf