Challenges in Procurement & Construction for Next Generation Nuclear Power Plants

April 2013
Introduction

• Overview of Nuclear Safety
• Outline of the general responsibilities relating to Nuclear Safety
• Propagation of Responsibilities
• A Practical Experience
Definition of Nuclear Safety

- **IAEA Definition**
  - The achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards.

- **French ASN definition**
  - Nuclear safety is defined as all technical measures and organizational measures for design, construction, operation, shutdown and dismantling of facilities including a source of ionising radiation, as well as transport of radioactive materials, in order to prevent accidents and to limit their effects.
Public perception

OECD – Public Attitudes to Nuclear Power 2007

Ipsos MORI Poll – Dec 2011

OECD – Public Attitudes to Nuclear Power 2007

Plan Design Enable
Why it is important
- To ensure that all parties deliver on their responsibilities starting with the Licensee and propagating into the Supply Chain
- To deliver sustainable safe electricity
- To allay public fears
Management of Nuclear Safety by Licensees

• Achieving Understanding
  – Hazards and their mitigation
  – Safety Cases
  – Integrated Management Systems

• Nuclear Safety Values
  – Everyone is personally responsible for nuclear safety
  – A questioning attitude is cultivated
  – Nuclear safety undergoes constant examination

• UK Licensees bound by 36 Licence Conditions
  – A breach of any one could lead to a sanction by Regulators
  – But there to set the framework for operations
Propagation of Responsibilities to the Supply Chain

- Licensees Responsibilities
  - Definition of Safety Requirements (technically and contractually)
  - Communication of Requirements
  - Ensure pragmatic approach to Safety Classification
  - Nuclear Baseline Organisation with Intelligent Customer capability
  - Management Control and Supervision
  - Change and Non Conformance Control
  - Robust Audit processes to assure NSR delivery
Propagation of Responsibilities to the Supply Chain

• Primary Contractor’s Responsibilities
  – Propagation of Requirements to Supply Chain
  – Management and Supervision
  – Change and Non Conformance Control

• And so on through out the Supply Chain
Nature of the Supply Chain

- Many opportunities for failure
- Owner/licensee and regulatory oversight of vendors, manufacturers and contractors is more difficult because of the global nature of the supply chain
- Many interfaces
Propagation of Responsibilities to the Supply Chain

• Challenges
  – Understanding requirements
  – Embedding the requirements specification and contractual documents
  – Ensuring the right culture

SAFETY CULTURE? or SAFETY AWARENESS?
Propagation of Responsibilities to the Supply Chain

- Challenges
  - Oversight
  - The ability of Licensees or representatives to adequately control all aspects of the construction project, including planning, scheduling, procurement and oversight of contractors
  - Owner/licensee and regulatory oversight of vendors, manufacturers and contractors is more difficult because of the global nature of the supply chain
Propagation of Responsibilities to the Supply Chain

- Challenges
  - Communication
    - Communication may be confused because of differences between what is conveyed verbally or in writing (e.g. word choice, message content) and what is expressed through the non-verbal cues (such as demeanour (behaviour towards others), tone, physical posture, practices) observed by recipients and used to assess the importance, integrity and sincerity of the message.
  - Establishing an open reporting culture in complex environments with different national cultures, contractors and regulators.
Propagation of Responsibilities to the Supply Chain

• Challenges
  – Leadership
    • Leadership at all levels
    • Ensuring that all leaders are aware of the implications of nuclear safety and that they regard the safety culture as a driver for excellent performance
  – International Cultures
    • Communication and language understanding is critical
    • e.g. “..... procedures will eventually be updated following client comments…”
    • The international supply chain is a reality
Propagation of Responsibilities to the Supply Chain

- Individual understanding
  - All participants need to understand their particular role in delivering Nuclear safety so it’s not just a case of:
Propagation of Responsibilities to the Supply Chain

- All this sounds a little theoretical but it can work in practice and...
- The basic principle of identifying NSRs and assuring their execution is applicable to all nuclear projects irrespective of location be it UK or France
Recent Experience at ITER

- International Thermonuclear Experimental Reactor
Recent Experience at ITER

- Some ITER facts:
  - 500,000 t eq of Nuclear Concrete
  - 500MWe target
  - First nuclear plasma in 2024
  - Project end date 2050

- Potential for contamination is high:
  - activated dust and corrosion products
  - equivalent dose rates are very high in the vacuum vessel during operating: (500 to 10,000 Sv/h)
Recent Experience at ITER

- Atkins part of Joint Venture with Assystem (Fr), Iosis, (Fr) and Empresados Agrupados, Spain
- Responsible for the design of 34 nuclear and non-nuclear buildings
- Atkins lead on Nuclear Safety Team
- Experience relates to UK build in that the responsibilities are the same:
  - Definition of Requirements through to assurance of execution
Recent Experience at ITER

• Challenges
  – To define the Nuclear Safety Requirements
  – To successfully communicate the requirements
  – To develop a methodical approach to cascading NSR and assuring delivery through the Supply Chain
Recent Experience at ITER

• Approach
  – Development of methodology to capture NSRs and Contractor Control Plans
  – Definition of Qualité Définie (QD) and Exigences Définies (ED) for each Structure, System or Component
    • Basically the “What” and the “How”
  – QDs and EDs need to be developed for every stage of the project from Design → Installation → Comms → O&M
  – NSR database to capture all QDs and EDs for use and audit traceability purposes
Check of Compliance with all EDs with each previous ED and QD in addition to impact assessment on related QDs

QD ED Lifecycle

<table>
<thead>
<tr>
<th>Tender Design QRA</th>
<th>Const. Design QRA</th>
<th>Manufact. QRA</th>
<th>QD</th>
<th>Installation QRA</th>
<th>Commiss. QRA</th>
<th>O&amp;M QRA</th>
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QCR 1
QCR 2
QCR 6

Plan Design Enable
NSR DataBase

- Needs robust DB
- Provides traceability and audit evidence
- Access to be controlled

Need to avoid “Garbage In”, “Gospel Out”
Recent Experience at ITER

- **Training**
  - Engage Disciplines to provide the EDs for the Preliminary Design
  - IO and OE in the use of the NSR database
  - Contractors in their responsibilities relating to the Control Plans
Recent Experience at ITER

• Successes
  – Raising awareness of NSRs and their implementation through current Supply Chain
  – Increased commitment by Contractors to deliver
  – Greater communication between parties on the management on NSRs
Conclusions

• Propagation is aided by:
  – Clear understanding and communication of requirements
  – Open culture to promote challenge at all stages
  – Robust audit process to demonstrate compliance with requirements

but
  – How this is achieved is bespoke to Licensee but the start and end points are the same