Radiation Protection Culture in Context

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Introduction

Nuclear companies have to operate to high standards of Environment Health and Safety (EH&S) from a moral, business and public acceptance perspective. To deliver high levels of consistent performance it is necessary to engage with the workforce at a cultural level. Safety Culture is the subject of guidance by the IAEA which is equally applicable to the four major areas of safety on a nuclear facility:

Nuclear | Radiological | Conventional (including occupational) & Environmental

To develop and deliver a high EH&S standard there is a need to understand the different characteristics and common management factors in order to have a successful integrated hazard management process, supported by a strong safety culture. Radiation protection professionals have a vital role in strengthening and supporting the Radiological Protection Culture in the Integrated Safety Management Systems. British Nuclear Group in 2006 developed a model to communicate and assist its leadership to develop such a Safety Culture. This is presented below:

British Nuclear Group

Environment, Health & Safety - The Map

To deliver the highest EH&S standards, we need to understand the differing characteristics and common management factors of the four main hazards on our sites.

Common Management Factors:

Leadership

- Set clear standards, expectations and accountabilities.
- Visibly demonstrate commitment to EH&S
- Lead by example with your own behaviour
- Open to learning and challenge
- Communicate safely before production
- Listening and coaching

Management Systems

- Work control (hazard identification, risk assessment, hierarchy of controls).
- Advance planning, preparation and training.
- Pre-task 'One Minute' Risk Assessment (eg STAR/STOP etc).
- Implement good housekeeping standards.
- Integration of supply chain and contractors.
- Operational Experience Feedback (OEF - both our events and others).

Culture

- Intolerance of degraded plant and equipment conditions: plant operates as designed.
- Compliance, but with a questioning attitude
- Using behavioural observations.
- Conservative decision taking
- Supporting the development of EH&S competencies
- Instilling 'Right First Time' and 'Continuous Improvement' attitudes.

Nuclear Safety

Hazards

- Unplanned criticality.
- Major release of radioactivity.
- Degradation of reactor core and nuclear fuel integrity.
- Degradation of chemical plant containment and process integrity.
- NB Whenever a nuclear safety hazard is identified it must be given an overriding priority.

Characteristics

- High consequence/low probability events - loss of control and/or containment.
- Defence in depth - no single error results in a major event.
- No obvious and immediate threat; remoteness from the 'end event'; difficult to make the connection - beware complacency.
- No personal health consequence of a single error (unless it breaches the final barrier!).

Controls

- Emphasis on containment of hazardous materials and control of energy sources (including core integrity in reactors).
- Requires knowledge of, and compliance with, safety case via rules, procedures, instructions.
- Requires strong emphasis on compliance, attention to detail and conservative decision taking.
- Extra importance of management of change and learning from experience.
- Requires underpinning technical understanding and ongoing refresher training and management re-enforcement (to counter non-intuitive nature): need for SQEPs.
- Lagging indicators are useless (the event or its pre-cursor has happened!): must monitor a basket of 'leading' indicators.

Radiological Safety

Hazards

- External radiation exposure
- Internal radiation exposure (eg via inhalation/ ingestion of radioactivity).
- Contamination control.

Characteristics

- Routine hazard directly present on our active plants.
- Presence can only be made visible using specialised instrumentation.
- Not part of normal consciousness - particular training neede.
- Health consequences (if any) at normal occupational levels are indirect, delayed and stochastic (i.e subject to chance).
- Exposure to very high doses (eg in major accident situations) can lead to skin burn, organ damage or even death.

Controls

- Emphasis on containment of radioactivity and protecting people from the hazard.
- Control by use of engineered features (eg shielding, ventilation, change barriers, radiation and contamination alarms, robotics), management systems (eg ALARP studies, access control systems) and personal protective equipment (PPE eg respiratory protection, electronic dosemeters).
- Local individual knowledge and awareness can greatly influence your dose.
- Radiological protection is a branch of occupational health and safety - similar control systems to asbestos, chemicals, mutagens, carcinogens.

Conventional Health & Safety

Hazards

- Typical Conventional Safety hazards include:
  - Slips, trips and falls
  - Electricity
  - Machinery
  - Lifting
  - Working at height
  - Asphyxiation/confined spaces
  - Stored energy (eg pressure systems, steam, springs).
  - Building fire
  - Display screen equipment
- Occupational Health hazards include
  - Chemicals and substances hazardous to health
  - Noise
  - Stress
  - Individual fitness for tasks
  - Substance abuse (drugs and alcohol).

Characteristics

- Routine hazards directly present in the workplace.
- Most threats generally obvious, evident and well understood.
- People have direct experience, can use common sense.
- These mainly have direct and immediate health consequences (injuries etc).

Controls

- Seek to eliminate the hazard where feasible, but then reduce, isolate and control by use of systems and PPE (eg isolations, harness, respiratory protection etc).
- Inspections, hazard logs, near miss logs.
- Lagging indicators (eg DACR) have some value, in addition to leading indicators.

Environmental Protection

Hazards

- Release or disposal of unauthorised or noxious substances into the environment, potentially giving:
  - health effects on humans
  - health effects on flora and Fauna
  - loss of amenity
  - other long term effects (eg climate change).
- Inappropriate or unsustainable use of natural resources, eg water, energy, raw materials.
- Other effects on quality of life, eg noise, transport.

Characteristics

- Consequences can range from immediate and obvious (eg acid/oil spill to river) to long term and indirect (eg CFC release, to discharges).
- Sometimes a complex relationship between plant event and potential environmental effect.
- Underpinning environmental science sometimes open to debate (eg climate change) and reliant on precautionary approach to uncertainty.
- Sociental and political importance of environmental issues has been raised over recent years: strong differences of view can exist on some issues, depending on perspective.

Controls

- Controls and indicators cover a combination of those for nuclear, radiological and conventional safety since such events can often result in environmental impacts.
- Control hierarchy: avoid, reduce/reuse/ recycle, lastly minimise disposals. Look after all our wastes via rigorous waste management practices.
- Prevention and minimisation of releases and disposals must comply with BPEO (Best Practicable Environmental Option), BPM (Best Practicable Means) and BAT (Best Available Technology).
- People need fundamental understanding of environmental impact of each task and knowledge of local plant significant environmental effects: requires specific operator training.

Conclusion

By understanding the nature of the four Safety disciplines and the common management factors, an organisation can tailor its communication, training, management and leadership of an integrated risk management system. They will also be able to develop a safety culture that strongly maintains the organisation's capability to meet standards and expectations of society.

The radiological protection professional has a vital role to assist an organisation in the management and development of a strong radiation protection safety culture as part of the integrated hazard management system.