

Role of Regulatory Body in Influencing Licensees for Strengthening Radiation Safety Culture

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Safety Culture and its Importance



- Human factor and safety culture were identified as major contributors to serious accidents world has seen so far.



- Three Mile Island, Chernobyl and Fukushima-Daiichi nuclear power plants witnessed
 - Damage to nuclear reactors and
 - Consequent release to the environment of substantial quantities of radioactivity
- INSAG-4 1991; INSAG-7 1992; INSAG-27 2017



3 Principles of Radiation Protection

Two principles are source-related and apply in all exposure situations

- The principle of **JUSTIFICATION**: any decision that alters the radiation exposure situation should **do more good than harm**.
 - This means that, by introducing a new radiation source, one should **achieve sufficient individual or societal benefit to offset the harm it causes**.
- The principle of **OPTIMIZATION** of protection: the likelihood of getting exposed, the number of people exposed, and the magnitude of their individual doses should all be kept as low as reasonably achievable,
 - This means that the **level of protection should be the best under the prevailing circumstances**, maximizing the margin of benefit over harm.

One principle is individual-related and applies in planned exposure situations

- The principle of application of **DOSE LIMITS**: The total dose to any individual from regulated sources in planned exposure situations other than medical exposure of patients **should not exceed the appropriate limits**



Justification



Optimization



Dose Limits



Radiation Protection (RP) Culture

- The term “RP culture” means the way in which RP is founded, regulated, managed, performed, preserved, and perceived in the workplace,
- It reflects the attitudes, beliefs, perceptions, goals, and values that all parties involved **SHARE** in relation to RP

[IRPA Paris workshop, December 2009]





A Good RP CULTURE Provides

- Visibility to the fundamentals of Radiation Protection (science and values)
- Shared responsibility among HP professionals, operators, regulators and management
- Maintenance of RP heritage and facilitate its transmission
- Better quality and effectiveness of RP
- Improvement in communication with society



Key elements of RP culture



Knowledge



Values and ethics



Principles : Justification, ALARA, Limitation



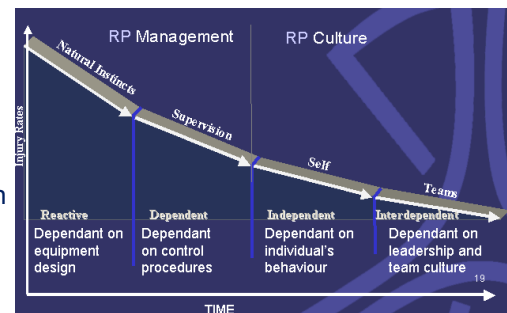
Experience



Behaviour



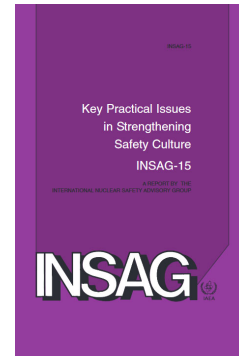
History of Radiation Protection





Importance of organisational culture in RP

- The International Nuclear Safety Advisory Group has described the culture of an organisation as "the mix of shared values, attitudes and patterns of behaviour that give the organisation its particular character. Put simply, it is 'the way we do things round here'" (INSAG-15, 2002).
- The culture of the organisation in which radiological protection is practiced has a significant impact on aspirations to maintain or improve radiation safety.



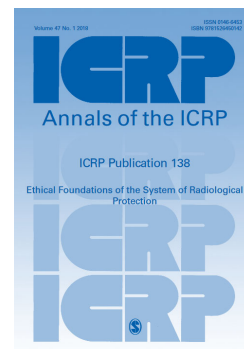
Organisational culture & RP

- The System of Radiation Protection should ensure that the voices of those who advocate good radiological safety practice are "**properly heard**" by organisational leaders and senior managers.
 - This can be particularly difficult in a target-driven culture where their focus is on other targets.
 - This difficulty can be compounded in the aftermath of corporate restructuring and loss of organisational memory.



Ethics and values of RP

- ICRP Publication 138 (ICRP 2018) identifies the three pillars on which the System of Radiological Protection is built:
 - Science of radiological protection with combining knowledge from different disciplines;
 - A set of ethical and social values;
 - Experience accumulated from the day-to-day practice of RP professionals.
- Ethical dilemmas which can be viewed through different ethical lenses. For example
 - deontological ethics emphasize duty to do the right thing for an individual,
 - whereas utilitarian ethics focus on the greatest good for the greatest number.
- Applying different ethical theories may not lead to the same outcome.



Importance & challenges of communicating RP issues

- Communicating radiation protection issues can be very challenging for many reasons, incl.

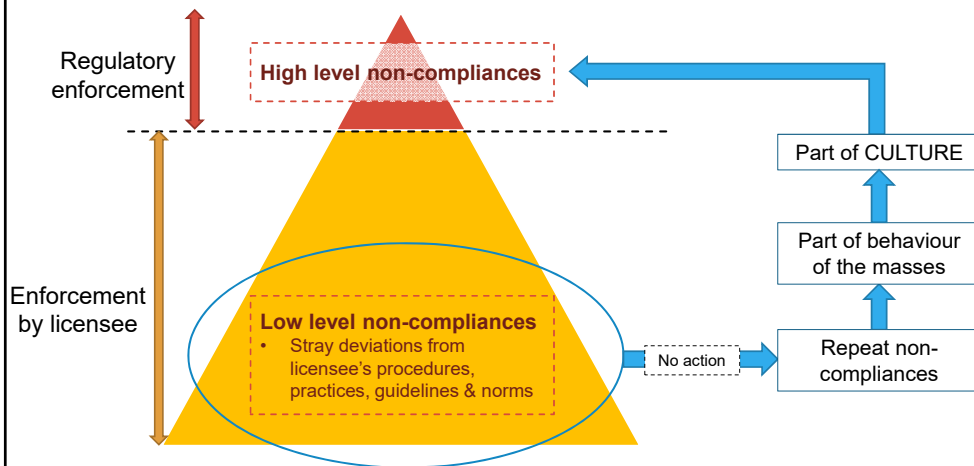
Inability to detect ionizing radiation through the five senses	Latency of radiation-induced biological effects	Unfamiliarity with the principles of radiological protection	Complicated radiation dosimetry	Controversy regarding nuclear power, nuclear weapons and radioactive waste	Inherent uncertainty of stochastic effects; scientific argument about matters such as the Linear No Threshold hypothesis

- these concepts/theories may be too familiar to HP professionals, but we must not forget how alien they may be to others.



Mission & role of AERB

- Mission - **“use of ionizing radiation and nuclear energy in India does not cause undue risk to the health of people and the environment”**
- Role - **Specify the mandatory high level requirements for radiation safety, oversight safety & enforce the same;**
- AERB Organisational Policies (IMS)
 - Practice inclusive, participative regulation with emphasis on positively influencing the licensee for compliance
 - Influence licensees to develop & maintain strong safety culture in their organizations

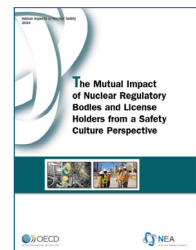
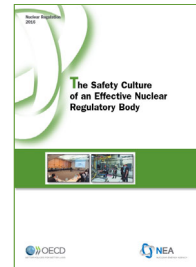


Positive Influence of regulator can prevent manifestation of low level non-compliances to 'Culture', thus eliminating 'High Level Non-Compliances' requiring regulatory enforcement

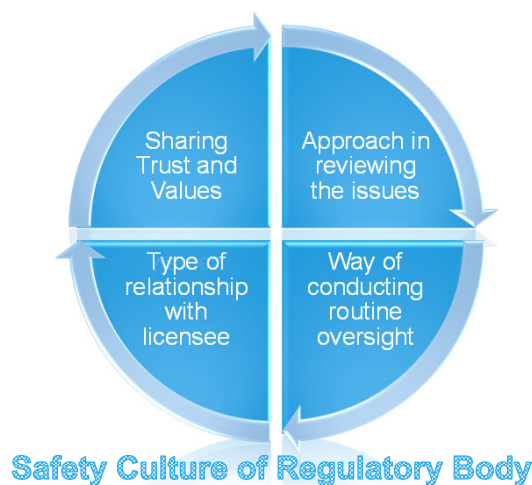


Positive influence of regulatory body

- Prime responsibility and accountability for safe operation & radiation protection – *rests with licensee*
- Regulatory body's role - *oversight of licensees' activities*
- Regulatory bodies, by their nature, deeply influence licensee's safety culture and sense of accountability for safety
- This influence is mutual, from licensee to regulatory body, it is pervasive and may be unseen
- Regulatory body cannot successfully, impose, enforce or regulate culture, rather, can encourage and mentor its development



How regulatory body influences safety culture

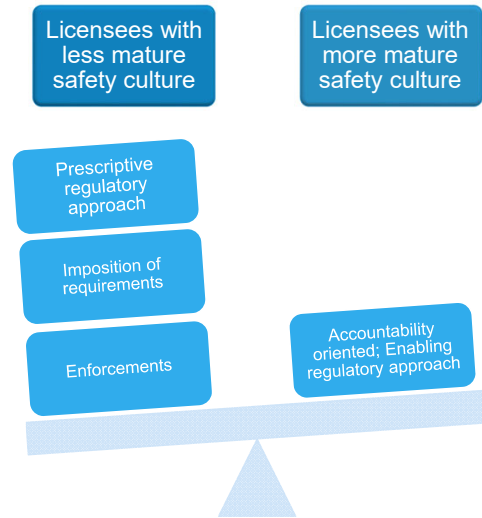


Low level deviations (e.g. improper usage of PPEs, low level spillages, minor release of radioactivity due to unknown reason)	
Tolerate <i>as dose limit is not exceeded & hence regulatory intervention is not required</i>	Influence licensees to take care <i>Example: 'White' deviations in inspection</i>
Spread of behaviour in masses	Check on sample basis whether licensees mechanism is effective
EVENT	Manifestation of behaviours into EVENT precluded

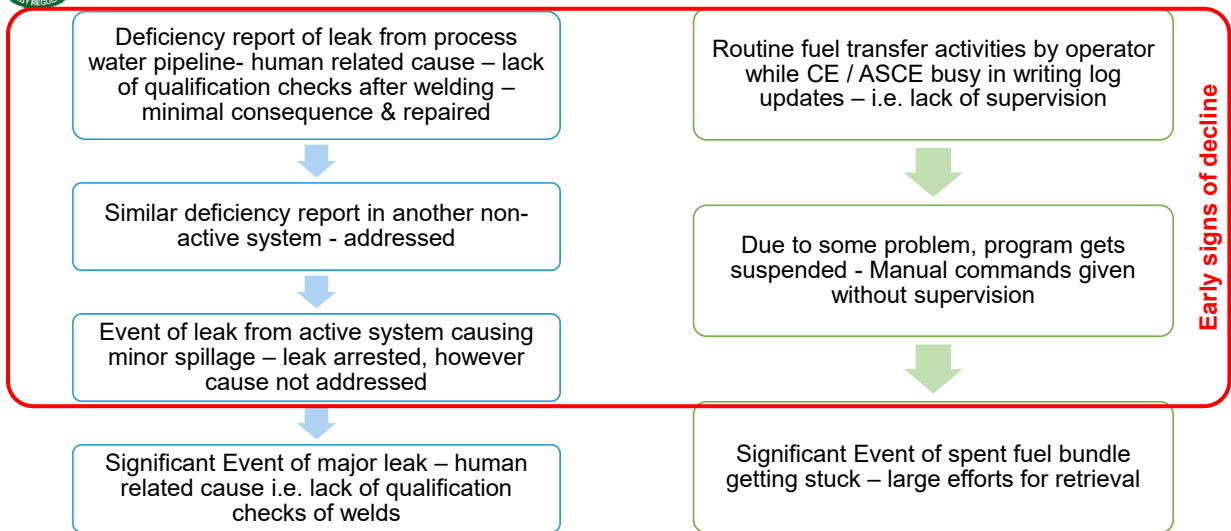


Approach of regulatory body – Prescriptive vs Enabling

- Regulatory focus - to influence licensee to move towards a higher level of cultural maturity, in the long-term interests of safety
- How to judge maturity level of culture, examples?
 - Repeat non-compliances
 - Interactions with workers & plant management in inspections and meetings
 - Plant management unwilling to lead actions towards safety by example
 - Violations not informed willingly; noticed by regulatory body
 - Large back-log of safety related work



Capturing early signs of decline - example





How early signs of decline are captured - examples

- Regulatory inspections (through checklists filled by Inspectors)
 - Job observations – Adherence to procedures, Supervision of activities, Panel operations based on memory rather than written down instructions
 - Surprise visit to work locations – use of recommended PPEs, proper use of dosimetry devices, sitting in high dose area without work
 - Maintenance activities – repeat maintenance activities on a particular system, breakdowns due to similar reasons
- Safety Reviews of Events (Human Factors -> Organizational Factors -> Decline in culture)
 - Non-conservative actions by operator while handling an event due to some reason (Human & Organizational Factors) – early signs captured during review
 - In such cases safety significance increased due to potential consequences
 - Reviews at higher levels, to address the HOF related issues.



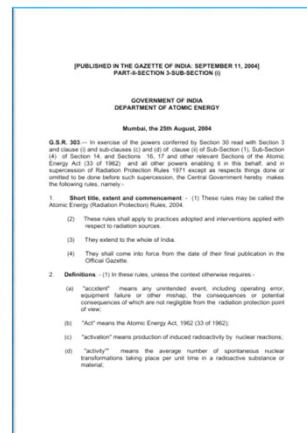
Other avenues to capture safety culture of licensee

- Assessment of Safety Performance during the year
- Periodic Safety Reviews – trends of causes of events, data on repeat maintenance / breakdowns, increasing trend of RPP deviations, etc.
- Licensing interviews of operating personnel
- Senior Management Certification Interviews
- Conduct of licensee representatives during meetings of safety review committees

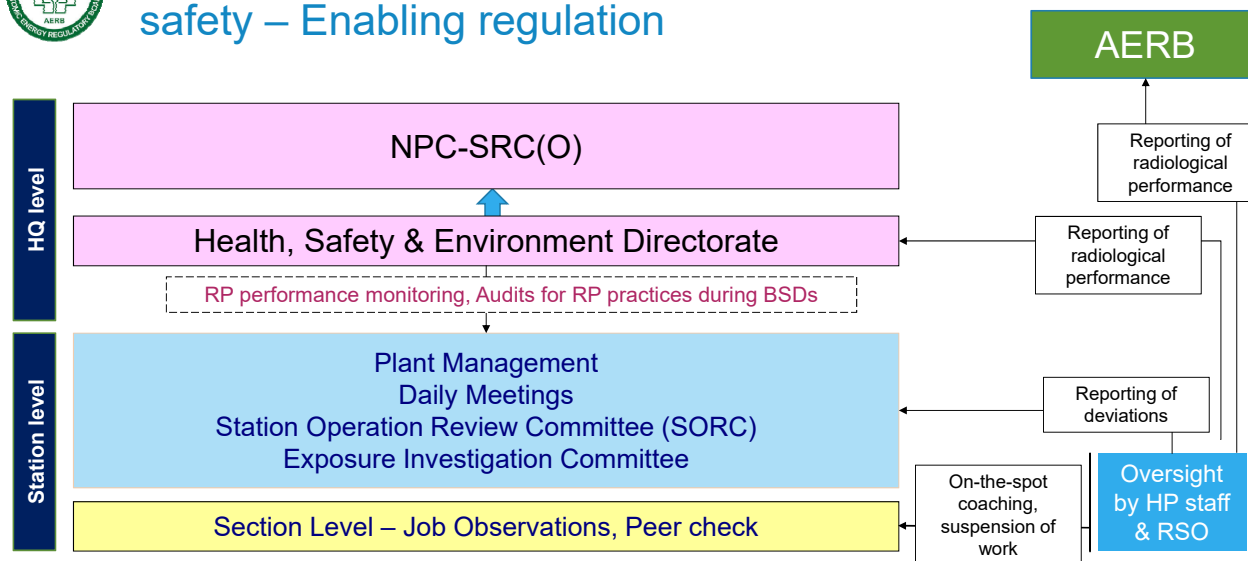


Role of RSO for RP culture

- AERB approves 'Radiological Safety Officer' for NPPs under the Atomic Energy (Radiation Protection) Rules, 2004
- RSO instructs the workers on suitable measures for optimizing exposures and steps for ensuring adherence to regulatory requirements for RP
- RSO reports the radiological safety status to AERB
- RSO is like 'eyes' and 'ears' of AERB at NPP site
- A vigilant RSO is more likely to influence workers for following RP requirements in day to day activities

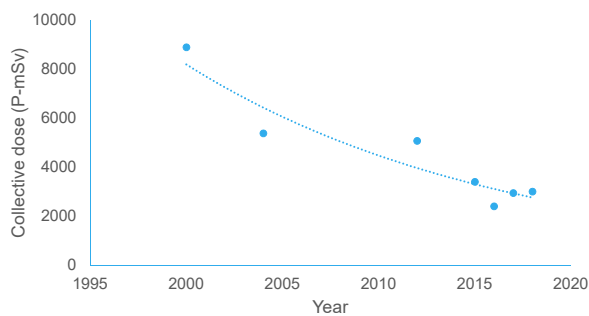


Mechanisms of licensees for self-regulation of radiation safety – Enabling regulation

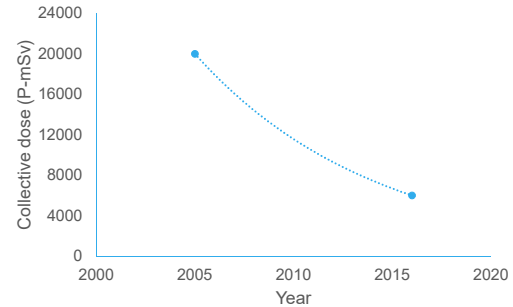




Optimization of collective dose over years



Annual collective dose of twin Unit BWRs



EMCCR of 220 MWe PHWRs



Trust building: participation of licensees in regulatory activities

- Involving licensee representatives in development of regulatory documents
 - Better understanding of the intent of regulations helps in improving compliance
- Inviting licensee representatives for safety review meetings
 - Clear communication of regulatory intentions w.r.t. addressing of deficiencies
- Meeting with management of Licensee Organization
 - Discussion on significance of addressing certain issues need urgent attention.



Finally

- *'to be trusted, you must communicate successfully; to communicate successfully, you must be trusted'.*
- It takes years to built trust among licensees and regulators with respect to priority to safety
- Robust safety culture at licensees paves way for building trust with regulator and thus an 'enabling regulation'
- With expansion of nuclear power program, it is time for more 'enabling' regulation rather than a 'prescriptive & enforcing' one

