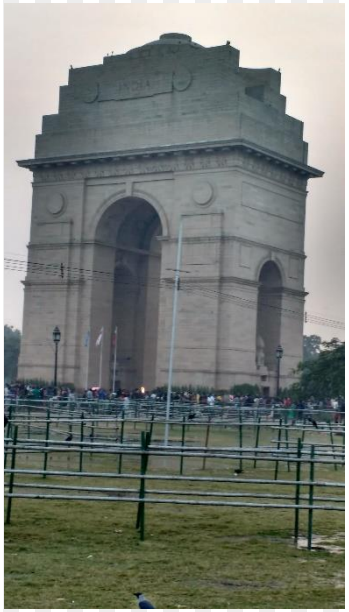
‘Applied Nuclear Safety and Security Culture in Practice’

Dr. N. Ramamoorthy

Adjunct Professor, NIAS, Bangalore

Consultant to AERB, Mumbai

Ex-Director, NAPC/IAEA, Vienna



Amity Univ. hosted Training Event for WINS Academy

Noida, September 26-28, 2019

Disclosure and Disclaimer

- Presentation of personal, professional views → → essentially analytical and philosophical points
- Coverage in broad context (mostly global) - *not India-specific*
- <u>Views are not those of NIAS/ IAEA / AERB / DAE</u>
- No sponsors; No conflict of interest

Scope - Outline

- Title Assigned vis-à-vis Details given by Organisers for envisaged coverage → '2-fold coverage' design
- Some Elements of Nuclear & Radiation Safety and Nuclear Security (incl. of Radioactive Materials, RM)
- 'Culture' aspects & applying in (NF/RF) Practice
- (inescapable) Human Element/Factor aspects → Human Reliability factor
- *Practice-specific issues cum challenges - mainly related to Radiation Applications, RM (sources)*
- **3 concepts proposed; appeal for adoption/practice**

Preamble - Background

- Nuclear Safety and Security (NS&S)

- 'interface cum overlap' invariably, more so in nuclear & radiation technology applications

- strictly not two independent entity

- Very long history on Safety matters - nuclear & radiation
- Security aspects - physical protection alone since long back; focus on other aspects becoming significant since 20 years
- NS&S: Technology related aspects, Legal framework aspects, Regulatory systems, Practices, ….. and 'Safety / Security Culture' → Human element related aspects → 'Human Reliability'

Recent Events of Knowledge Exchange Benefit of Relevance to the Current Event

- Discussion Meeting on Human Reliability Program in Industries of National Importance held at NIAS, Bangalore April 24-26, 2019
- Round-Table on Nuclear Security held at ORF, New Delhi, Jan 11, 2019
- Int. Conf. Security of Radioactive Material, IAEA, Vienna, Dec 3-7, 2018
- xxxxx
- *Int. Conf. Effective Nuclear and Radiation Regulatory Systems, IAEA, The Hague, Nov 4-7, 2019*

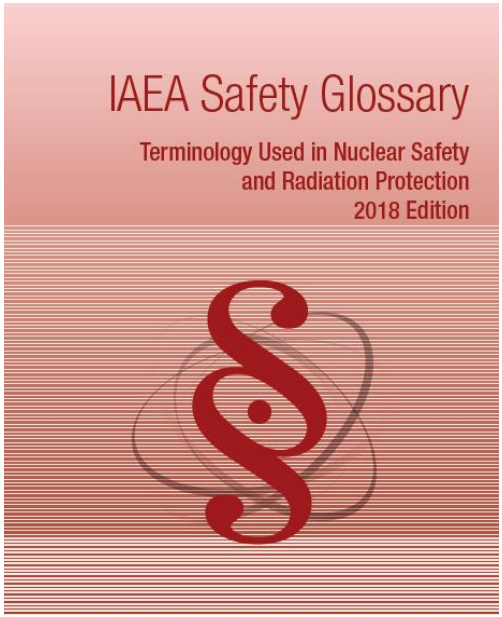
IAEA Glossary: Nuclear Safety; Nuclear Security

(Responsibility lies with the Nation)

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

Nuclear Safety

'CNS'; .....



2. The prevention and detection of, and response to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving *nuclear material*, other *radioactive material* or their associated *facilities*.

Nuclear Security

CPPNM/A; ...

Defining, Understanding Culture?!

- Culture: The way of life of groups of people - that is, the way they do things. Different groups may have different cultures. Culture is passed on to the next generation by learning.

- TAMU: 'Culture refers to the cumulative deposit of knowledge, experience, beliefs, values, attitudes, meanings, hierarchies, religion, notions of time, roles, spatial relations, concepts of the universe, and material objects and possessions acquired by a group of people in the course of generations thro' individual & group striving'.

'Repository of Values'!

Culture of Organisation→ Safety & Security Culture

- Organisations develop & practice cultures of their own, with members sharing similar core values & attitudes.
- *Culture includes traditions that reflect what has worked in the past, as well as the way people have learned to look at their environment and themselves.*
- These impact also how members deal with (*ethical issues and*) safety and security of the Organisation.
- The way safety and security is perceived, valued, prioritised and integrated, would reflect the strength of Organisation's safety/security culture.

Safety & Security Culture: IAEA definition

- Safety culture: ‘assembly of characteristics, attitudes and behaviours in individuals, organizations and institutions which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance’.

- Security culture: ‘assembly of characteristics, attitudes and behaviour of individuals, organizations and institutions which serves as means to support and enhance nuclear security’.

Safety & Security Culture

safety culture

The assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, *protection and safety issues* receive the attention warranted by their significance.

- One of the fundamental management principles of NF/RF is to establish *(& continually nurture)* such Culture →
- Culture influences the organisation's structure & style, the **attitudes**, approaches and **commitment of individuals** at all levels in the organisation →
- **Human** and Organisational factors, involved among others
- **Need for expanding the 'Human' factors - addressing 'Reliability' related aspects**

‘Culture’ Elements: Features, Practices

- ‘Safety Culture’ to ‘Culture for Safety’ - 2016 Conf. Call - How an organisation’s culture prioritises and values safety
- Culture for Safety encompasses: Technology; Safety System; Management System; Strategy → Culture is an integral part (not isolated) + continuous (evolving) journey
- Recognition of Values; Leadership; Accountability; Continual Learning-Driven spirit (Questioning & Learning trait); Defence-in-Depth; … → ‘periodic self-assessment & peer review’
- *Recognise impact of local (regional) cultures (traditions) & their potential influence on ‘Culture for Safety’*
- *Addressing paradigm issues: Nothing has happened; S&S duty of manager; I don’t care; I know it all; xxx (& what not)*

Human Resources (HR) → Human Element Factor → Human Reliability (HuRel)

- Human Resources (HR) and HR Development (HRD) aspects well recognised and addressed (*mostly, if not invariably*)
- HR requirements beyond professional & technical competencies - especially in critical roles & functions → for safety of system & facility → safety of staff, public, property, environment, society, nation, etc.
- *Safety synonymously includes Security in the above bullet*
- All the above → Human Reliability aspect → high significance in the case of nuclear and radiation field
- → **'Holistic attention to HUMAN factors essential'**

Human Element/Reliability Aspects (to me)

- Human being: individual - intrinsic characteristics (*oh my genes*) - perceptible & imperceptible features - *not a machine/robot* →
- Human as part of: Family - Society - Profession/Job environment *(crucial industry - NF/RF)* - Nation
- Extreme diversity in background - education, economy, upbringing, culture, health, region/language, others →
- **Impact of Personal laws of Nations in addressing Human Reliability - Right to Privacy, Human Rights, ...**
- nutshell: '**One size does not fit all!**'
- Impact of above aspects is inescapable in every walk of life!
- → Need to address 'Human' factors in NF/RF & other crucial industries (+ societal life too) → HuRel is of high significance

HuRel Impairment Factors & Drivers

among many others

- Stress, Anxiety, Depression, Complacency, …
- Nature of work: e.g. repetitive; passive role mostly; low or slow career progression,
- Human aspiration vis-à-vis Reality of job held & its future prospects
- Family related causes - several; Life-style changes
- Need for money and/or greed
- Indoctrination - systematic influencing
- Human vulnerabilities exploited → victim to blackmail
- similar others

Management of Human Reliability (HuRel)

- Plans to address Human Reliability - Design of program (HuRel program, HRP) & its implementation
- Periodic & continual monitoring & evaluation of the reliability of all personnel dealing with NM, RM, associated facilities, xxx
- *Evaluation of people for HuRel is easily said than done!*
- **Goal: identify tendency/deficiencies, such as, declining judgement capability, depression, despair, doubts on integrity, and …. etc.; identify & remove persons of proven or doubtful reliability**
- US HRP includes *inter alia* reviews by supervisors, medical examination, testing for substance abuse (alcohol, drugs), ...
- US HRP Roadmap - guidance & facilitation to establish HRP - sequential process of concepts, training, documents, implement, evaluate, ...

Drawing a Distinction, NF-NM vis-à-vis RF-RM

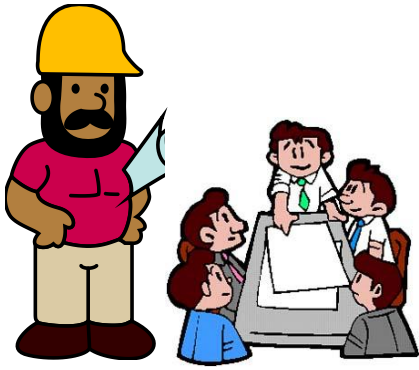
- Nuclear Facilities (NF), NM invariably with national entities, or under their purview - governance, guards, guns, barriers, tech-aids, … *(by and large with better compliance record)*
- Radiation Facilities (RF), 'other radioactive materials' (RM), associated activities & practices, are widely spread out, under variety of (heterogeneous) stakeholders *(more challenging)*
- Vast differences in priorities, culture, discipline, environment
- Vulnerabilities in many radiation practices: public places; field operations; industrial competition; etc.
- 'orphan sources': indicator of deficient inventory & accounting
- potential security & safety risks high (*harm may be less though*)

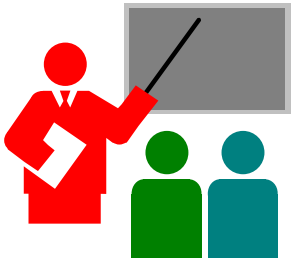
Wide-spread, Large Prevalence of RF & RM

- High importance of applications of ionising radiation in medicine and industry
- Growing global interest in adoption & expansion of various radiation techniques & facilities → IAEA: 'Atoms for Peace and Development' orgn.
- Societal & economic gains from applications of radiation technologies in medicine & industry - key driver for numerous players to set up facilities and offer services - incl. private entities, entrepreneurs, among others - e.g. national centres, hospitals, industries,.
- Benefits accruing to end-users → Increasing the roles & challenges to ensure safety/security culture ambience & duties of regulatory entity/system

Radiation Sources Safety & Security: Human factor based Challenges *(IAEA-CN-269 Dec 2018 talk)*

- HR issues in Radiation Technology (RT) Practices: high attrition & turn-over of qualified staff - e.g. certified operators, RPO/RSO; career growth??
- HR issues in NDT-Radiography: field working conditions demanding - multiple pressures - high attrition & turn-over of qualified staff
- uncertain availability of trained & qualified HR on sustained basis; *lure of greener pastures, 'soft' jobs, …..*
- Human Element: complications due to personal, familial, social issues of HR holding crucial roles → resentment, depression, violence, … tendencies → potential threat to security-safety? *(akin Lufthansa-German Wings Pilot case; German male nurse case; …)*





Nurturing & Sustaining 'Culture' *(RF context, applicable to NF too)*

- Practical challenges, encountered or reported, in many countries → emphasis to all stakeholders on 'appeal for conscious attention to Culture' → inculcating & fostering:
- High degree of self-discipline + self-regulation in everyday practice involving radiation sources - part of safety & security culture - essential from management to technical & auxiliary staff of organisation (*easily said than done*)→ commitment & attitude
- Effective use of communication & covering all relevant staff
- Awareness campaign - at every level, multi-tier approach
- *'Keeping a watch, incl. thro' socials', on persons in crucial posts*
- Remaining engaged with various stakeholders for empathy, mutual understanding - *e.g. AERB events with end-user groups & corresponding professional bodies*

3-Concept Supplement Scheme (by analogy)

- Akin '**CSR** - Corporate Social Responsibility' prevalent in 'Industries' and 'Industry-like (service) operations'
- To advocate and foster adoption of **Corporate Radiation Responsibility - CRR** by RF owner(s) - higher the risks at RF, greater is the need to bring such entity(ies) in.
- Similar for NF too; **Corporate Nuclear Responsibility** (CNR)

- Akin Quality Policy Statement display in Offices - Industry; Corporate HQ; Service Centres; etc.
- To encourage establishing '**Nuclear/Radiation Safety Commitment Policy**' display by NF/RF Licensee/Employer

3-Concept Supplement Scheme (by analogy)

- Akin Hippocratic Oath of Ethics Commitment undertaken by physicians (medical practitioners) -
- To institute and foster a practice of 'Oath of Commitment to Nuclear/Radiation Safety' to be undertaken by select group of radiation workers - during their qualifying phase, or while being certified for responsible positions in NF/RF- e.g. RF-specific posts: RPO/RSO; Radiation processing plant operators; Radiographers; Medical Physicists; NM Technologists; …
- Similar for NF personnel too, e.g. reactor manager; reactor operators; RPO/RSO; xxx,

Advocacy for 3-Concept Supplement Adoption

- Towards further enhancing the effectiveness of Nuclear (and Radiation) Safety & Security (NS&S) regulatory functions and sustaining the NS&S Culture
- Not just slogan-based; Supplementary means to reiterate & strengthen the systems/practices - NS&S Culture is the responsibility of every stakeholder
- Effective management of NS&S enforcement would stand to gain from such additional means of engaging the licensees & other practitioners in the NF/RF everywhere

  'By admitting your inadequacies, you show that you're self-aware enough to know your areas for improvement - and secure enough to be open about them.' - A. Grant

Exercise Suggested in Group Tasks

- Discuss and draw up a CRR plan for a Cancer Hospital and for a Radiography Company
- Propose Nuclear/Radiation Safety Commitment Policy statement for a research reactor facility and/or for a gamma radiation processing plant
- Prepare a template of Oath text for personnel on their becoming eligible for being certified/qualified for jobs in NF/RF

'Nuclear techniques are used extensively in industry to increase product quality & safety, benefiting both producers and consumers; radiation tools make industrial production cleaner and more effective'. (Late) *Mr. Y. Amano, DG, IAEA*

Sum-up: Focus on Human Reliability approach & action plans is vital for nuclear/radiation field (and society too);
- nurturing Culture and harnessing Security-Safety synergies
- consistent with National setting in terms of governance, laws, population, policy priorities, ….

'Discretion is the better part of valour'

Thank you

Q & A - Discussion

nramasta@gmail.com