

The system
of radiation protection,
a framework for radioactive
waste management

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Radiation Protection Waste Management

- Borderlines:
 - Waste, including effluent
 - Disposal, including
 - Discharges of effluent
 - Clearance of materials for recycling or reuse
- Optimisation
 - is a matter of protection, but
 - technical options, reasonable cost, societal dimension
- European Court Judgement
 - Case C-29/99 (10 December 2002) on EAEC competences
 - no artificial distinction between radiation protection, safety and waste management

Specificities of Waste Disposal

- Prospective assessment
- Liable to affect future populations
 - Extremely long time horizon
- Scenarios
 - Probabilistic (potential exposures
 - Uncertainties and unpredictable events (e.g. intrusion, ice age...)
- Natural & Engineering aspects
 - site geology, design concepts, multiple barriers, safety functions
- Societal aspects (decision making, stakeholder involvement)
 - No undue burden to future generations
 - Consequences of delayed decision making
 - Preserve choices for future generations (retrievability)

ICRP Recommendations

- Publications 77, 81, 103:
 - 1998:
 - Radiological protection policy for the disposal of radioactive waste (publication 77)
 - Radiation protection recommendations as applied to the disposal of long-lived solid radioactive waste (publication 81)
 - The 2007 Recommendations of ICRP (publication 103)
- The system of protection
- Potential exposures
- Exposure situations
 - Dose and risk constraints
 - Reference levels

System of Protection

- Justification
 - linked to operations giving rise to waste: fuel cycle
 - “concentrate and contain” or “dilute and disperse”
- Optimisation
 - Management, processing
 - Disposal
 - How to evaluate benefit of engineering options in terms of protection?
 - Judgemental process rather than formal optimisation
- Dose limitation
 - not applicable to post-closure phase

Potential exposures

- Operation: annual probability of occurrence
 - consequences in terms of total exposure or health detriment
- Post-closure: probability of occurrence (at all times)
 - consequences in terms of annual dose
 - over extended periods of time
 - probabilities/uncertainties:
 - need for mathematical tools
 - multi-attribute presentation for decision making

Risk constraints

- Aggregated approach: combining doses and probabilities
 - comprehensive evaluation of all relevant exposure situations and associated probabilities
- Dis-aggregated: separate consideration
 - identification of representative scenarios
 - no precise quantification of probabilities
 - other indicators: duration and extent of exposure

Potential exposures: Scenarios

- Normal evolution
 - increased uncertainties at very long time scales
- Intrusion
 - no assessment of probability
 - reduce possibility/plausibility
 - e.g. geological disposal: depth
- Defence in depth
 - Safety Culture

Exposure situations

- Disposal operations: planned
 - dose/risk constraint
- Post-closure
 - period of institutional control, monitoring
- Long term:
 - emergency/existing situation
 - loss of memory: existing situation

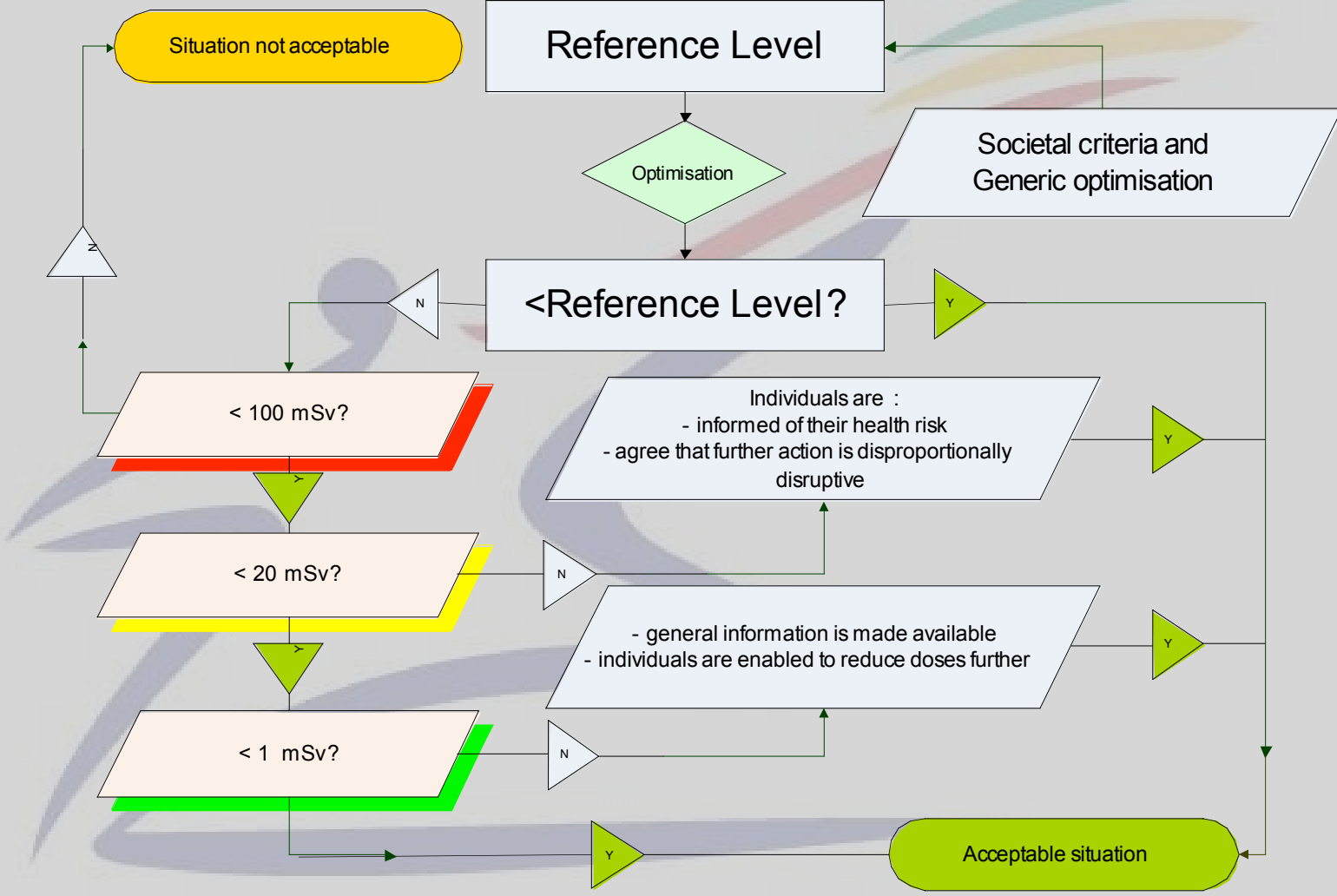
Constraints

- A prospective and source related restriction on the individual dose from a source, which serves as an upper bound on the dose in optimisation of protection for that source.
- For occupational exposures, the dose constraint is
 - a value of individual dose used to limit the range of options considered in the process of optimisation.
- For public exposure, the dose constraint is
 - an upper bound on the annual doses that members of the public should receive from the planned operation of any single controlled source.

Constraints/Reference Levels

- Source related prospective tool for optimisation
- Societal basis (bands of constraints):
 - equity (dose distribution)
 - information/training, individual dosimetry
 - involvement in the management of exposures
 - benefit (individual, societal)

Reference levels



Constraints/Reference levels for waste disposal

- Dose constraint: 0,3 mSv per year
- Risk constraint: 10^{-5} per year
- Reference level: 20-100 mSv per year
 - Probability that such a situation arises at any point in time? Uncertainties?
 - Benchmarks, not design criteria

EC initiatives

- Actions in the area of Waste Management
 - Joint Convention
 - High Level Group
 - European Nuclear Energy Forum
- Article 37 Euratom Treaty
 - impact of planned disposal on other MS's
- Revision/Recast of Basic Safety Standards
- Networks (ALARA)

Waste management policy

- *Each EU Member State to establish and keep updated a national programme for the safe management of radioactive waste*
- *No wait and see*
- *Geological Disposal*
 - *preferred option for HLW*
- *Public involvement*

Revision of Euratom BSS

- Allow for ICRP/IAEA
- More binding requirements on:
 - Natural radiation sources
 - Criteria for exemption and clearance
 - Cooperation between MS for emergency planning and response
- Review of regulatory control system
 - Graded approach to regulatory control
- Consolidation of current Directives

Consolidation of Euratom BSS

- Better legislation: simplification of “acquis” by codification or recast
 - BSS Directive 96/29
 - Directive 97/43 (MED)
 - Directive 89/618 (Public Information)
 - Directive 90/641 (Outside Workers)
 - Directive 2003/122 (HASS)
- Revision of BSS Directive 96/29
- Radon:
 - Commission recommendation 90/143/Euratom
- **Drinking Water Directive**

Exposure situations

- Distinguish:
 - Planned
 - include identified NORM industries
 - Existing (Radon, building materials, contaminated areas)
 - Emergency
- Transition:
 - Existing situations develop into planned situation
 - NORM industries
 - Planned situation may give rise to an emergency situation
 - Emergency situation in the long term becomes an existing situation
 - Planned situation may leave behind an existing situation:
 - Residues from past practices and activities
 - Effluents, clearance of materials, dismantling
 - Orphan sources
 - Closed disposal sites

Exemption and clearance

- Same levels for both concepts, including for transport
 - basis: RS-G 1.7 (close to RP 122)
 - however: a study has been launched to investigate the differences
- Higher values (MS's, not harmonised) for:
 - Specific practices
 - Specific materials (e.g. metals, small amounts of building rubble)
- Residues from NORM industries
 - dilution/mixing with other materials?

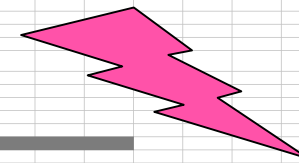
Regulatory control

- Graded approach:
 - Exemption/notification
 - Registration
 - cf. current « authorisation in cases of a limited risk, in accordance with conditions laid down in legislation »
 - Licensing
 - cf. “prior authorisation”
 - Licensing requirements for different types of practices
- Explicit consideration of requirements for the management of radioactive waste

Timeline revision/recast BSS



Sponsorship
of IA-BSS



ALARA Networks

- Self-sustained network originally funded by EC
- New specific networks:
 - Non-Destructive Testing
 - NORM industries
 - Medical?
- International: RECAN
- In all areas of protection:
 - occupational, public, medical exposure
- Forum for exchange of:
 - experience, good practice, stakeholder involvement

Conclusion

- Time to revise the BSS
 - and to consolidate all existing legislation
 - integration of natural and artificial sources
 - harmonisation/uniformity versus flexibility
 - little need for amending national legislation
- Explicit consideration of Safety and Waste
- Impact of new ICRP recommendations
 - especially for emergency planning and response
 - protection of the environment
 - guidance (publ. 77, 81) on waste disposal still valid