

**Observations on the development  
of the  
new EURATOM-BSS**  
(and references to the IAEA BSS)

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# Present documents

**IAEA:** *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (IBSS)*

**1996**

**EU:** *Council Directive laying down basic safety standards for the health protection of the general public and workers against the dangers of ionizing radiation (EU BSS)*

**1996**

# Since that time....

*UNSCEAR: reports to the UN General Assembly  
latest: 2008*

*ICRP: The 2007 Recommendations of the International  
Commission on Radiological Protection.  
Publication 103. (Ann. ICRP 37, 2-4)*

**(New categorization: planned, emergency, existing)**

*(R. Clarke: new ideas ... but ... )*

# Revision (Recast) Processes

- IAEA: Secretariat + invited experts
  - RASSC
  - MS's
  - Secretariat+ experts
  - RASSC (2010 Dec)
- EU: Commission + Working Group
  - Expert Group (Art. 31): confirmed 2010 Feb
    - + 'opinion' to COM
  - Inside the COM
  - Council: WPAQ – planned 2011 Feb
  - HU PRES (1st half 2011)

# Recast in the EU

In a single Directive former:

- BSS (96/29/Euratom)
- medical (97/43/Euratom)
- emergency info (89/618/Euratom)
- outside workers (90/614/Euratom)
- HSS/orphan sources (2003/122/Euratom)

# Draft Contents

- I. Subject matter and scope
- II. Definitions
- III. System of protection
- IV. Responsibilities for regularity control
- V. Requirements for RP education, training and information
- VI. Justification and regulatory control of planned exposures
- VII. Protection of workers, apprentices and students
- VIII. Protection of patients and other individuals submitted to medical exposure
- IX. Protection of members of the public
- X. Protection of the environment

+ 16 Annexes

# Annexes

1. Bands of reference levels ... for existing and emergency
- 2-6: HSS (definition, recording, marking) (2 sets)
- 7: Placing on market of new products
- 8: List of sectors involving NORM
- 9: Exemption and clearance criteria (updated)
- 10: Individual monitoring  
(urging the COM: European Radiation Passport)
- 11-12: Elements of emergency plans
- 13: Elements of Rn action plans
- 14-15: Gamma emitted building materials
- 16: Non-medical imaging

# A brief history...

1895 November: *W.K.Röntgen*'s discovery of X-rays

1896 February: *H.Bequerel*'s discovery of radioactivity

1896 March: *T.A.Edison*'s paper in Science: eye irritations

1902: *W.Rollins*: 'X-rays could kill higher life forms'

1925: *A.Mutscheller*: '*tolerance dose*' (~ 2 mGy/day)

1934: ICRP: *tolerance dose*: adapted the 2 mGy/day

1956: ICRP: *permissible dose*: 50 mSv/year

Safe  Unsafe



# The ICRP 26 concept (1977)

Clear distinction:

Deterministic vs . stochastic

For stochastic: **no „safe” region**

Two concepts: **LNT** (assumption for design!)

keep **as low as reasonably achievable**  
(ALARA)

# Basic principles

- *Justification (J)*
- *Optimization (O)*
- *Dose limitation*

For J & O: comparison of harms and benefits

- Common unit: **monetary base (harm:  $\alpha$ )**
- O: search for a minimum of the **collective dose**

# In practice

Net benefit (B):

$$B = V - (P + X + Y)$$

*V* – gross benefit

*P* – cost of production/activity

*X* – cost of protection

*Y* – cost of detriments,  $Y = \alpha S$

**J:**  $B > 0$ ,

**O:** maximum B vs. S:  $\frac{\partial B}{\partial S} = 0$

If  $V = \text{const.}$ ,  $P = \text{const.}$ :  $\frac{\partial X}{\partial S} = -\frac{\partial Y}{\partial S} = -\alpha$

# Merits & problems

+ The system is consistent

- But not good: 'moral' difficulties

(1) the determination of  $\alpha$   
(national  $\alpha$ ? vs. international dose limits?)

(2) the key role of S:

- scenario A: 10 workers: 1 mSv each:  $S = 10$  man-mSv

- scenario B: 1 worker: 8 mSv :  $S = 8$  man-mSv

Is scenario B really a **better solution**?

# ICRP 103

- No more  $\alpha$ -s
- Opposing the use of S for detriment estimation!

But!

- Still **Justification & Optimization**

**Who will decide, on what basis?**

**How to take into account social aspects?**

The system is not consistent but good ???

# Why good?

UNSCEAR – 2008:

*'The average annual dose to monitored workers in the nuclear fuel cycle has gradually declined since 1975 from 4.4 mSv to 1.0 mSv at present'*

Question:

- What are the contributions of
  - technological development
  - optimization ?

# Justification in IBSS (draft 3.0)

## Safety principles

**# 4: 'Facilities and activities that give rise to radiation risks *must yield an overall benefit*'**

## IBSS – draft 3.0

**2.8: '... no practice is undertaken unless justified'**

*'...measures are in place for determining the **justification of any type of practice...**'*

**Footnote 12:** *'Such measures may involve several **governmental entities**, such as ministries justice, immigration and security, not necessarily having direct responsibility for the safe use of radiation'*

# Personal comments

## Concerns & Suggestions:

### (1) **Subjectivity!**

**Solution(?):** Copy the sentence from the draft Guide!

### (2) Footnote 'governmental entities'

(**above** and **below**)

**Solution(?):** *Each MS ... define a sequence of bodies responsible for decisions on various levels (graded approach)*

e.g.: new NPP: Parliament, referendum

medical diagnosis: the MD involved (patient?)



# Justification in EU BSS

Much more critical: **legally binding text**

The same problem for a long time...

Feb 2010: *'... shall be justified: the decision shall be taken **with the intent** to insure that the individual or societal benefit resulting from that decision shall offset the detriment that it might cause.'*

**May be an acceptable compromise...**

# Optimization in IBSS (draft 3.0)

## Safety principles

*# 5: Protection **must be optimized** to provide the highest level of safety that can reasonably be achieved*

## IBSS – draft 3.0

*Requirement 11: ‘The **regulatory body shall establish requirements** for optimization of protection and safety and require that protection and **safety is optimized**’*

*3.2: ‘registrants and licenssese shall ensure that protection and safety **is optimised**’*

# Personal comments

## *Concerns & Suggestions:*

(1) **Subjectivity!**

**Solution(?):** In the same manner as at J

(2) since '*...**economic and social factors**...*' shall be taken into account, is it the RB's task?

(3) '*... the magnitude of individual doses and the number of people exposed...*' **in case of contradiction?**

(4) Optimization is not a process finished by a single action...

# Optimization in EU BSS

Much more critical: **legally binding text**

The same problem for a long time...

Feb 2010: '*...RP shall be optimized **with the intent that the magnitude and likelihood of exposures and the number of individuals** exposed are kept as low as reasonably achievable,...*'

**May be an acceptable compromise...**

*However, **the dose vs. number**  
**and the societal factor***

*questions are still not solved. Shall it be a task for the RB?*

## ... in general ... (1)

How is it done in the present societies (EU)

*J: Not needed in general – from the point of protection of the environment*

(environmental impact assessment study)

e.g.: emissions of airplanes vs. this meeting

*O: Car industry: limits. **No ALARA-like legal device!***

limits + 'spontaneous' efforts for reduction

## ... in general ... (2)

Optimum: **the best**

e.g.: dental X-ray equipment

**Just a single one?**

Other aspects, like easy handling: „social factor“?

To avoid misunderstanding:

the concept of **trying to find** the optimum is correct!

# My dream

**J: with the intent...**

**O: other options seriously investigated  
strive for ... optimum (or near-optimum) solution...**

**J & O: clear definition of those who decide!**

# Medical exposures

Growing role, larger population doses

UNSCEAR – 2008:

*‘With regard to the peaceful uses of radiation, medical exposures were by far the dominant form.’*

*‘... continue to increase...’*

*‘ 1988 1 380 million diagnostic inv., 0.35 mSv per caput dose*

*2008 3 100 million diagnostic inv., 0.60 mSv per caput dose’*

- **Reflected in more detailed discussion**

**Medical Protection Officer – clearly defined!**



# Non-medical imaging

Growing role, larger population doses

Main question: justification

EU draft: '*... special attention is given to the justification of practices involving non-medical imaging exposure...*'

Example: screening at airports  
backscatter X-rays

Dose : typically below 1  $\mu\text{Sv}$  (Collective doses?)

**compare to the 10s of  $\mu\text{Sv}$ -s during flight! (J?)**

# Protection of the environment

‘Old’ argument: ~ automatic

New requirement: prove it!

UNSCEAR – 2008:

*‘... no evidence to support changes...’ ‘no effects are expected at chronic dose rates below 0.1 mGy/h or at acute doses below 1 Gy to the most exposed individuals in the exposed **population.**’*

*Criticism from developing countries: ‘luxury’*

ICRP: Special commission

work on models

no values (limits etc.)

# Protection of the environment - EU

Practical problem:

*(1st raised at Nuclear Safety directive)*

**The word 'environment' is not mentioned in Euratom Treaty!**

Co-decision with Parliament is needed

or?

Move text **to preamble!** *(not legally binding)*

# Radon levels

UNSCEAR – 2008:

*‘Exposures due to inhalation of Rn by people living and working indoors vary dramatically depending on the local geology, building construction and **household life-styles...**’*

**Social aspects** are very important

EU draft: each MS can set more rigorous limits

Suggested values:

Dwellings:	existing:	300 Bq/m <sup>3</sup> (ICRP, WHO, 2009)
	new :	200 Bq/m <sup>3</sup> ( <b>later: goal of 100</b> )

# Lens of the eye

Indications of higher risks & lower threshold (if at all)

UNSCEAR – 2008 (Chernobyl):

*‘Among the persons exposed to the highest radiation doses in 1986 and 1987, there are some reports of increased incidence of **leukaemia and of cataracts**; there is no other consistent evidence to date of other radiation-related health effects.’*

**Waiting for ICRP**

EU: Up to the last minute ...

# General evaluation - comparison

**No major differences**

(minor: e.g.: aircrew: IAEA: existing, EU: planned)

**Different structures**

- partly due to different functions

**IAEA draft: ~ 160 pages**

**EU draft: ~ 80 pages – **nothing really missing!****

**IAEA: some material should be moved to Guides**