Entwicklungen im Strahlenschutz

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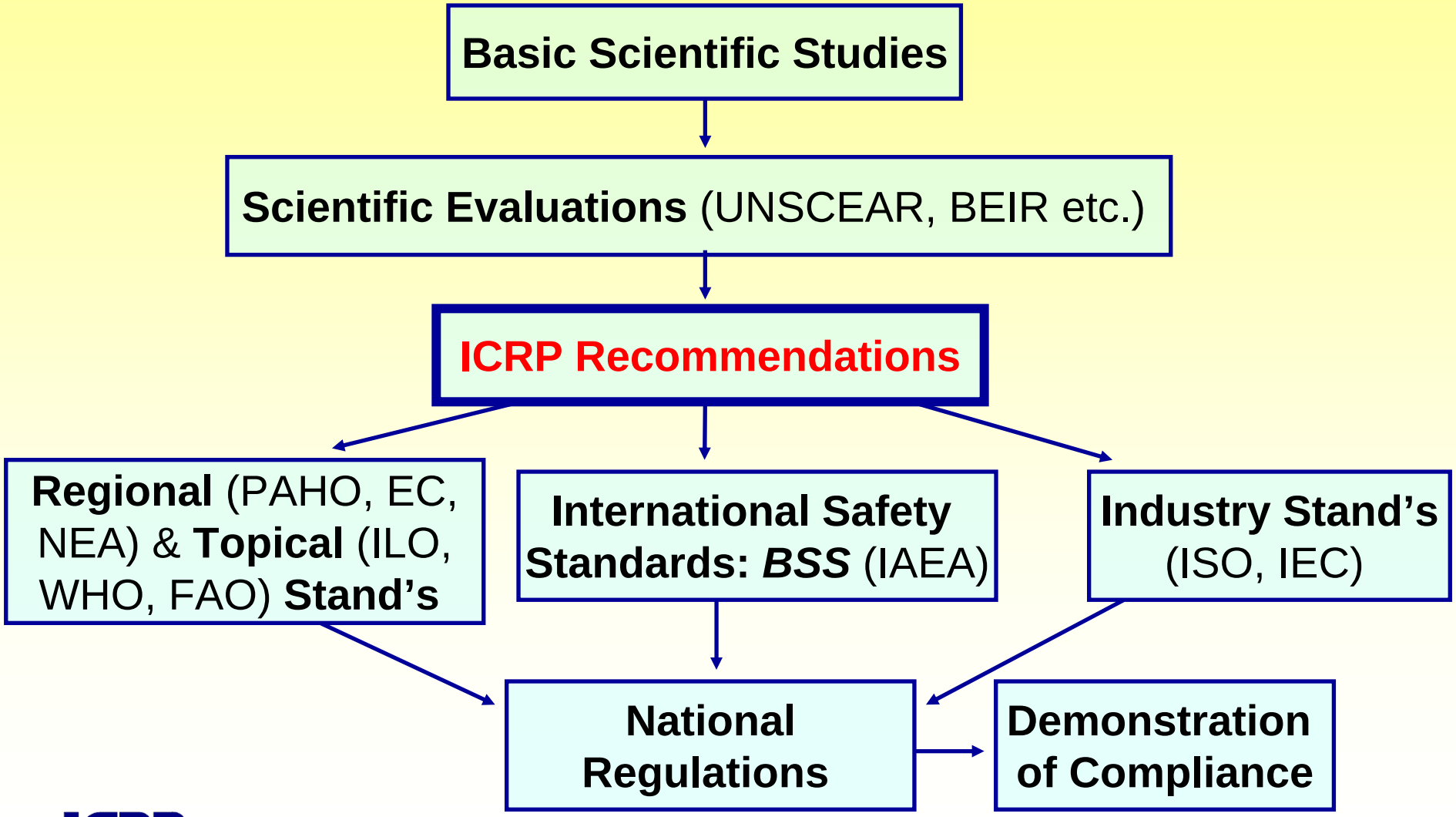
- **International Commission on Radiological Protection**
  What ICRP does and why
- **Waste disposal and potential exposure**
  Concept developments since Publication 46 (1986)
- **The ethical basis of ICRP Recommendations**
  Justification (political) – optimisation – limits & constraints
- **The 2007 Recommendations = *Publication 103***
  Focus on the exposure situation, not on the process
  Protection of the environment

About ICRP

ICRP In The Cosmic Scheme



Waste disposal and potential exposure

Waste Disposal

- **Publication 46 (1986): Radiation Protection Principles for the Disposal of Solid Radioactive Waste**

  Defines principles; notes probabilistic nature – describes potential exposures [not the term!]; discusses truncated collective doses

Waste Disposal

- **Publication 77 (1998): Radiation Protection Policy for the Disposal of Radioactive Waste**

  Clarifies policy; collective dose – don't ignore, but disaggregate & discuss uncertainty; constraint: 0.3 mSv

Collective Dose: Logical, But Is It Right?

Equates
many small doses to
few large doses…

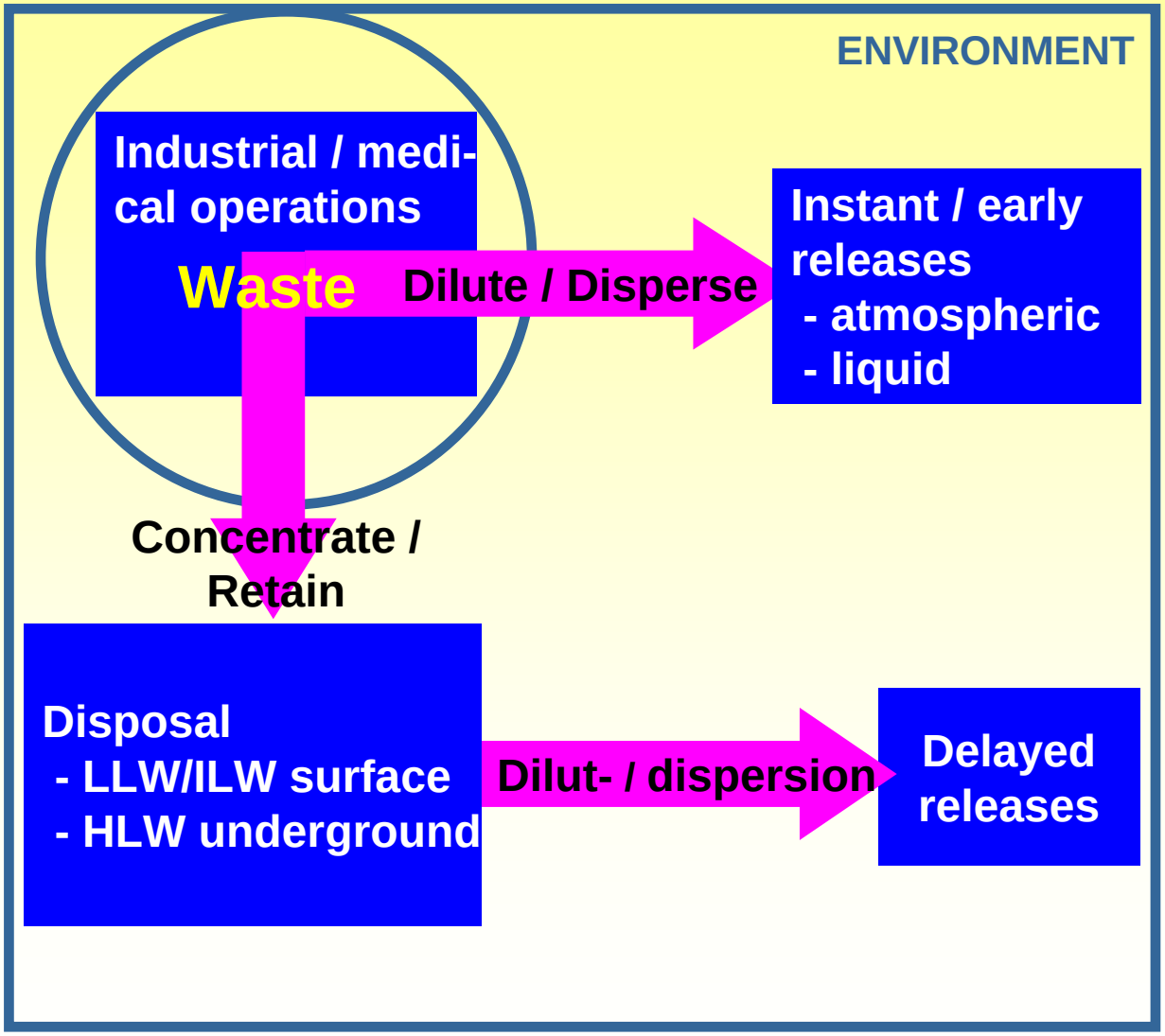
Are 500 road traffic
casualties just as bad as
500 plane crash victims?

Waste Disposal

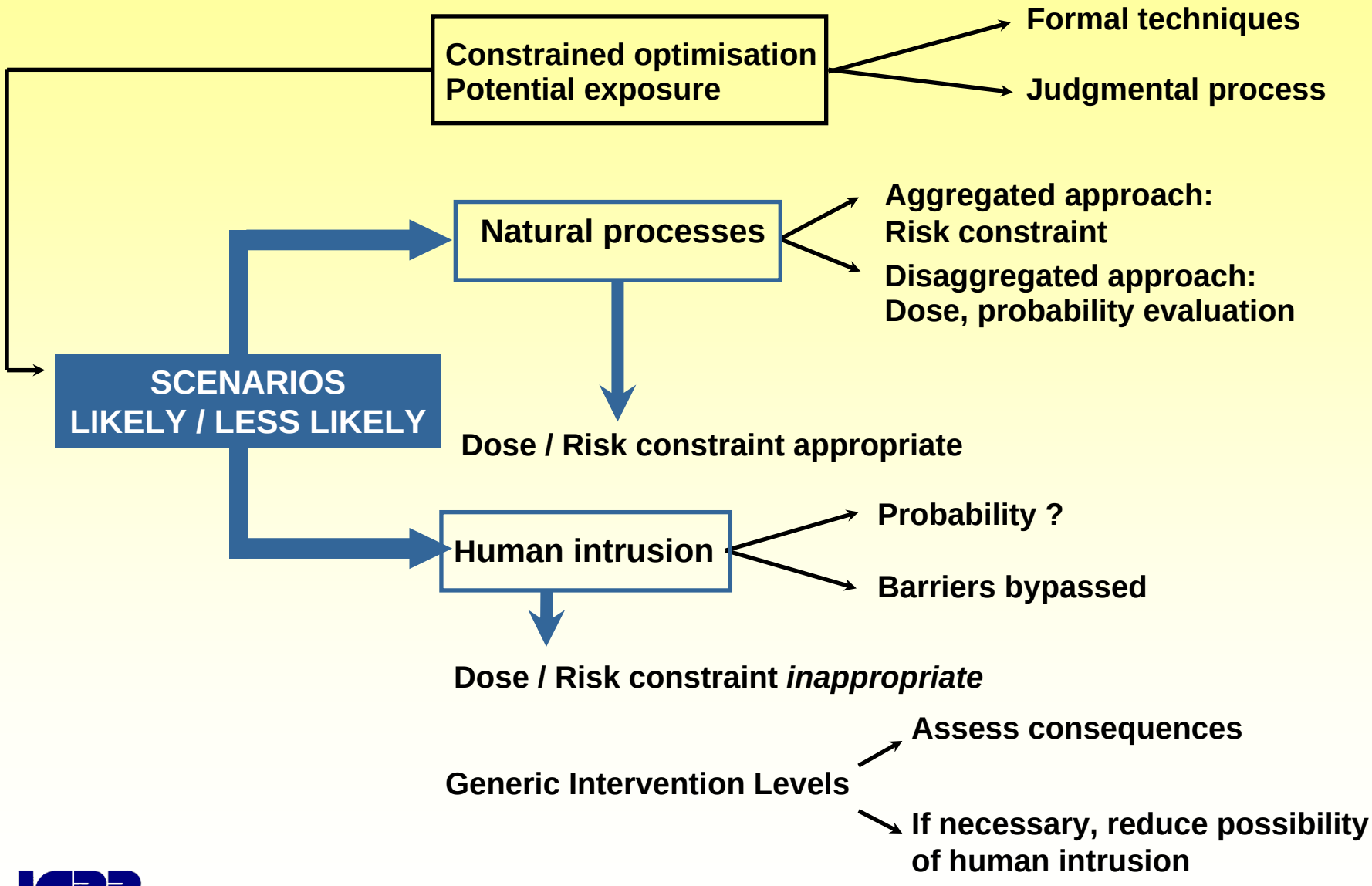
- **Publication 81 (2000): Rad. Prot. Recommendations as Applied to the Disposal of Long-lived Solid Rad. Waste**

  Dilute & disperse / Concentrate & retain; optimisation by qualitative judgement; consider natural processes & human intrusion

Strategies for Waste Disposal



Methodological Options



Potential Exposures

- **Publication 64 (1993): Protection from Potential Exposure: A Conceptual Framework**
- **Workplace accidents**
  - *Number of people affected: small*
  - *Detriment = health risk to those directly exposed*
- **Large disasters**
  - *Number of people affected: large*
  - *Detriment: also contaminated land, food restrictions, etc*
- **Exposures in the far future, e.g. from waste repositories**
  - *Considerable uncertainties*
  - *Dose calculations: to compare protection options; not to project detriment*

Assessment of Potential Exposures

- **Publication 76 (1997): Protection from Potential Exposures: Application to Selected Radiation Sources**

- **Risk constraints to guide optimisation of protection against *workplace* accidents**

  Prob (accident) * Prob (death | accident dose)

  This Expectation Value not appropriate for long-lived waste – cf. definition of Risk, Chapter 3 of BMU draft

- **Recommended generic risk constraints:**

  Potential exposure of workers: 2 10^{-4} per year

  Potential exposure of the public: 1 10^{-5} per year

Publication 81 Conclusion

- If the appropriate constraint is satisfied for natural processes;
- If reasonable measures have been taken to reduce the probability of inadvertent human intrusion;
- If sound engineering and managerial principles have been followed;
- Then radiological protection requirements can be considered satisfied.

The ethical basis of ICRP Recommendations

The Principles of Protection

Source-related, in all exposure situations:

- **Justification**
  More benefit than detriment
- **Optimisation of protection**
  Dose and risk constraints to
  (a) increase equity,
  (b) consider multiple sources

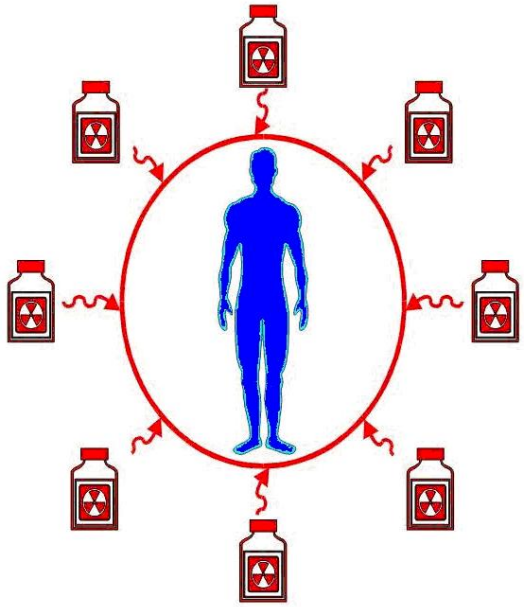
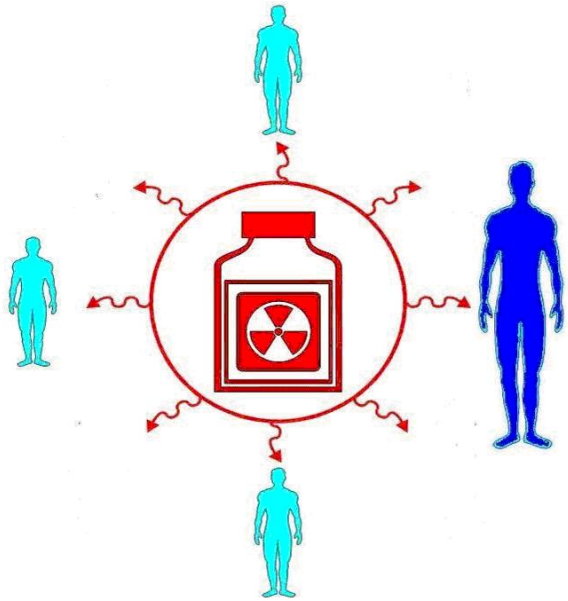
Individual-related, in planned exposure situations

- **Application of dose limits**
  Except medical exposure of patients

ICRP Value Judgements - Constraints & Equity

Utilitarian ethics	**Deontological** ethics
Judge actions by the consequences	*Some duties are imperative*
Justification	***Limitation***
Do more good than harm	*No individual unduly harmed*
Optimisation	***Dose constraints***
Maximise good > harm	*Increased equity = emphasise the individual*

Limits, Levels – Constraints & Multiple Sources

DOSE LIMITS	DOSE CONSTRAINTS / REFERENCE LEVELS
Protect individuals from PUBLIC and OCCUPATIONAL exposure…	
from ALL regulated sources, in PLANNED exposure situations	from a source, in ALL exposure situations
	

The 2007 ICRP Recommendations

ICRP Consulted Widely on the 2007 Recommendations

Nominal Probability Coefficients (% Sv^{-1})

Exposed popula-tion	Cancer		Heritable effects		Total detriment	
	Publ 60	2007	Publ 60	2007	Publ 60	2007
Whole	6.0	5.5	1.3	0.2	7.3	**5.7**
Adult	4.8	4.1	0.8	0.1	5.6	**4.2**

Nominal Probability Coefficients (% Sv^{-1})

For practical protection purposes,

the overall risk coefficient of ~5%

is still appropriate

BMU draft para. 8.3.2 uses 5.7% to get 1.8 mSv;
5% would yield 2 mSv

A Reminder:

$$1 = 2$$

Stakeholders Are Engaged in Optimisation

In 1990, a Process-Based Approach

Practice	Intervention
increases exposure or risk	*reduces exposure or risk*

Optimise protection = reduce collective dose;

restrictions on individual dose constrain the optimisation

In 1990, a Process-Based Approach

Practice

increases exposure or risk

Dose limit

Dose constraint

Protection optimised

Intervention

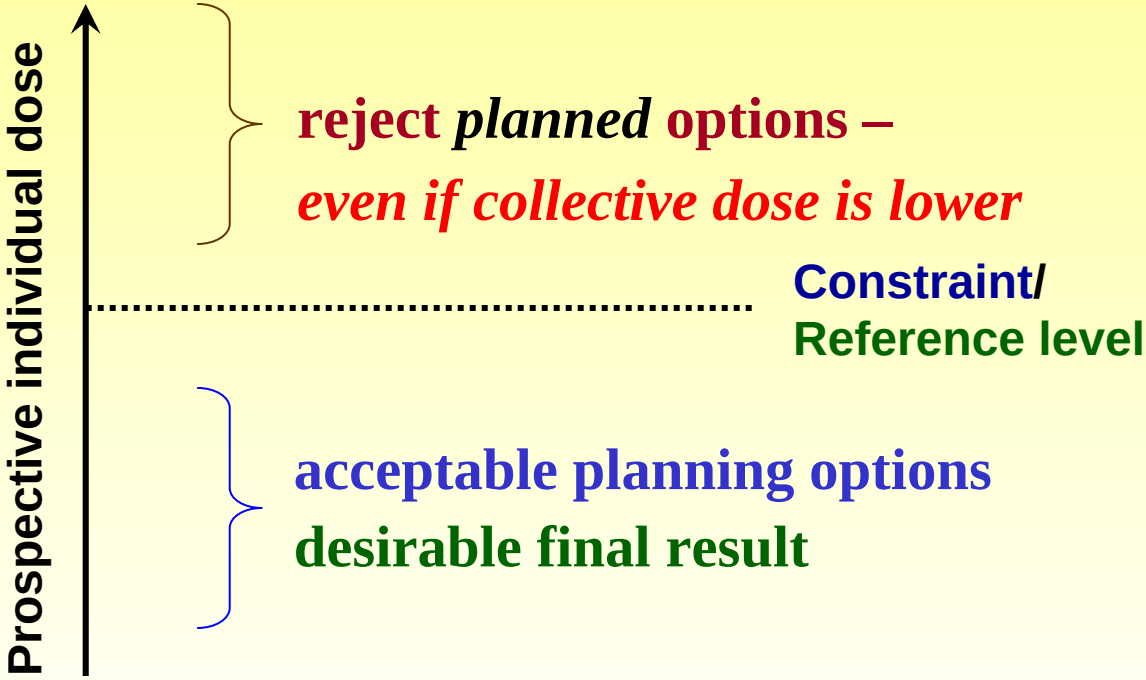
reduces exposure or risk

Optimisation…

Intervention level

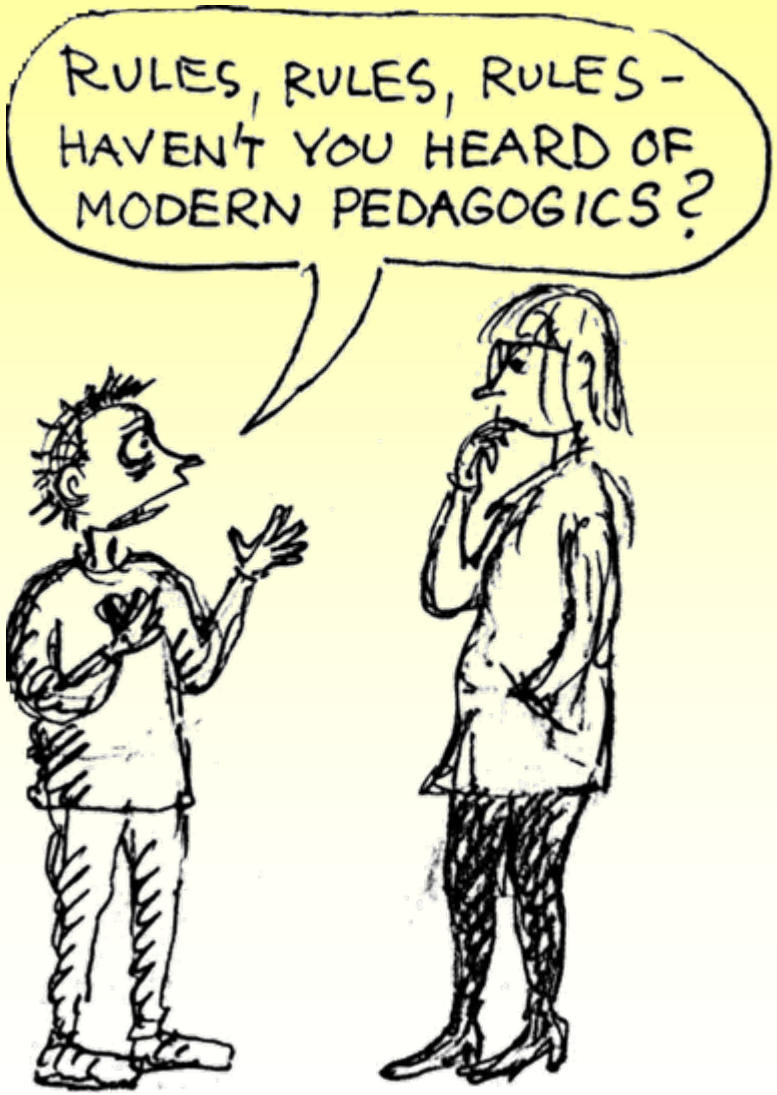
…but what happens here?

2007, Exposure Situation: Planned / Emergency / Existing



Inappropriate to *plan to allow* higher exposures

Regulatory Philosophy



Why Protect Other Species?

- ***NOT*** **driven by concerns of existing radiation hazards**

- **Fills a conceptual gap**

  Science to show that other species are adequately protected if individual humans are protected (cf. Chapter 5.2, BMU draft)

  - and methods to improve protection if required

- **Further guidance will be provided**

To Summarise, ICRP is...

- **Retaining the fundamental principles of protection**
- **Clarifying how they apply to sources and the individual**
- **Changing focus from process** *(practice/intervention)* **to exposure situation** *(planned/emergency/ existing)*
- **Extending the concept of source-related constraints to all situations**
- **Updating weighting factors and detriment**
- **Maintaining the current dose limits**

The 2007 ICRP Recommendations