

IAEA Safety Standards to control exposures to the public in post-accident situations

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GLOBAL 2011

Chiba, Japan, 11-16 December 2011



IAEA

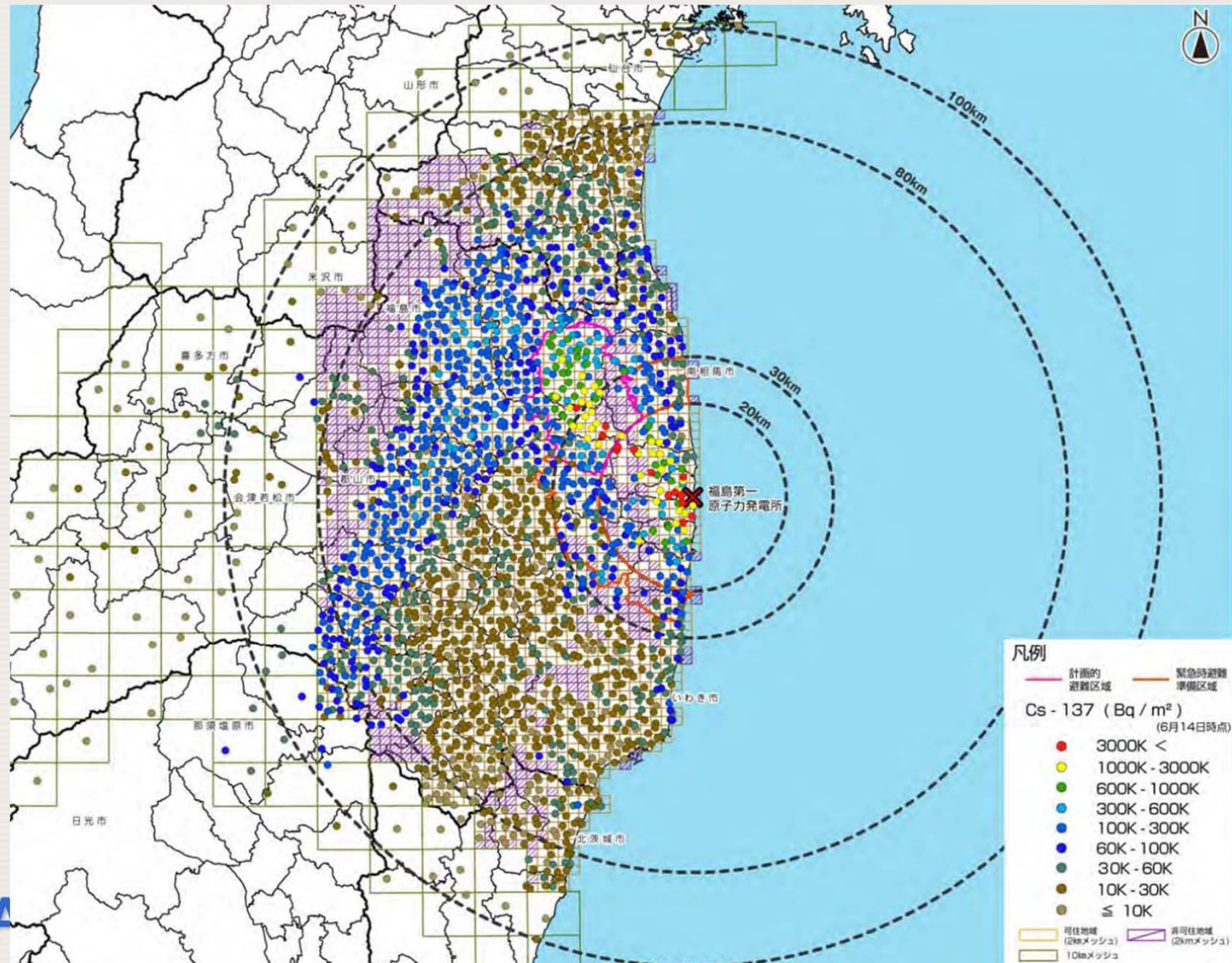
International Atomic Energy Agency

Content

- The situation
- The system of Radiation Protection in the IAEA Safety Standards
- Remediation
- Management of waste generated during remediation
- Public perception
- Conclusions

The situation

Activity of Cs-137 on the ground



General conditions

- Cs-134 and Cs-137 are the dominating radionuclides
- External exposure is the dominating pathway
- Internal exposure is less important due to strict food monitoring
- Affected areas
 - Residential, agricultural, forest
- Remediation work started

Affected areas

Land use	Area affected (km ²) with		Total
	Annual doses > 20 m Sv	Annual doses > 5-20 mSv	
Inhabited area	10	41	51
Roads	4	9	13
Agricultural land	88	261	349
Forest	408	935	1343
Other	5	18	23
Total	515	1263	1778

Aims of remediation

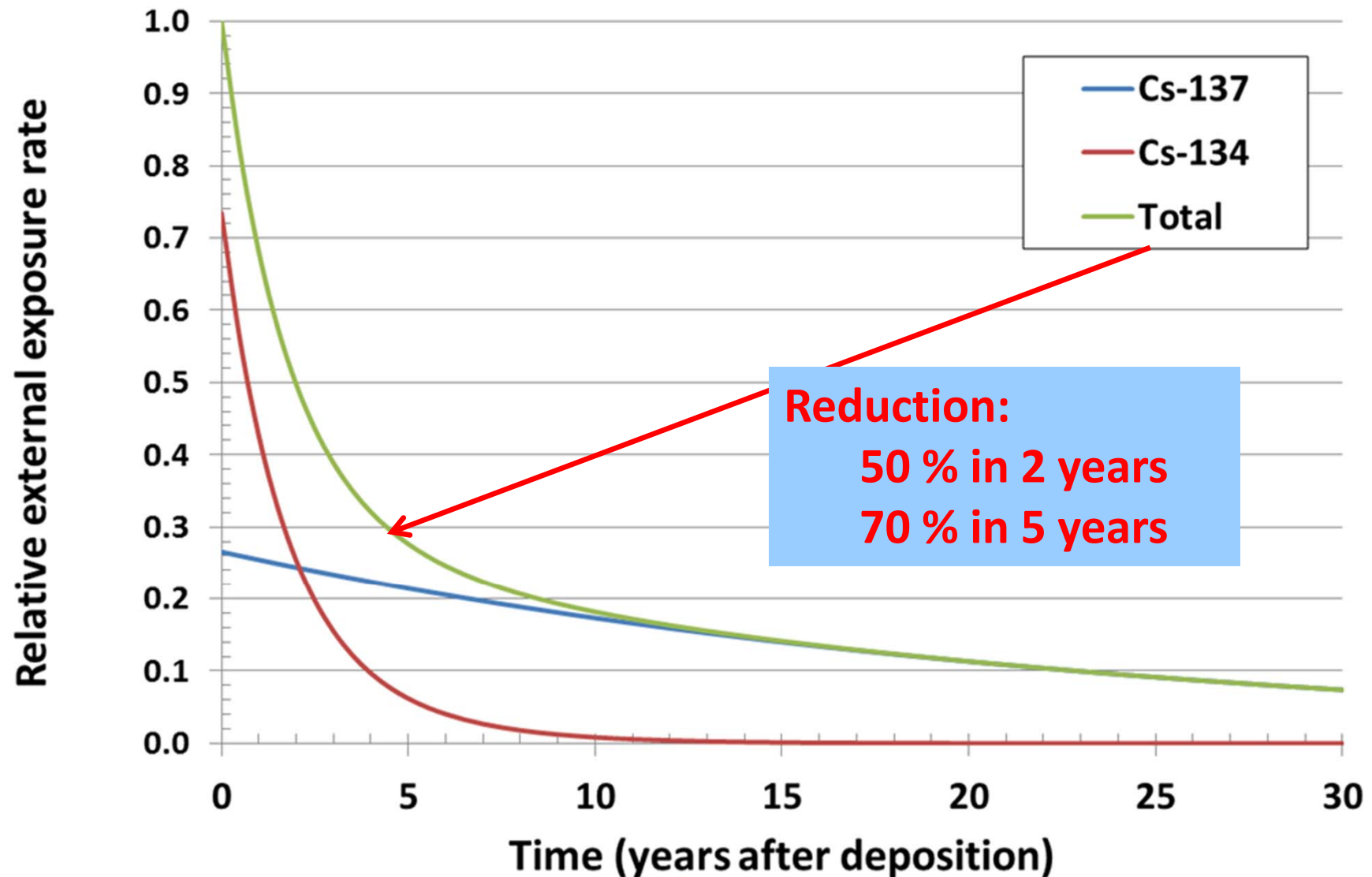
- Areas with effective doses above 20 mSv/a:
=> Reduce doses to levels below 20 mSv/a
- Areas with effective doses below 20 mSv/a:
=> Continue remediation efforts
=> Long-term goal is 1 mSv/a
- Specific attention to children (school, kindergarten)
- Aims are in line with IAEA Safety standards

Natural background exposures

UNSCEAR (2008)

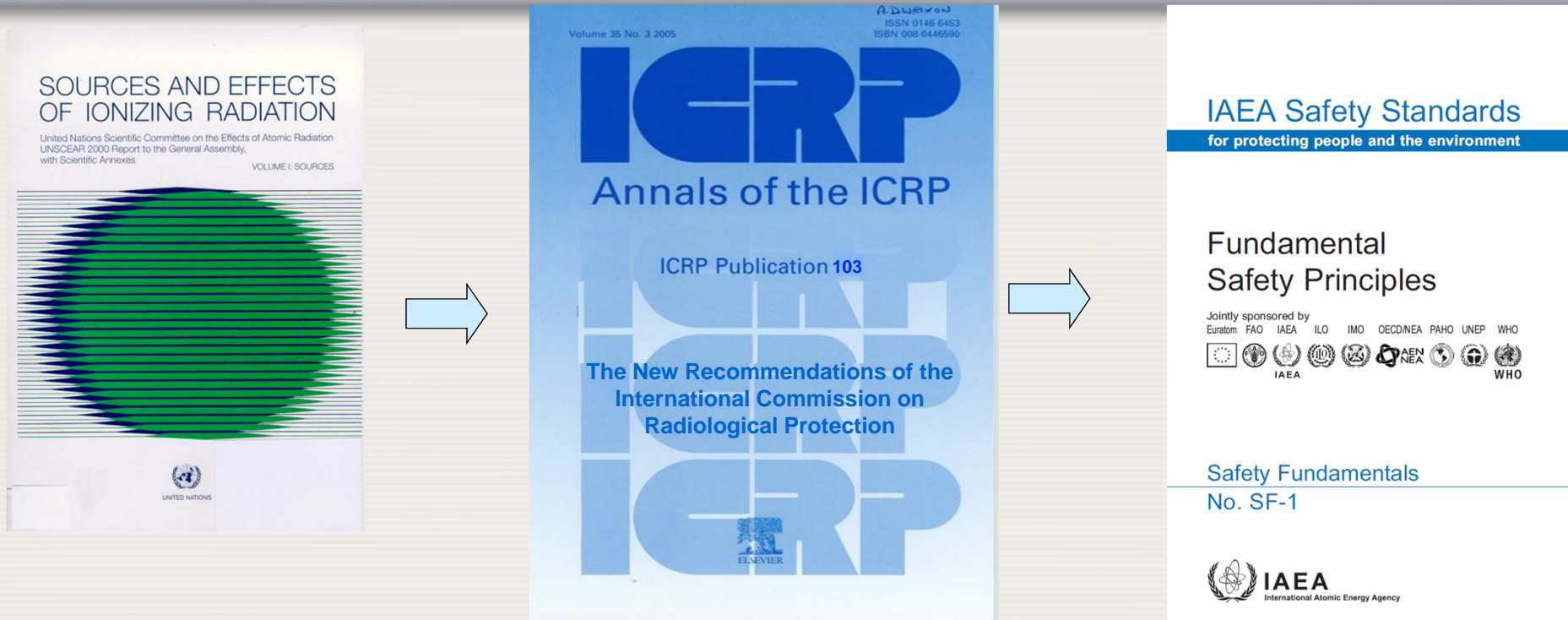
- Global average: 2.4 mSv/a
- Typical range: 1-13 mSv/a

Decline of external exposure from Cs-134 and Cs-137 (ratio 1:1) due to radioactive decay and weathering



The System of Radiation Protection in the IAEA Safety Standards

Development of International Standards



UNSCEAR:
Scientific
Reports



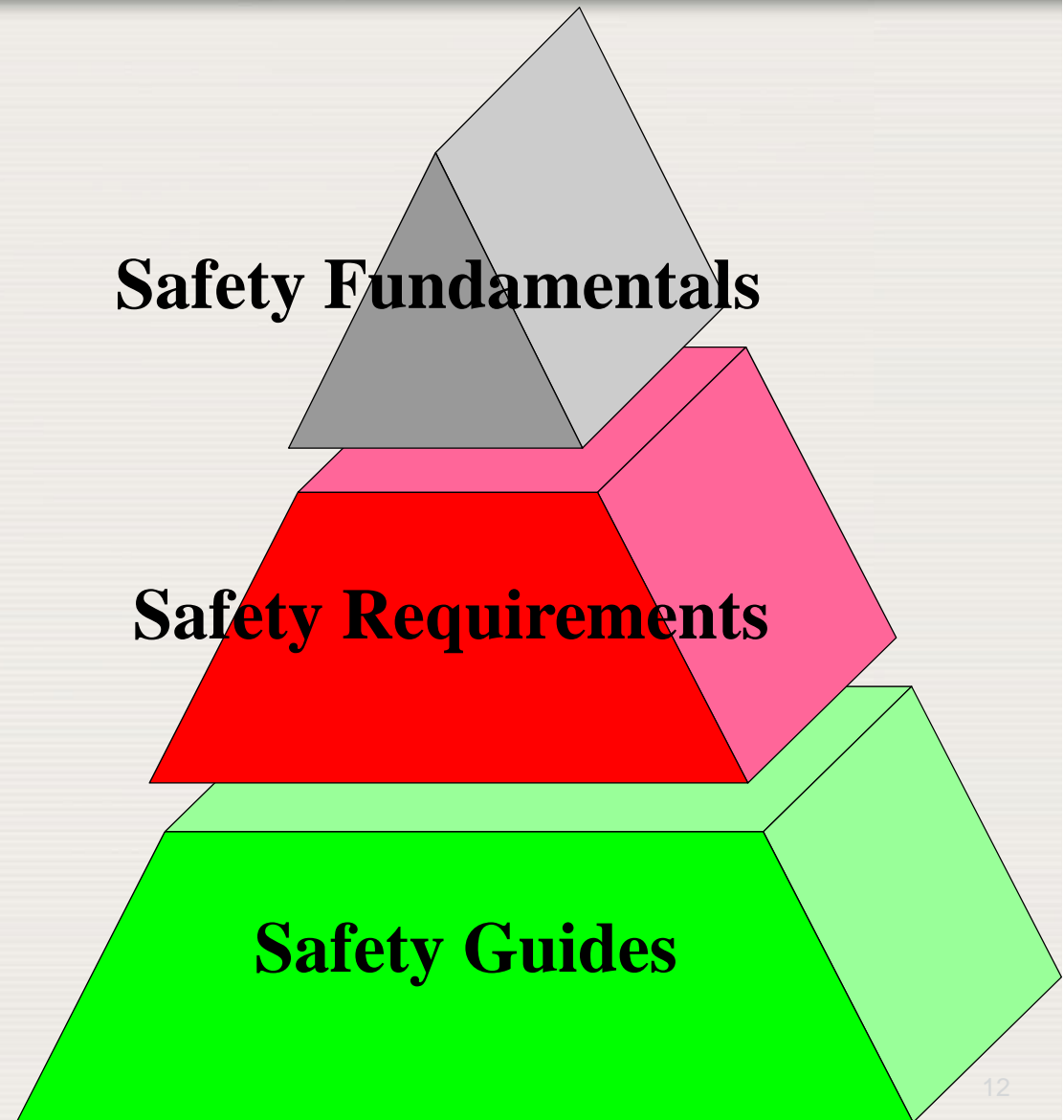
ICRP:
Recommendations

IAEA:
Safety
Standards

IAEA Safety Standards

Global Reference Point

- Safety for protecting people and the environment
- from harmful effects of ionizing radiation.



The new IAEA Basic Safety Standards

- Integration of Recommendations in ICRP 103 (2007)
- Approval by the IAEA Board of Governors (Sept. 2011)
- Replaces BSS (1996)

IAEA Safety Standards

for protecting people and the environment

Radiation Protection and
Safety of Radiation Sources:
International Basic
Safety Standards

INTERIM EDITION

General Safety Requirements Part 3
No. GSR Part 3 (Interim)



http://www-pub.iaea.org/MTCD/Publications/PDF/p1531interim_web.pdf

Emergency preparedness

*Early
March 2011*



IAEA Safety Standards

for protecting people and the environment

Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency

Jointly sponsored by the
FAO, IAEA, ILO, PAHO, WHO



General Safety Guide

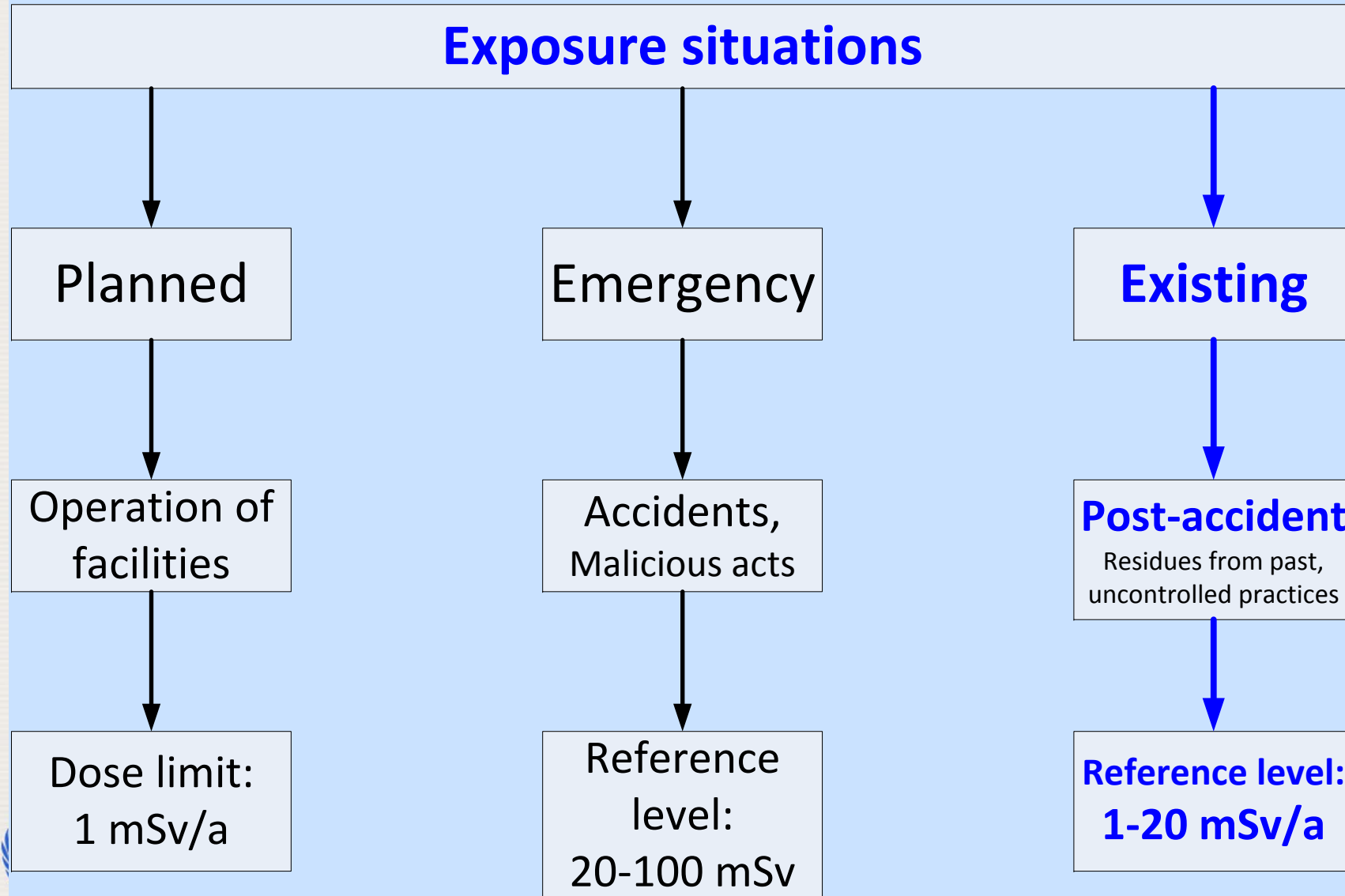
No. GSG-2



Protection against radiation risks

- Basic requirements on radiation protection and safety
- Reflects a broad international consensus
 - Co-sponsored by FAO, ILO, OECD/NEA, PAHO, WHO
- Establish basic requirements for
 - General public
 - Workers
 - Patients
- Basis for legislation in many countries

Three exposure situations for *Public exposure*



Existing exposure

Radiation Protection Principles

Justification

Actions should be adequate to the risk

Do more good than harm

Optimization

Exposure levels, People exposed, Duration

ALARA:

As Low As Reasonably Achievable, economic and social factors being taken into account

Limitation

Reference level: 1-20 mSv/a

Case by case by regulator

**Experience
Feasibility
Interested parties**

Reference levels

Reference levels are given in terms of dose

- They are **not limits**,
- ... **but doses that should not be exceeded**

Dose to be assessed for a representative person

- a more highly exposed individual in the population

Optimization

- Include all, also non-radiological impacts
- Consider
 - ... technical, economic, societal factors
 - ... exposures to workers
 - ... resulting public exposures resulting from management and disposal of waste
- Dialogue with stakeholders
- Optimization to continue, even if exposures are below the reference level

Priorities

- Priority to the higher exposed population groups
- All reasonable steps shall be taken to prevent doses remaining above the reference level
- Setup of a monitoring programme
- Control of exposure for remediation workers

Remediation of land

Remediation of Affected Areas

2007



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Remediation Process for Areas Affected by Past Activities and Accidents

Safety Guide
No. WS-G-3.1



Reference levels for remediation

- Reference levels are given **in terms of exposure only**
 - Annual effective dose
 - Organ doses
 - Cumulative doses over specified periods
- BSS **does not give** reference levels for
 - Surface activities on roads (Bq/m²),
 - Agricultural land (Bq/m²),
 - Soil (Bq/kg)
 - Food- and feedstuffs Bq/kg)

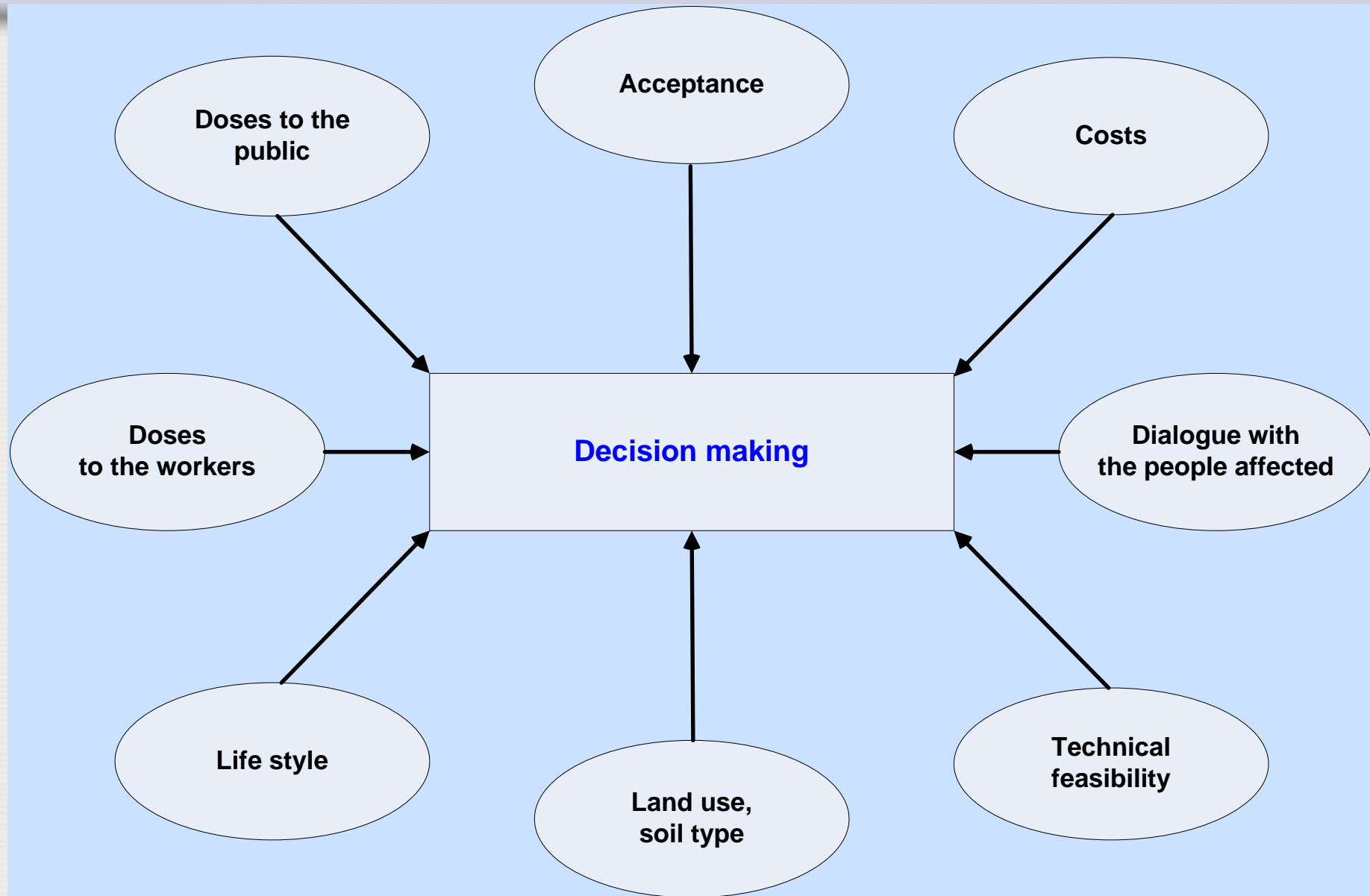
No pre-defined reference levels for activities

- Exposure to humans is the result of a complex interaction of
 - Radionuclides involved
 - Relevance of the exposure pathways
 - Environmental conditions
 - Farming practice
 - Human habits

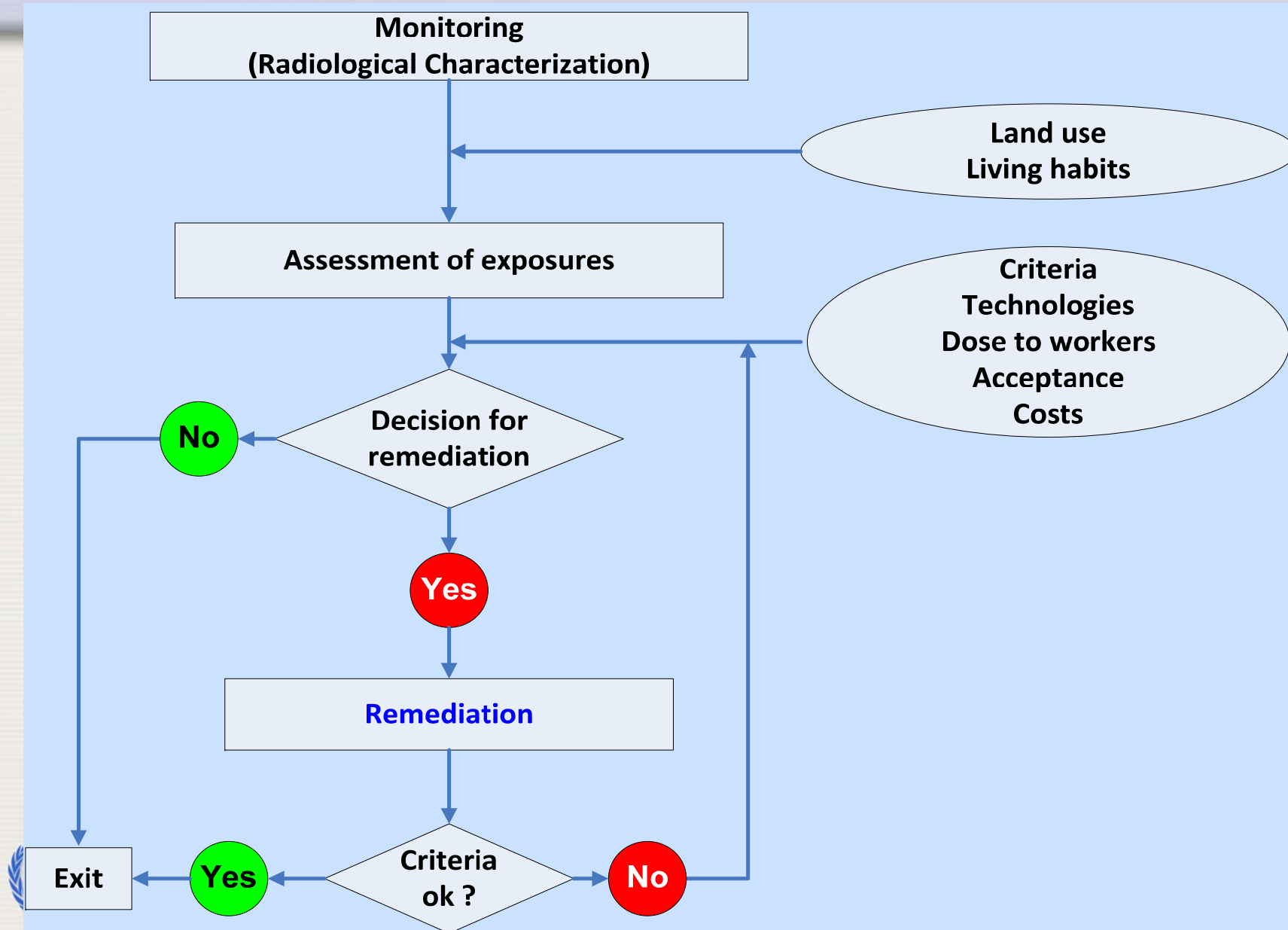
=> Case-by case consideration is necessary

- Pre-determination could cause a serious mis-allocation of resources

Input for decision making



Remediation process



Management of waste generated during remediation

Clearance

Clearance

- Removal of *radioactive material*
 - that was is under regulatory control
 - within a authorized *practices*

Clearance level

- A value, established by a *regulatory body*
 - in terms of *activity concentration [Bq/g]*,
 - below which *regulatory control* may be removed

Clearance levels

- Clearance levels in the BSS
 - Cs-134, Cs-137: 0.1 Bq/g
- Values assume unrestricted use of such materials
- **Specific clearance levels** may be developed **for waste for disposal** in landfills

Radioactive Material in the Environment

IAEA (GSG-1, 2009):

Waste arising from remediation operations

- will have to be managed as radioactive waste and
 - be either stabilized in situ or
 - disposed of in appropriate disposal facilities

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Classification of Radioactive Waste

General Safety Guide

No. GSG-1



2009

Very low level waste (VLLW):

Waste that

- ... does not need a high level of containment and isolation and, therefore,
- is suitable for disposal in
- near *surface landfill type facilities* with limited regulatory control
- ... Typical waste in this class includes
 - soil and rubble with low levels of activity concentration.
 - ...Concentrations of longer lived (> 30 years) radionuclides in VLLW are generally very limited

Safety assessment

- Only cesium is involved
- Cesium is strongly bound to the soil matrix
=> very slow migration
- Cs-134 decays away quickly
- Engineering barriers similar to landfills for municipal waste
- Safety has to be demonstrated appropriately

Public perception

Japan: Cesium in Baby Milk Powder Sparks New Fear of Radiation

Article

f Share 0 retweet 1 Share

Rate this Story 0 0

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Text Size + -

By [Anissa Haddadi](#) | December 6, 2011 6:39 PM GMT

A leading [Japanese](#) Food manufacture says radioactive cesium has been detected in its baby formula and has recalled the products.

The Company issued a statement Tuesday, launching an immediate recall of 400,000 cans of powdered milk for infants.



[View Full Image](#)

Reuters

The powdered milk measured up to 30.8 becquerels of radioactive cesium per kilogram but although the level remains well below the government's recommended limit of 200 becquerels per kilo, the company decided to go ahead with the recall.

 says it does not know how the cesium got into the powdered milk but added the incident might have been caused after prevailing winds picked up radioactive substances from the Fukushima-Daiichi nuclear plant.



Radiological aspects

- Activity concentration
 - 30.8 Bq/kg in powder
 - 4.3 Bq/l in baby milk
- Possible exposure: 0.07 $\mu\text{Sv}/\text{d}$ (NISA)
- 0.07 μSv are received during 1-2 minutes flight @10 km height

Consequences

- Global distribution of this information
- 400 000 cans of milk powder recalled
- Shares fall (of the producer) and rise (of the competitor)
- Possible implications
 - for farmers
 - for the producing region

What's the problem with perception

- Often a general mistrust
- Complexity of the radiation protection system
 - Exposure situations
 - Planned, existing emergency
 - Exposure groups
 - Public, workers, patients
 - Quantities
 - Activity, Doses, Dose rates, Organ doses, Dose limits, Reference levels
- Different contradicting voices

Conclusions

- IAEA safety standards
 - ... are based on the science and practical experience
 - ... implement a well accepted system for radiation protection
 - ... cover all aspects to manage of post-accident situations
 - ... reflect an international consensus:
 - Developed in a transparent process
 - To be approved by IAEA Member States
- Remediation aims for affected areas in line with IAEA Safety Standards
- Public acceptance is an important issues; it requires a careful and continuing dialogue

Thank you