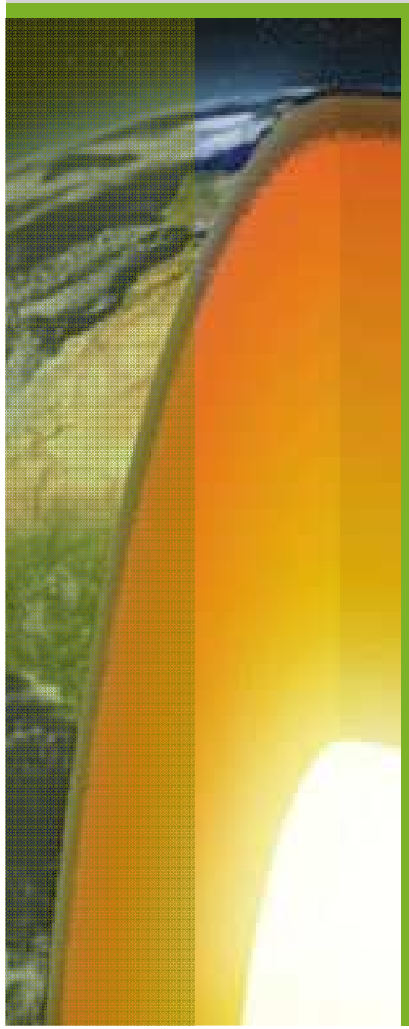
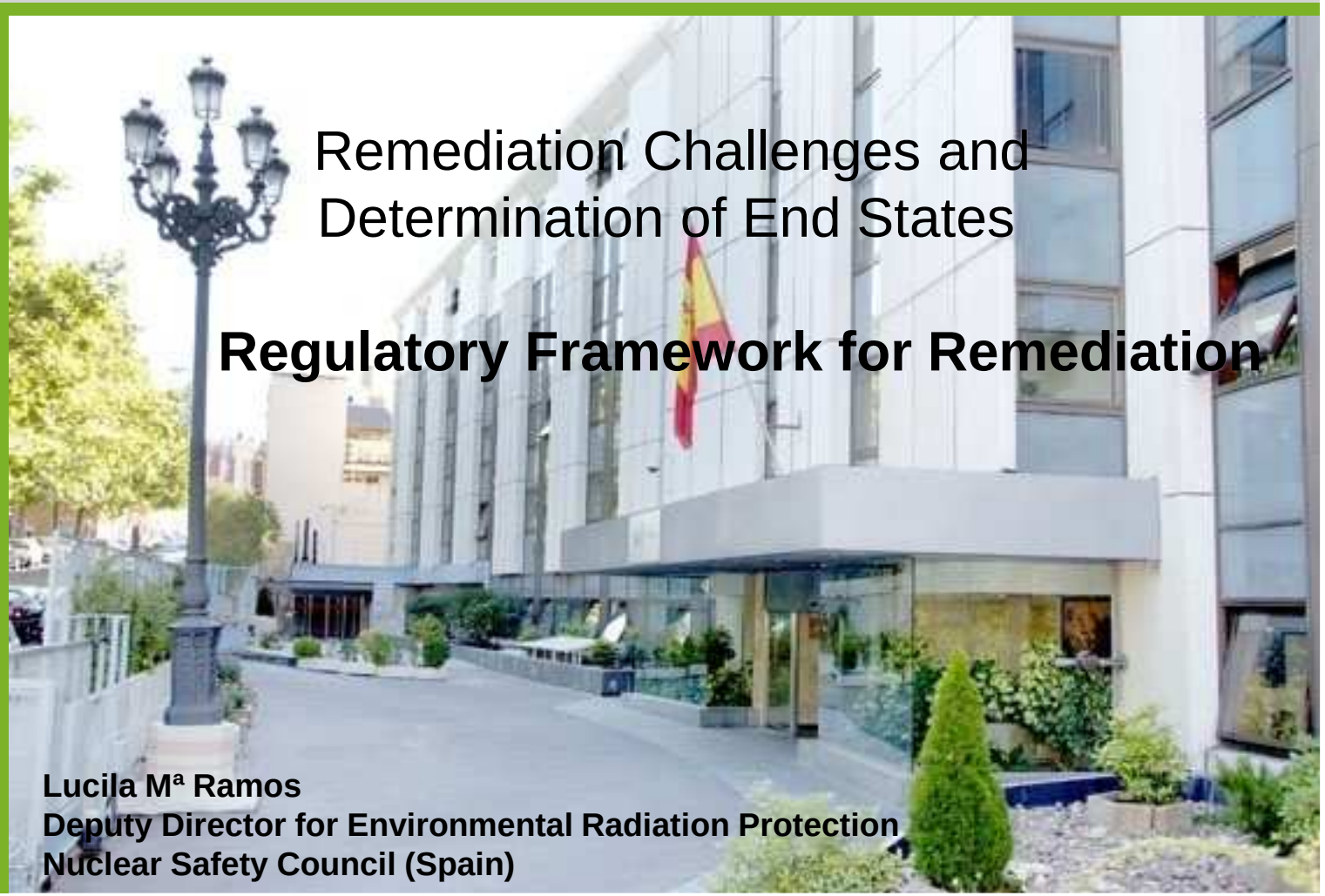
CSN CONSEJO DE SEGURIDAD NUCLEAR

IAEA. Vienna , 28 Jan-1 Feb 2013

International Expert's Meeting on Decommissioning and Remediation after a Nuclear Accident





Remediation Challenges and Determination of End States

Regulatory Framework for Remediation

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Regulatory framework for remediation after a nuclear accident

CONTENTS

01. Introduction

- **Some accidents at nuclear facilities:**
  - **major impact on the population and environment**
  - **important challenges to the owner/operator and country**
  - **trans-boundary implications**
- **After the emergency phase is declared ended, remediation activities need to be implemented considering:**
  - **technical, societal, environmental , economic… matters**
  - **short and long term**
- **Post accident situation: 'existing exposure situation' (ICRP, 2007)**
- **The transition from an emergency to an existing exposure situation:**
  - **characterized by a change in management:**
    - **from strategies mainly determined by urgency, with potentially high levels of exposure and predominantly central decisions,**
    - **to more decentralized strategies aiming to improve living conditions and reduce exposures**
  - **may occur at different times within the contaminated areas**

02.1

Regulatory Framework

- **ICRP-103 (2007): General principles for the implementation of the system of protection in planned, emergency and exiting exposure situations.**
- **ICRP-111 (2011): Application of the Commission's Recommendations to the Protection of People Living in Long-term Contaminated Areas after a Nuclear Accident or a Radiation Emergency.**
- **IAEA Fundamental Safety Principles. Principle 10 (No. SF-1, 2006)**
- **IAEA Safety Guide WS-G-3.1: Remediation Process for Areas affected by Past Activities and Accidents" (2007).**
- **IAEA International Basic Safety Standards (2011)**

  Adoption of ICRP 103 Recommendations

02.2 Responsibilities for Remediation of Contaminated Areas (BSS)

Governments

- Include in legal/regulatory framework for protection and safety, provision for the management of existing exposure situations:
  - **specify the general principles underlying protection strategies**
  - **assign responsibilities for establishment/implementation of protection strategies**
  - **provide for the involvement of interested parties**

Regulatory bodies

- Establish a protection strategy, defining: - **The objectives to be achieved**
  - **Appropriate reference level**

Authorities (Regional, local..) assigned to implement the protection strategy

- Provide arranging for evaluation of : - **remedial and protective actions and**
  - **efficiency of the actions planned and implemented**
- Ensure that information on potential health risks and means for reducing exposures is available

02.3 Responsibilities for Remediation of Contaminated Areas

- **The first fundamental decision to be taken by the authorities at the end of the emergency situation is to allow people to live in long-term contaminated areas.**

  - **Implies the setting of a radiation protection criterion:**
    - ✓ **Above which the population must be relocated,**
    - ✓ **Below which inhabitants may stay subject to certain conditions**

- **The management of an existing exposure situation relies on the implementation of a remediation program**

  - **Considering social, economic, health, environmental,… aspects**
  - **Priority to protection of people with the highest exposures, while reducing all individual exposures to as low as reasonably achievable**

  - **Take self-help protective actions into account**

    ➡ **Stakeholder engagement key to the development and implementation of protection strategies.**

03.1 Application of the Radiation Protection Principles

- **Fundamental protection principles applicable to post-accident situation**
  - **justification of implementing protection strategies**
  - **optimization of the protection achieved**

  Existing exposure situations can not be managed in an "a priory" way

  → **Dose limits do not apply**

- **Justification applied:**
  - **Initially, decision to allow people to live in the long-term contaminated areas**
  - **Secondly, definition of the protection strategies to reduce individual exposures**

- **Justification of protection strategies should also take into account other non-radiological factor that could be vital in the decisions making process:**
  - ✓ **economic, political, environmental, social, and psychological.**

- **Justification should be considered for all protective actions in a protection strategy,**

03.2 Application of the Radiation Protection Principles

- **Optimization of protection is a source-related process, which should guarantee the selection of the best protection strategy**

- **In order to reduce inequity in the distribution of individual doses, ICRP introduced the concept of constrained optimization.**

  ➡ **For both, emergency and existing exposure situations, the dose criterion to serve as dose restriction is termed: 'reference level'**

- **The optimization process in existing exposure situations presents some specificities, facing particular challenges:**
  - **consumers versus producers interest,**
  - **local versus national and international population,**
  - **inhabitants taking multiple decisions in their daily life**

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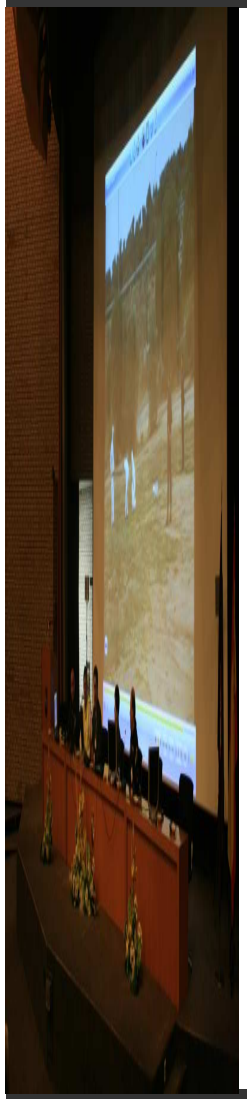
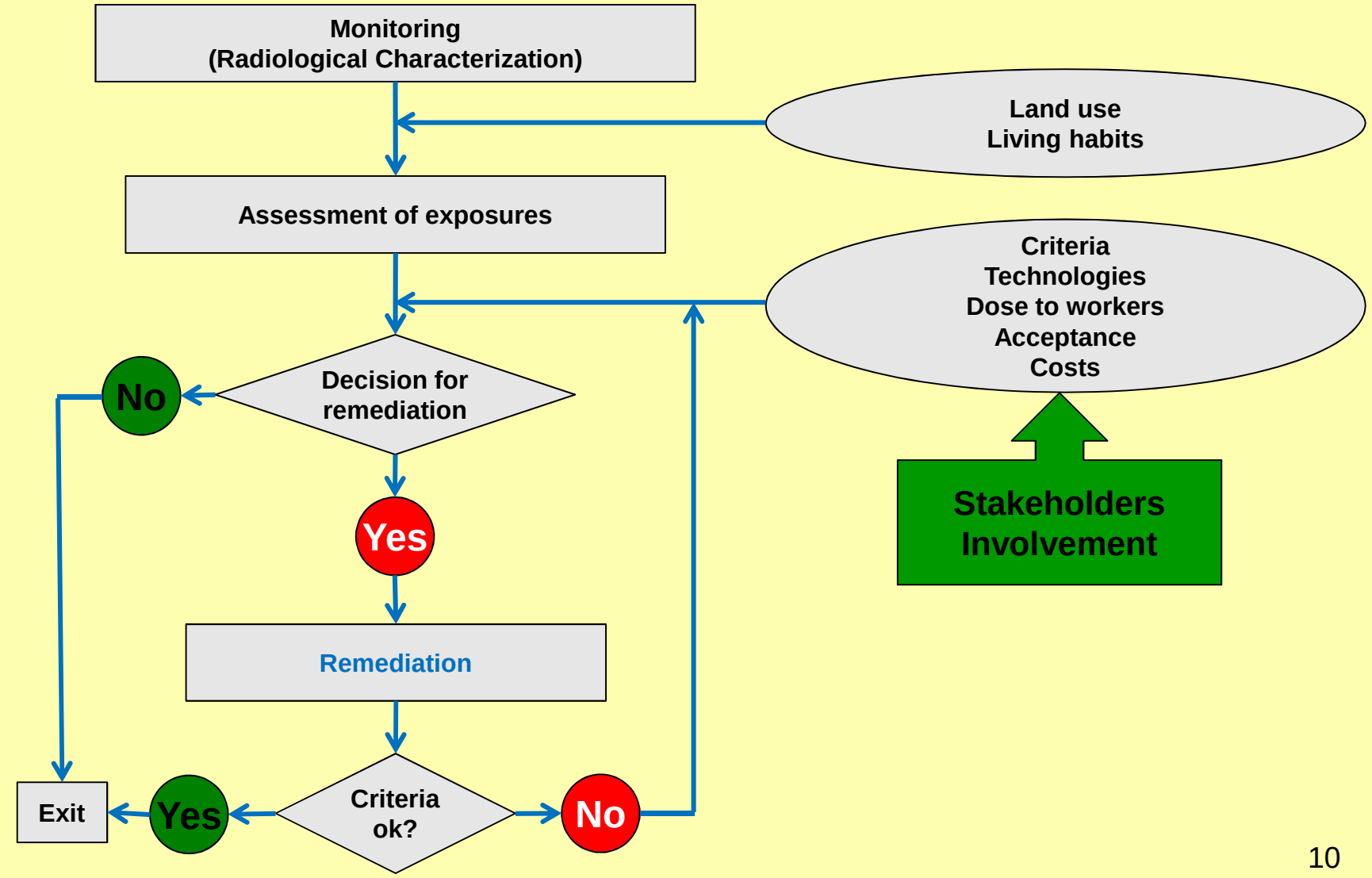
03.3 Application of the Radiation Protection Principles



- **The optimization process in a post-accident situation:**
  - **can be implemented step by step, considering the prevailing circumstances**
  - **is a forward-looking iterative process taking into account technical and socio-economic factors, and requiring qualitative and quantitative judgments**
- **Decision-aiding techniques can be used to guide the selection of protection strategies.**
- **The best option or strategy is always specific to the exposure situation and represents the best level of protection that can be achieved under the prevailing circumstances.**

  ⟶ **Not necessarily the one resulting in the lowest residual dose level**

03.4 Remediation – An iterative process



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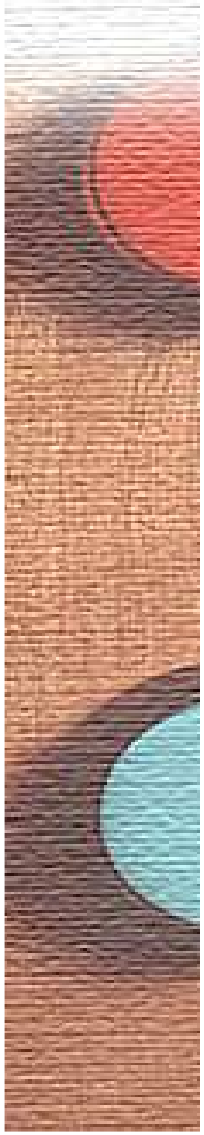
04.1. Criteria



- **Reference levels are used:**
  - ✓ **prospectively, for planning of protection strategies**
  - ✓ **retrospectively for evaluating effectiveness of protection strategies**
- **ICRP introduced three bands of constraints or reference levels according to the characteristics of the exposure situation.**
- **The chosen value for the reference level will depend upon the prevailing circumstances of the exposure under consideration.**
- **Established in terms of individual annual effective residual dose (mSv/y)**
- **Should be selected from the lower part of the 1–20 mSv/year band.**
- **Intermediate reference levels may be adopted by national authorities to improve the situation progressively.**
- **A typical goal value is 1 mSv/year or less in the long term**

04.2 Criteria

Reference Levels

100 mSv

20 mSv

1 mSv

Emergency exposure situation

Protection actions aiming to reduce exposure dose to 20 mSv/y or less.

- Maximun value 100 mSv (acutely or in a year)
- Long term efforts needed in high dose area

Existing exposure situations

Reducing additional exposure to 1 mSv/y

- Long-term exposure after emergency situation
- Stages in post accident situations, a range of values in this band

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05.

Long-term surveillance

Radiation and health surveillance programs implemented after the emergency phase, given uncertainties concerning future potential health effects

- **Objectives of radiation monitoring :**
  - ✓ **assess current levels of human exposure (external and internal)**
  - ✓ **estimate environmental levels of contamination, and**
  - ✓ **allow the prediction of their evolution in the future.**

➡ **A monitoring record system should be established:**

- ✓ **evolution of exposure situation/effectiveness of the protection strategies**
- ✓ **important for determining potential groups at risk**

- **Objectives of long-term health surveillance programs**
  - ✓ **follow-up of individuals who have received significant exposures**
  - ✓ **'medical monitoring' of the general population**

➡ **Health registries established to allow effective long-term health surveillance of the affected population and epidemiological studies**

06.

Self-help actions

- **Inhabitants may take some "self-help" protective actions:**
  - **intended to characterize their own radiological situation and**
  - **adapting their way of life to reduce exposure**

- **Self-help protective actions mainly consists of:**
  - **Control of external exposure**
    - ✓ **Living place mapping, identifying places with higher exposure levels**
  - **Control of internal exposure**
    - ✓ **Having access to measurements of local products**
    - ✓ **Adapting dietary habits to reduce ingestion of contaminated food**
    - ✓ **In private gardens, measuring the radiological quality of grown food stuffs and using proper agricultural techniques.**
  - **Supervising the radioactive contamination of the environment**

- **Self protection actions should be facilitated by authorities**
  - **providing results of measurements, information and training**
  - **ensuring regular whole-body counting of the affected population**
  - **Setting up local forums with representatives of the population and experts**

07.1

Regulatory Perspective

- **Systems of radiological protection after an accident with radiological consequences have been developed both internationally and in individual countries.**
- **Experience shows that there is a need for additional progress, taking into consideration lessons learned worldwide.**
- **Policy and strategies for remediation of contaminated areas should be developed further by regulators and the international community, including:**
  - ✓ **coordination of remediation plans with emergency response plans**
  - ✓ **Improvement of methods for remediation decision-making process**
  - ✓ **monitoring the environment, food and people**
    - → **facilitate dose assessment and decision-making**

07.2

Regulatory Perspective

- ✓ **Development of strategies, guidance and tools for the management of contaminated products,**
  - → **Considering producers, sellers and consumers viewpoints**
- ✓ **Efficient application of technologies for characterization**
- ✓ **Strategies for stakeholders involvement and communication**
- ✓ **Take into consideration the management of the waste generated during remediation**
- ✓ **Promote efficient ways for public communication**
- ✓ **Develop permanent systems for sharing information/experience**

- **Some of these aspects are already under consideration**
  - **IAEA (NSAP), EU (Euranos, Neris Projects), NEA, individual countries**

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