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RADIOLOGICAL PROTECTION DURING THE DISMANTLING OF NUCLEAR FACILITIES

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(ENRESA)**

INTRODUCTION

- **ENRESA**

- Spanish National Company for Radioactive Waste Management is in charge for the dismantling of nuclear facilities.
- ENRESA has dismantled Vandellós I Nuclear Power Plant, is finishing the dismantling of an experimental reactor and other research facilities and is carrying out the dismantling of José Cabrera Nuclear Power Plant.

- **APPLICATION OF ALARA CRITERION**

- Based on the Spanish Radiation Protection Regulations and guides of the Regulatory Body (CSN).
- Established in a Manual applicable to all the ENRESA activities and projects.
- Is applied from the project phase and developed in the operational phase establishing specific objectives related with individual and collective doses, dose rates, contamination levels...
- The Manual establish the organization to implement the ALARA criterion. All contractors and workers are involved.



INTRODUCTION

- **ALARA COMMISSION (MANAGEMENT LEVEL):** Advisory body composed of managers and department heads involved in projects with ALARA programs and in operational installations.
 - Promotion of ALARA culture.
 - Approval and endorses ALARA policy and dose objectives.
 - Provision of financial, technical and administrative resources.
- **ALARA COMMITTEE (EXECUTIVE LEVEL):** Executive body formed in the operational/dismantling installations composed of managers and heads of the relevant services.
 - Promotion of ALARA policy and dose objectives.
 - Periodically is informed on practices, ALARA studies, and training programmes. Reviews the results obtained and the corrective actions.
 - Coordination of the all groups involved (installation, central organizations, contractors).
 - Provision of financial, technical and administrative resources.
- **ALARA GROUPS (TECHNICAL LEVEL):** Technical groups established for specific jobs formed by the relevant services in the installations.
 - Promotion of improvements.
 - Coordination with Radiation Protection Service and reports to management.
 - Analyse of specific activities and plan specific jobs, follow work and analyses results finally propose the necessary improvements.

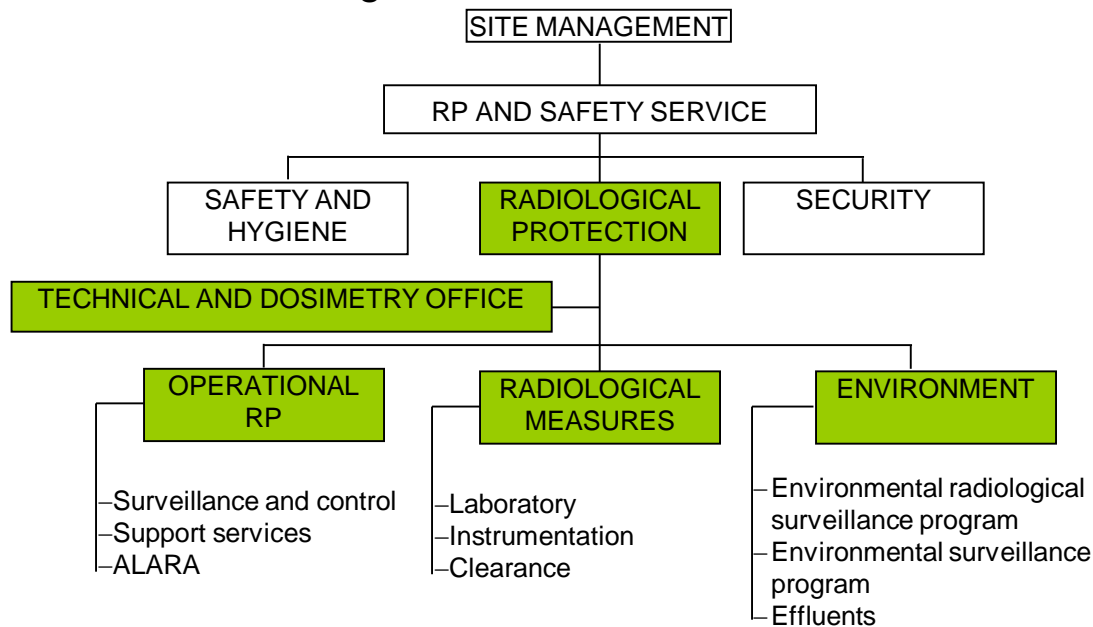
SPECIAL RADIATION PROTECTION ISSUES

- Continuous change of the radiological and conventional risks
- Works on equipment and systems never before touched
- Removal from service of the protection systems
- Workers accustomed to refuelling activities more than decommissioning
- Workers unaccustomed to working with radiation



RADIATION PROTECTION PROGRAM AND ALARA

- ORGANIZATION
 - During the decommissioning is necessary the reorganization and reinforcement of Radiation Protection organization.



ALARA PROGRAMME FOR DISMANTLING

- Objective: to keep exposures to workers and public as low as reasonable achievable. In practice this objective is:
 - Collective dose < predicted dose
 - Maximum individual dose < 10 mSv/year
 - Avoid internal contamination
- Organization: multidisciplinary structure involving operation, maintenance, contractors and workers
- Structure: ALARA Committee and ALARA groups
- In general the ALARA techniques are oriented to avoid internal contamination by alpha emitters:
 - Use of confinement structures and portable ventilation systems.
 - Installation of specific ventilated areas for loading, closure and removal of waste.
 - Implementation of the best cutting techniques reducing surface and air-borne contamination and minimizing external doses
 - Conditioning of personnel access and exit points helping during the undressing (phases with the highest risk of internal contamination).
 - Use of special protective equipment and training on the use.
 - Use of peelable paints to fix surface contamination and to protect decontaminated zones.

ALARA TECHNIQUES

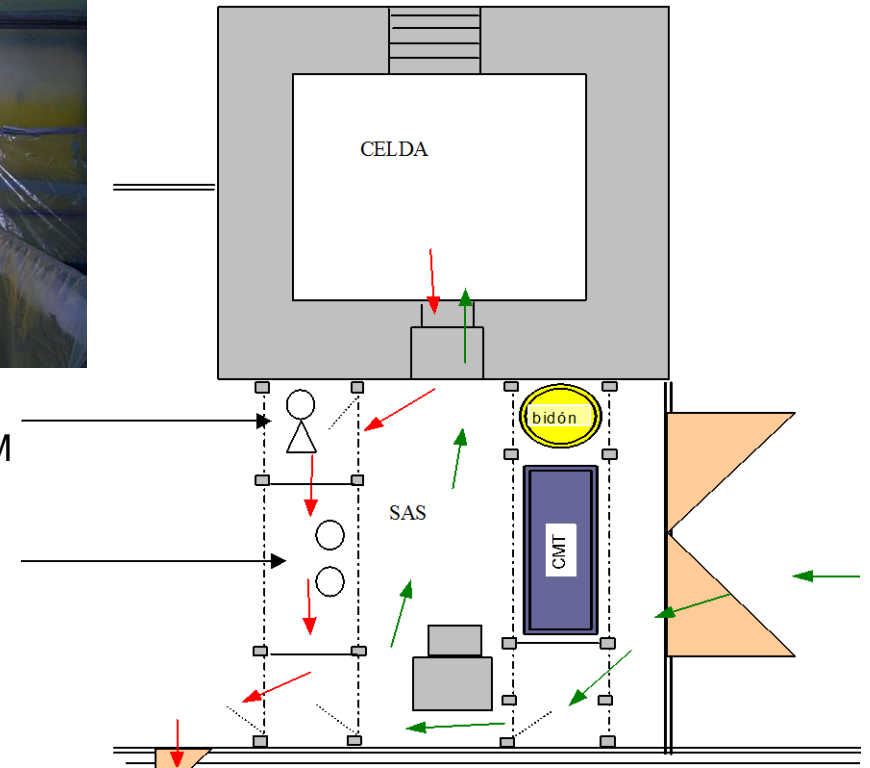


- USE OF SPECIAL PROTECTIVE EQUIPMENT.
- PERSONNEL EXIT. PREVIOUS SHOWER AND HELP IN UNDRRESSING
- CONTINUOUS MONITORING OF ALPHA AND BETA AIR-BORNE CONTAMINATION WITH ALARM (WORKS WITH ALPHA RISKS).

ALARA TECHNIQUES



- PREPARATION OF ISOLATED ENTRANCE ROOM
- INDEPENDENT ROUTES FOR:
 - WORKERS AND MATERIALS
 - ENTRANCE AND EXIT



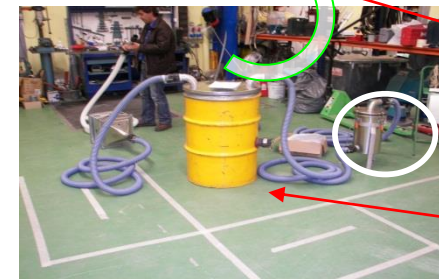
ALARA TECHNIQUES



- USE OF SPECIAL TOOLS TO MINIMISE DISPERSION
- USE OF CONFINEMENTS
- USE OF SPECIAL EQUIPMENTS FOR REMOVAL ACTIVE LIQUIDS



HEPA filter

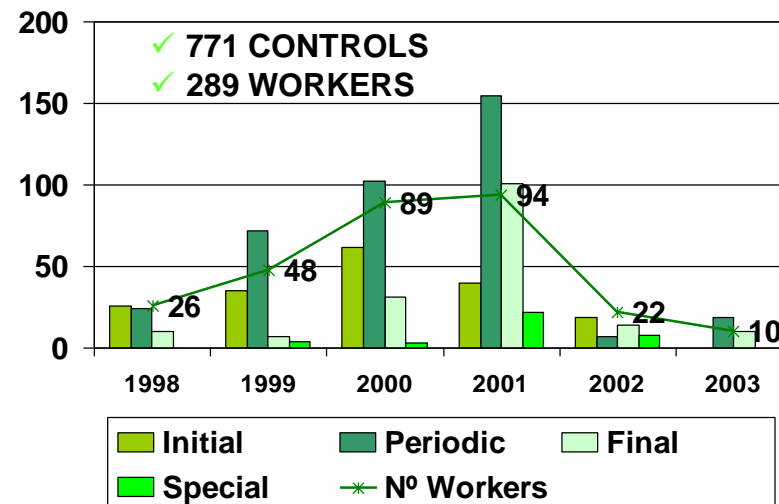
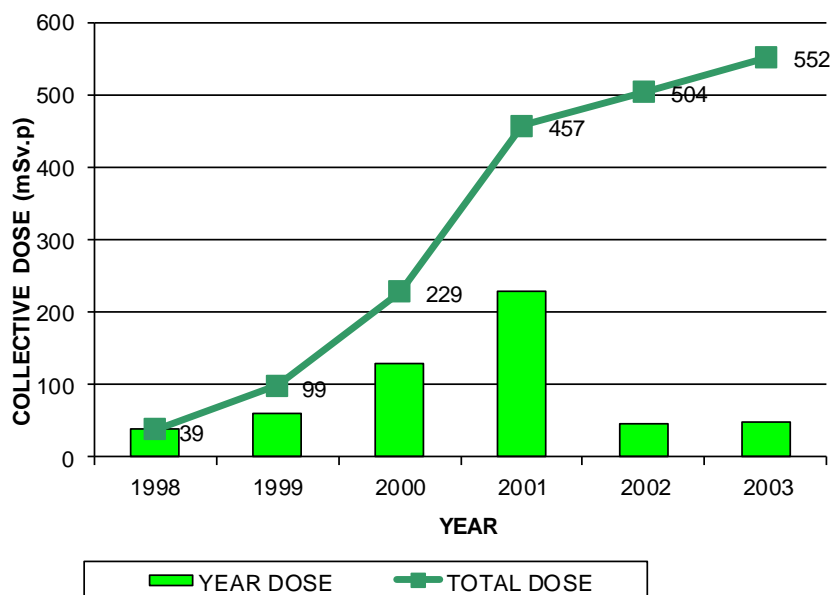


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Disposal drum

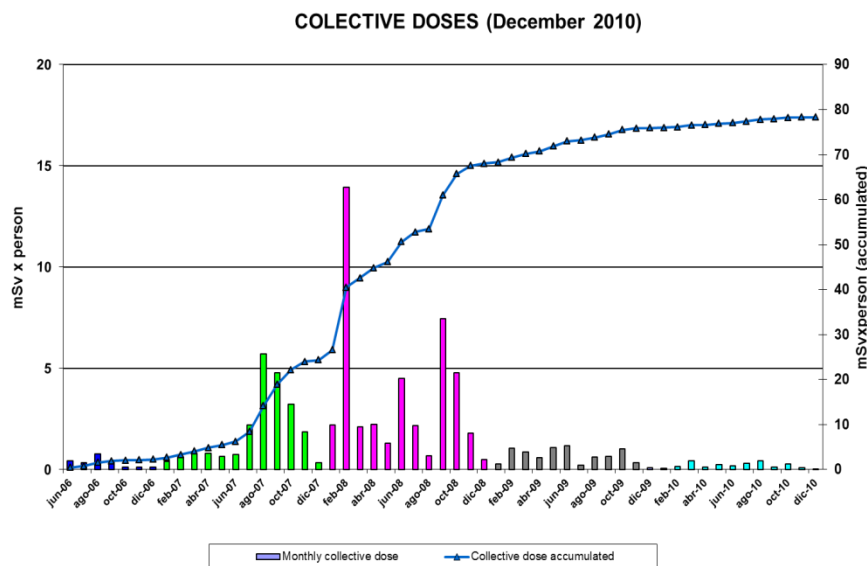
VANDELLOS 1 RESULTS

- EXTERNAL DOSES: 552 mSv.p < predicted (603 mSv.p)
- INTERNAL DOSES: 7 WORKERS << ANNUAL LIMIT (24 mSv.p)



RESEARCH INSTALLATIONS RESULTS (DECEMBER 2010)

- EXTERNAL DOSES: 78 mSv.p < predicted
- INTERNAL DOSES: 1 WORKER << ANNUAL LIMIT (1.7mSv)
 - 165 CONTROLS
 - 107 WORKERS



DISMANTLING OF JOSE CABRERA NUCLEAR POWER PLANT

- Is an old PWR (1970-1996).
- There is poor structural shielding and very limited interior space.
- The radiological monitoring systems is inadequate for decommissioning.
- There is a high risk of external exposure due to segmentation of the major primary circuit components.
- There is a high risk of hot particles.
- Strict regulatory requirements for the design of ventilation systems (fixed and portable) and depression in buildings, areas and confined enclosures.
- The existence of internal contamination in large reinforced concrete structures oblige the use of large cutting and demolition equipment few compatible with requirements of the ventilation systems.



Racks removal (José Cabrera

CONCLUSIONS

- ✓ The application of the ALARA principle to the dismantling of installations does not differ to the form used for operational installations, although in practice many differences exist.
- ✓ Decommissioning of the nuclear plants require the adaptation of the radiation protection programmes established during normal operations. This adaptation extends from documentary aspects, to increased human and technical resources and the reorientation of operational practices.
- ✓ The ALARA principle should be taken into account from the time the work is planned and all involved should participate in its implementation.
- ✓ Regardless of the external radiation risk level which may exist in the installation, close attention must be paid to the risk of internal contamination which will be greatly increased compared to normal operation.
- ✓ The presence of hot particles must be also taking into account in some kind of dismantlings.