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CENTRE D'ÉTUDE SUR L'ÉVALUATION DE LA PROTECTION DANS LE DOMAINE NUCLÉAIRE

ALARA in Decommissioning: The point of view of the ISOE WG-DECOM

ISOE
Information System on Occupational Exposure

ALARA for Decommissioning and Site Remediation Workshop

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NEA NUCLEAR ENERGY AGENCY

IAEA International Atomic Energy Agency

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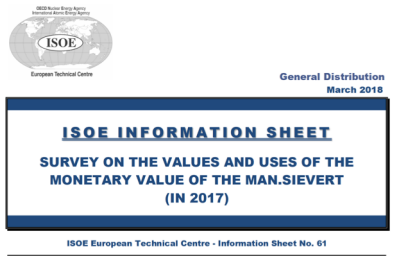
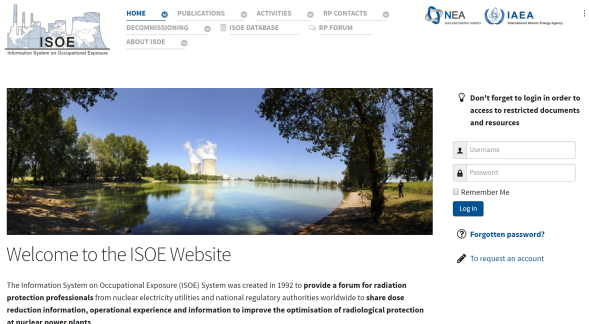
ISOE and the WG DECOM

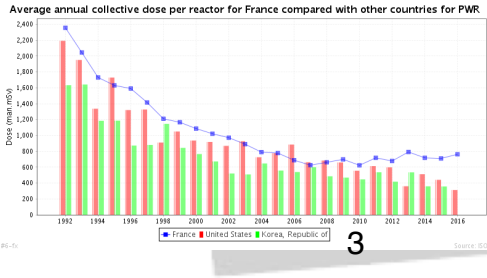
- ISOE stands for Information System on Occupational Exposure - www.isoe-network.net -.

- Created in 1992 and sponsored by NEA/OECD and IAEA, it consists in a broad network of RP experts:
  - 76 utilities,
  - 28 regulatory bodies,
  - 29 countries.

- A great resource in order to share practices (ISOE Symposium & Forum), benchmark (ISOE Database), improve performances (ISOE Reports) and thus reduce occupational exposures in operating nuclear power plant.







ISOE and the WG DECOM

- Since early 2000ies, decommissioning has became a growing subject in OECD countries. A need for a network of radiation protection (RP) experts in order to discuss RP and related issues relevant to such activities was identified, leading to the creation of ISOE WG DECOM (Working Group on Radiological Aspects of Decommissioning Activities in Nuclear Power Plants).

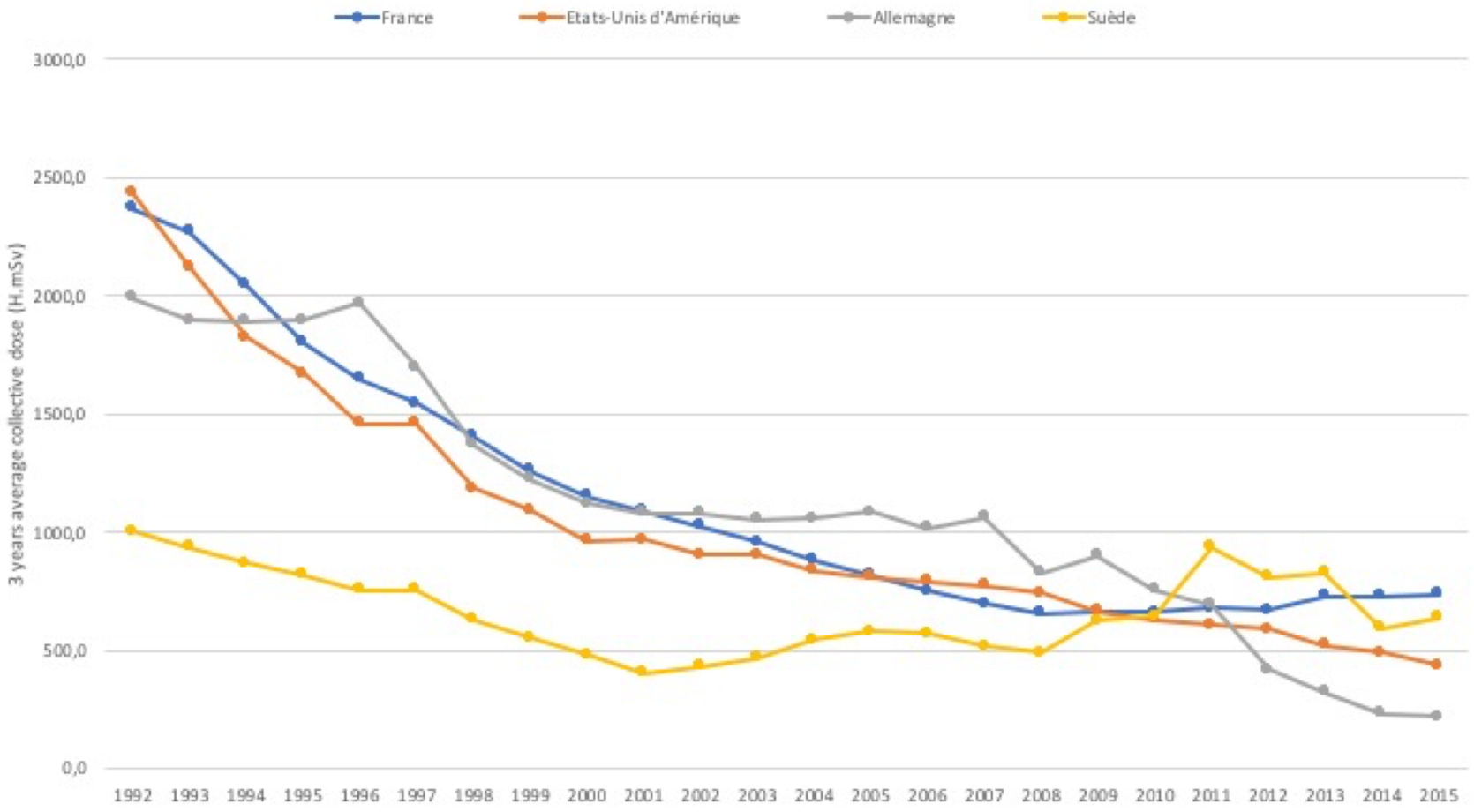
- WG DECOM is a network of RP experts from utilities and Authorities who are involved in NPP decommissioning projects. Its work is based on a comprehensive understanding of national contexts and operational experiences exchanges/gathering.

ALARA

- According to ICRP 103, *'the principle of optimisation is defined by the Commission as the source related process to keep the likelihood of incurring exposures (where these are not certain to be received), the number of people exposed, and the magnitude of individual doses as low as reasonably achievable, taking economic and societal factors into account*'.

- In practice, implementation of ALARA in nuclear power plant in operation relies on many factors:
  - Financial aspects,
  - Organization (engage the management and workers),
  - Human and technical resources (RP staffing),
  - Training of RP staff and information of workers (building competence),
  - Experience of routine maintenance work (feedback, improvement, culture),
  - Networking (a nuclear industry challenge),
  - Facility knowledge (characterisation),
  - Source term management (Zn injection, primary coolant purification, etc.),
  - Etc.

- In addition to a noticeable decrease of collective exposures, average individual dose in nuclear power plant in operation is about 1 to a few mSv.y-1.



Decommissioning

- A 10 to 15 years project which costs a lot for no profit (kWh). Range from 600 to 800 M€ (EPRI) and it's increasing (see Songs 2 and 3 for instance).

- Various strategies:
  - Immediate (IAEA and Authorities),
  - Differed (safe store: often linked to funding),
  - Entombment.

- Waste management often seen as a driving factors of the overall project as well as the final end-state.

- But, collective exposures easily reach a few H.Sv per reactor (Zion: 4 to 5 H.Sv, Jose Cabrera: 3 H.Sv, Songs 1: 3 H.Sv) and RP staff face huge challenges with increase potential for internal contamination, asbestos, lead, etc. which must be carefully dealt with (holistic approach).

- And it's a political and societal challenge.

ALARA and decommissioning

- If we move back to what explains success in operation:
  - Financial aspects,
  - Organization (engage the management and workers),
  - Human and technical resources (RP staffing + rad. wastes management),
  - Training of RP staff and information of workers (new players + cultural change),
  - Networking (a nuclear industry challenge),
  - Facility knowledge (characterisation),
  - Source term management (full system decontamination, contamination, etc.).

- But:
  - ~~Experience of routine maintenance work (feedback, improvement, culture)~~

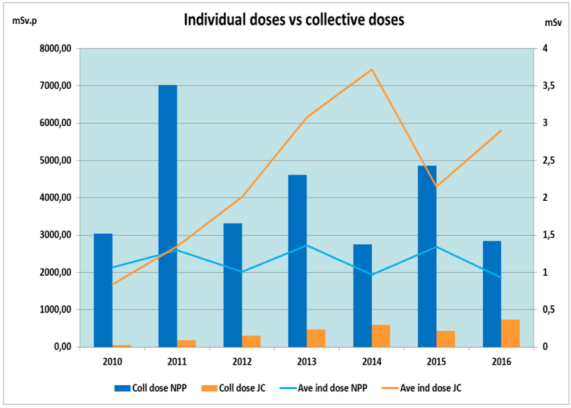
- Are we doing good? Are doing ALARA? Is our collective dose target reasonable?

ALARA and decommissioning

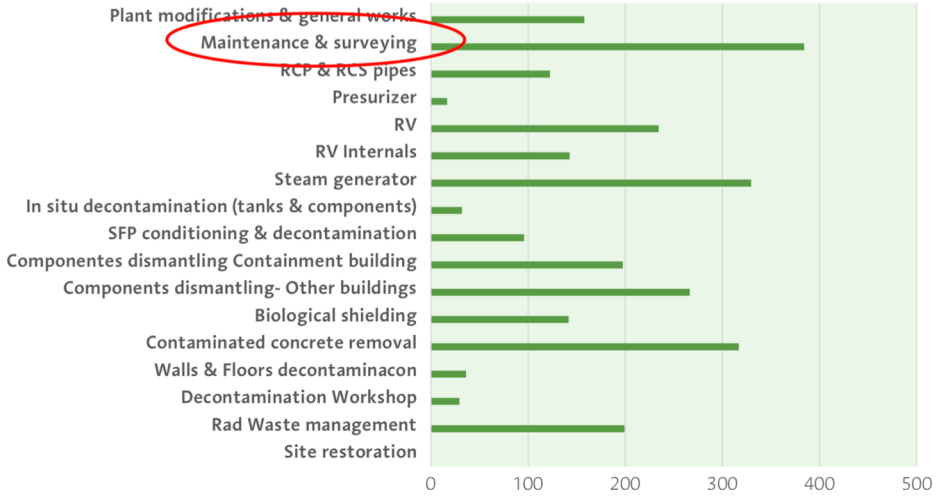
ACTIVITIES	Collective dose (mSv-p)	
Plant Modifications & General Works	157,84	5,8%
Maintenance & Surveying	384,16	14,2%
Main Components	846,00	31,3%
In situ decontamination(tanks/components)	31,96	1,2%
Spent Fuel Pool conditioning & decontamination	95,79	3,5%
Components dismantling - Containment building	197,47	7,3%
Components dismantling - other buildings	266,43	9,9%
Biological shielding	141,79	5,2%
Contaminated concrete removal	316,92	11,7%
Walls & floors decontamination	36,07	1,3%
Decontamination workshop	29,38	1,1%
Rad Waste management	199,12	7,4%
Site restoration	0,00	0,00
total	2702,93	

Individual doses

	Number of persons 10 mSv -20 mSv	
	NPP	José Cabrera
2010	1	0
2011	73	2
2012	2	0
2013	18	15
2014	0	24
2015	20	5
2016	0	22



Collective dose (mSv-p) by activity (main components splitted)



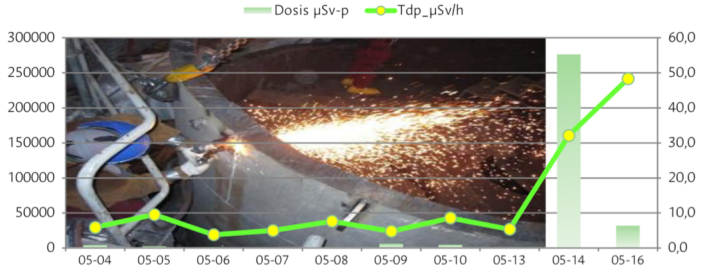
ACTIVITY:	Collective Dose mSv	Man-h
SURVEILLANCE & MAINTENANCE	384,16	191550

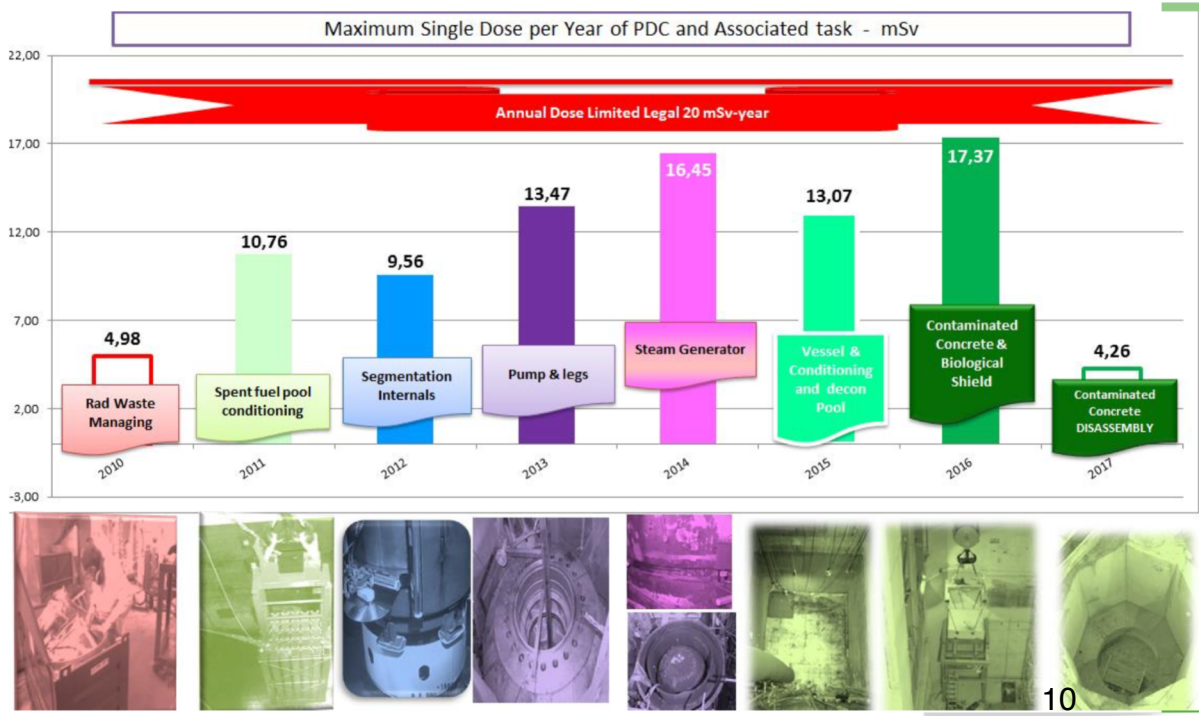
02 - SURVEILLANCE & MAINTENANCE		H-p	Dosis µSv-p	Tdp_µSv/h
02-01	Ocupational Health & Safety	11443	16251	1,4
02-02	Medical Services	58	104	1,8
02-03	Instrumentation Maintenance	4294	9982	2,3
02-04	Mechanical Maintenance	6136	26270	4,3
02-05	Electrical Maintenance	4403	10254	2,3
02-07	Security	1440	1032	0,7
02-08	Radiation Protection	69444	204044	2,9
02-09	Fire Protection	13283	6532	0,5
02-10	Decontamination & Housekeeping	73890	104538	1,4
02-11	General Services	5883	5155	0,9

ALARA and decommissioning

ACTIVITY:	Collective Dose mSv	Man-h
Main Components_STEAM GENERATOR	329,71	12090

05 MAIN COMPONENTS : Steam Generator		H-p	Dosis µSv-p	Tdp_µSv/h
05-04	Scaffolding	*704*	**4143**	5,9
05-05	Isolation removal	*278*	**2655**	9,6
05-06	Stem pipe removal	*364*	**1381**	3,8
05-07	Water supply pipe removal	*163*	**815**	5,0
05-08	Instrumentation removal	*104*	**796**	7,7
05-09	Steam section removal	*1294*	**6191**	4,8
05-10	Supports removal	*551*	**4724**	8,6
05-13	Confinement & filtration equipment	*187*	**1006**	5,4
05-14	SG Segmentation in situ	*8605*	**276252**	32,1
05-16	SG Segmentation in the SAS	*657*	**31742**	48,3





Concluding remarks

- Characterisation strategy during the transition phase (operating to decommissioning) and when work will start is of key importance for the success of the project:
  - Waste management,
  - Occupational exposures,
  - Site remediation (avoid a future legacy)
- Identify requirement for RP staff and workers skills (contamination) to maintain RP (as well as safety) culture to adequate standards,
- Holistic approach for a relevant risk management,
- Engage workers in the project.