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Training for Nuclear Decommissioning

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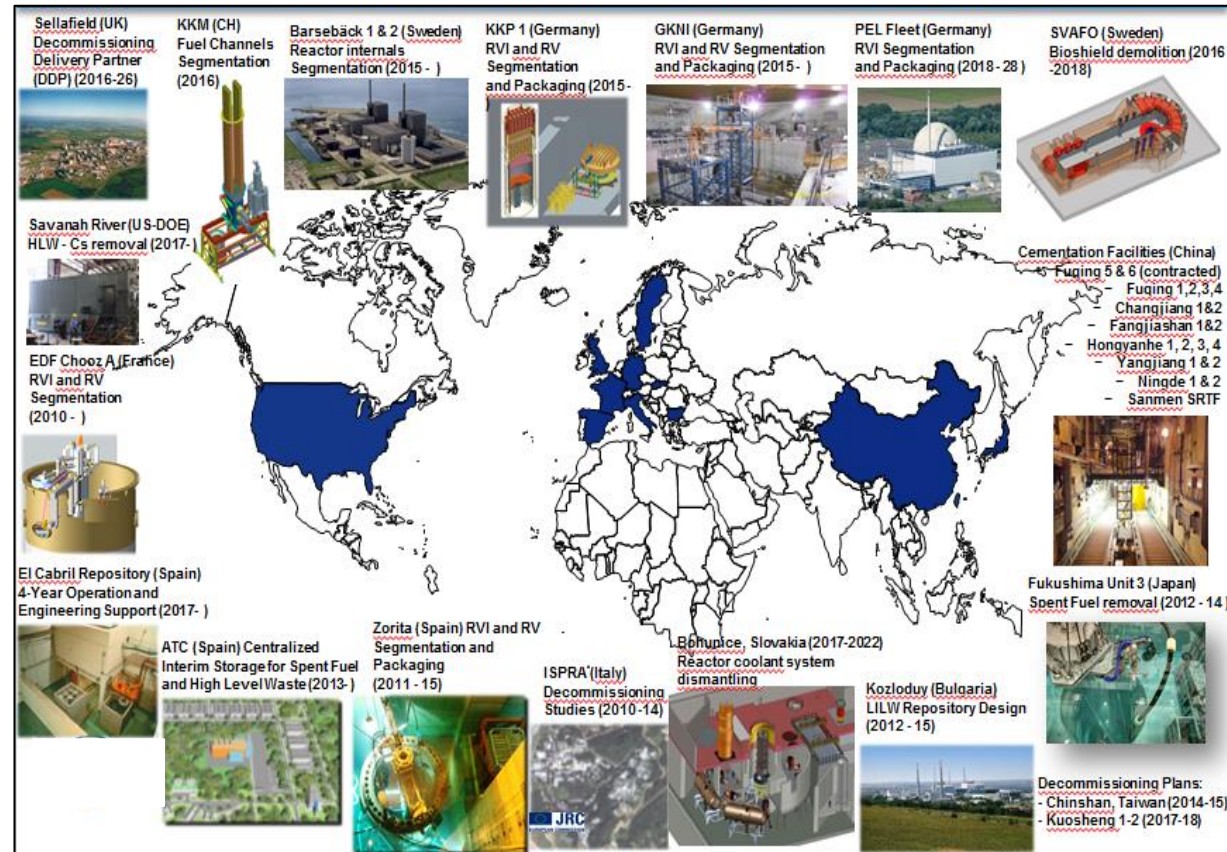


Agenda

- Introduction
- Training Programs
 - Classroom training
 - Hands-on training
 - Site visits
- Examples
- Conclusions
- Q&A

Introduction

- Several nuclear facilities goes into decommissioning in the coming years
- Owners, stakeholders, regulators and the supply chain needs to be properly prepared
- Training in nuclear decommissioning by experienced persons is one way to prepare properly



Training Programs

- Westinghouse has prepared several training programs
 - For different customers
 - For different purposes
- A decommissioning training can comprise
 - Single courses
 - Tailor made programs
 - Basic training
 - Advanced training



Training Programs

- The training programs contain different types of training to maximize the learning:
 - Classroom
 - Hands-on
 - Site visits
- Classroom training
 - Traditional theoretical training
 - Real examples
 - Lessons learned



By involving lessons learned the trainees get examples of good and bad performance as well as cause

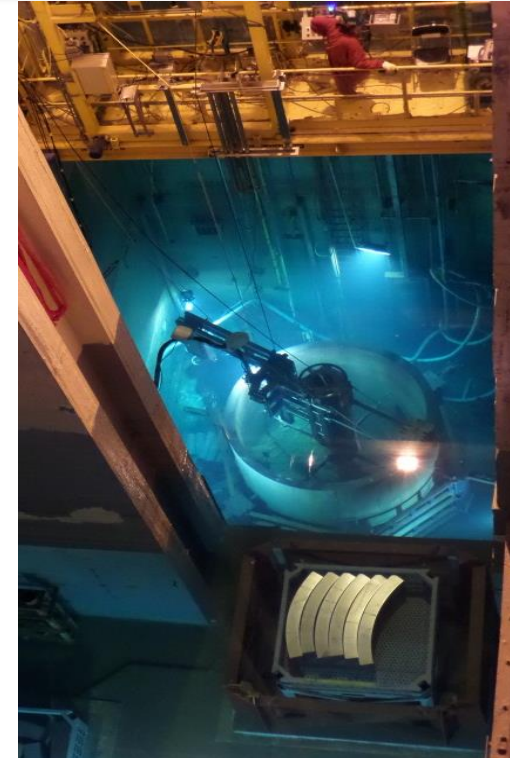
Training Programs

- Hands-on training
 - Starting with theory
 - Equipment setup and operation
 - Mock-up cutting or equivalent
 - Based on previous classroom training
- Site visits
 - Decommissioning activities
 - National systems (disposal facilities, transport systems, interim storages)
 - Combine with learning in classroom



Training Programs

- Some of the most popular training topics are:
 - Introduction to decommissioning
 - Decommissioning planning and cost estimation
 - Characterization
 - Decontamination techniques and applications
 - Segmentation of reactor vessel internals and reactor pressure vessels
 - Major components removal
 - Dismantling and demolition techniques
 - Biological shield demolition
 - Radioactive waste estimation
 - Waste management technologies and equipment



Examples

Introduction to decommissioning

- Trainees: No prior decommissioning knowledge
- Basic or introductory training courses comprising topics:
 - Planning
 - Decommissioning regulation
 - WBS
 - Scheduling
 - Cost estimation
 - Characterization
 - Full system decontamination
 - Segmentation of reactor internals and RPV
 - Radioactive waste estimation
 - Dismantling techniques
 - Demolition techniques
- 3 weeks training including site visits to decommissioning site and final disposal facility

DAY		Estimated time (h)
TUESDAY 18	Welcome, introduction, and general instructions	1
	Regulations IAEA/USA	4
	Decommissioning strategies	3
WEDNESDAY 19	Decommissioning strategies for BWR/PWR	5
	Characterization: Activation analysis (Vandellos I/Zorita cases)	3
THURSDAY 20	Characterization activated zones sampling Vandellos I and Zorita cases	4
	Vandellos I: overview of a SAFSTOR project	2
	Characterization : waste characterization	2
FRIDAY 21	Site preparatory works (site reorganization, general functions and case studies: building modifications for decommissioning (CIEMAT/ZORITA)	8
MONDAY 24	Characterization : General strategy and contaminated zones/equipment	2
	Decontamination (full system decontamination, decontamination workshops, concrete decontamination, case studies CIEMAT/VANDELLOS I)	6
TUESDAY 25	Available dismantling techniques	2
	Dismantling techniques for RPV& its internals and large equipment	2
	Zorita reactor internals and vessel segmentation experience	4
WEDNESDAY 26	Demolition techniques (removal of activated concrete and demolition techniques)	4
	Work breakdown structure	4
THURSDAY 27	Estimation of radioactive and hazardous waste	8
FRIDAY 28	Cost estimation	8

Examples

Advanced decommissioning planning

- Trainees: Basic decommissioning background, no practical experience
- Purpose for trainees to perform D&D tasks after training
- Advanced training courses including:
 - Decommissioning strategies
 - Waste management
 - Waste estimation
 - WBS & Scheduling
 - Cost estimation
 - Internals and RPV segmentation
 - Large components removal
 - Logistics in decommissioning
- 3 weeks training including site visits to decommissioning sites and disposal facilities

DAY	TOPIC	Estimated time (h)	KEY TOPICS
MONDAY	Classroom training 9, WBS Methodology	4	<ul style="list-style-type: none"> • Man-hour estimation (team composition, macro-components, productivity rates, difficulty factors) • Work procedures • WBS and cost analysis for segmentation • WBS for full system decontamination • WBS for large components and bioshield
	Classroom training 10, Scheduling	4	<ul style="list-style-type: none"> • Decommissioning schedule set up • Interdependencies between activities • WBS and schedule dependency • Schedule analysis • Case studies
TUESDAY	Classroom training 11, Safety and Radiation Protection During Decommissioning	4	<ul style="list-style-type: none"> • Risk, safety, precautions and response measures • Exercises and presentation • Classroom discussions
	Classroom training 12, Dismantling & Demolition Techniques	4	<ul style="list-style-type: none"> • Dismantling techniques • Demolition techniques • Removal of activated and contaminated concrete • Case study, biological shield demolition
WEDNESDAY	Visit SKB's Facilities in Forsmark	8	<ul style="list-style-type: none"> • SFR – Final repository for short-lived low and intermediate level waste • Information and guided tour.
THURSDAY	Classroom training 13, Logistics in Decommissioning	4	<ul style="list-style-type: none"> • Introduction • Logistics in decommissioning planning • Case study: Large components removal
	Classroom training 14, Cost Estimation 1	4	<ul style="list-style-type: none"> • Introduction to decommissioning cost estimation • Basis of Estimate • Cost Breakdown Structure • Cost elements
FRIDAY	Classroom training 15, Cost Estimation 2	8	<ul style="list-style-type: none"> • Uncertainties in decommissioning cost estimation • Contingency & risk estimation and calculation • Benchmarking • Exercises in cost estimation

Examples

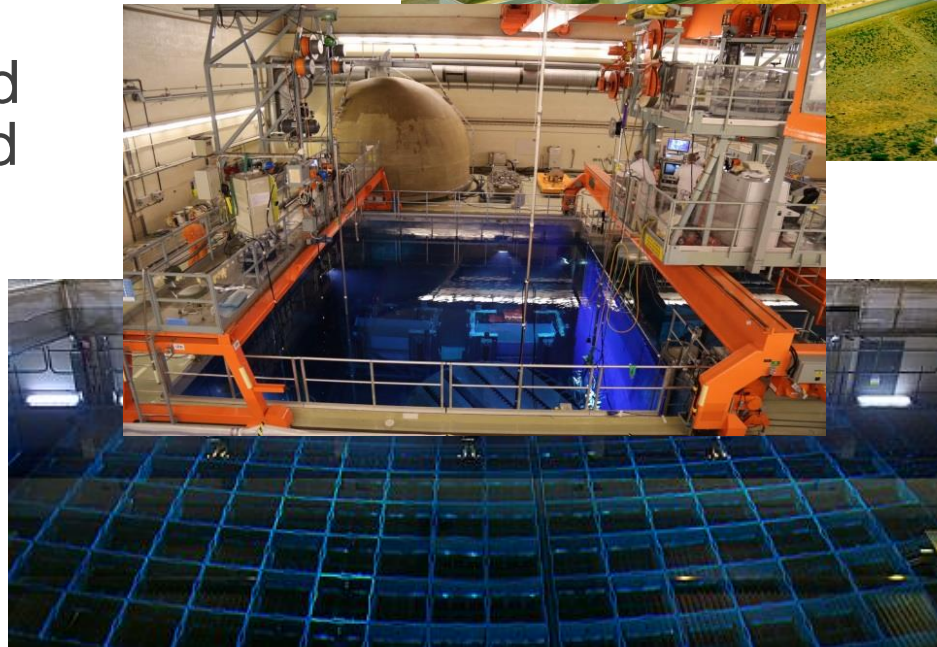
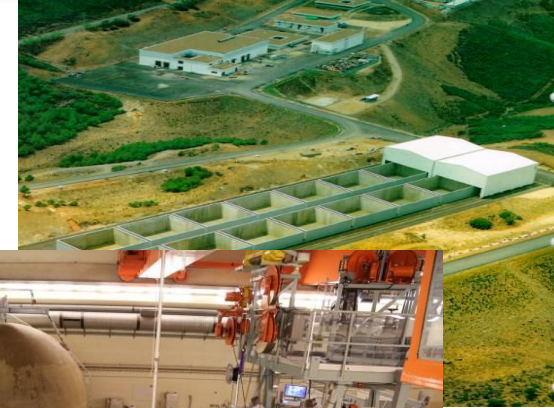
Hands-on segmentation training

- Trainees: Experienced decommissioning people training for decommissioning in practice
- Mix of theoretical and practical courses including:
 - Segmentation classroom and hands-on training in the following areas
 - Advanced segmentation technologies
 - Preparatory work
 - Hydraulic training
 - Working bridge, pole handling and camera training
 - Shearing tool training
 - Disc cutting training
 - Band saw training
 - Packaging training
 - Dismantling planning
 - Full system decontamination
 - Worker dose estimation
 - Waste estimation
 - Bioshield demolition
 - Waste packages
 - WBS methodology
 - Cost estimation
- 3 weeks training including site visits to decommissioning sites and disposal facilities

DAY		Estimated time (h)	KEY TOPICS
MONDAY 20	RPV&I dismantling mock up training 5, Band sawing training.	8	<ul style="list-style-type: none"> • Detailed information on design of band saw tools. • Positioning of band saw tools to mock-up. • Instructions and practical training on mock-up (cutting).
TUESDAY 21	RPV&I dismantling mock up training 6, Packaging training.	4	<ul style="list-style-type: none"> • Information and handling of different systems. • Instructions for optimization of packaging. • Practical training on packaging.
	RPV&I dismantling mock up training 7, Introduction to Repair and Modifications	4	<ul style="list-style-type: none"> • Electrical Discharge Machning (EDM) • Mechanical Clamp Repairs • Laser • Virutal Reality
WEDNESDAY 22	Classroom training 4, Segmentation - RPV & Internal dismantling plan case study.	4	Adapting knowledge from training to Chinshan/Kuosheng (or other examples) dismantling plan case study.
	Classroom training 5, Segmentation - RPV & Internal dismantling plan case study.	4	<ul style="list-style-type: none"> • Identify information for RFQ (work scope). • Applying the preparatory work on the case study.
THURSDAY 23	Classroom training 6, Focused Topics - Full system decontamination.	4	<ul style="list-style-type: none"> • Full system decon vs. sub system decon. • Chemical fundamentals and processes for decontamination. • Real life application of the DfD process.
	Classroom training 7, Focused Topics - Worker dose estimation.	4	<ul style="list-style-type: none"> • Dose exposure during decommissioning. • Historical dose exposures during segmentation projects. • Dose estimations based on historical data.

Conclusions

- Owners, stakeholders, regulators and the supply chain needs to be properly prepared for decommissioning
- A combination of theoretical and practical training is effective and appreciated by trainees
- Show examples from real decommissioning projects
- Include session on lessons learned from actual projects in each training to gain best experience and knowledge transfer



Training in Nuclear Decommissioning by experienced persons gives valuable insight into real examples

Q&A

Thank you for your attention!

