

# 2012 International ISOE ALARA Symposium

Ft. Lauderdale, Florida USA

## Barsebäck NPP POST-OPERATING PROGRAM

Challenges for the company and for the RP team during the transition phase

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# 2012 International ISOE ALARA Symposium



**... or how to**

- remain the personnel and knowledge
- prepare the station for the dismantling



**.....and at the same time to**

- save Dose, Time and Money

# 2012 International ISOE ALARA Symposium



**Barsebäck NPP is located in southern Sweden on the west coast of Scania**

## The beginning .....



**15 May 1975**

## ...and the end



**31 May 2005**

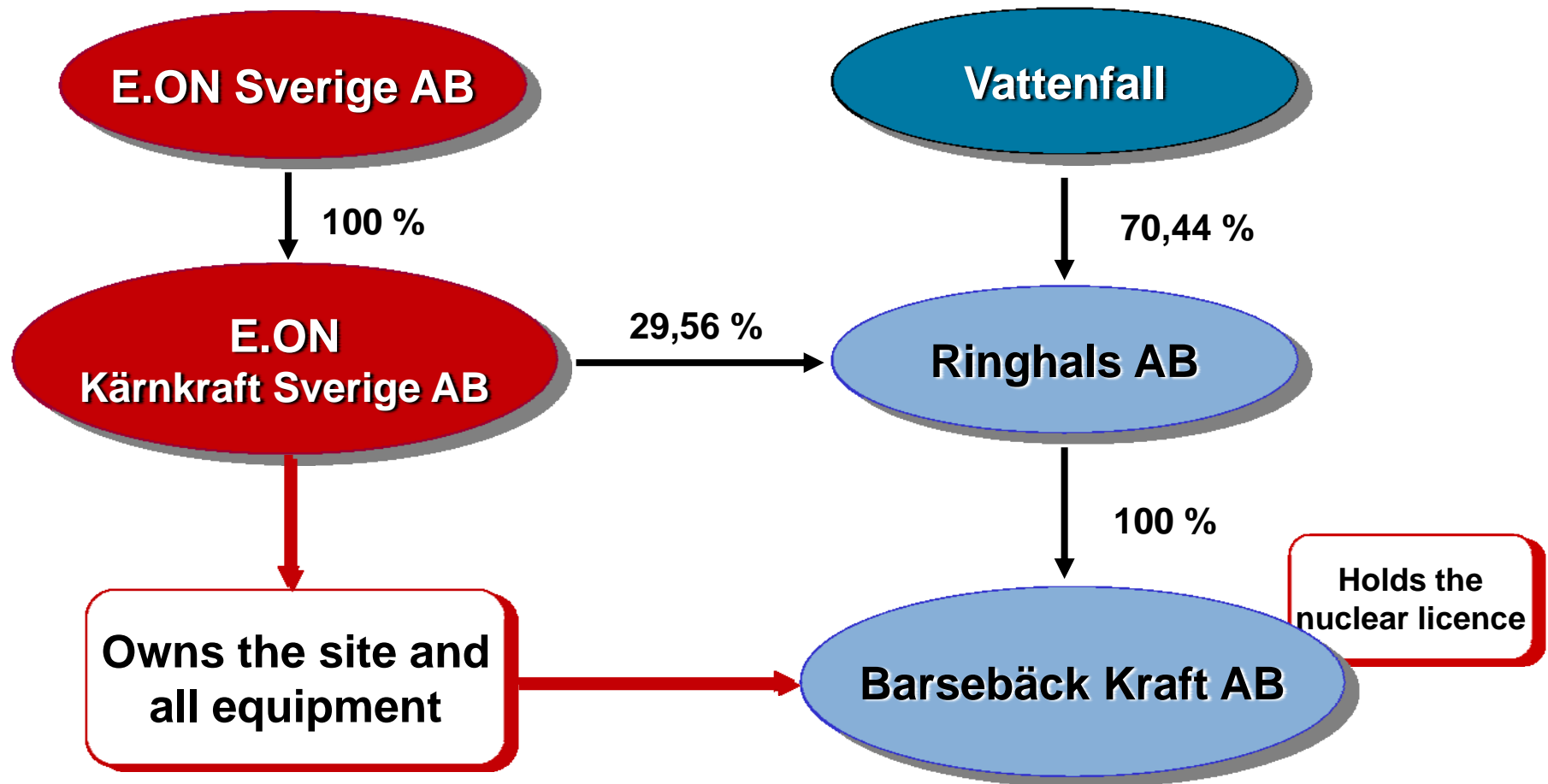


# Barsebäck NPP – Unit 1 and 2



Type:	BWR
Capacity:	1800 MWt / 615MWe
First connection to the grid:	May 15, 1975 / March 21, 1977
Contractor:	ASEA Atom (Westinghouse Electric Sweden)
Owner of the plant:	E.ON Kärnkraft Sverige AB, EKS
License owner:	Barsebäck Kraft AB, Vattenfall
Operated by:	Barsebäck Kraft AB, Vattenfall
Production, Barsebäck 1:	Total 93,4 TWh net (1999)
Production, Barsebäck 2:	Total 108 TWh net (2005)
Status, Barsebäck 1:	permanently shutdown since 30 Nov 1999
Status, Barsebäck 2:	permanently shutdown since 31 May 2005
Operating status, Barsebäck 1 and 2:	Service operation (care and maintenance)

# Owner relations Barsebäck Kraft AB



Accountability  
Openness  
Effectiveness

Managing  
Director  
BKAB

## Decommissioning Barsebäck NPP

Barsebäck  
Change over - BO

Safety & Quality  
Economy  
Planning

### Decommissioning

- Dismantling
- Waste handling
- Chemistry & radiology
- Environment

### Service Operation

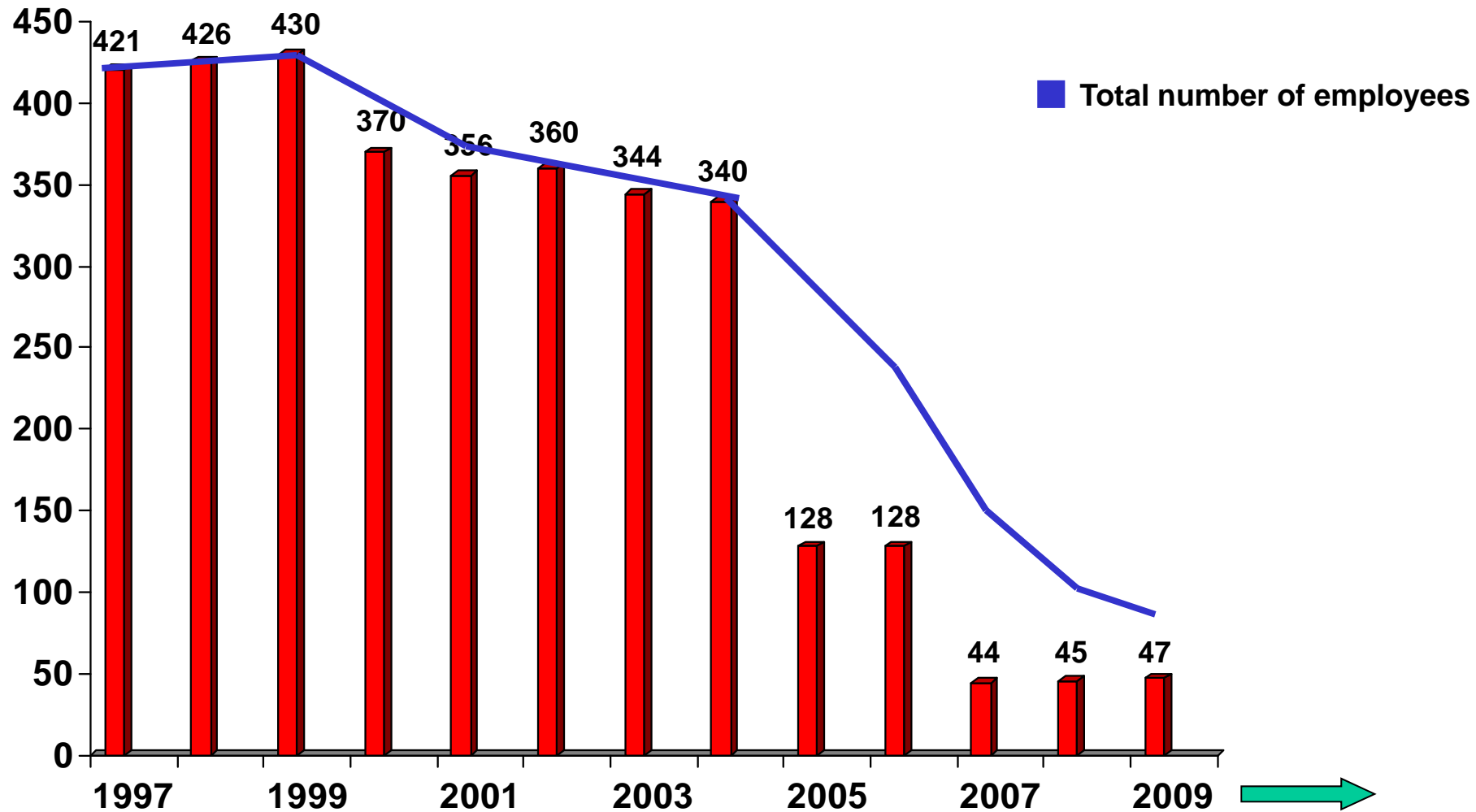
- Mec maintenance
- EI maintenance
- I&C
- Maintenance of buildings
- Supervision
- Modifications
- NDT
- Safeguard
- Waste operation
- Security
- Fire protection
- RP
- Industrial safety

### New Business

### Support

- Emergency planning
- HR
- Administration
- IS/IT/phone
- Purchasing
- Communication
- Documentation/archive
- Competence

# Number of employees, top to bottom



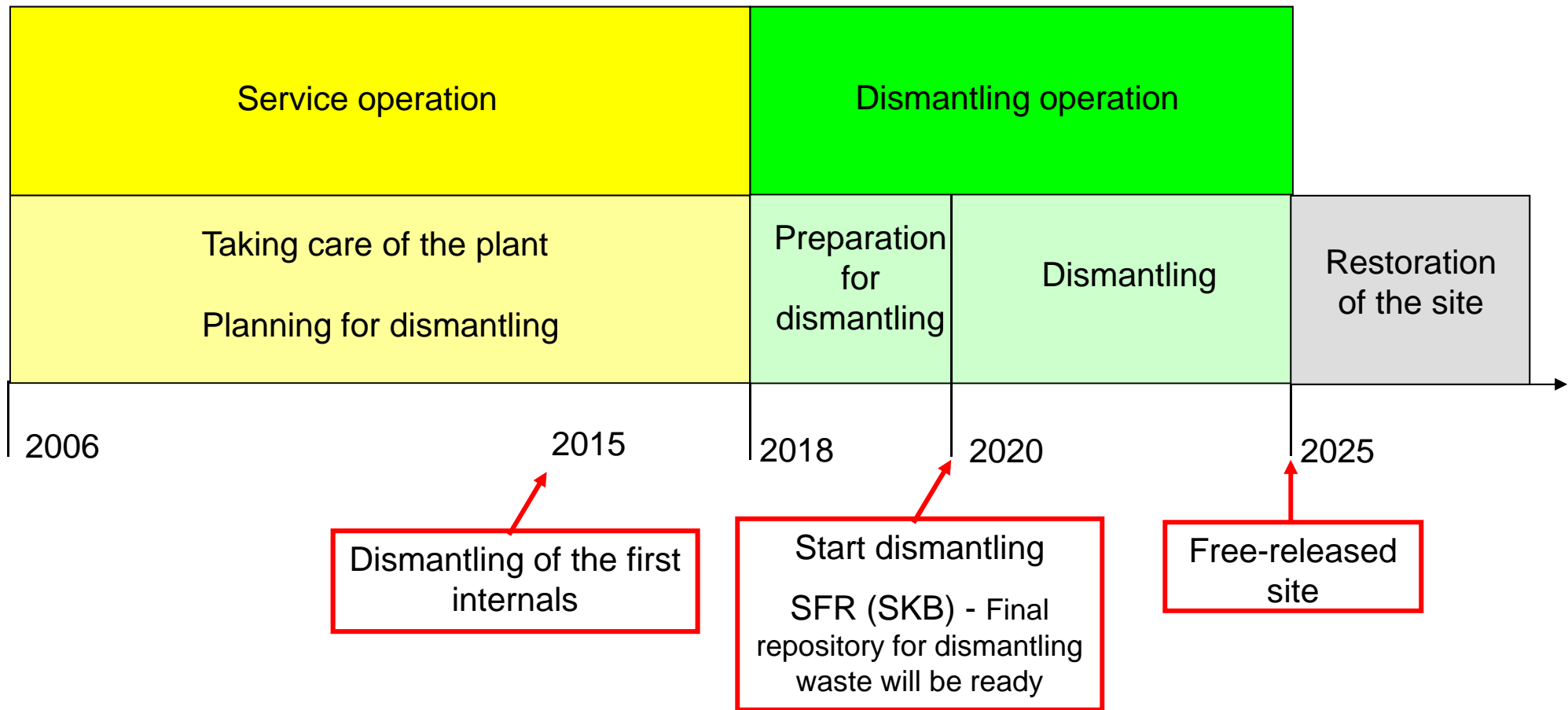


# Employees 2012

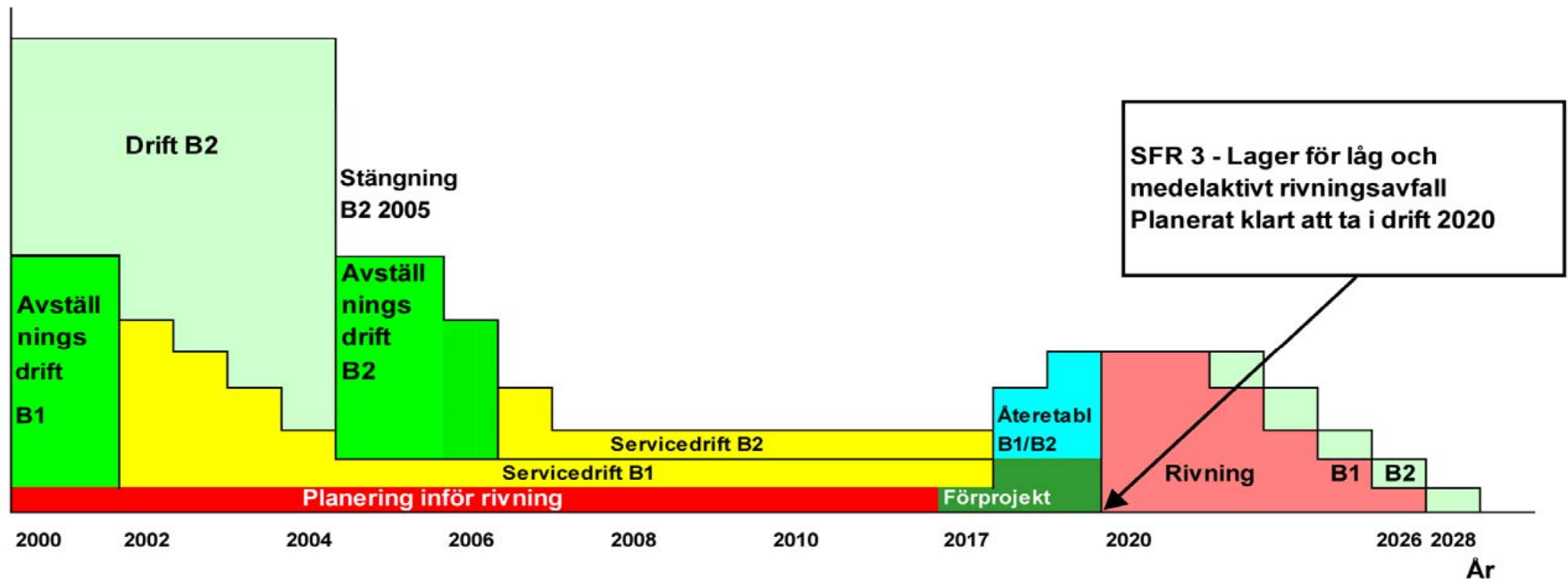
- Totally 50 employees in BKAB
- ... but about 250 persons on the site
  - 50 in BKAB
  - 80-150 work on distance for Ringhals AB
  - 5-10 work for KSU with training
  - 40 contractors, security etc.

**AND app. 700 students/year**

# Planning scenario for unit 1 and 2



# The Decommissioning of Barsebäck NPP



# Approach for Service operation

## Safe

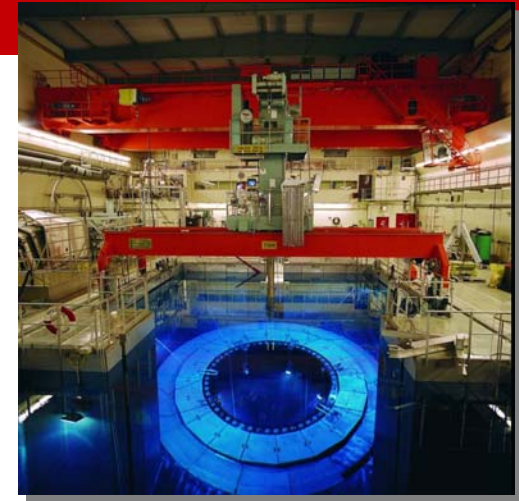
- Know and reduce risks (fire, flooding etc.) **Low dose**

## Simple

- Put plant in lowest energy state (drain systems and components, clean and drain pools, remove filters and resins, reduce ventilation requirements etc.)
- Reduce needs of surveillance and maintenance

## Cost optimized

- Optimize costs for Service Operation and future dismantling



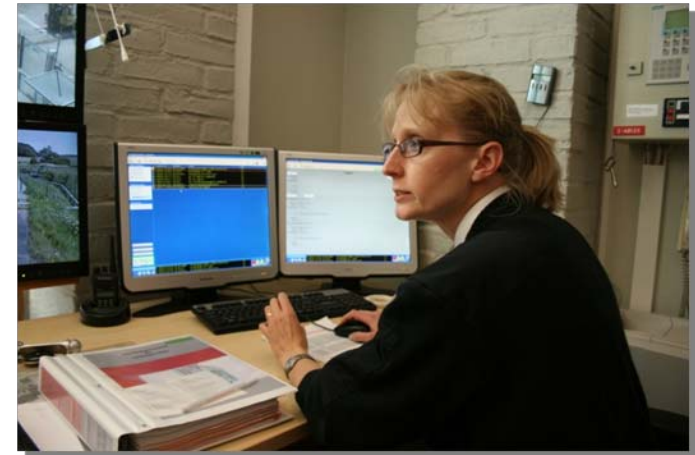
# Main activities during Service operation

## *Supervision of the Service operation*



Supervision during operation – two control rooms

The central control room is unattended since 17 December 2007 and supervision of the Service operation is handled by VDI and LOP



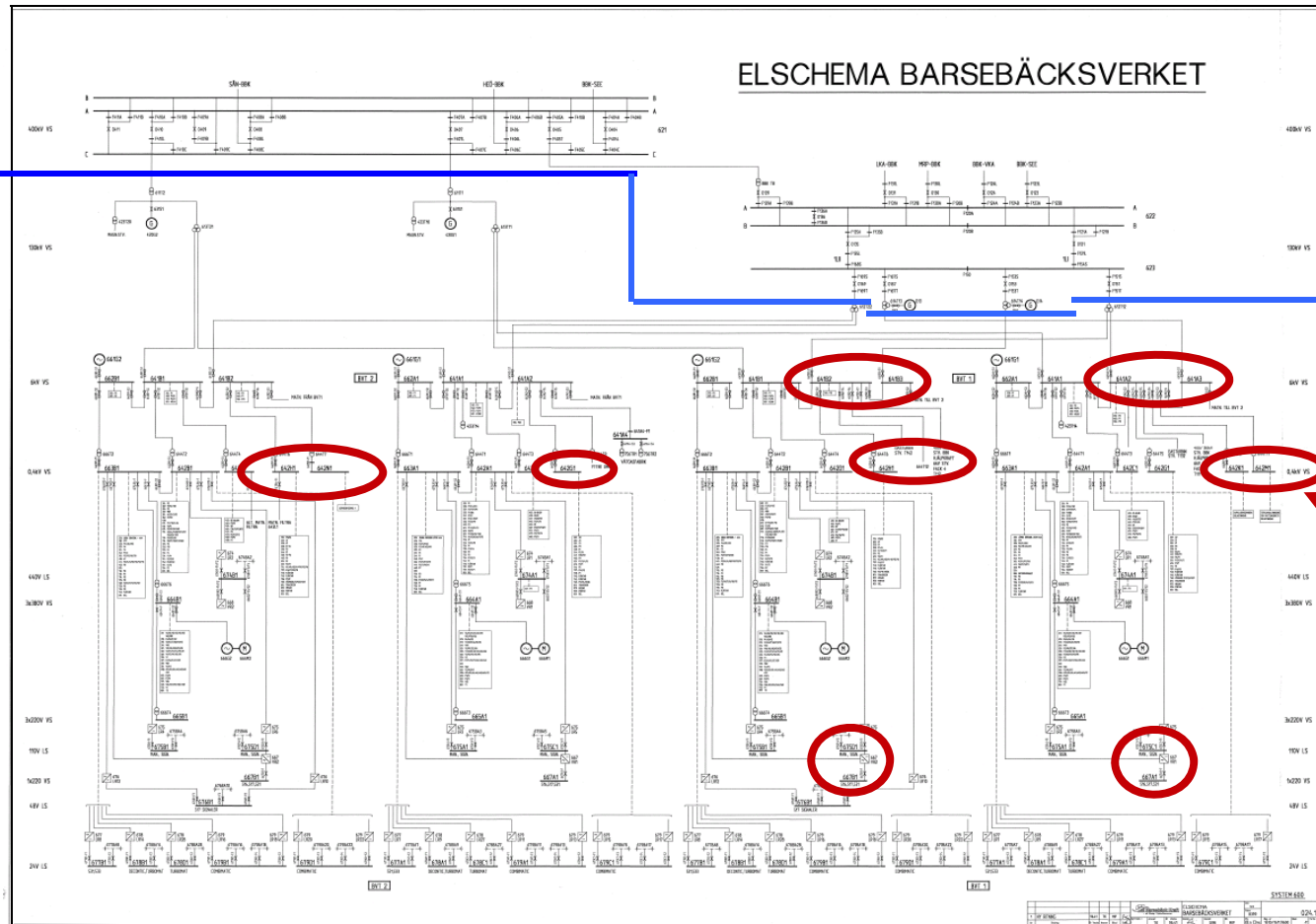
Supervision during Service operation  
- In the security “room”

# Main activities during Service operation

## Rebuilding of the electricity systems and operation systems

Svenska Kraftnät /  
E.ON

Barsebäck NPP



Electrical schedule -  
Barsebäck NPP during  
operation with Unit 1  
and 2

**RED =**  
Requirements for  
Service operation.  
Approx. 20% are left



# Main activities during Service operation

## *Energy saving activities*

- Electricity

2007                      28700 MWh

2011                      12000 MWh (prognos)



- Heat

2007                      13000 MWh

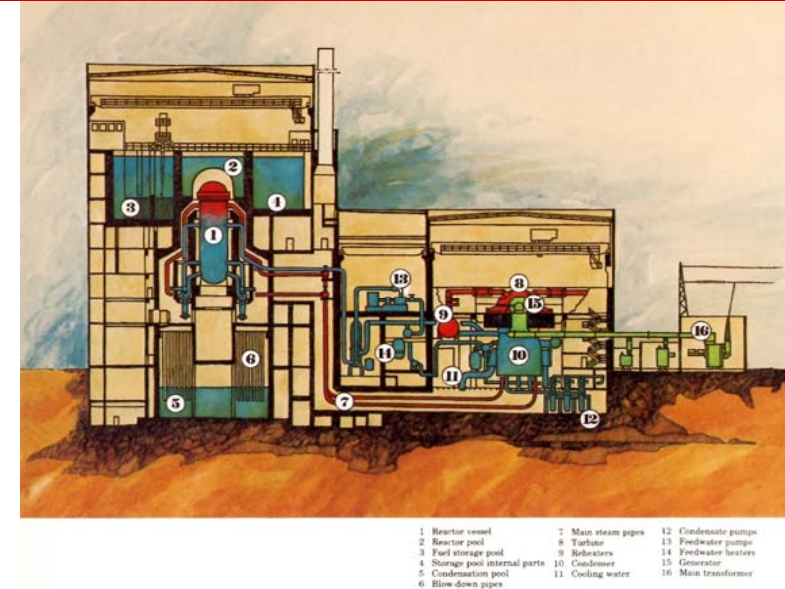
2011                      7400 MWh (prognos)



# Main activities during Service operation in RP

## The Decontamination project

- 3 Decontamination cycle for both units
- Collective dose in total for both units is 138 mSv



System decontamination has been done during 2007/2008, at unit 1 and 2 of the primary systems and the lower parts of the reactor vessels

	UNIT 1	UNIT 2
DF – overall	298	93
Average dosrate, before	0,7 mSv/h	0,8 mSv/h
Average dosrate, after	0,03 mSv/h	0,03 mSv/h
Volume/surface	160m <sup>3</sup> / 1800 m <sup>2</sup>	160m <sup>3</sup> / 1800 m <sup>2</sup>
Anion / Cation	1000l/4000l	1000l/3000l

## Main activities during Service operation in RP

# The Decontamination project

## Process computer



~~Control panel~~



## Chemical dosage module



## Measuring bridge



## Heater



## Valve module



## Particle filter



## Pump



## Ion Exchanger



## UV-module



~~On level 5~~

# Main activities during Service operation in RP

## ■ Radioactivity measurement around Barsebäck NPP

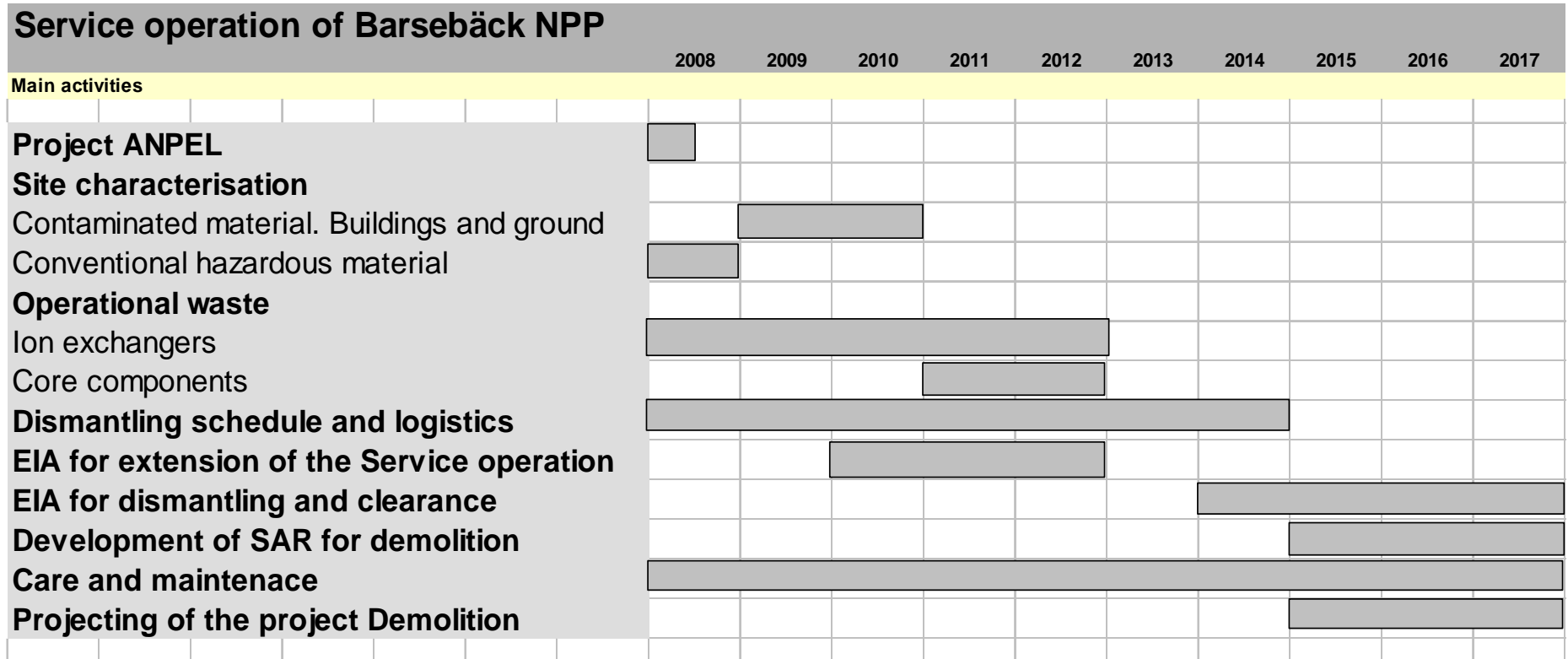
First step: The SSM (Swedish Radiation Safety Authority) and Lund:s University used the site area to test and validate new surface scanning equipments.

Second step; A full site characterization, surface and ground contamination (KAKA)



# The Decommissioning of Barsebäck NPP

## Activities during Service operation



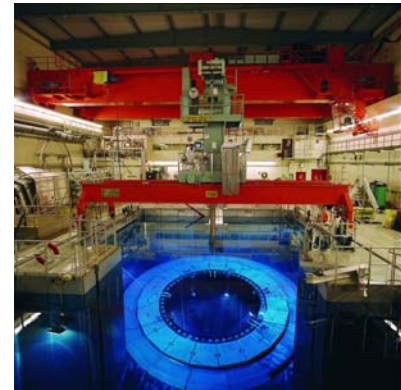
**"New business"**



# Preparation for the dismantling and the NEW BUSINESS

## Our first questions

- In what way can we use the power station as we're not allowed to operate it and it's personnel?
- For how long time can we use the site?
- What do we need to do to prepare the station and site for any eventual new business?
- **What about ALARA**





# Basic needs

**It's important to offer a  
good work environment  
interesting jobs  
and  
the site must be economical to “operate”**

# New Business ideas

- Barsebäck Training and Maintenance Centre
  - In corporation with KSU
  - “Craftsmanship and safety culture”
  - Training in pumps, valves, control rod drives, handling RPV internals etc.
  - Testing tools and other equipment for other plants
- Leasing offices, shops and storages
- Storing and maintaining test block for NDT
- Consultants to other companies e.g. SKB
- Selling spare parts to other NPP:s
- Laundry hub for Sweden (UNITECH)

# New business

## Barsebäck Training and Research Centre

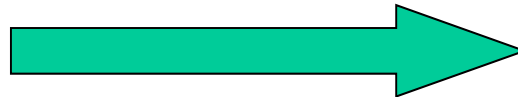
- Training in workmanship
- ALARA and RP training
- Testing of equipment
- Test of working methods
- Research and Development (R&D)
- Re-use of components, by selling or letting out



# RP challenges

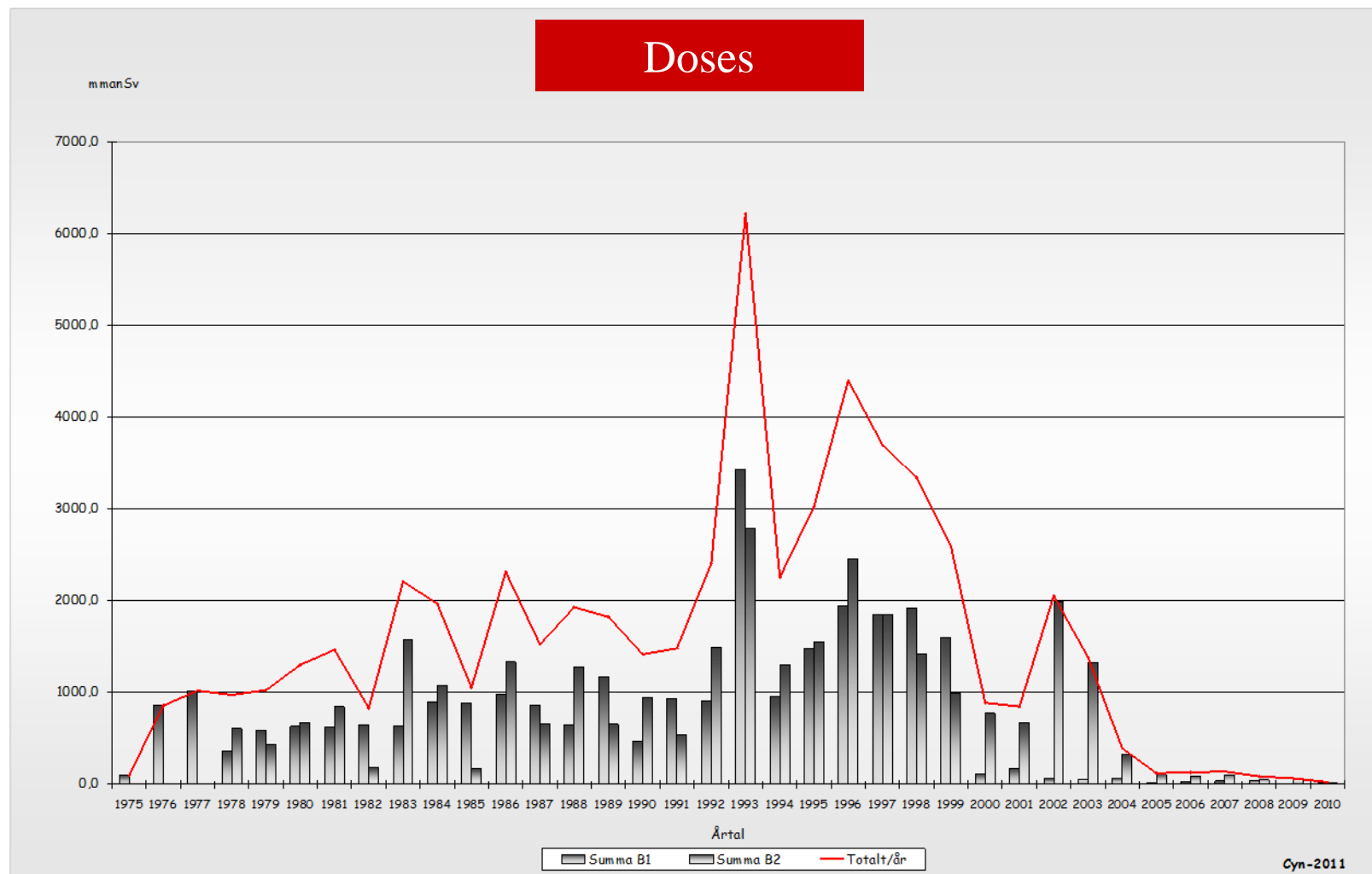
## Barsebäck Training and Research Centre

- Training in workmanship
- ALARA and RP training
- Testing of equipment
- Test of working methods
- Research and Development (R&D)



**BUT how to combine  
this with our ALARA  
goals**

# RP challenges



# Barsebäck Training and Research Centre

**BKAB offer now practical tests and training in a realistic environment with the goal to reduce doses, costs and to rise safety.**

- With a structured system for **Continuous Professional Development** (CPD) Courses. We give the base for all vital training and knowledge of work-methods, safety regulations and what is expected to maintain a good safety and ALARA culture as well as a good professional performance for maintenance personal and contractors in NPP:s

In the following I'll give a few examples

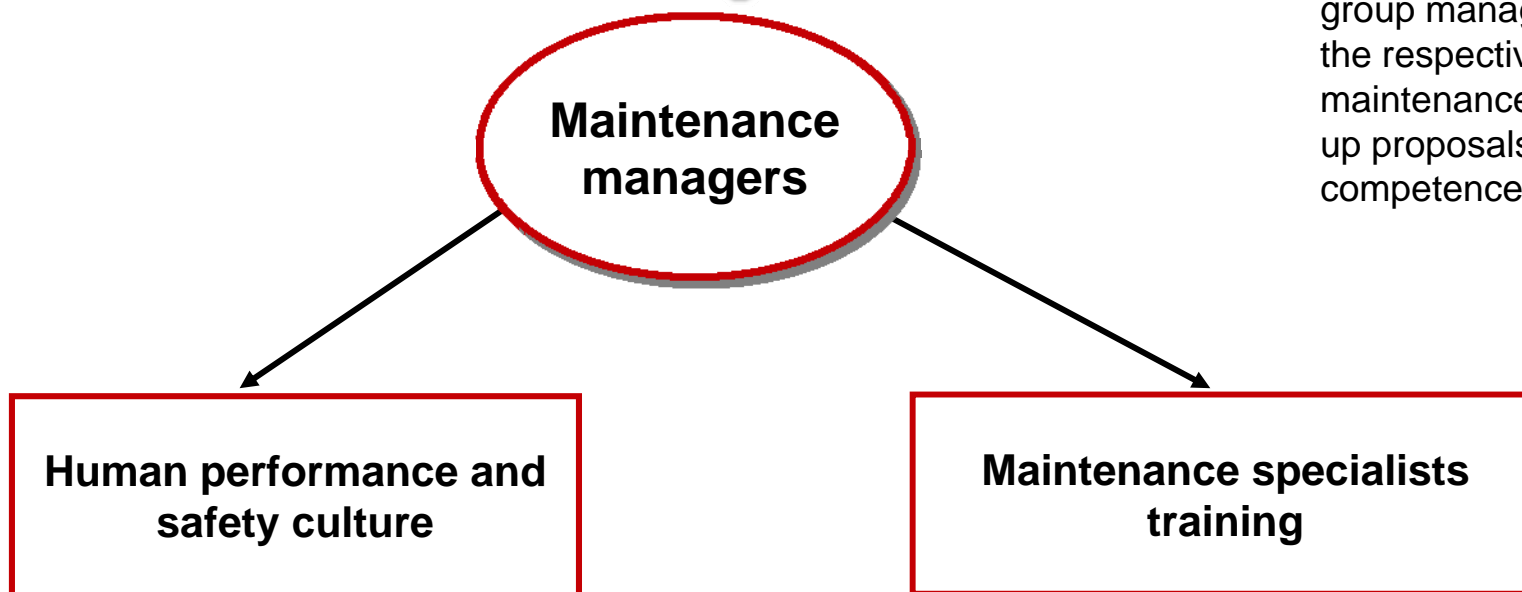




# Barsebäck Training and Research Centre

A board has been established with representatives from all Swedish NPPs and KSU to ensure that customers' needs are met, and that any gaps between line organisations and training organisations are minimised.

## The training board



Smaller working groups, consisting of group managers and subject specialists in the respective disciplines in the maintenance department, in order to draw up proposals for training targets and competence requirements.



# Training in workmanship

Joint industry-wide maintenance training for all power stations personnel  
and for contractors.



# Barsebäck Training and Research Centre

## Training in workmanship

The course further develop basic knowledge of **working practices, safety regulations** and their background, together with training in what can be expected in order to maintain a good **safety culture** and a high level of **human performance**.

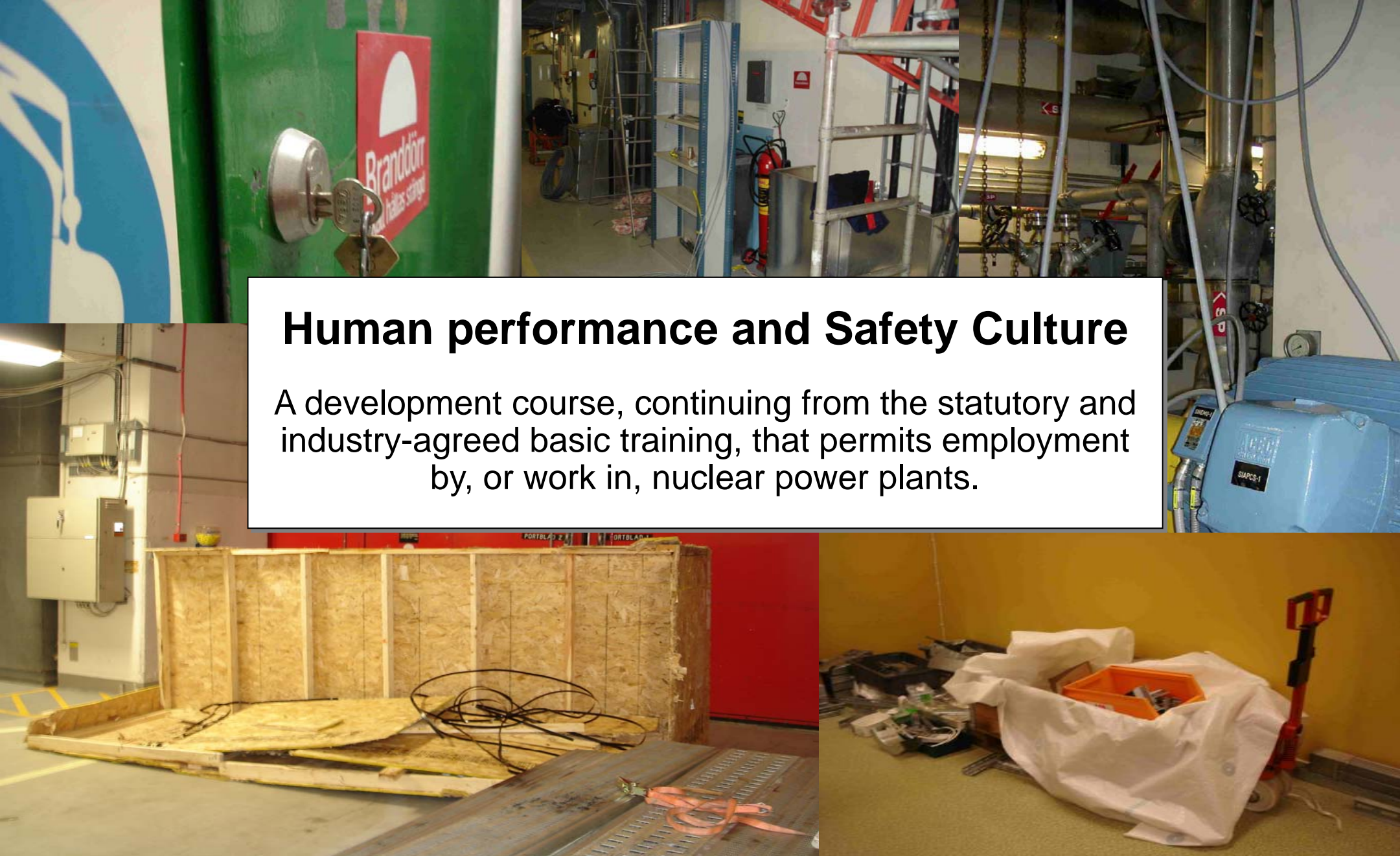


The training is performed as **hands-on training in a realistic environment**.



**The training meets the Regulatory requirements and follows IAEA's and WANO's guidelines.**





## Human performance and Safety Culture

A development course, continuing from the statutory and industry-agreed basic training, that permits employment by, or work in, nuclear power plants.

# Barsebäck Training and Research Centre

## Human performance and safety culture

### Target group

Human performance and safety culture training is intended for internal and external maintenance personnel.

### Qualifications for admission to the course

Completed and approved Protection and Safety Training (§6), Radiation Protection Technology (§7), System Cleanliness, ESA/SAFEM and Accident/HLR.

### Course targets

On successful completion of the course, students will demonstrate a high level of human performance and good safety culture when working in, or for or in connection with, nuclear power plants, in accordance with specified internal and external requirements.

# Barsebäck Training and Research Centre

## Human performance and safety culture

### Monitoring of efficacy

What are the effects of the training?

### Examples of indicators

- no-one failing to wear a helmet in controlled areas
- fewer deviations from technical specification due to failure of fire cell integrity
- reduced trend for need of reworking

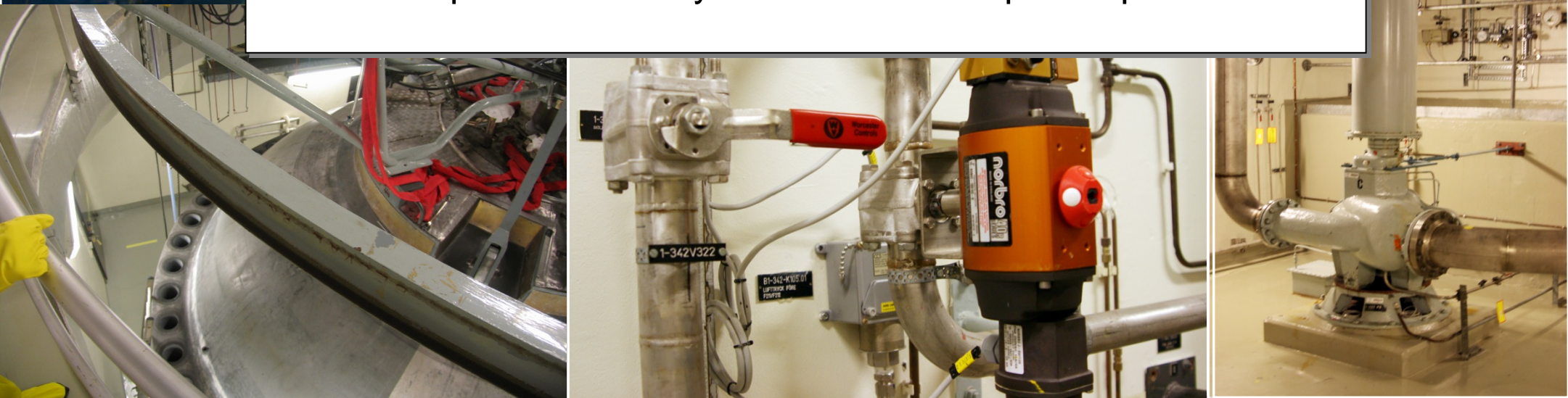






## Maintenance specialists training

Specialized training for work in areas such as fault tracing, dismantling/erection, service and maintenance of selected components and systems in nuclear power plants.



# Barsebäck Training and Research Centre

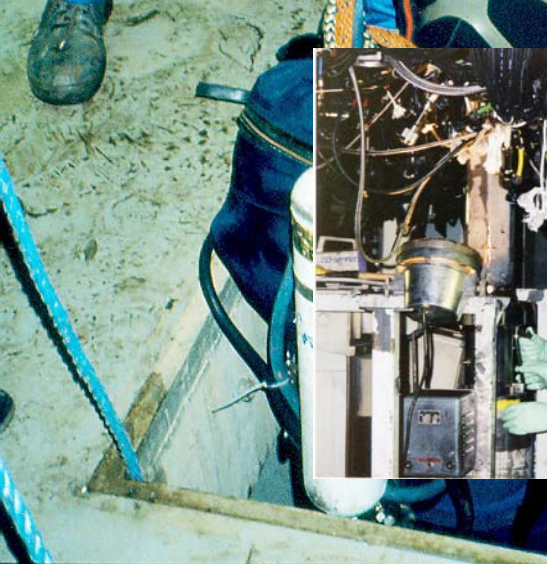
## Maintenance specialists training

- Generator training
- Main circulation pumps, dismantling/ erection
- Main circulation pumps, service
- Shutdown reactor cooling system pumps, dismantling/ erection
- Shutdown reactor cooling system pumps, service
- Feed water pumps
- Voith hydraulic couplings
- Condensate and drain pumps
- Reactor vessel and work with reactor internal components
- Valve actuator service
- Pump course, general
- Valve course, ball valves
- Valve course, gate valves
- Valve course, control/throttle valves
- Valve course, safety valves
- Pipe support systems/dampers
- Power electronics
- Instrumentation technology, vibration measurement
- Electrical installation (MBE)
- Testing, electrical systems, I/C (MBE)
- Radioactivity monitoring systems
- Radiation measurement system, retraining
- Combimatic/Decontic
- UPS, static inverters
- Lifting training





# RP training



# Barsebäck Training and Research Centre

## RP training

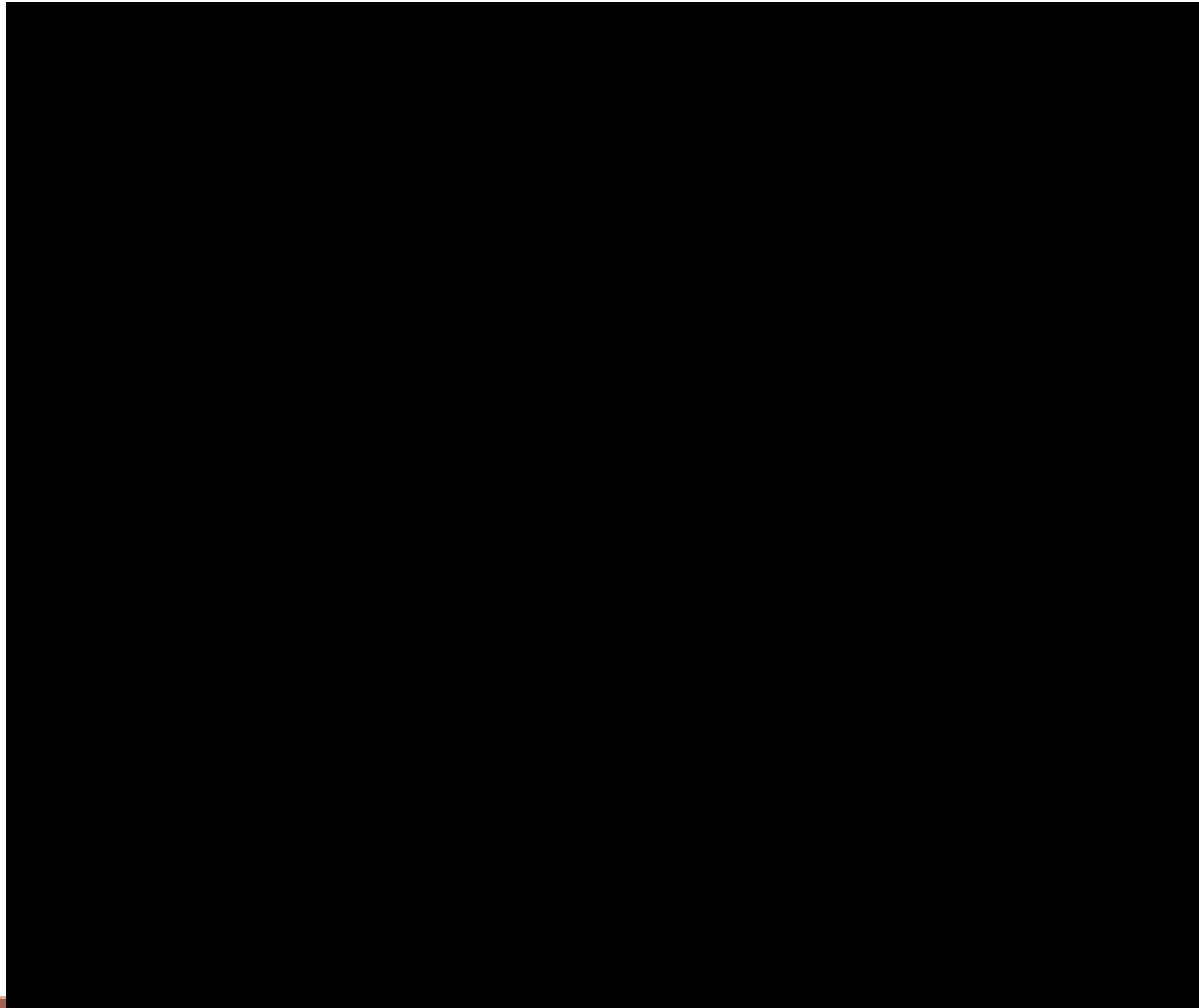
- **Training of Health Physicists and RP technicians**

In cooperation with Lund:s University, experts in the National emergency response organisation are trained in how to find and measure contaminations and sources. This includes also possibilities to test different types of instrumentation.

- **Training of Police forces**

- Ongoing development of an **Advanced Course on ALARA in Nuclear Installations** a project in co-operation between CEPN and Barsebäck NPP

# Barsebäck Training and Research Centre





# Other on-going activities

**Test of equipment and work methods**

**Research and Development (R&D)**

**Sell unique components**



# Opportunities

With this we have shown that the shut down of Barsebäck NPP has created an unique opportunity for next generation to use the plant for other purposes.

- Dose levels in most areas are very low and this makes it possible to do train workers, do research and other work ***in reality and in accordance with the ALARA principle***. (As an example 60 persons only received 4mSv during one week at the BTRC.)
- For all projects a good planning process is most important. Do not underestimate the need for your own staff, to practise methods and handling devices before the real project starts. Time is money.

# Barsebäck Training and Research Centre

EUROSAFE TRIBUNE  
FORUM  
#013  
JULY 2008



**SECURING NUCLEAR SAFETY  
IN FUTURE YEARS** Review of the main themes discussed  
at the EUROSAFE Forum  
held in Berlin in November 2007

## OPERATIONAL EXPERIENCE FEEDBACK WORKSHOP

**“There is no shame in not  
knowing, the shame lies in  
not finding out”**



## SEMINAR 1 | Nuclear installation safety

**Simulation codes and experi-  
mental tests: the head and legs  
of nuclear safety research**



The introduction of new types of reactors as well as changes in the management of nuclear fuel translate into a significant need of high-level expertise based on the availability of updated data from experimental tests aimed at validating increasingly sophisticated simulation codes. At a time where a growing number of safety cases is submitted to safety authorities and the supporting technical safety organisations, the necessity to dedicate sufficient investments to research as an essential support to relevant expertise was reflected in several lectures at this 2007 seminar.

# 2012 International ISOE ALARA Symposium

**Did we**

**No**

**Yes**

- remain the personnel and knowledge



**Have we**

- prepared the station for dismantling



**...at the same time saved**

**Dose**



**Time**

????????????????

**Money**





A photograph of the Barsebäck Nuclear Power Plant at dusk. The plant's two large, dark, rectangular containment domes are prominent, each topped with a tall, thin chimney that has a red light at its peak. The plant's various buildings and structures are illuminated with warm orange and yellow lights, which are reflected in the calm water in the foreground. The sky is a deep blue, and the overall scene conveys a sense of quiet activity at the end of the day.

**Thank you  
for your attention**

**From Dusk to Dawn  
To the future with help of the past**

The decommissioning of Barsebäck NPP and all related activities, today and in the future, will serve as an important experience for the Swedish Nuclear industry.