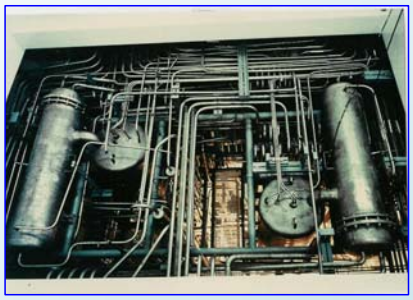
IAEA Workshop „Decommissioning Technologies“
06-10 July 2009 Karlsruhe, Germany

Decommissioning of Hot Cells at the Karlsruhe Reprocessing Plant (WAK)



Dr. W. Dander

Head of Department
Dismantling and Decommissioning

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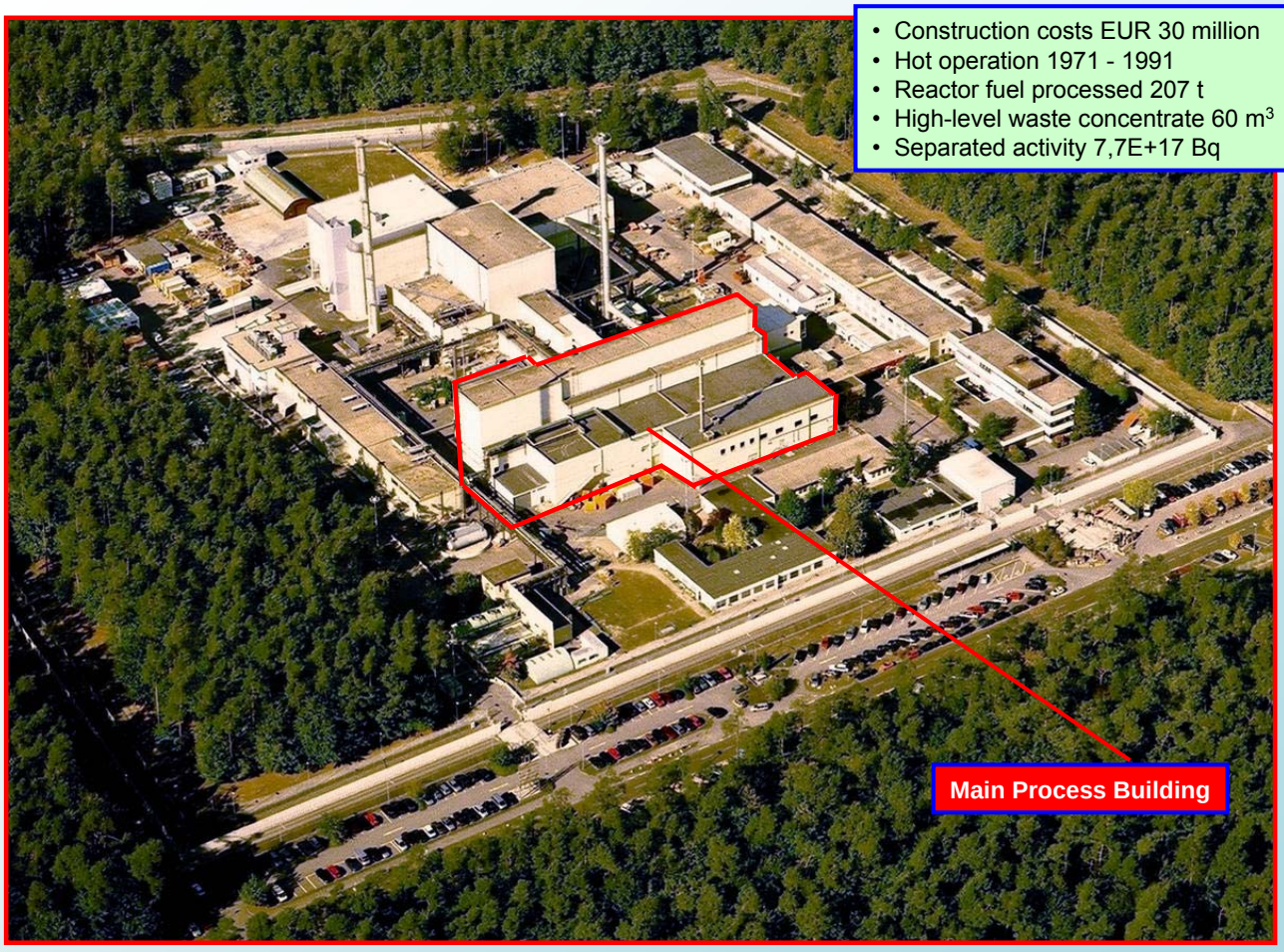
Foreman Dismantling and Decommissioning
WAK Process Building



Decommissioning Steps

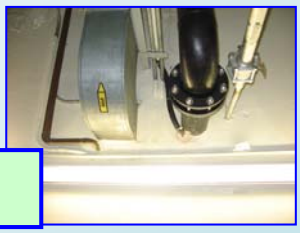
Reprocessing Building → STEP 1 Deregulation 1992 - 1994 → STEP 2 Dismantling Single Systems 1995 - 1999 → STEP 3 Remote Dismantling 2000 - 2002 → STEP 3 Manual Dismantling 2003 - 2016

STEP 6 Demolition of Buildings 2019 - 2023

VEK Construction → HLLW Vitrification 2009 - 2010 → STEP 4 Deregulation 2010 - 2011 → STEP 5 Remote Dismantling 2008 - 2015 → STEP 5 Manual Dismantling 2015 - 2019

Status of Decommissioning

1,700 t of 1,900 t of process, ventilation, and machine technology dismantled



200 of 1,140 feedthroughs mortised, drilled

100 t of highly contaminated concrete structures remain to be dismantled

1,150 of 1,440 m² stainless steel liner removed

230 t of 340 t cables removed

4,500 of 9,000 dowels removed

200 of 370 saw blocks removed

5,300 m² of 43,400 m² building surfaces subjected to radiological control, decontamination, and release measurements

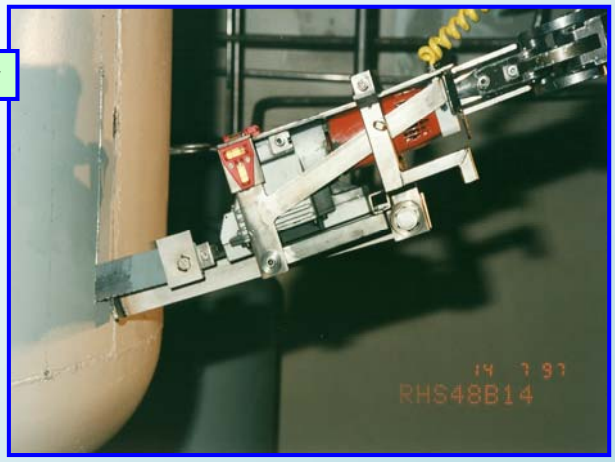
Principle WAK Dismantling Requirements

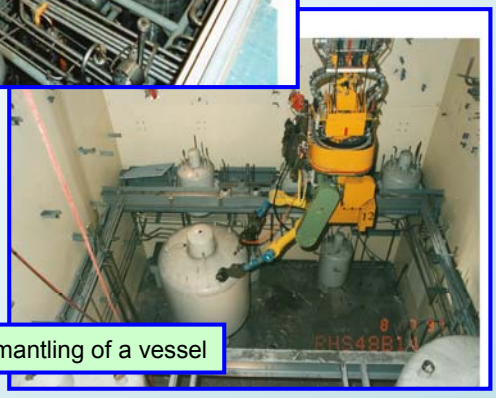
- Remote Dismantling
  - local dose rate: > 0.5 mSv/h
  - object surface dose rate: > 100.0 mSv/h
  - conventional human safety risk: high
- Semi-remote Dismantling
  - local dose rate: ~ 0.5 mSv/h
  - object surface dose rate: < 100.0 mSv/h
  - conventional human safety risk: low
- Manual Dismantling
  - local dose rate: < 0.5 mSv/h
  - object surface dose rate: < 2.0 mSv/h
  - conventional human safety risk: low

Remote Dismantling

Electrical **m**aster-**s**lave-**m**anipulator (**EMSM**3) entering a process cell

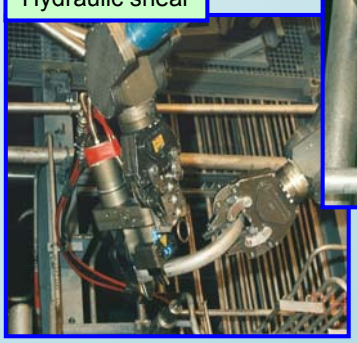
Pad saw

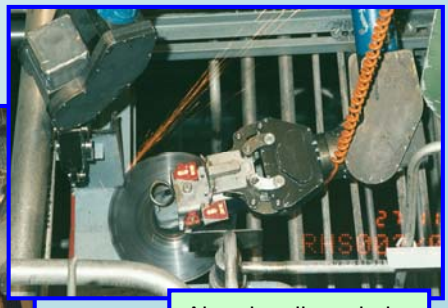




Dismantling of a vessel

Hydraulic shear





Abrasive disc grinder

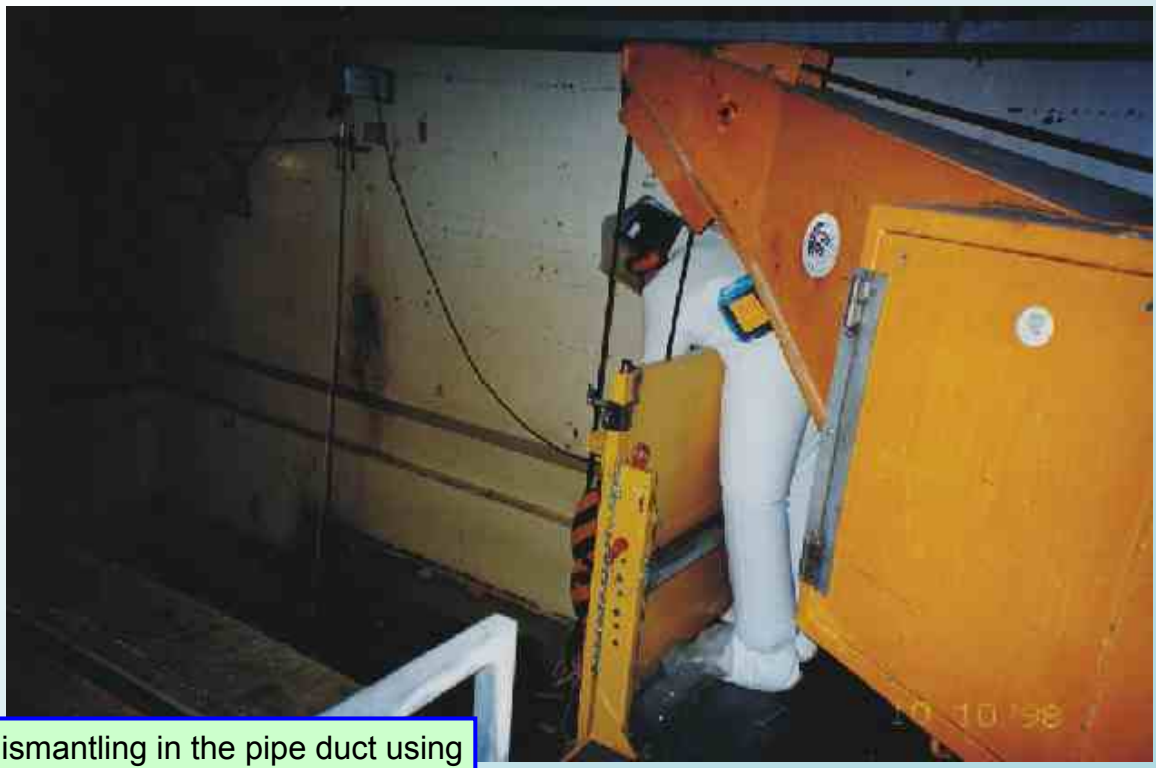
Remote Dismantling


ZIII_nachher.jpg


Zelle_leer1.jpg

Number of cells: 4
Largest cell: 7 x 7 x 12 m
Removed equipment: 1,400 t
Dismantling time: About 1 year
Operating mode: 3 shifts

Semi-remote Dismantling



Semi-remote dismantling in the pipe duct using a hydraulic shear on a crane hook. The shear is operated from a shielded working platform.

Radioactive Contamination: Individual Protection on Site

Surface contamination		Safety measures
α-activity (Bq/cm²)	β-activity (Bq/cm²)	
≤ 0.05	≤ 0,5	Hot-zone protective clothing
> 0.05 ≤ 0.5	> 0.5 ≤ 5	Additional: • glove • overshoe • mask
> 0.5 ≤ 5	> 5 ≤ 50	Additional: • glove • overshoe • mask • fleece overall
> 5 ≤ 50	> 50 ≤ 500	Additional: • non-ventilated protective suit • mask
> 50	> 500	Additional: • ventilated protective suit • mask

hot-zone protection

Material costs : **7.62 EUR**

add. fleece overall

18.84 EUR

add. protective suit

49.37 EUR

ventilated protective suit

178.09 EUR

Hot-zone protective clothing	Hot-zone protective clothing, additional:	Hot-zone protective clothing, additional:	Hot-zone protective clothing, additional:
	• glove • overshoe • mask • fleece overall	• non-ventilated protective suit • mask	• ventilated protective suit • mask

Direct measurement for room air monitoring BA33

Sampler for room air monitoring

Analysis of filters for room air monitoring

Dust cover

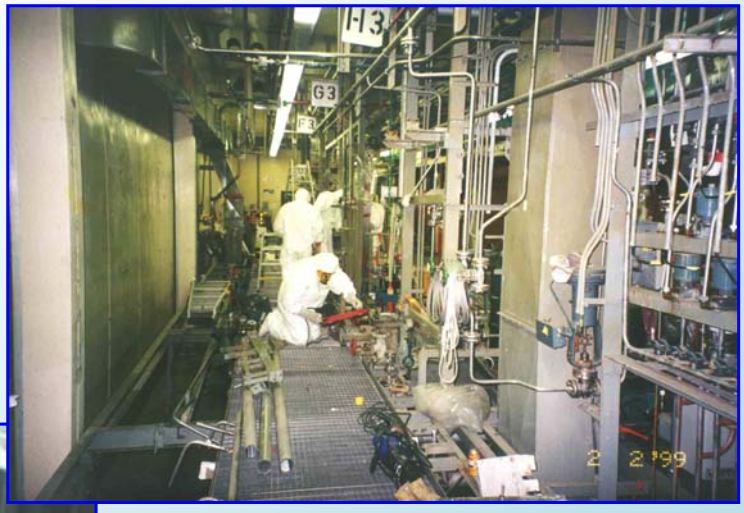
Vacuum cleaner

…… in use

Cutting of fuel element racks by means of band saws

Cutting of pipelines by means of hydraulic shear

Dismantling in the valve gallery



Dismantling of the Pu evaporator box in cell VIII using a compass saw

Cutting of floor liner in room 253 using angle grinders

Removal of floor liner in cell VII by plasma cutting

Mechanical dismantling cell: Prior to and after removal of the stainless steel liner

Mortising of concrete screed below the floor liner

Upon completion of the disassembly work in room 259, the PVC floor cover was removed first. Then, all room surfaces and the surfaces of the walls, ceiling, and floor screed were ground of manually.

Hot Spots in Room 259

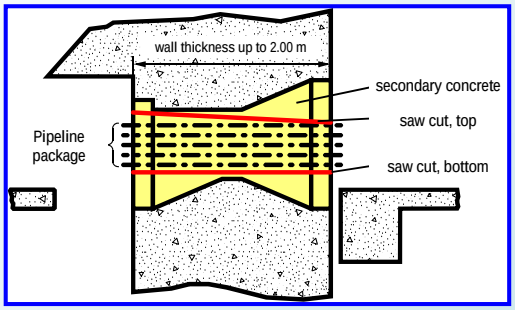
Measurements revealed sharply confined hot spots on the floor, with the values measured reaching up to > 100,000 ips.

Eliminated Hot Spots in Room 259

To eliminate these hot spots, the screed in these areas was mortised by a paving breaker. The surfaces treated were cleaned by sucking off the rubble.

Removal of Wall Feedthroughs

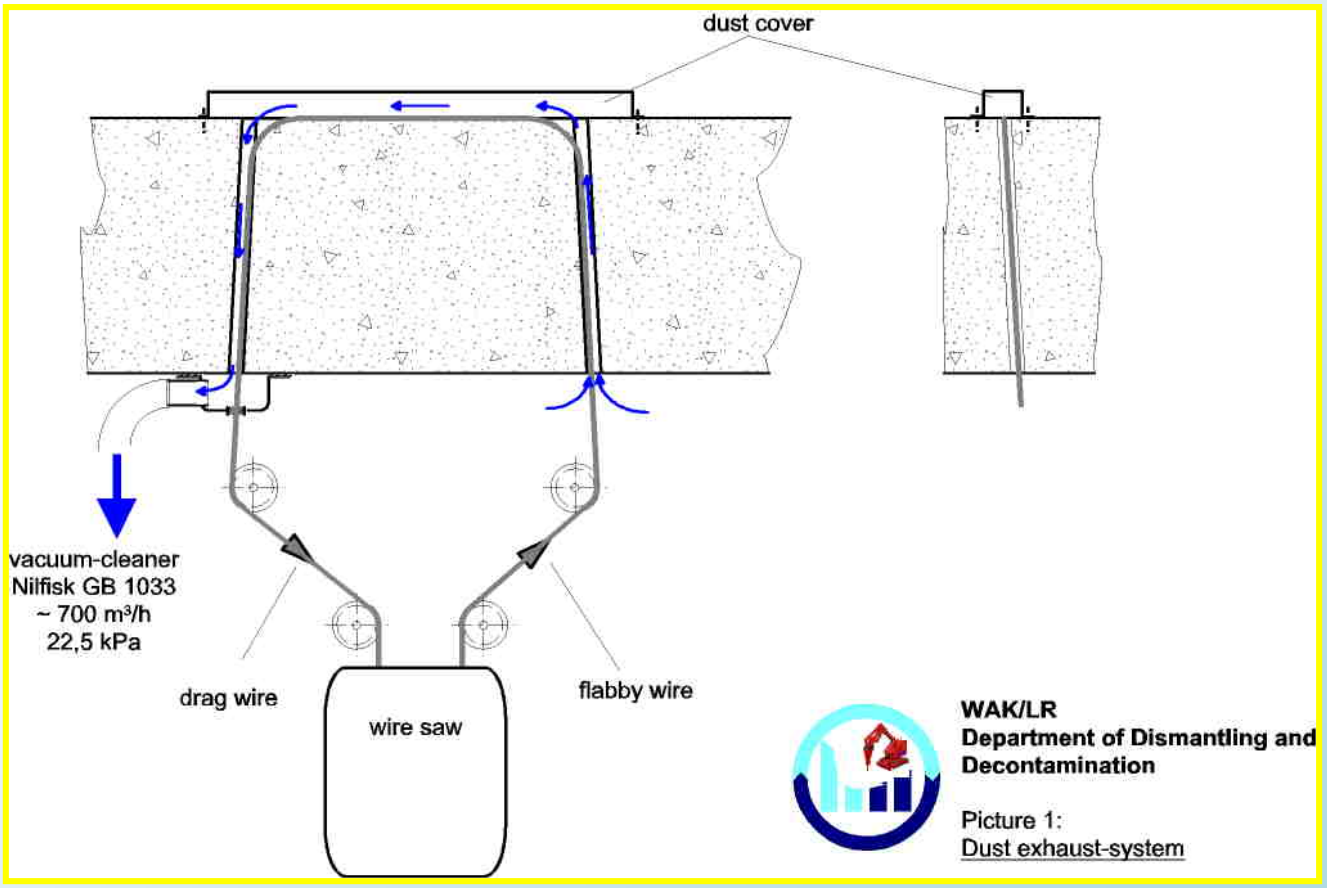
Rope saw in use



Pulling the block

Lowering the block

Dismantled block



Wire saw

Pulling out dowels using hydraulic pulling device

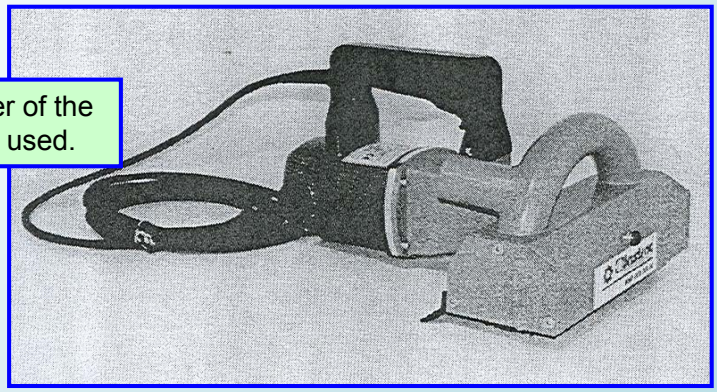
Drilling out of dowels

Data:
- Cell VII about 800 dowels
- so far, about, 4,500 dowels have been removed

Manual pulling using a striking weight

Process for the Removal of Hot Spots

For smaller areas (2 – 3 m²), a manual cutter of the types BMP-HED 200/50 or 200/70 may be used.



Fabr.: Tyrolit
- keine Staubentwicklung
- Geringer Verschleiß
- 115,00 €/St.

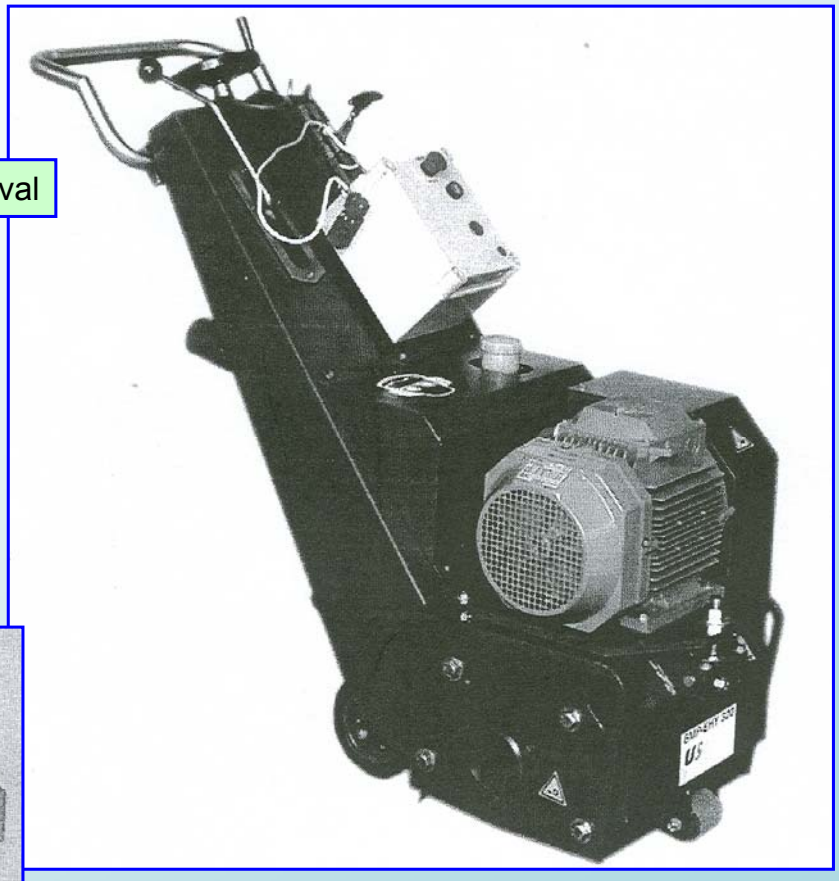
For small areas (up to 1 m²), conventional angle grinders with diamond-coated grinding disks are used.

Manual grinding

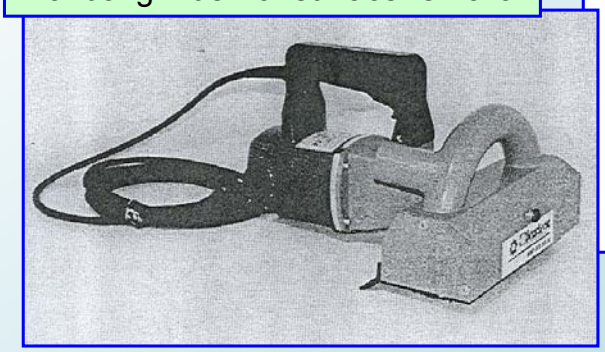
Manual grinding performance:
About 2 m^2/d

Layer thickness 2-3 mm

Concrete grinder for floor removal



Manual grinder for surface removal



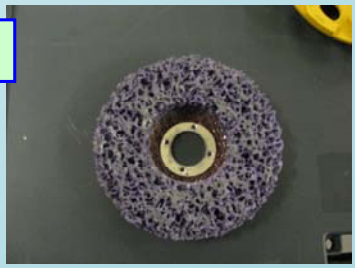
Tools

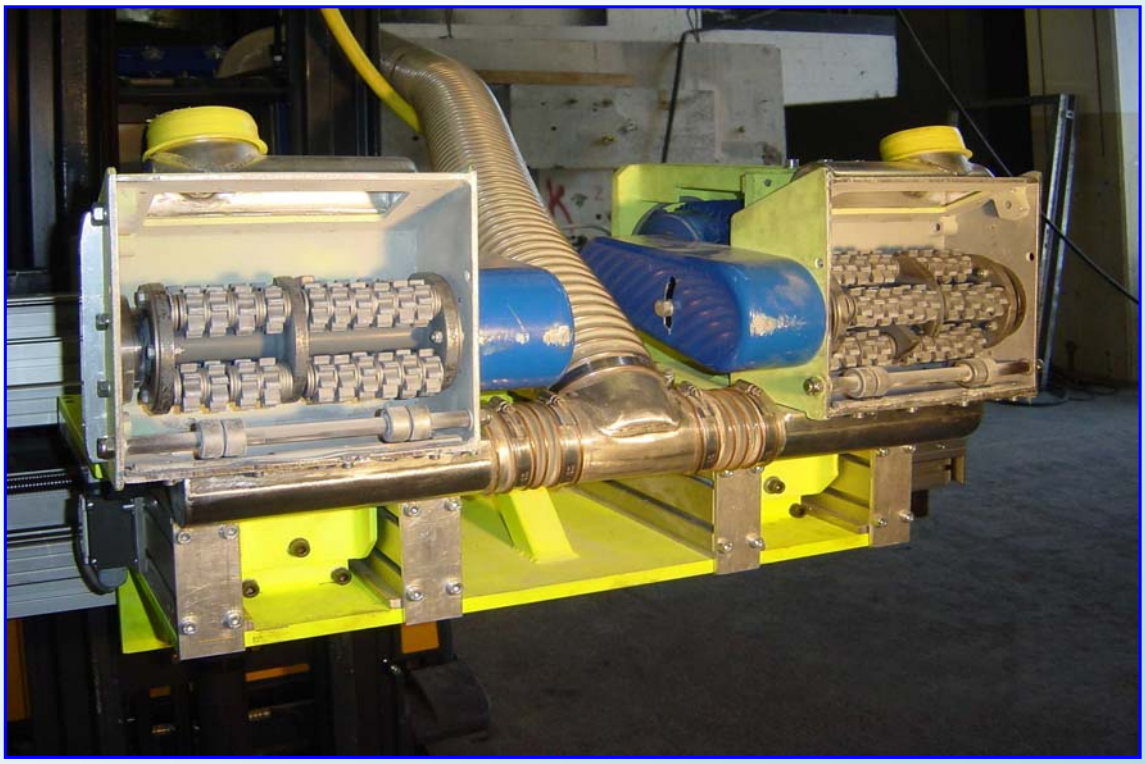
Diamond grinder

Diamond grinding disk

Cutting disk

Polishing disk





Double shaver head for mechanical surface removal

Forklift with attached shaver

Shaver fixed to a modular rack

Mechanical Surface Removal Data

Removal width	2 x 0.185 m = 0.37 m
Removal rate	1.4 – 1.8 m/min
Removal depth	3 mm
Roughness depth	< 1 mm
Rotating speed of shaver	1,800 rpm
Theoretical removal rate	40 m^2/h
Range of shaver on a forklift (without change of position)	5 m height, 2 m width
Range of shaver on a rack (without change of position)	9.7 m height, 2.6 m width
Removed surface area (without change of position)	Shaver on forklift 10 m^2
	Shaver on rack 25 m^2 wall 5.5 m^2 ceiling
Daily performance, including fitting times	15 m^2/d

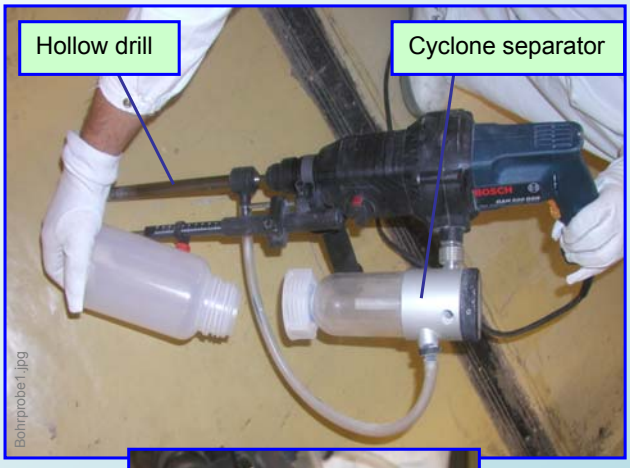
Measurements in Room 259

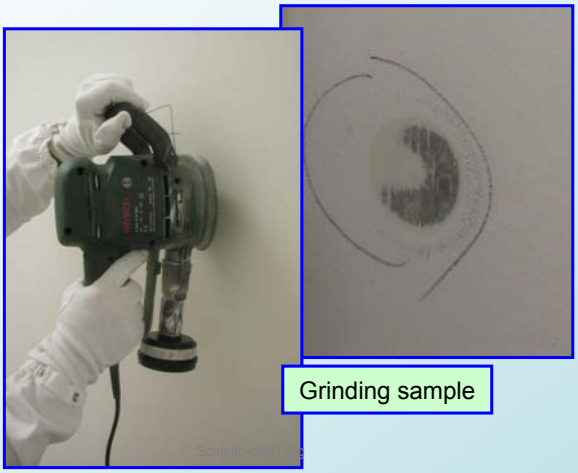
A COMO instrument was used for the radiological measurement of the room surfaces

COMO measurement instrument

Sampling

Scratch sample





Grinding sample

Drilling sample

About 6,000 samples analyzed so far

In-situ Measurement Setup