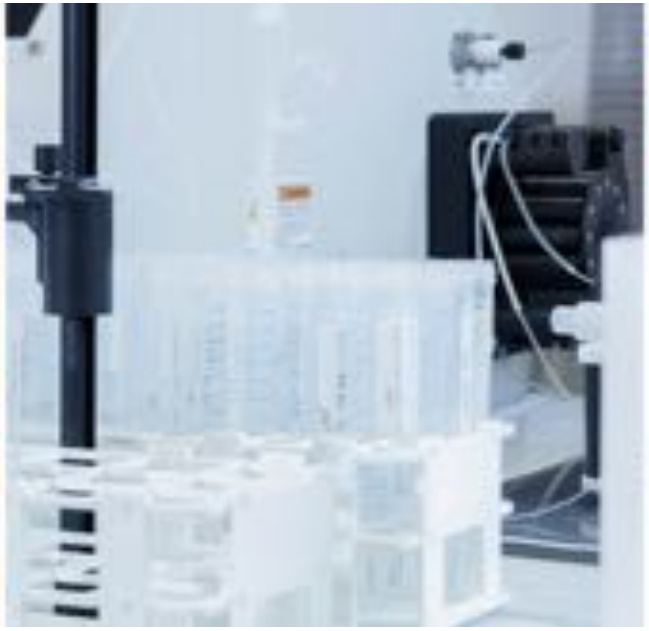
RESTRICTED CLEARANCE- PAH‘S POSING A CHALLENGE IN DISMANTLING

S. FLECK



VKTA Dresden
STRAHLENSCHUTZ | ANALYTIK | ENTSORGUNG

WHAT IS VKTA?- SHORT HISTORY OF THE RESEARCH SITE ROSSENDORF

- 1956: The central institute of nuclear physics (later: central institute for nuclear research) of the GDR was founded

- till 1992: traditional site with research reactors, an isotopeproduction for many different radionuclides, processing fissile material and different accelerators

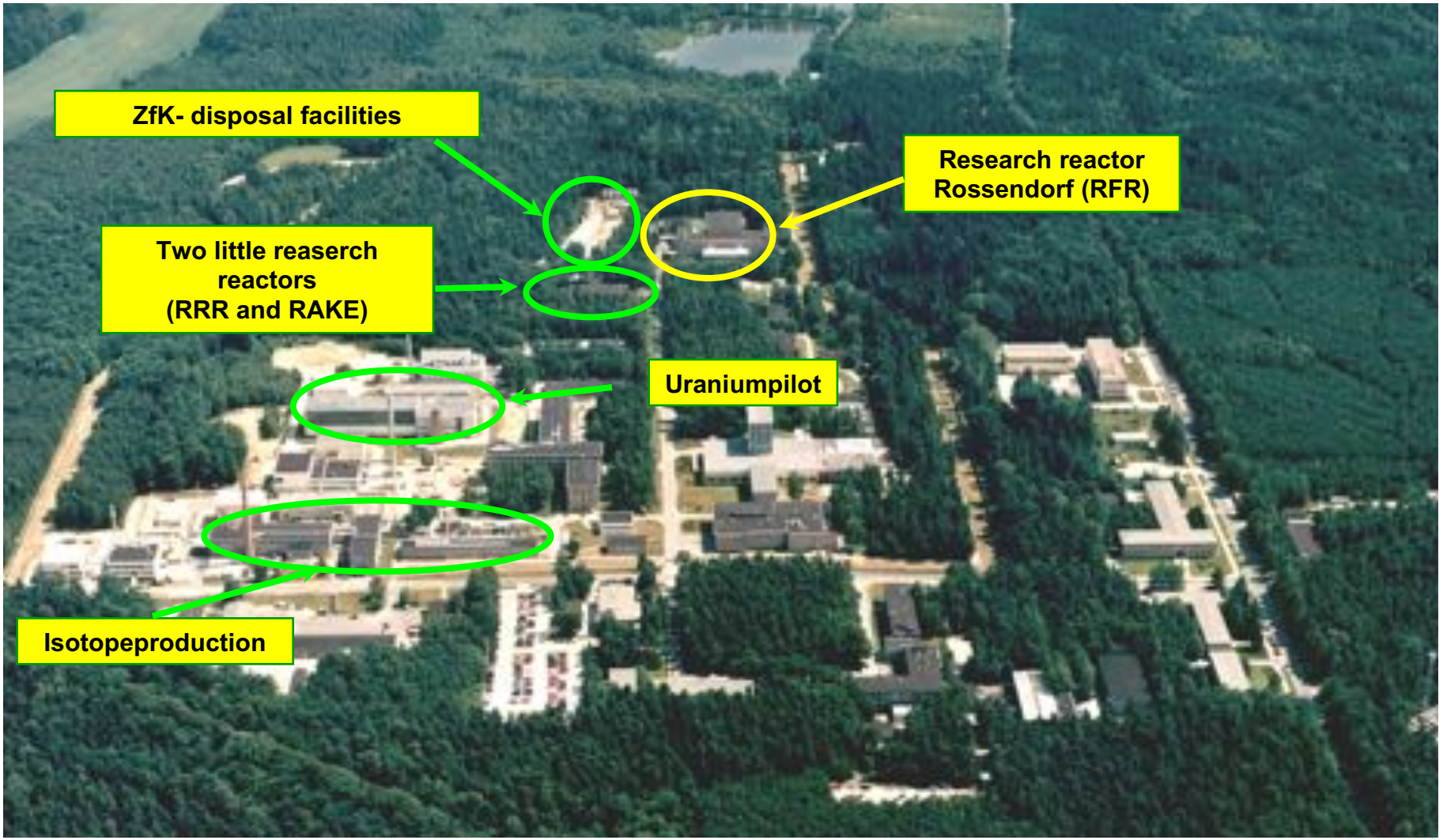
- 1992 after reunification in Germany the research site was newly arranged and subdivided:
  - FZR - Forschungszentrum Rossendorf e. V. (now HZDR)
  - VKTA - Verein für Kernverfahrenstechnik und Analytik Rossendorf e. V.

- actual:
  - ~ 100 employees, charged by the Free State of Saxony
  - forward-looking organised and renamed 2014:

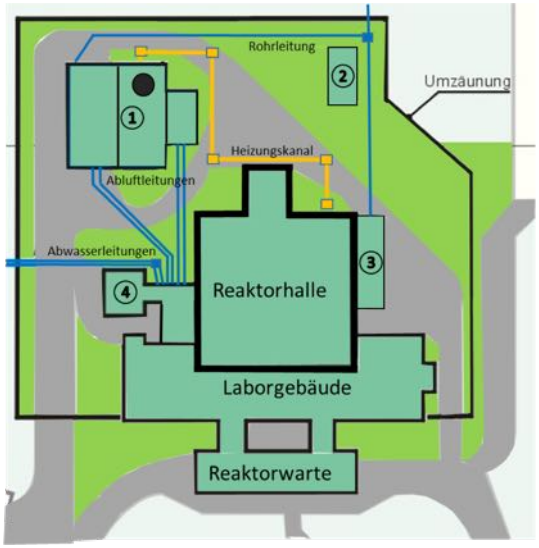
    VKTA - Strahlenschutz, Analytik & Entsorgung Rossendorf e. V.

    VKTA - Radiation Protection, Analytics & Disposal Rossendorf Inc.

DISMANTLING - OVERVIEW



DISMANTLING – ROSSENDORF RESEARCH REACTOR (RFR)



DISMANTLING – FORMER DISPOSAL FACILITIES

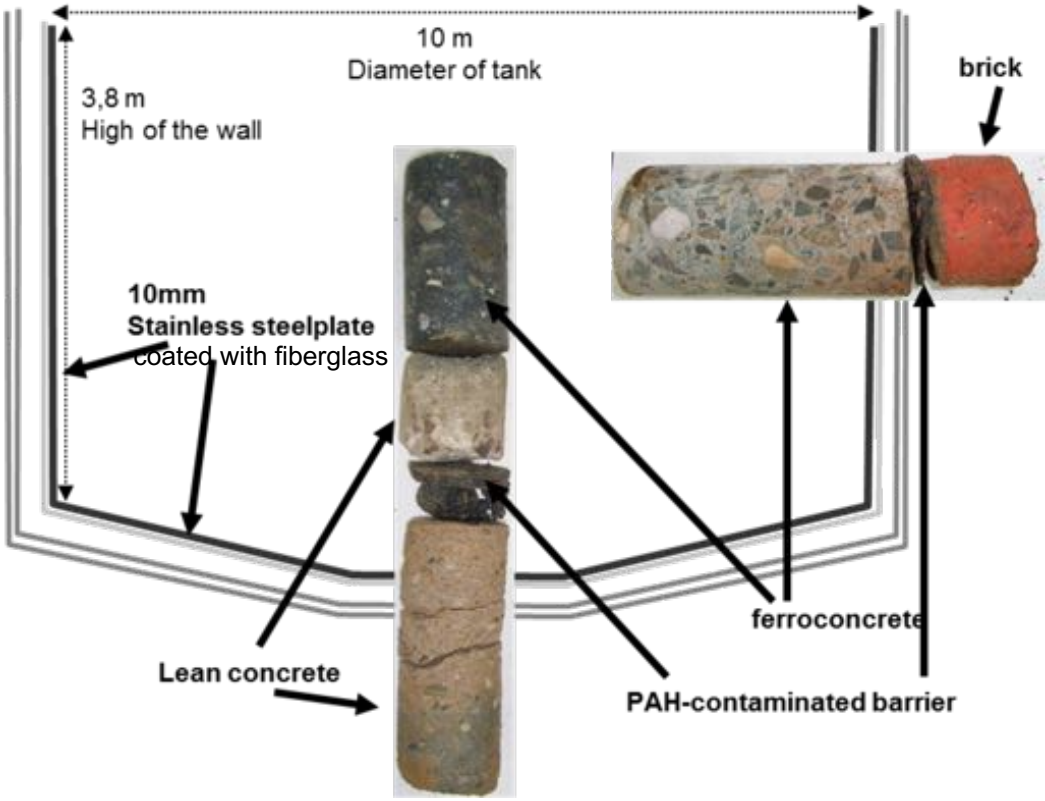
DISMANTLING – WASTEWATERTANK FROM RFR HISTORICAL EXPLORATION

The tanks during the construction- that‘s what we know!

Before dismantling we have to explorate the building. What‘s the black material?

DISMANTLING – WASTEWATERTANK FROM RFR

Pump house in the front of the tanks



history

- 40 years in use
- water with acids, bases, organic solvents, toxins …, radio-nuclides
- harmful substances in building materials?

CHEMICAL DESCRIPTION

Investigate chemical substances:
- Start of construction
- Specific substances
- Change in use
- Documentation of building
- Accident during use
- Organoleptic test

Radionuclide inventary:
Radioactive contamination = chemical contamination probably

waste act:
- LAGA guides of federal states of germany
- DepV
- BBodSchV
- groundwater

Research flow: find parameters, analysis in VKTA- laboratory, evaluation (limit and allocation value)
Ideal: investigation before planning– often during the dismantling

ENVIRONMENTAL PROTECTION AT DISMANTLING OF NUCLEAR FACILITIES- THE PRINCIPLE

The German Radiation Protection act (StrlSchG) governs the unrestricted clearance and the clearance of solid materials for disposal via landfilling and the clearance of solid materials and liquids for disposal via incineration.

Clearance (for disposal)

-> low (radio)activity residue is converted into a (conventional) waste with hazardous or non-hazardous properties, following conditions must be fulfilled in addition to the results of measurements:

- an acceptance declaration of the disposal plant has to be obtained
- the waste authority responsible for the disposal plant has to receive a copy of the acceptance declaration
- the disposal method has to be confirmed by the nuclear licensing authority responsible for the owner
- and, where applicable, mutual consent from the authorities has to be established

ENVIRONMENTAL PROTECTION AT DISMANTLING OF NUCLEAR FACILITIES

As regards to the radionuclide examinations, a selected range of radiochemical separation and measuring methods were used

Applied radionuclide analysis techniques

Parameter	Methods	RC separation required
Co-60, Cs-137, Eu-152, Eu-154	Gammaspectrometry	no
Sr-90	LSC	yes
H-3	LSC	yes
Fe-55, Ni-63	LSC	yes
C-14	LSC	yes
U-235, U-235, U-238	Alpha spectrometry/ ICP-MS	yes
Pu-238, Pu-239/240	Alpha spectrometry	yes
Am-241	Alpha spectrometry	yes

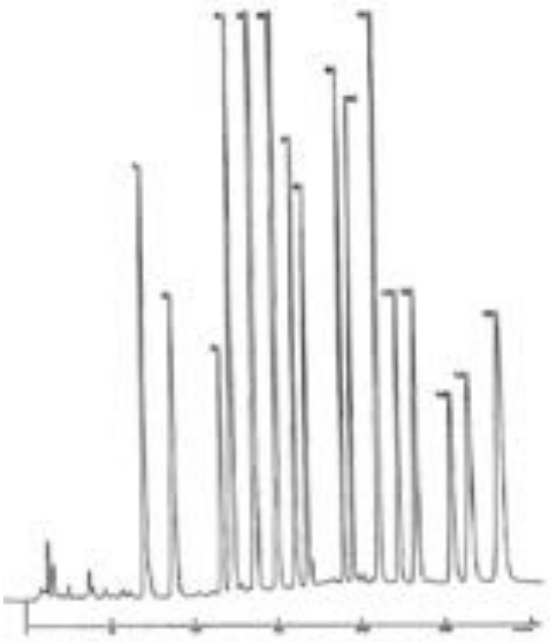
ENVIRONMENTAL PROTECTION AT DISMANTLING OF NUCLEAR FACILITIES

After clearance, the residues are subject to the requirements of (conventional) waste act.

There are for example:

- Recycling Economy/ Waste Management Act (KrW-/AbfG)
- Permit German Federal State Working Group on Waste (LAGA)
- DIN norms Federal Soil Protection Law, Federal Soil Protection Ordinance
- Company-specific regulations Ordinance on Landfills
- Radiation protection regulations Ordinance on Environmentally Compatible Storage of Waste (AbfAblV)
- Technical Rules for Hazardous Substances (TRGS)
- Packing Ordinance

ENVIRONMENTAL PROTECTION AT DISMANTLING OF NUCLEAR FACILITIES- WE SEARCH ALSO FOR



Name	Summen-formel	Molare Masse	Prozent an Kohlen-stoff	CAS-Nummer	Struktur
Naphthalin	$C_{10}H_8$	128,17 g/mol	93,75 % C	091-20-3	
Acenaphthen	$C_{12}H_{10}$	154,21 g/mol	93,05 % C	083-32-9	
Phenanthren	$C_{14}H_{10}$	178,23 g/mol	94,05 % C	085-01-8	
Fluoranthen	$C_{16}H_{10}$	202,26 g/mol	95,0 % C	206-44-0	
Benzo(a)-anthracen	$C_{18}H_{12}$	228,29 g/mol	94,45 % C	056-55-3	
Benzo(b)-fluoranthen*	$C_{20}H_{12}$	252,32 g/mol	95,2 % C	205-99-2	
Benzo(a)pyren*	$C_{20}H_{12}$	252,32 g/mol	95,2 % C	050-32-8	
Dibenz(a,h)-anthracen	$C_{22}H_{14}$	278,35 g/mol	94,7 % C	053-70-3	

PAH contaminated barrier: HPLC chromatogram of 8 from16 EPA-PAHs

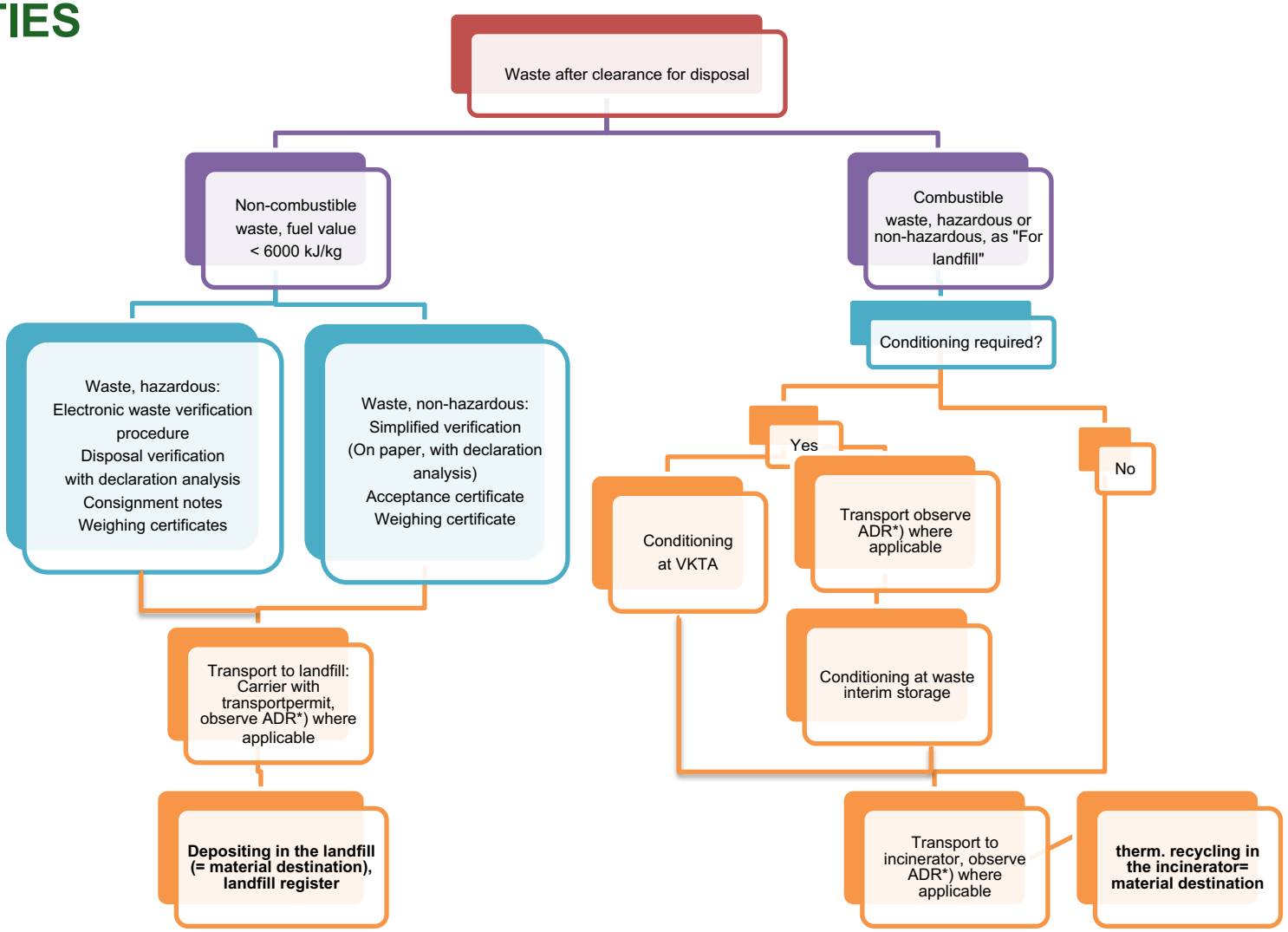
ENVIRONMENTAL PROTECTION AT DISMANTLING OF NUCLEAR FACILITIES- WE FOUND

Object of analysis	Concentration/content	Reference value
Drinking water		Acc. to TVO (limit value): 0.2 µg/l (Σ PAH)
Building rubble	> Z2 without layer; hazardous waste with layer	Acc. to LAGA (assignment value):1 mg/kg (Z0) … 15 mg/kg (Z2) for utilisation (Σ PAK); phenols in eluate
Tar layers	30.000…118.000 mg/kg	Hazardous waste acc. to AVV: 1000 mg/kg (Σ PAH)
Soil	2 … 13 mg/kg	Acc. to LAGA (assignment value) 3 mg/kg (Σ PAH)
Eluates from building rubble	210 µg/l	Ground water (test value acc. to BBodschV path soil – ground water) 0.2 µg/l (Σ PAH)

Our examinations show that the existing barrier layers are highly contaminated with PAHs. Because of the high PAH contents and the significant barrier layer masses, the tanks had to be categorized as **hazardous waste**.

- no clearance of solid materials for disposal via landfilling
- clearance of solid materials and liquids for disposal via incineration

ENVIRONMENTAL PROTECTION AT DISMANTLING OF NUCLEAR FACILITIES



*) ADR- Hazardous Materials Regulations for Transport

ENVIRONMENTAL PROTECTION AT DISMANTLING OF NUCLEAR FACILITIES- HOW IT LOOKS LIKE?

collecting

packing

packing everything twice

ENVIRONMENTAL PROTECTION AT DISMANTLING OF NUCLEAR FACILITIES

Documentation of disposal material:

- Radionuclide and chemical analysis
- Simplified disposal verification/declaration of acceptance
- Confirmation of MD
- Material certification to verify clearance in StrlSchG with reference to the waste batches
- (waste act) Acceptance certificate signed by VKTA, carrier, incinerator
- Weighting certificate

At last the area had to be released from nuclear regulatory control.

ENVIRONMENTAL PROTECTION AT DISMANTLING OF NUCLEAR FACILITIES- OTHER EXAMPLE

- Problems with PAH also during decommissioning of RFR
- 2007/2008 building structure of reactor building and surrounding soil was sampled and analyzed

ENVIRONMENTAL PROTECTION AT DISMANTLING OF NUCLEAR FACILITIES- OTHER EXAMPLE

- significant contaminations with PAHs were found depending on the building materials used, e.g. subterranean exterior walls lined with tarboard
- contaminations had to be considered during the total demolition of the building (separation) and the disposal of rubble (reusable or waste)
- starting in 2014 until 2017
- all materials were sampled and evaluated again during demolition in order to determine disposal routes
- after careful separation a small percentage of rubble had to be disposed of as hazardous waste
- Final material results underran the German clearance values for unrestricted release
- soil of the remaining pits underran the guide value of 30 mg/kg PAH (sum)
- in 2017/2018, the pits were filled with high quality soil that underran the German guide values
- the ground water was constantly surveyed and no noticeable contaminations have been found

ENVIRONMENTAL PROTECTION AT DISMANTLING OF NUCLEAR FACILITIES- OTHER EXAMPLE

Today, the site of the former research reactor is awaiting release from nuclear regulatory control, expected mid-2019.

QUESTIONS?

Thank you

for your attention

VKTA – Radiation Protection, Analytics & Disposal Rossendorf Inc.

- Execution of research projects / scientific workshops
- Execution of education and trainings
- Consulting government and private authorities
- Services offered in radiation protection, analytics and disposal
- Execution of a measuring point for incorporation for Saxony
- Execution of the central collection point of radioactive waste
- Akkreditierung DIN EN ISO/IEC 17025

Bautzner Landstraße 400
01328 Dresden
Germany
www.vkta.de
kontakt@vkta.de