



Das Lebensministerium

De-mercurisation and disposal of NORM- Residues from Oil and Gas Industries

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Hg- Containing NORM- Residues from Oil and Gas Industries

Outlines

- Introduction; Regulatory base
- Gas and Oil Extraction in Germany
- Naturally Ocurring Radioactive Materials in residues of oil and gas extraction
- Treatment of mercury containing residues of the oil and gas industry and their disposal
- The permit of realease of de-mercurised residues according to § 98 StrlSchV



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Utilisation and disposal regulated by:

Annex XII, part A of the StrISchV
(German Radiation Protection Ordinance)



List of radioactive residues to consider:

*„1. Sludges and scales from
extraction of natural oil and gas“*

...



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Gas and Oil Extraction of Germany

Extracting Rates 1997 - 2003

Equivalent to about 20%
of total use

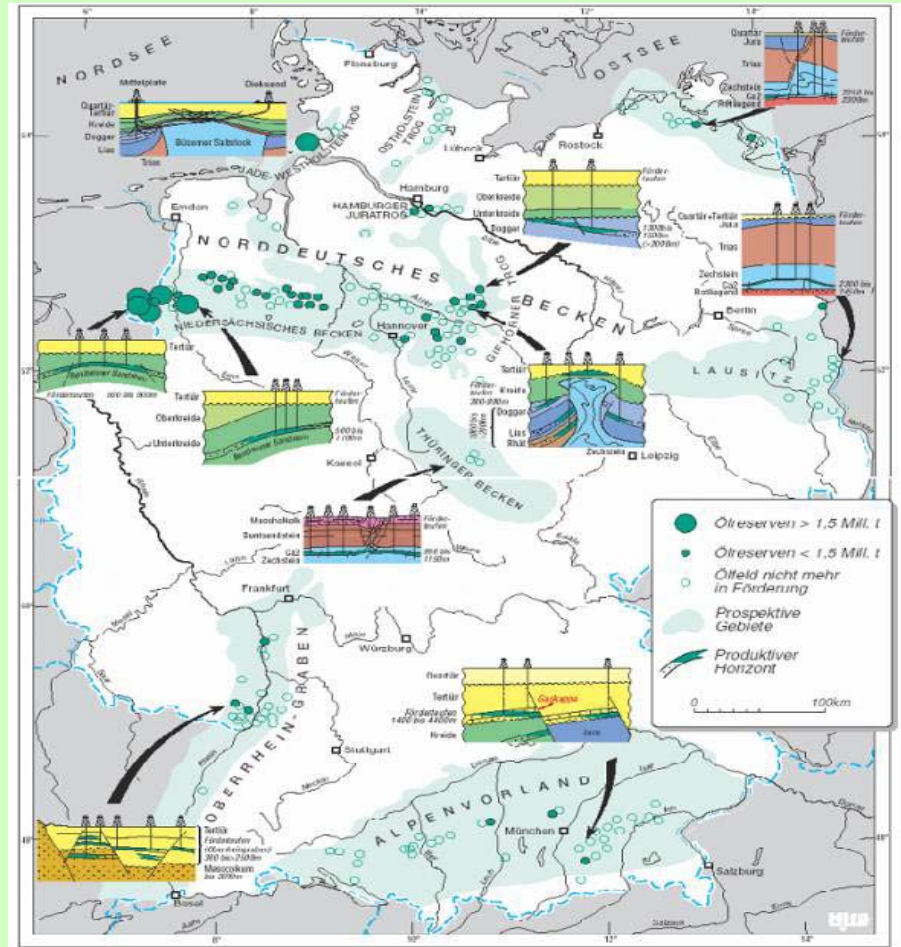
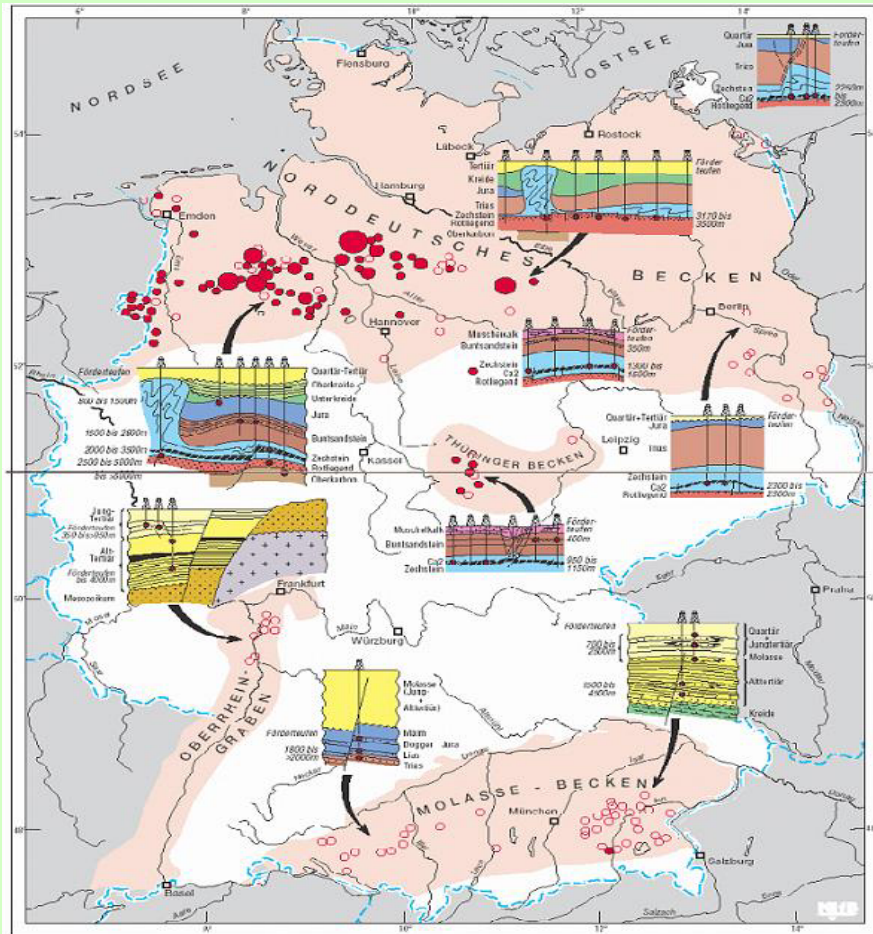
	1997	1998	1999	2000	2001	2002	2003
Gas extraction (billions m ³)	20,4	19,9	21,2	20,1	20,3	20,2	21,1
Oil extraction (millions- t)	2,8	2,9	2,7	3,1	3,4	3,7	3,8

from: *Erdöl und Erdgas in der Bundesrepublik Deutschland*. - Pasternak M., Brinkmann S., Messner J., Sedlacek R.; Niedersächsisches Landesamt für Bodenforschung, 2003.



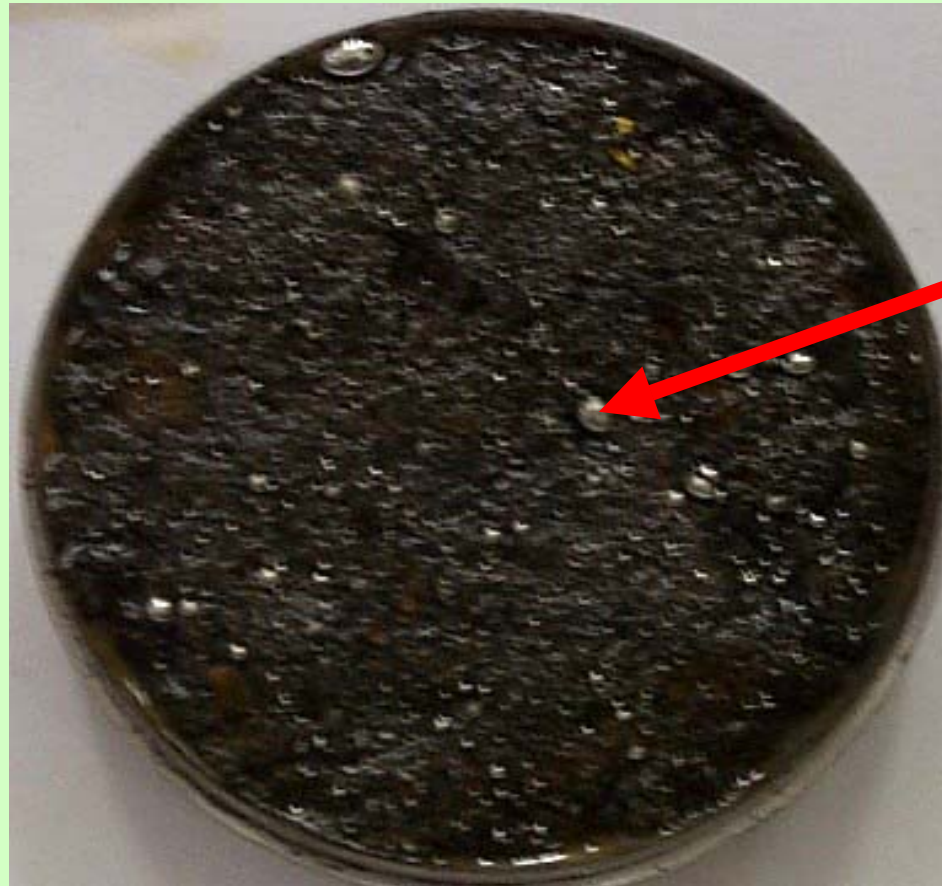
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Gas and Oil Extraction in Germany Extraction Regions



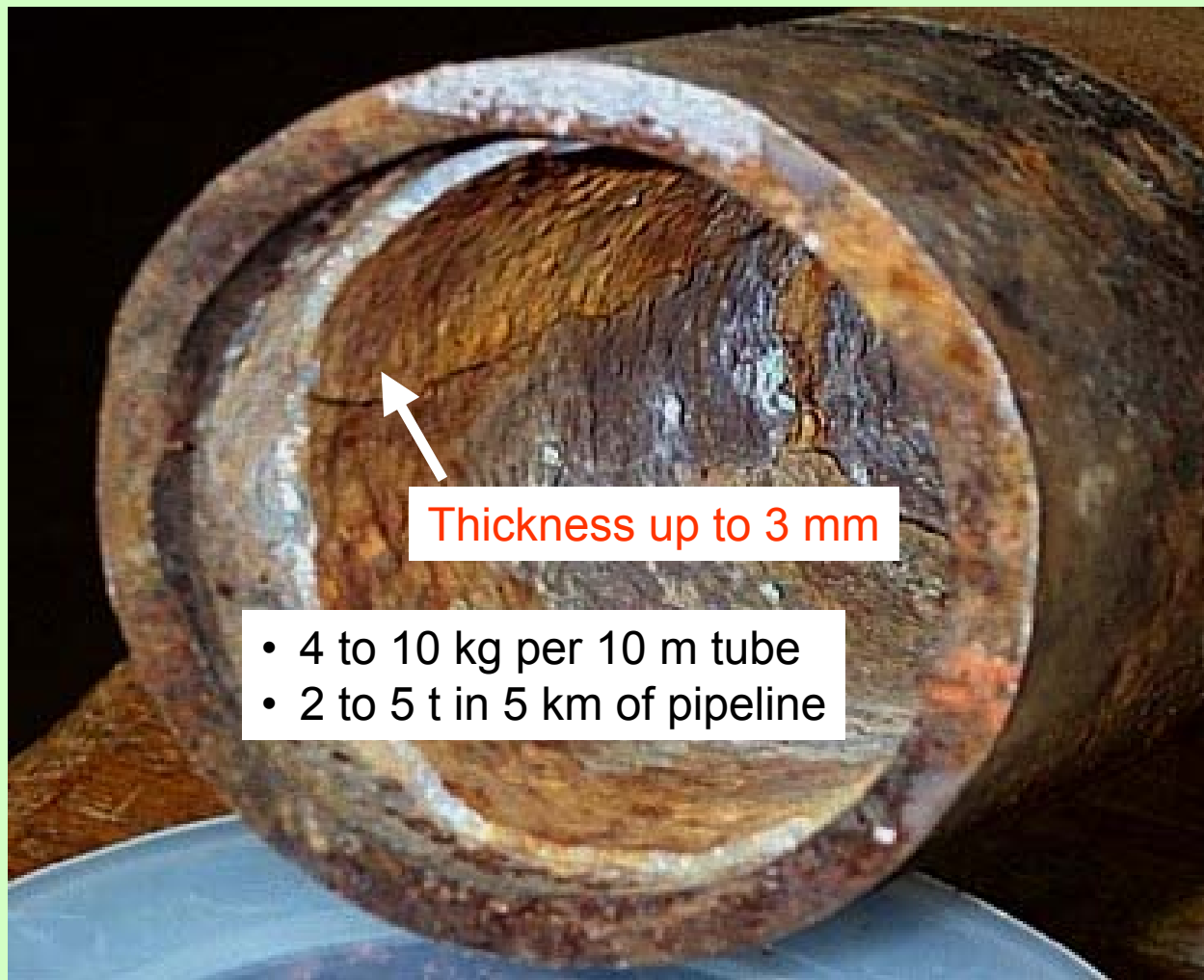
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Mercury Containing Sludge



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Mercury Containing Radioactive Scales in Tubes



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Types of residues

Sludges

- Non-solid residues in plant components (tanks, sev. r from different stages of purification and production
- Partially mixed with highly formation waters, rock par high concentrations of hy frequently containing mer

Scales

„*fur*“, or „*inkrustation*“; i.e. carbonates and sulphates, firmly adhering precipitations in tubes, fittings, and plant components

Genesis: pressure and temperature changes while ascension of the extracted gases and liquors in the lining tubes of boreholes, but also in further plant components

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Naturally Ocurring Radionuclides in Sludges and Scales in Bq/g

Radionuclides	Sludges	Scales
Ra-226	< 10 – 240	30 – 150 Max: 6.000
Ra-228/Th-228	< 10 – 30 Max: 80	10 – 50 Max: 2.000
Pb-210/Po-210	< 1 – 100 Max: 500	30 – 150 Max: 500

☞ Primordial radionuclides U-238 und Th-232 are very immobile, for the most part remaining in the productive formation, nearly not appearing in scales or sludges.

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3 Risky Matters for the Treatment of Sludges and Scales

**Natural
radionuclides**

**Pollutions by
organic substances
(hydrocarbons)**

**Heavy metals, especially
Mercury:
about 10 -15%, but
up to max. 30 mass-%**

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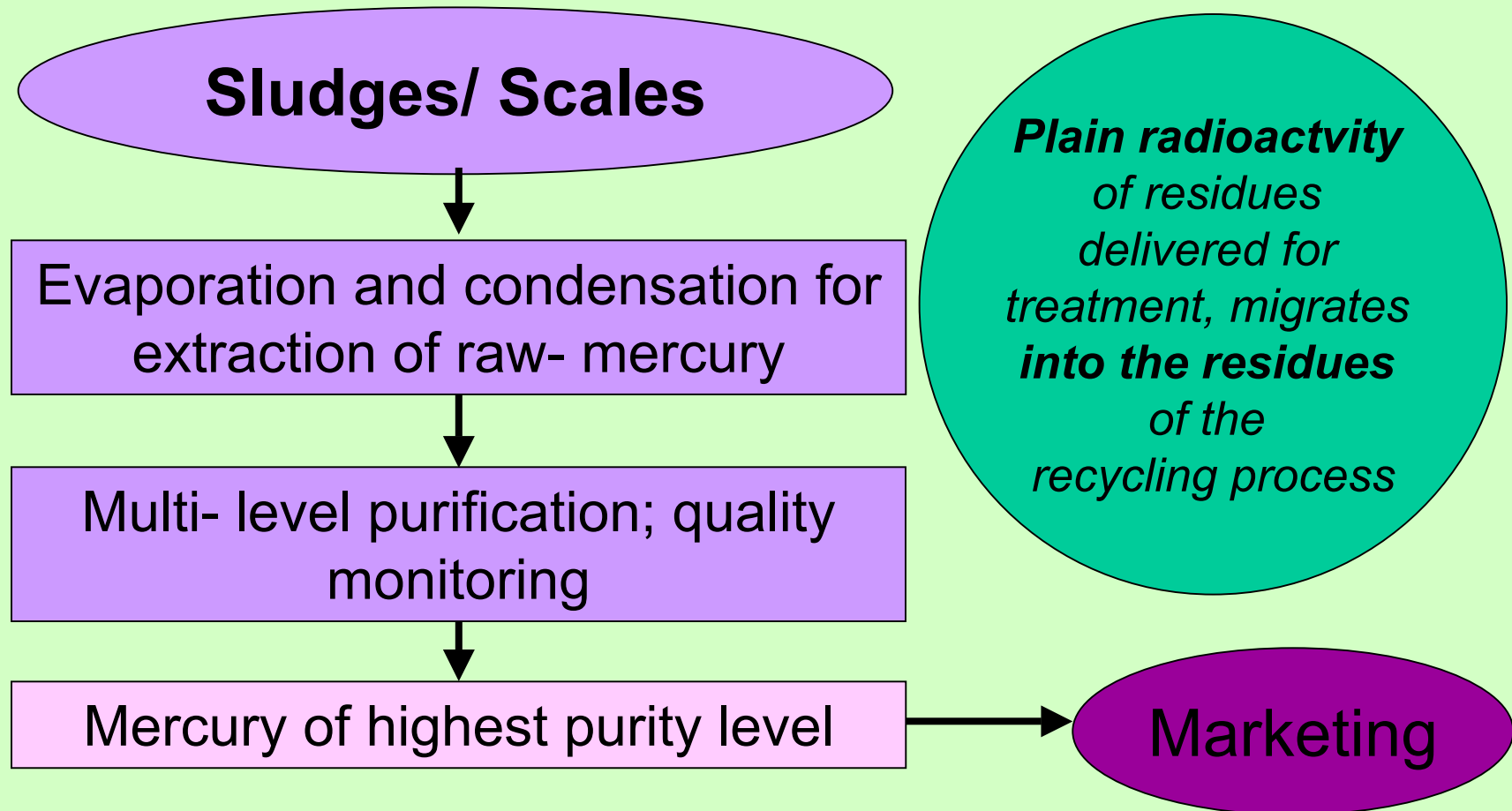
Mercury Winning in Saxony

Entrepreneur: **GMR**
Gesellschaft für Metallrecycling mbH in
Leipzig

The technology :
Thermic Treatment in Vacuum
(*vacuothermic de-mercurisation*)

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Treatment Process: (I) Vacuothermic De-mercurisation



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Treatment Process: (II) Treatment of de-mercurised residue

Cooling/ conditioning of the
de-mercurised RESIDUES

Analysis

Mineral residue
(radioactively contaminated)

Immobilisation by dint of
geo-polymer

Release and disposal



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Treatment Process: (III) Treatment of de-mercurised residue

Immobilisation of the residues by addition of a polymer (geopolymer) in a proportion of about 1 : 1; in barrels

Characteristics of the immobilisate:

- Long term stability,
- Hardened in barrels,
- No formation of dust at contacting, transportation and disposal
- Negligible low exhalation of radon
- Non detectable elution of harmful substances (radionuclides, heavy metals)



The immobilisation leads to a durable immobilisation of radionuclides (IAF)

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**Imported residues, at the present time,
are to be brought back after de-mercurisation.**

Others: Permit of release for de-mercurised residues from special supervision according § 98 StrlSchV (German Radiation Protection Ordinance)

*„A release can be carried out only
...if no objections...“*

Effektive dosis (reference value,
exposition for singular persons of population)

1 mSv/a

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**Disposal of the de-mercurised residue jointly
with further waste**



**Special regulation of annex XII Part C German
Rad.Prot.Ordinance**

Landfill



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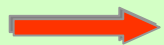
Treated radioactive residues containing mercury from 2002 to 2005

	Mass[t]
Residues delivered	251
Residues de-mercurised	151
Water and hydrocarbons	73
Mercury extracted	27

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Conclusions

- Demercuration of residues of oil and gas industries is an important contribution to reduce the dissemination of toxic mercury, and to manage radioactive residues (NORM).
- Commercial interest existing (e.g. from the Netherlands, Northern Germany)
- A visible part of mercury consumption can be covered by that way of raw materia winning .
- Disposal of the completely de-mercurised residues possible due to the reliable immobilisation of the radioactive components (criterion: recommended value 1mSv/a)



Permit according to annex XII part C, StrlSchV (in Saxony)





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Thank you
for your
attention!

