

# Gained experiences concerning the treatment of radioactive metal scrap from German NPP's

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*GNS Gesellschaft für Nuklear-Service mbH*

[www.gns.de](http://www.gns.de)

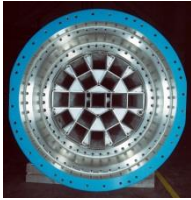
International Symposium  
Recycling of Metals

Studsvik, Nyköping, Sweden,  
2014 April 8th - 10th



# General Information about GNS

All German  
NPPs



## Spent Fuel and HLW from Reprocessing

*Treatment, Packaging, Transport,  
Interim Storage, Preparation for Final Disposal*

**Final Repository  
HLW**  
(exploration phase)



**We take care of ...**  
(i.e. Competence and Responsibility of GNS)



Responsibility for  
exploration, construction  
and operation:

**Federal Republic  
of Germany**



*Treatment, Packaging, Transport,  
Interim Storage, Preparation for Final Disposal*

## Management of Operational and Decommissioning waste (LLW/ILW)

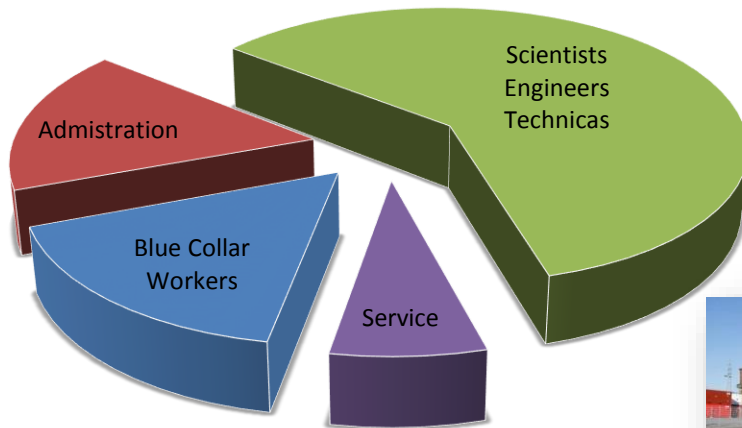
**Final Repository  
„Konrad“  
LLW/ILW**  
(construction phase)



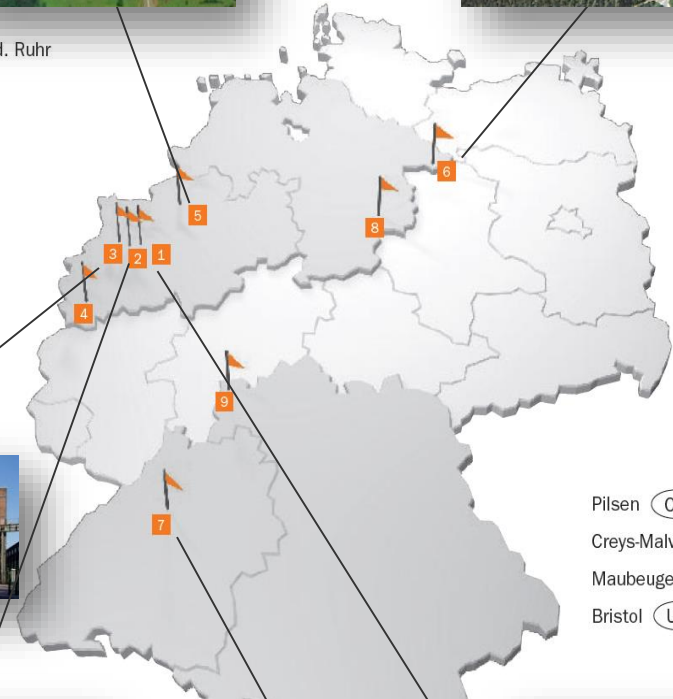
# General Information about GNS

**GNS-Group:  
Employees**

≈ 600



- 1 Essen
- 2 Mülheim a. d. Ruhr
- 3 Duisburg
- 4 Jülich
- 5 Ahaus
- 6 Gorleben
- 7 Karlsruhe
- 8 Peine
- 9 Alzenau



- Pilsen (CZ)
- Creys-Malville (F)
- Maubeuge (F)
- Bristol (UK)



**DBE/DBE TEC  
employees ≈ 800**



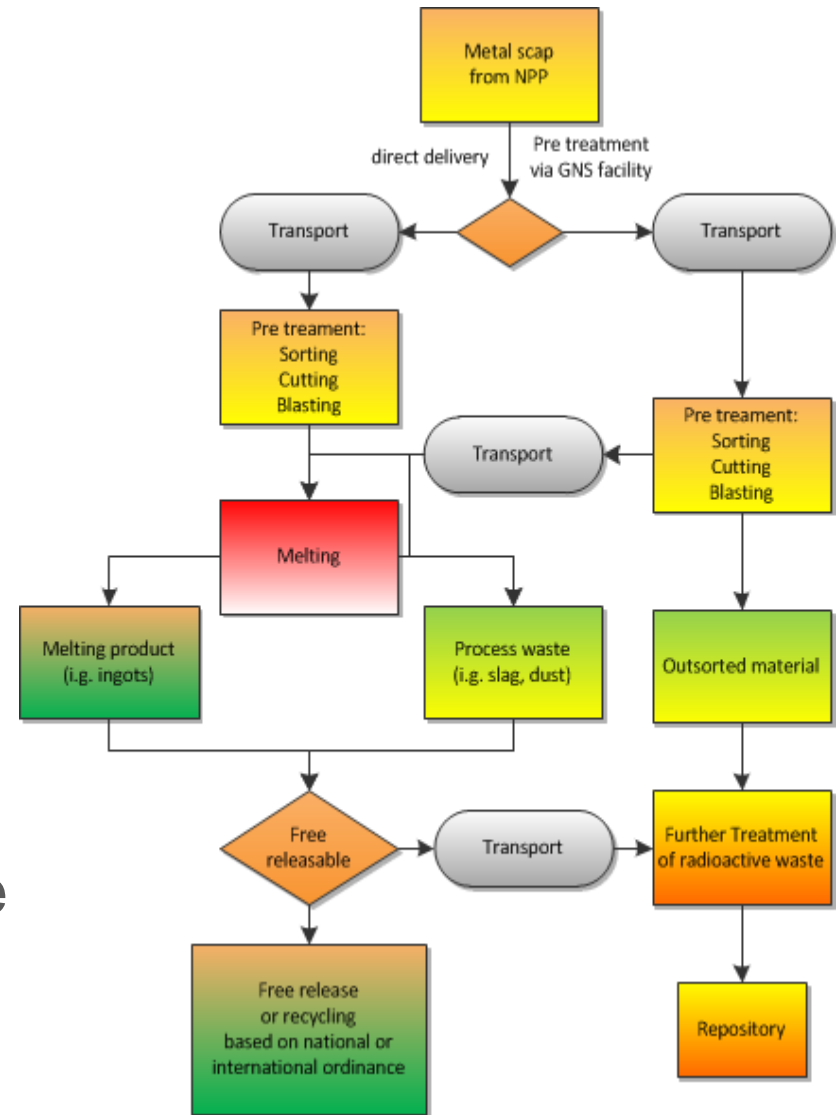
# The entire process

## Metal origin:

D&D projects and maintenance during down time periods

## Objective:

Maximize the recovery of recyclable material while minimizing the radioactive waste amount at the same time

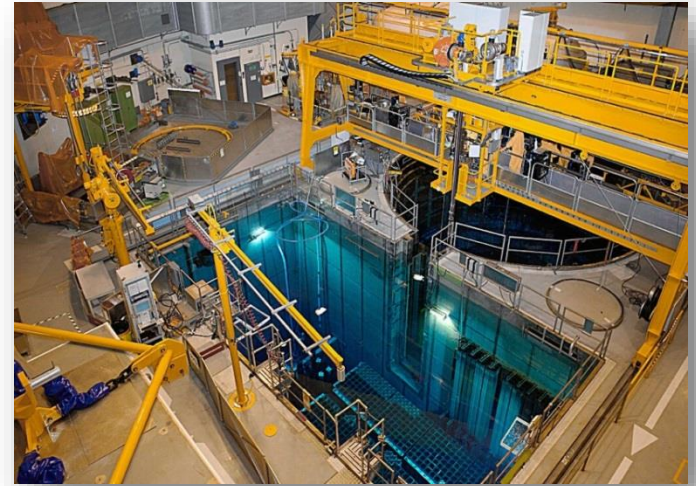


# The metal scrap

To achieve the objective

- a sorting process
- a specific activity calculation
- a detailed documentation

have to set up prior to the transport



Establishing a proper pre-treatment

- lowering the need for further pre-treatment
- impact on the processing time, results and cost factor effects

**→ Major role in the treatment outcome**

# Metal scrap – suitable ?



# Metal scrap – suitable ?



# Metal scrap – suitable ?





# Metal scrap – suitable ?



# Metal scrap – suitable ?



# Metal scrap – suitable ?



# Metal scrap – suitable ?



# The transport

When shipping metals, following must be observed:

- Dangerous goods regulations (ADR/RID, IMDG-Code)
- Guidelines for cargo securing (CTU, VDI)
- Transport permission - if needed
- Export-specific legal regulation

Further recommendations:

- Optimized loading
- Sufficient transport batch sizes
- Standardized transport logistics with CTU



# Optimized loading and tie-down?



# Optimized loading and tie-down?



# Optimized loading and tie-down?





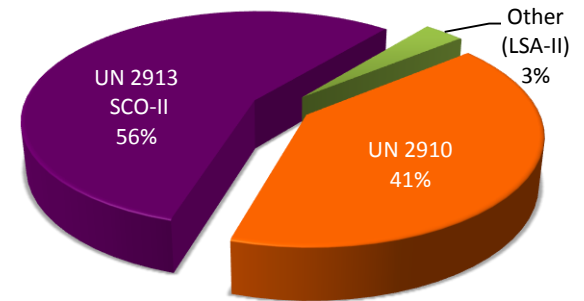
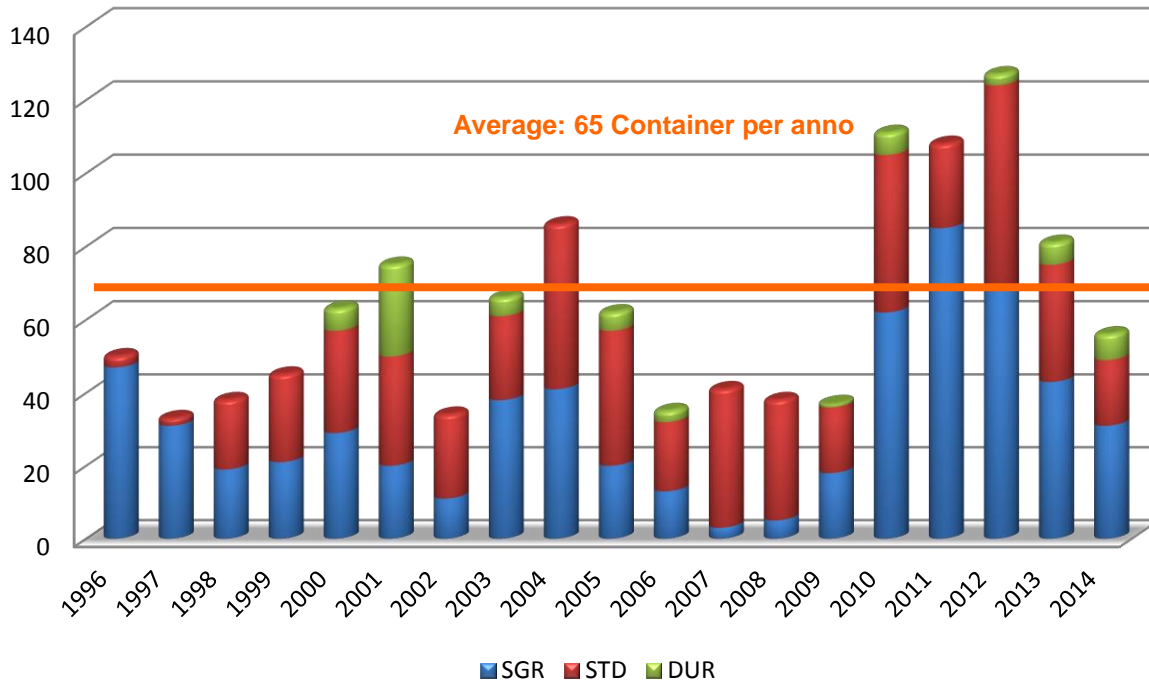
# Optimized loading and tie-down?



# Optimized loading and tie-down?



# The transport



## Summary:

- 396 transports with 1186 standard 20-foot container in total
- 20 transports per year with an average of 3,25 container per shipment
- Approx. 14,2 Mg per container

# The melting

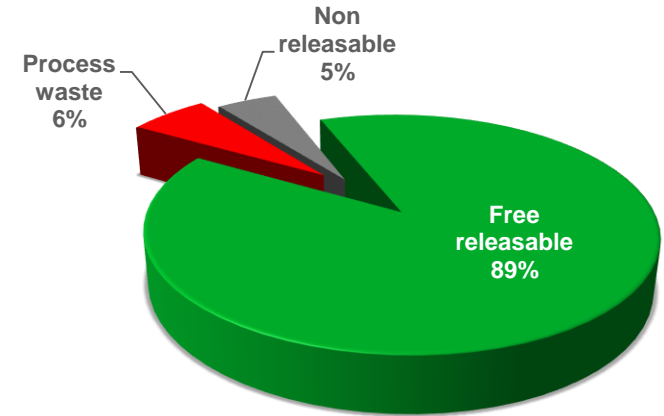
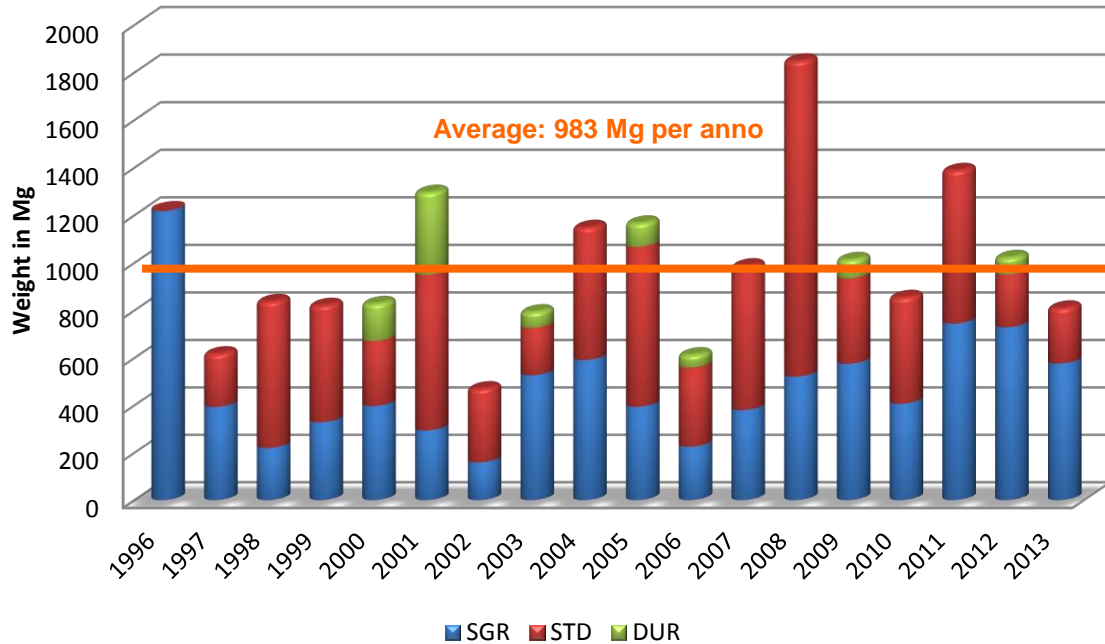
## Advantages of the treatment process

- High volume reduction factor
- Secure handling of treatment products
- Separation of the radioactive nuclides
- Lower efforts for radiological and chemical characterization
- Chemically inert and dry final product
- Simplified verification onto the compliance of the clearance regulations



**→ Minimizing the radioactive waste amount while maximizing the recovery of recyclable material**

# The melting

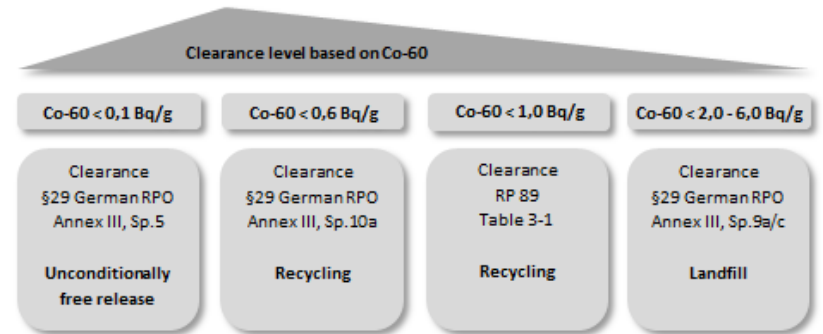


## Summary

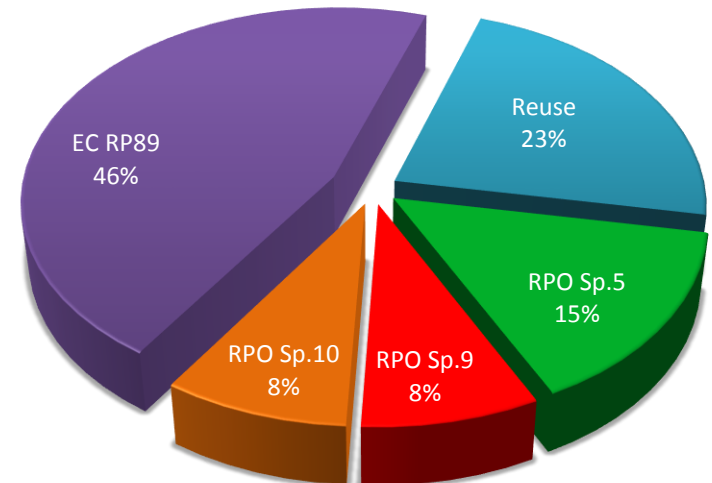
- In total 17.707 Mg of metals melted over three plants
- Resulting share of releasable material about ~ 16.000 Mg (89%)
- Barely 2.000 Mg (11%) remaining as radioactive waste

# Clearance

... based on respective applicable legal regulations and ordinances and its settled limit values



Fractions of approx. 16.000 Mg of releasable material are distributed among individual release and recycling channels



# Treatment of radioactive waste

Further treatment of process residues by GNS:

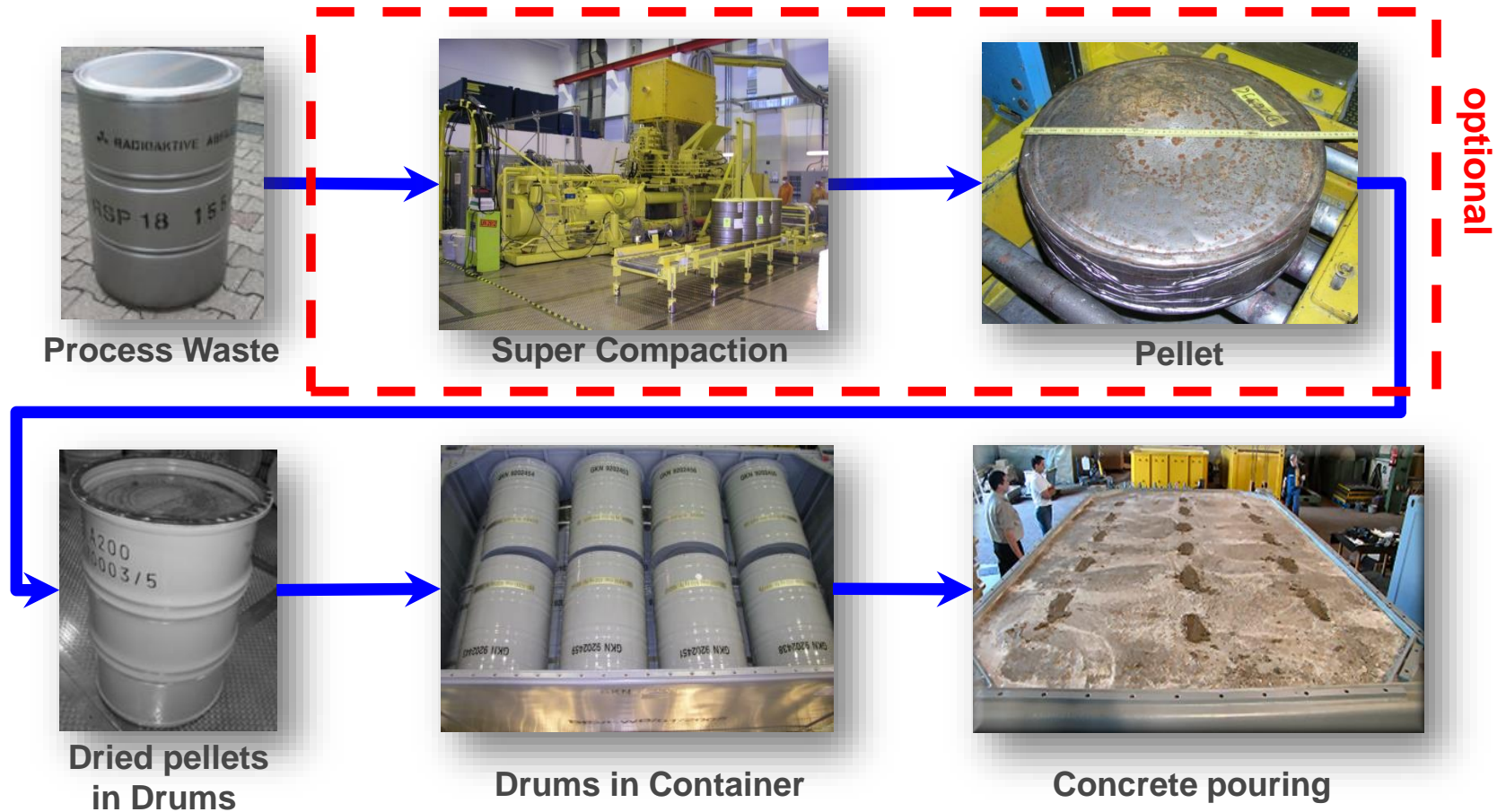
- Super compaction
- Vacuum drying
- Radiological characterization
- Verification of chemical stability
- Packing in a cask for interim/final storage
- Documentation, including consideration of the radiological and water law relevant limits



➔ **Waste packages holding high quality in terms of the German requirements within the interim/final storage**

# Treatment of radioactive waste

...one of many possible solutions





The entire metal melting process represents a

**highly efficient and future-oriented**

way of treatment offered as a

**„care-free package“ by GNS**

and its subcontractors

**... not only for German customers!**

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**Co- author:** Dr. Niemma Buckanie

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