

Final Symposium of the research project

## SeeOff – Strategieentwicklung zum effizienten Rückbau von Offshore-Windparks

Development of efficient strategies for offshore wind farm decommissioning

March 30<sup>th</sup> 2022



**SeeOff**

Strategieentwicklung zum effizienten  
Rückbau von Offshore-Windparks

## SeeOff - Strategieentwicklung zum effizienten Rückbau von Offshore Windparks (Development of strategies for sustainable offshore wind farm decommissioning)

### Project duration:

November 2018 – April 2022

### Projekt coordination:

City University of Applied Sciences Bremen  
Prof. Dr.-Ing. Silke Eckardt

### Website:

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

Supported by:



Federal Ministry  
for Economic Affairs  
and Climate Action

on the basis of a decision  
by the German Bundestag



- 09.00** **Welcome and introduction**  
(Prof. Dr.-Ing. Silke Eckardt, City University of Applied Sciences Bremen)
- 09.20** **Dismantling of offshore wind farms at sea**  
(Bernd Köhler, Deutsche Windtechnik)
- 09.40** **Comminution of offshore wind farm components and recovery of materials at land**  
(Dr. Sven Rausch, Nehlsen AG)
- 10.00** **Q & A Session**
- 10.20** ***Coffee Break and Networking in Lounge-Area***
- 10.35** **Economic efficiency of offshore wind farm decommissioning**  
(Janina Bösche, City University of Applied Sciences Bremen)
- 10.50** **Environmental impacts of offshore wind farm decommissioning**  
(Vanessa Spielmann, City University of Applied Sciences Bremen)
- 11.10** **Occupational safety of offshore wind farm decommissioning**  
(Mandy Ebojie, City University of Applied Sciences Bremen)
- 11.25** **Q & A Session**
- 11.45** ***Lunch Break and Networking in virtual Lounge-Area***
- 12.15** **Bringing economic efficiency, environmental impacts and occupational safety together: Multi criteria decision making for offshore wind farm decommissioning**  
(Vanessa Spielmann, City University of Applied Sciences Bremen)
- 12.30** **Public acceptance of offshore wind farm decommissioning**  
(Philipp Tremer, German Offshore Wind Energy Foundation)
- 12.45** **Q & A Session**
- 13.05** ***Goodbye and subsequent Networking in Lounge-Area***
- 13.45** **Closing of conference platform**

30.03.2022

# Comminution of offshore wind farm components and recovery of materials

How to run a 80.000 t/a scrap yard in a port ?

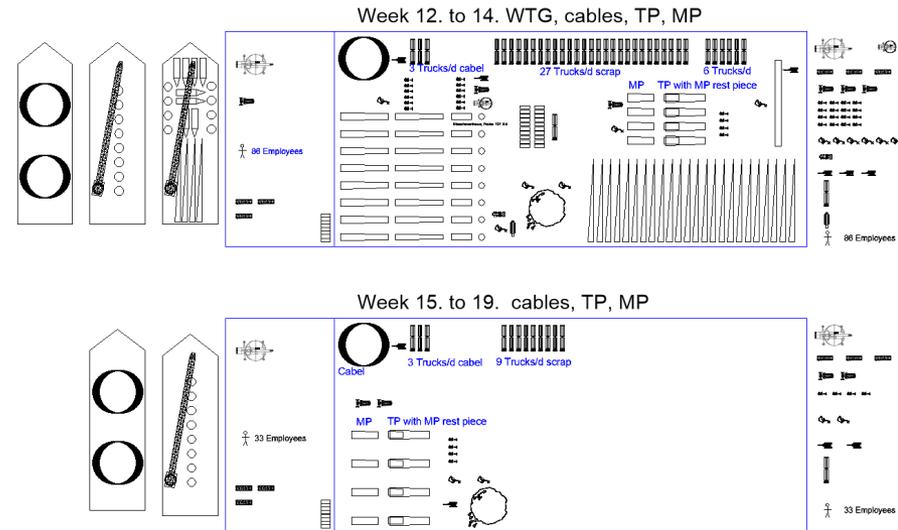
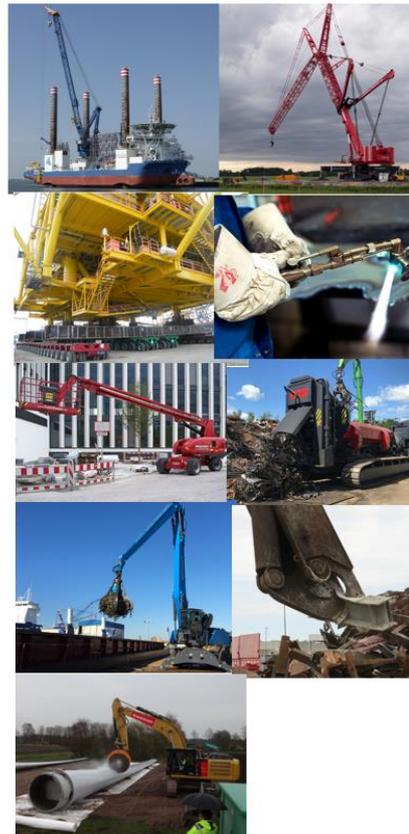
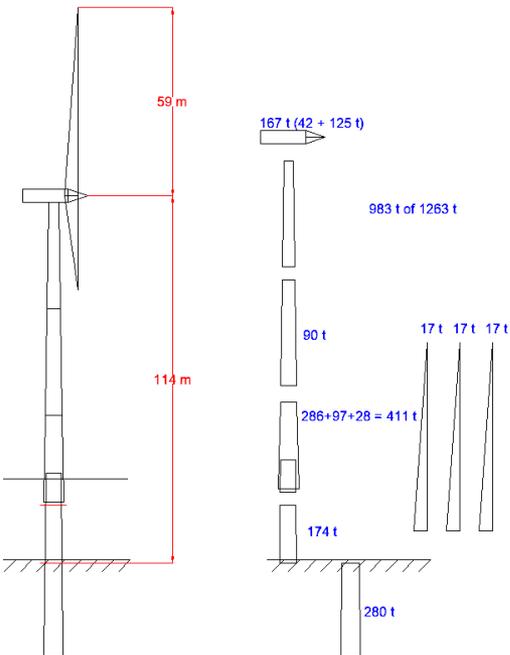
Dr. Sven Rausch  
Nehlsen AG



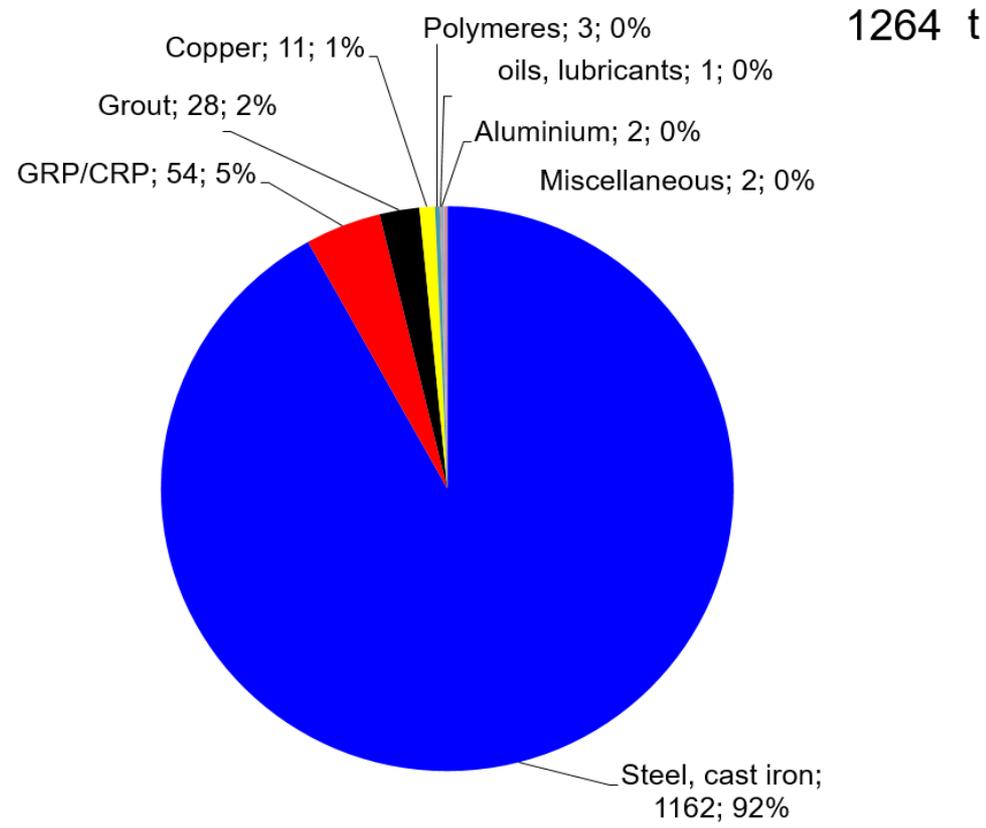
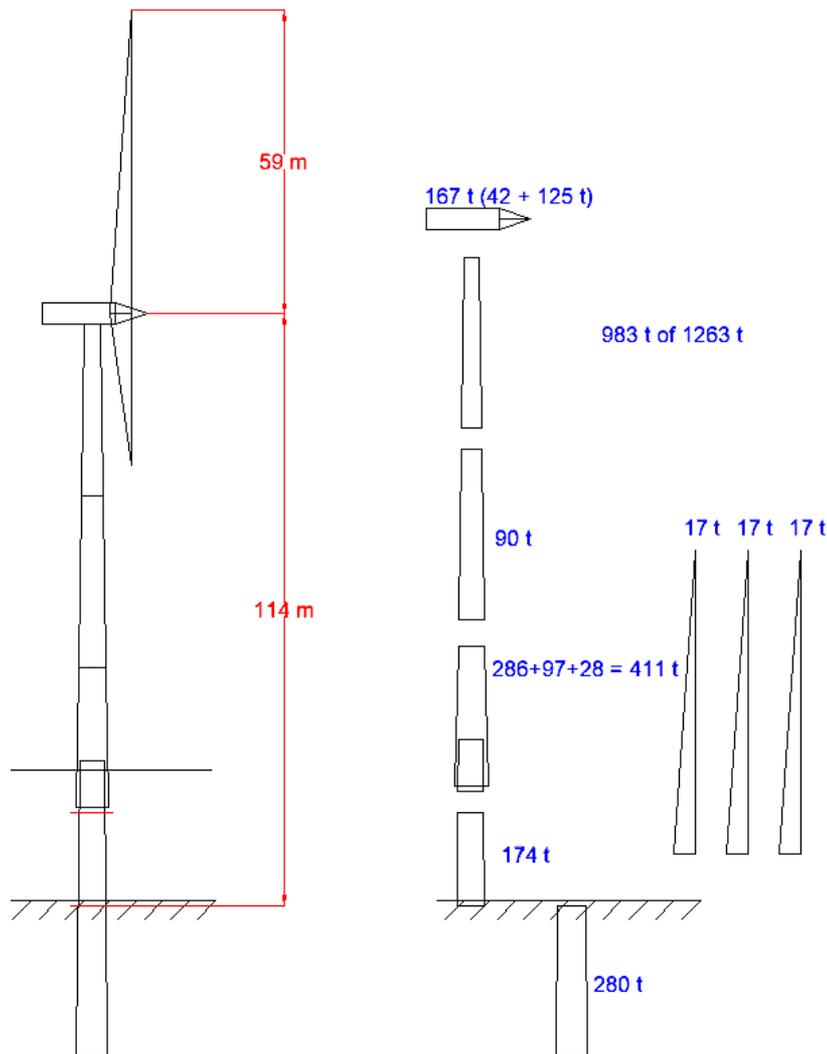
# SeeGff

Strategieentwicklung zum effizienten  
Rückbau von Offshore-Windparks

## Number of pieces vs. time, dimensions, weights, chemical composition, „Tools“, drawing for the different delivery phases for cost estimation



## 8 pieces (max. 411 t, 59 m), $\approx 1000$ t/WTG, $\approx 90\%$ steel, cast iron, 5 % rotorblades (GRP), 1 % copper (cables)



**Basic scenario 8 WT every 14 d, space (150 x 400 m).**

**Large 4. BISchV permission (8.11.2.4, 8.12.2, 8.12.3.2, UVPG, TA Luft, TA Lärm ... ), > 1 year.**



## „Tools“

### Ship crane and big auxiliary crane (load capacity $\approx 750$ t)



Several SPMT's (drive up and down +/- 300 mm,  $\approx$  40 t per axle line, )



## Reach stackers



**Global steel scrap market volume  $\approx$  1700 Mio. t/a (2020)**  
**„DanTysk scrap“  $\approx$  0,080 Mio. t**



## Electric arc furnace (EAF) or cooling scrap for oxygen converter process. scrap size limits 1,5 x 0,5 x 0,5 m

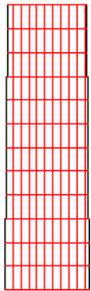


1,5 x 0,5 m → 200.000 steel plates/80 WT, cutting length ≈ 400 km,  
flame cutting speed 30 – 50 cm/min (100 – 25 mm)

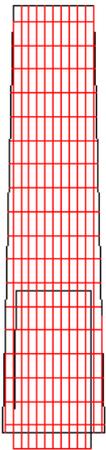
167,4 t (42,4 t + 125 t)



174 t



90 t



90 t



286+96,5+28,3 = 410,8 t



# Peak time (week 12 - 14 tower, MP, TP, nacelle) 20 flame cutters/shift !!!



## oxygen lances for cast iron hubs



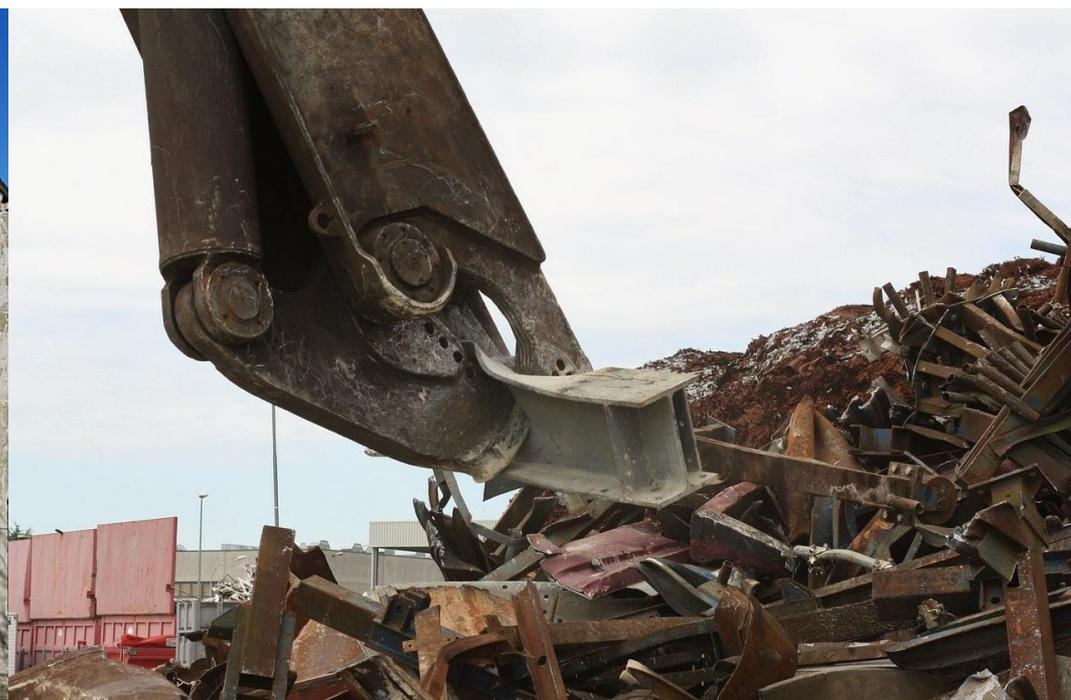
## Flame cutters lifting platforms



## Mobile hydraulic guillotine scrap shear (1000 t)



## Longfront excavator, hydraulic shear for steel profiles, tubes and cables



## Grab excavators for truck, ship or train loading



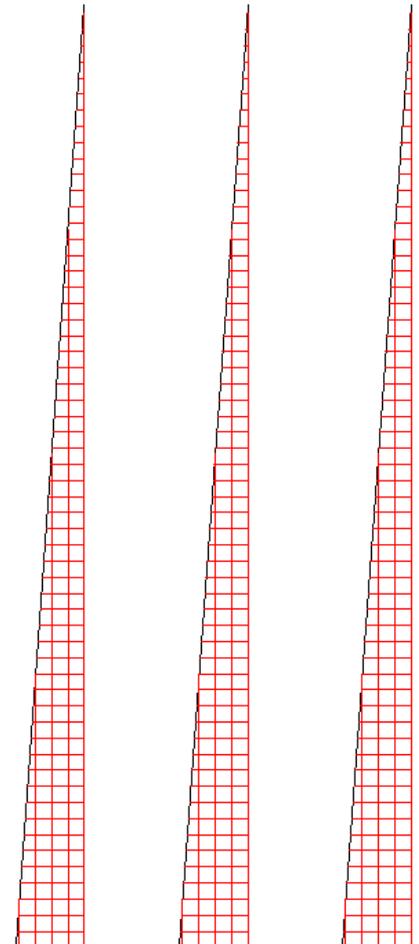
## „neocomp way“, 1. sawing (6 m)



## „neocomp way“, 2. breaking (pieces < ca. 1 x 1 m). Not in the port!



17,2 t 17,2 t 17,2 t



## „neocomp way“, GRP pieces < ca. 1 x 1 m at neocomp GmbH



# „neocomp way“, wet waste paper processing polymer residues



„neocomp way“, 3. breaking and mixing, pieces < ca. 50 cm)



## Mixture of GRP and wet waste paper processing polymer residues



„neocomp way“, 4. breaking , (diameter ca. 3 m, wall outlet ca. 40 mm)



## Final mixture of GRP and wet waste paper processing polymer residues Raw material for the cement kiln < 40 mm



# cement kiln, $\text{SiO}_2$ source and fuel for cement production



## Cable recycling, opening with an angle grinder.



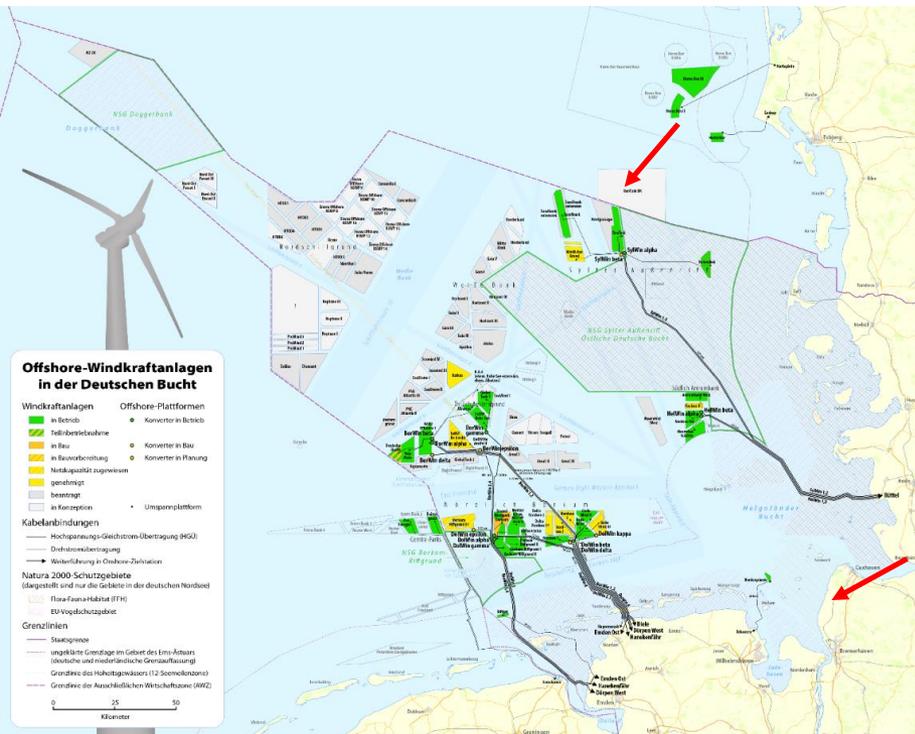
## Cutting with an hydraulic shear.



## Cable slitting and copper recovery.

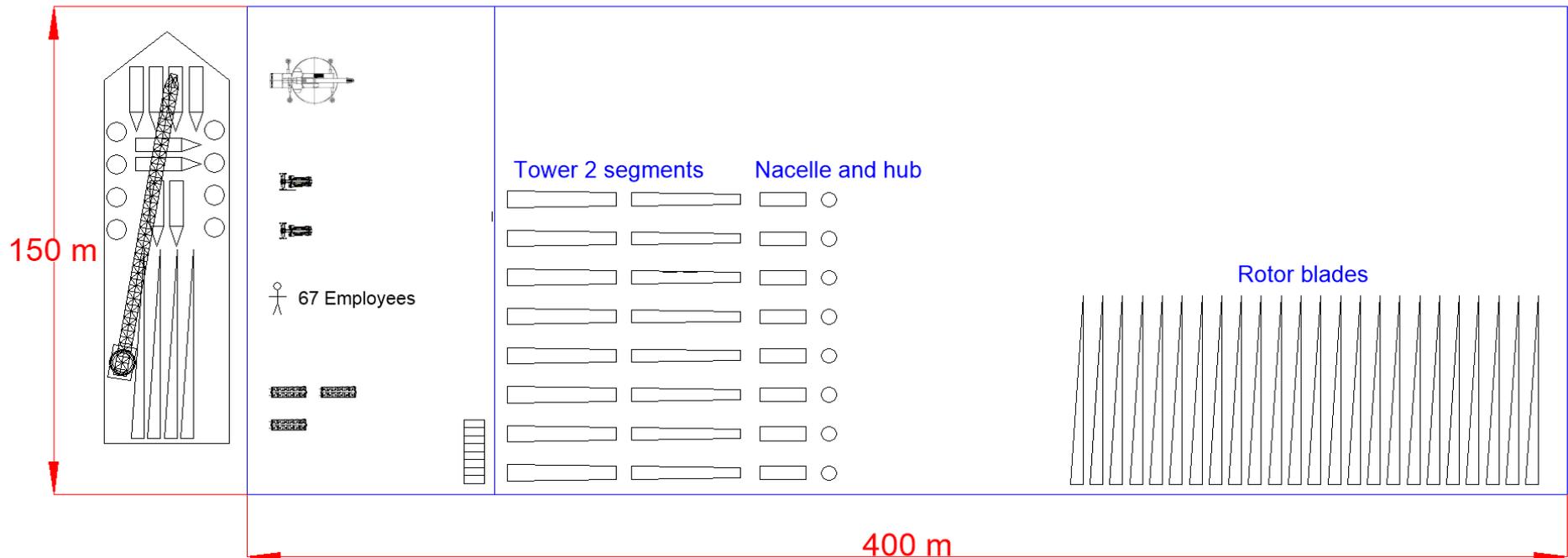


## Ship costs of up to 200000 €/d determine the workflow on land. 80 WT (3,6 MW/WT, Dan Tysk), BHV.



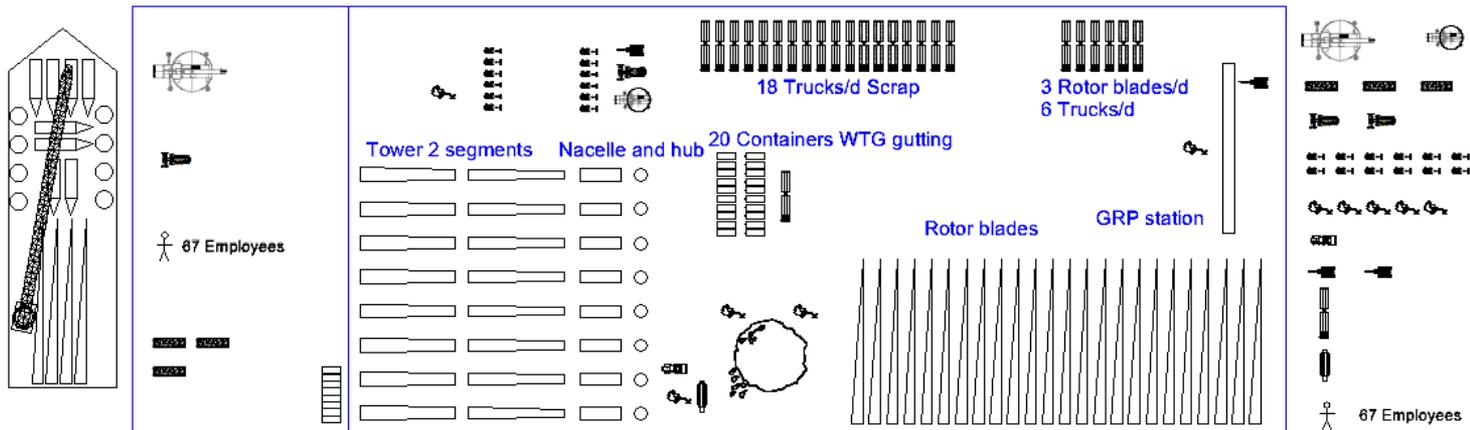
## Scrap yard layout, 8 WTG every 14 d

### Start landing 8 WTG

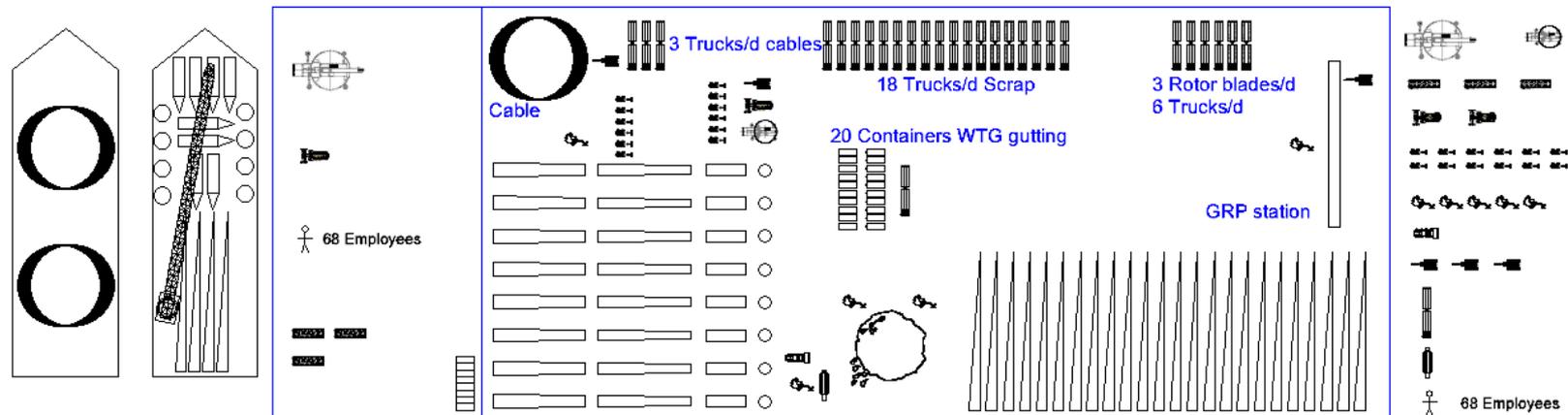


## 10 shifts/w, tower 206 t/d, nacelle 191 t/d, rotor blades 59 t/d, cables 66 t/d

### Week 1. to 9. WTG

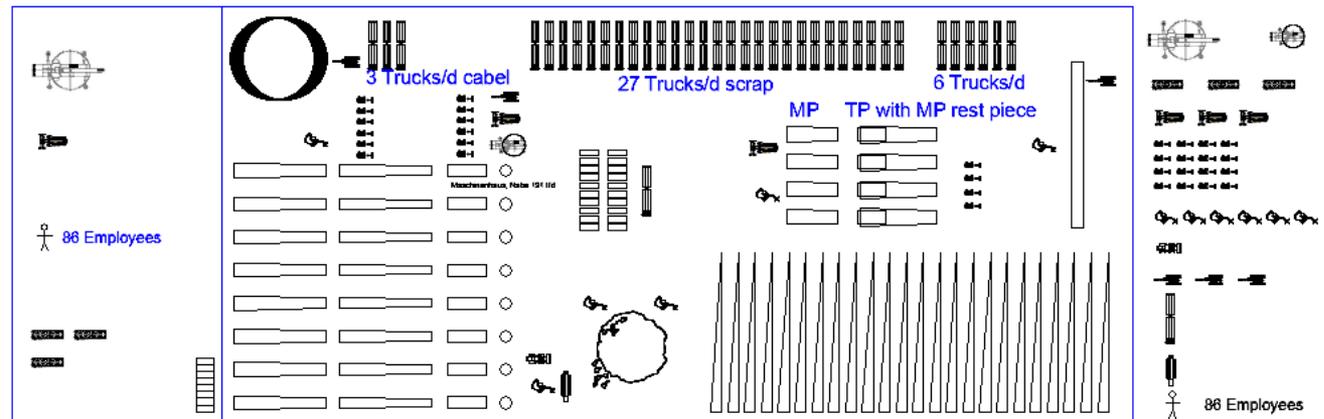
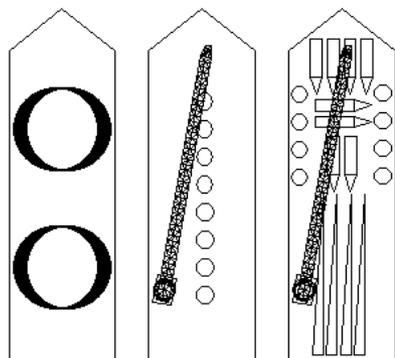


### Week 10. to 11. WTG and cables

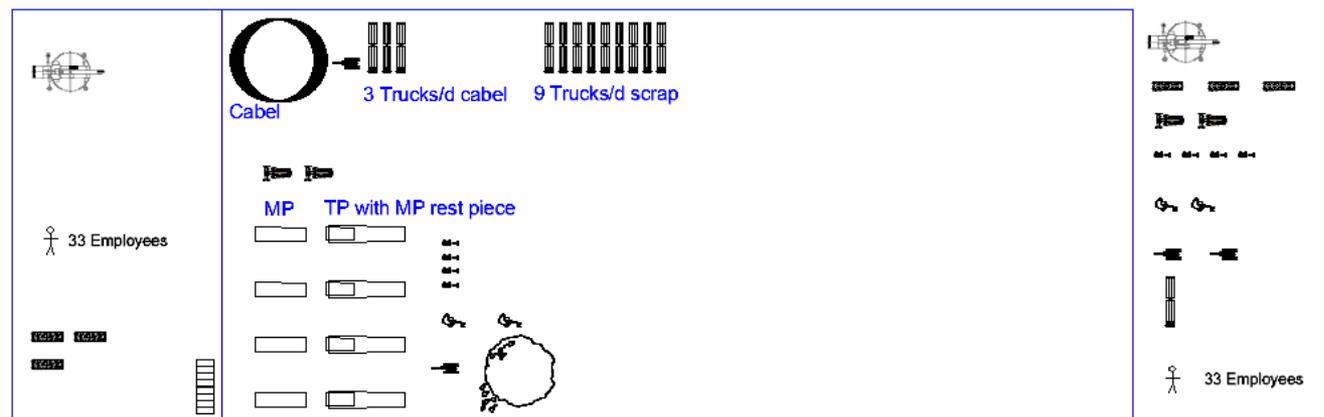
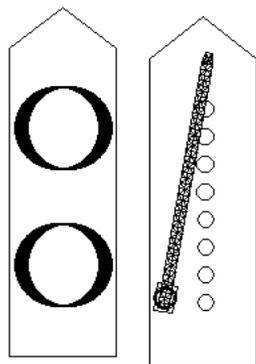


## 10 shifts/w, tower 206 t/d, nacelle 191 t/d, rotor blades 59 t/d, cables 66 t/d, TP + MP 203 t/d

### Week 12. to 14. WTG, cables, TP, MP

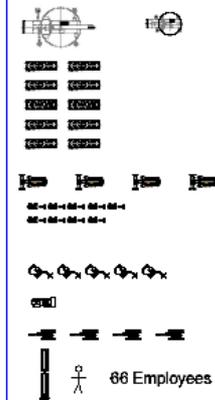
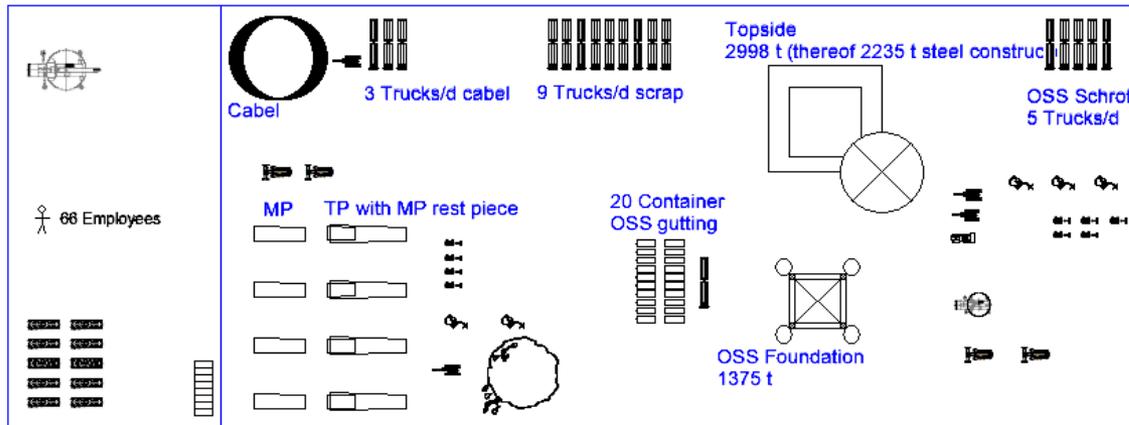
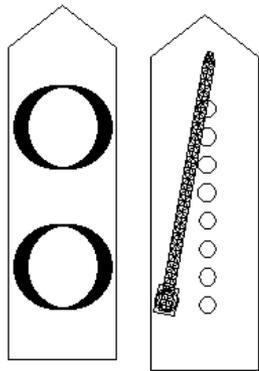


### Week 15. to 19. cables, TP, MP

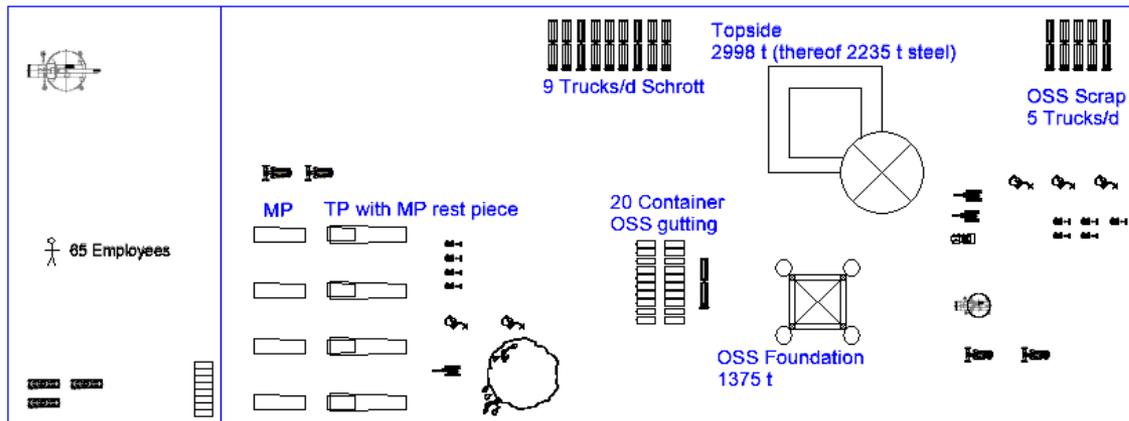
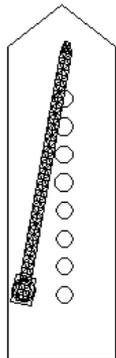


## 10 shifts/w, rotor blades 59 t/d, cables 66 t/d, TP + MP 203 t/d, OSS 109 t/d

### Week 20. to 21. cables, TP, MP, OSS

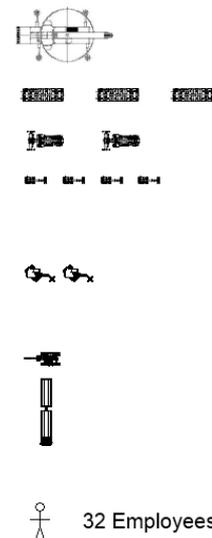
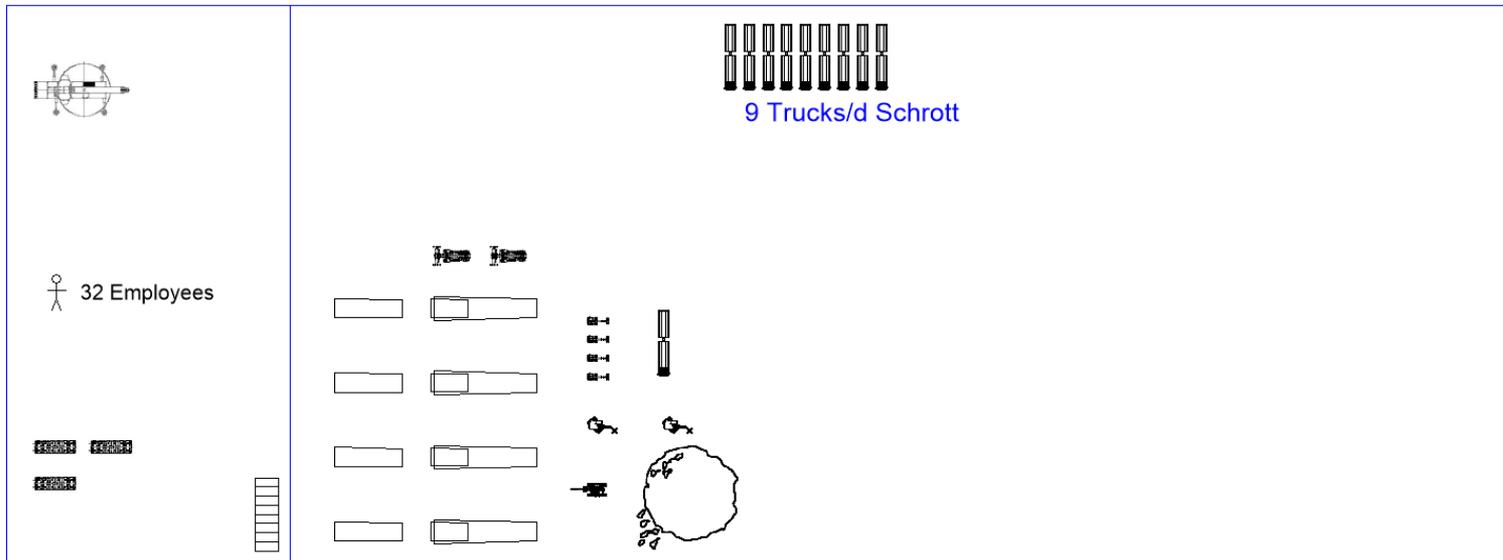
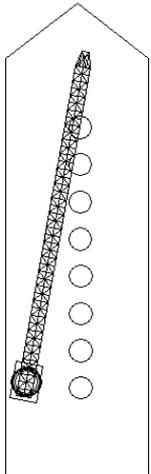


### Week 22. to 27. TP, MP, OSS



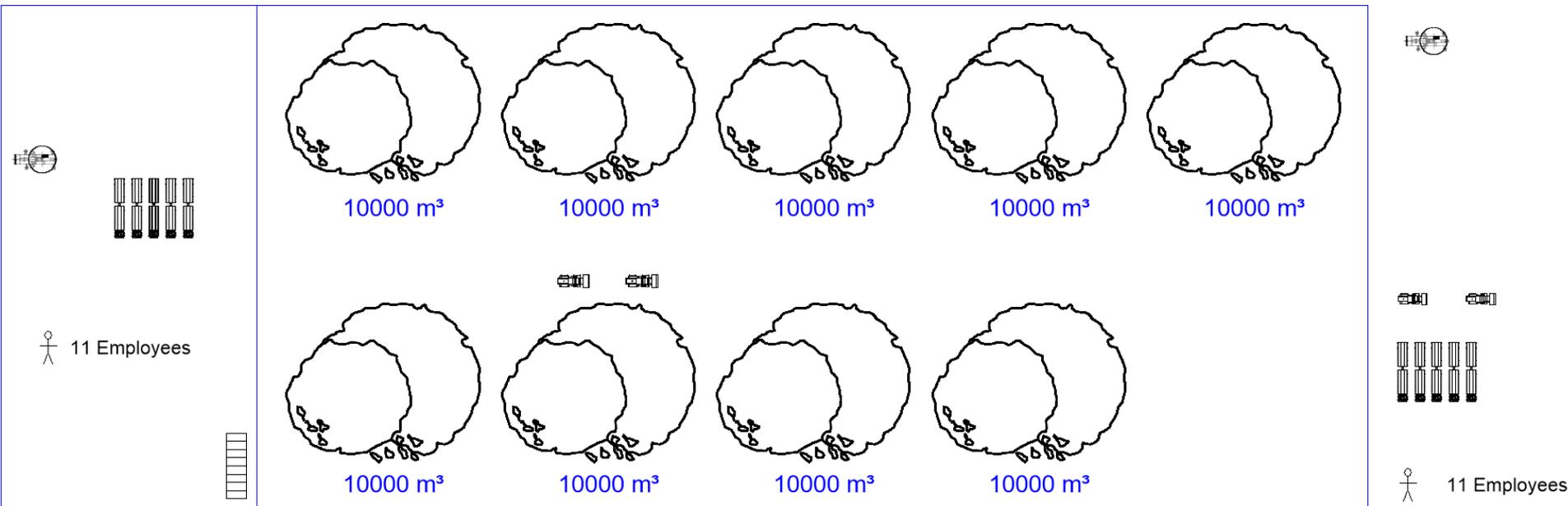
## 10 shifts/w, TP + MP 203 t/d

Week 28. to 57. TP, MP



# Unloading 117.000 t scour protection („stones“) in 6 weeks ≈ 4600 truck loads !!!

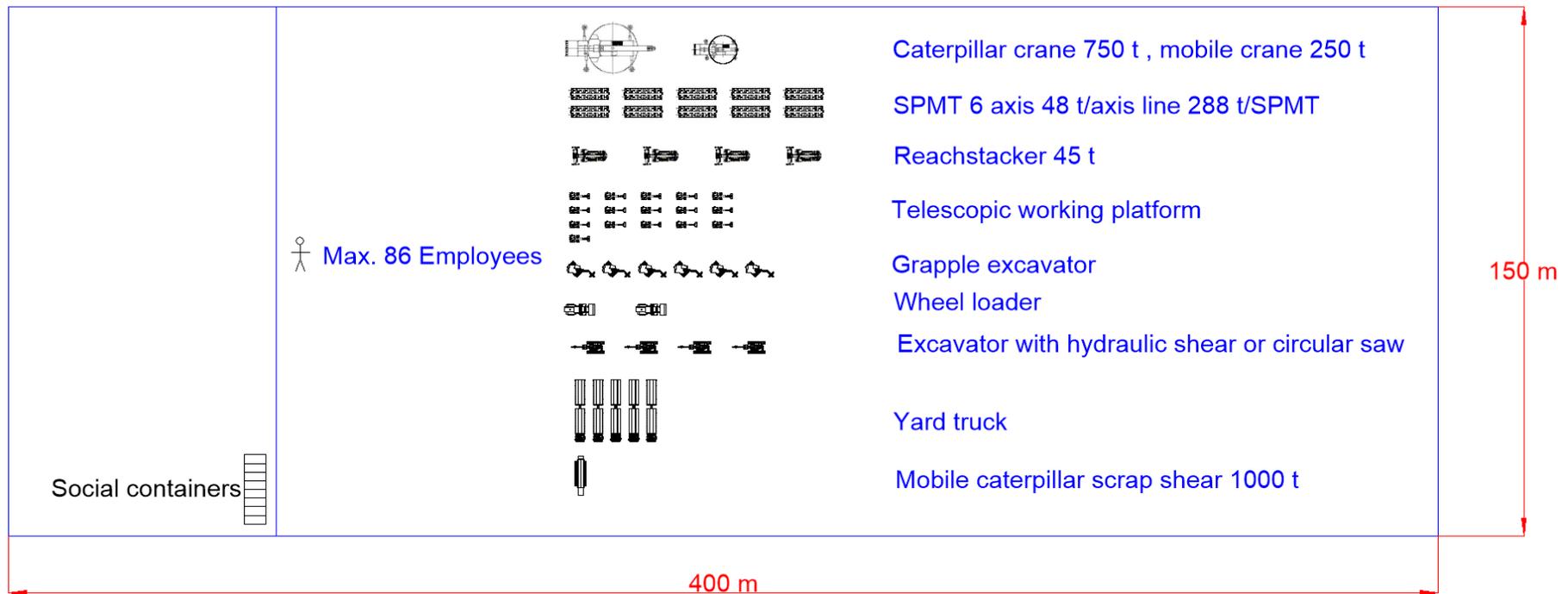
Week 58. to 63. scour protection



## Summary 1/2

Space 400 m x 150 m, up to 86 employees and a large machine park

### Maximum machine park



## Summary 2/2

1. Ship costs of up to 200000 €/d determine the workflow on land.
2. Don't save on space, machinery and personell due to high ship costs!
3. Don't underestimate the effort for a 4. BISchV permission (> 1 a) for a 80000 t/a port scrap yard (dust, noise, smell, traffic, water pollutant, work security ...).

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