

Waste Management of NORM Rejects and Hazardous Waste in Offshore Oil and Gas Production in Brazil (2002–2018)

MARCELO M. VALINHAS

Waste Management of NORM Rejects and Hazardous Waste

SUMMARY

1 INTRODUCTION

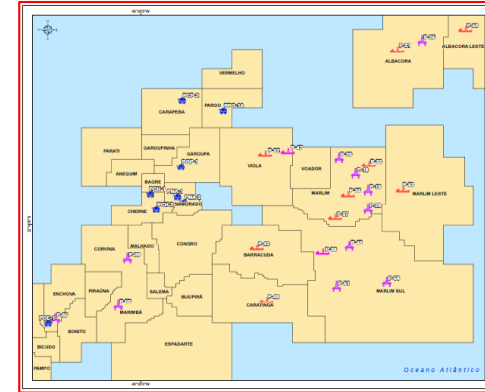
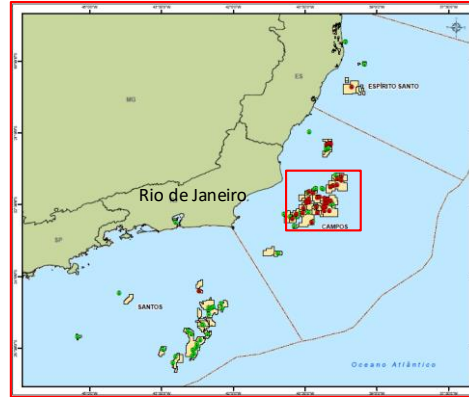
2 WASTE GENERATION

3 NORM WASTE STORAGE

4 CHALLENGES TO NORM WASTE DISPOSAL



Oil and Gas Exploration and Production – Brazil-Campos Basin



Daily Output

2.63 million barrels of oil equivalent a day. (10 th producer in the world)

Production Wells

7,265 (oil and gas)

Production Platforms

113

Daily Output

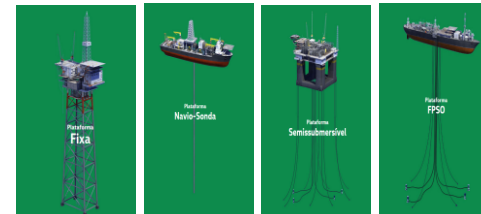
One million barrels of oil equivalent a day.

Production Wells

565 (oil and gas)

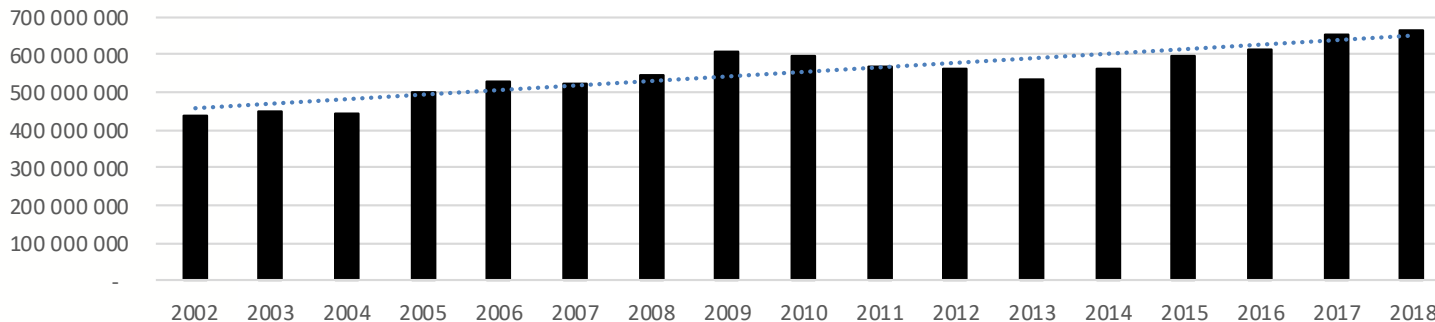
Production Platforms

52



Oil and Sludge Production – Campos Basin

Oil Barrels

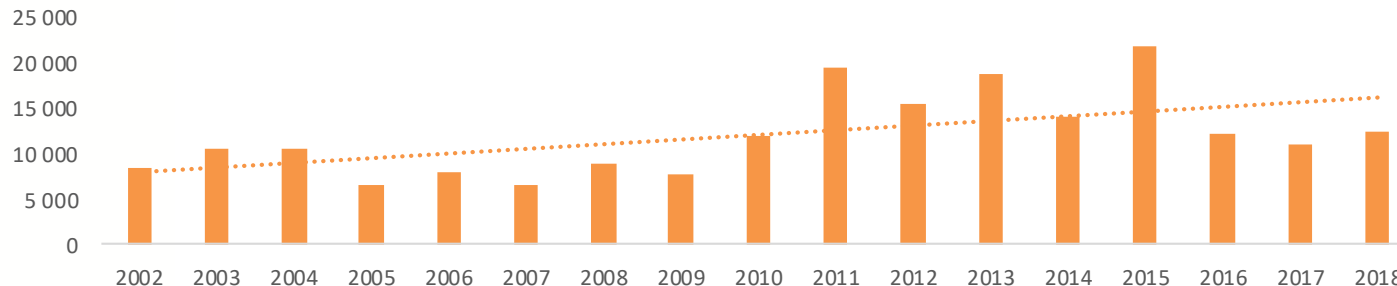


Around
46,000



Source: ANP website, 2019 - One barrel equivalent to 42 US gallons or 158,9873 liters

Sludge Drums (E&P)

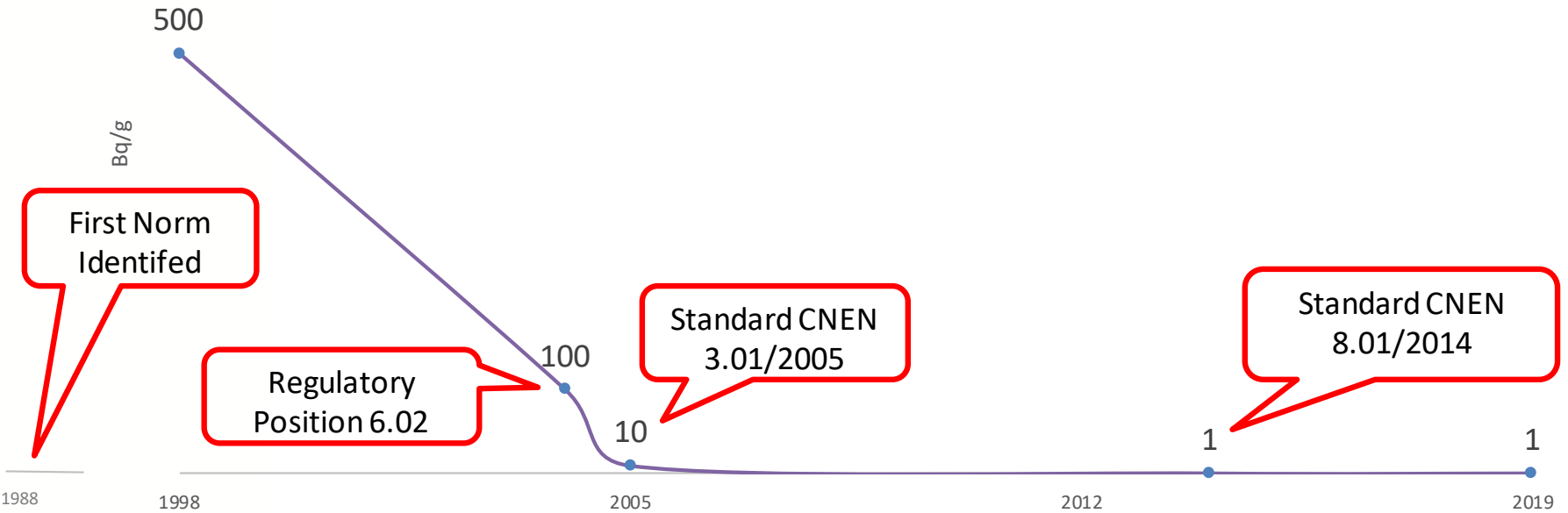


1



Source: SIGRE, 2019 - One drum equivalent to 140 liters

Regulations in Brazil - Clearance Level Ra 226



CNEN - Clearance Level Ra 226 and Ra 228 (Bq/g)

Clearance level - value, established by CNEN and expressed in terms of activity concentration and/or total activity, at or below which a source of radiation may be released from regulatory control . (Source:Nuclear Safety Glossary)

Waste Management of NORM Rejects and Hazardous Waste

1 PRESENTATION

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3 NORM WASTE STORAGE

4 CHALLENGES NORM WASTE DISPOSAL

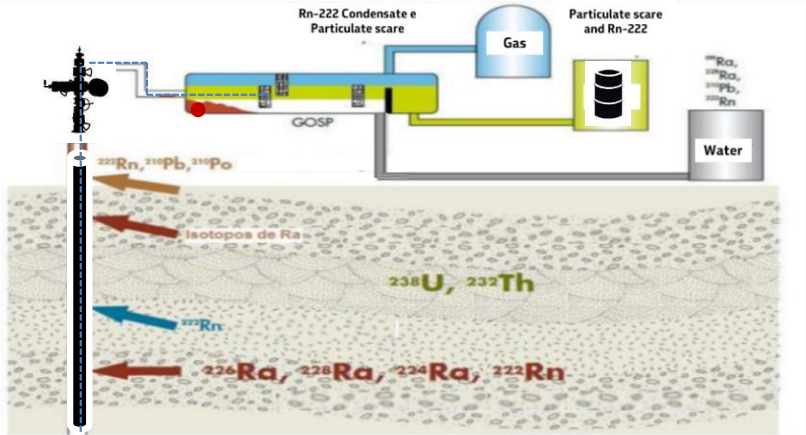


E&P Offshore Oil – Aspects and Impact

PRODUCTION

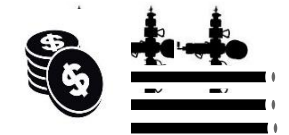
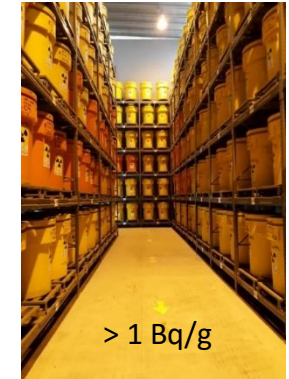
GENERATION

DISPOSAL



SLUDGE

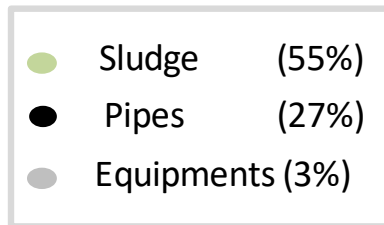
SCALE



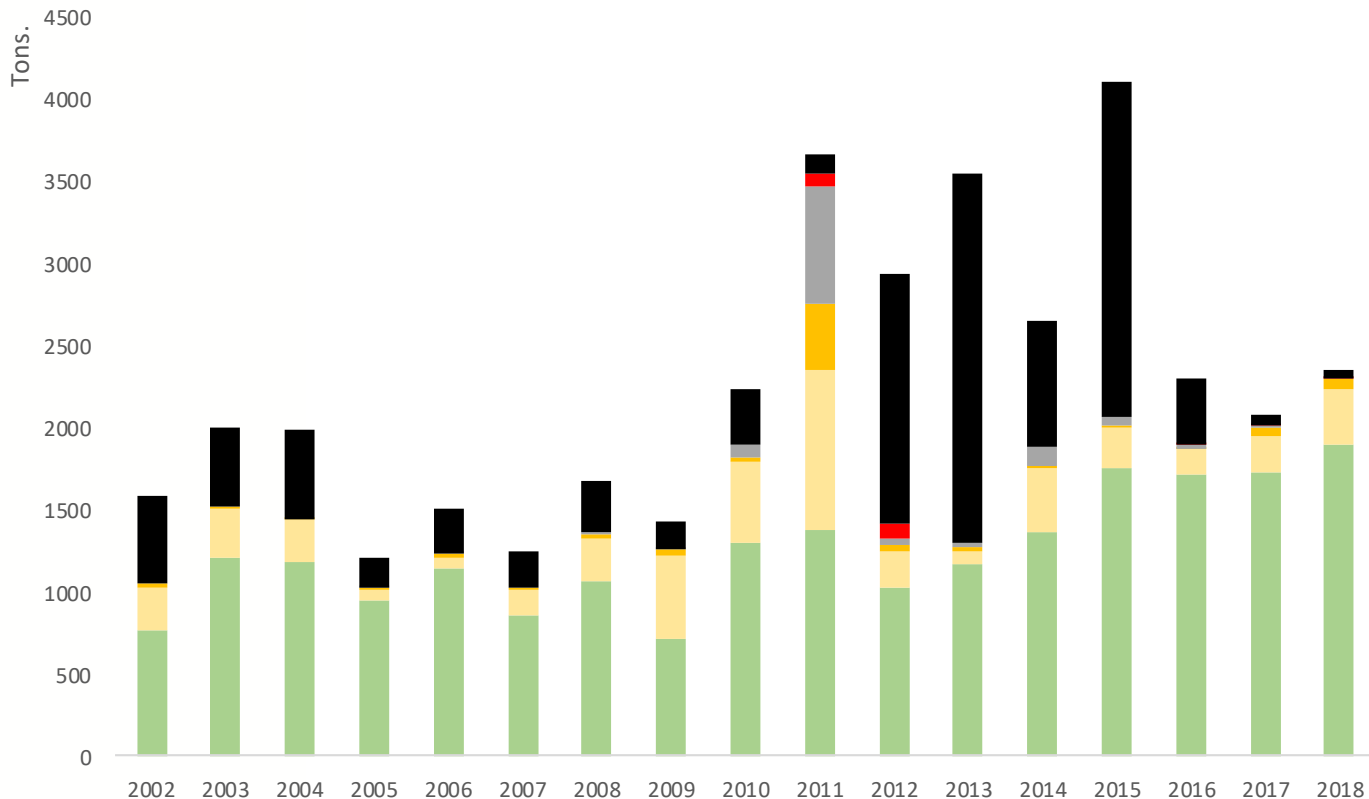
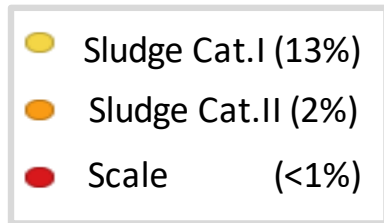
Contaminated Generated Waste



3R Waste (85%)



Reject (15 %)



Clean Service in Offshore Tanks

Clean Service



Generation



SLUDGE CAT II
(higher than 5.0 $\mu\text{S}/\text{h}$)



SLUDGE CAT I
(between 0.5 and 5 $\mu\text{S}/\text{h}$)



SLUDGE
(BG)

Disposal

Temporary Storage

800 ton

Temporary Storage

1,000 ton
(from 2014 on)

Industrial Landfill
(after encapsulation)

4,000 ton
(until 2014)

Coprocessing

21,000 ton



Recycled Pipes and Equipment

Temporary Storage



More than 79 thousand units

Clean Service



1,000 ton



10,000 ton

Generation

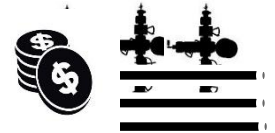
Scrap Metal
without NORM

± 11,000 ton

Scale with NORM

190 ton

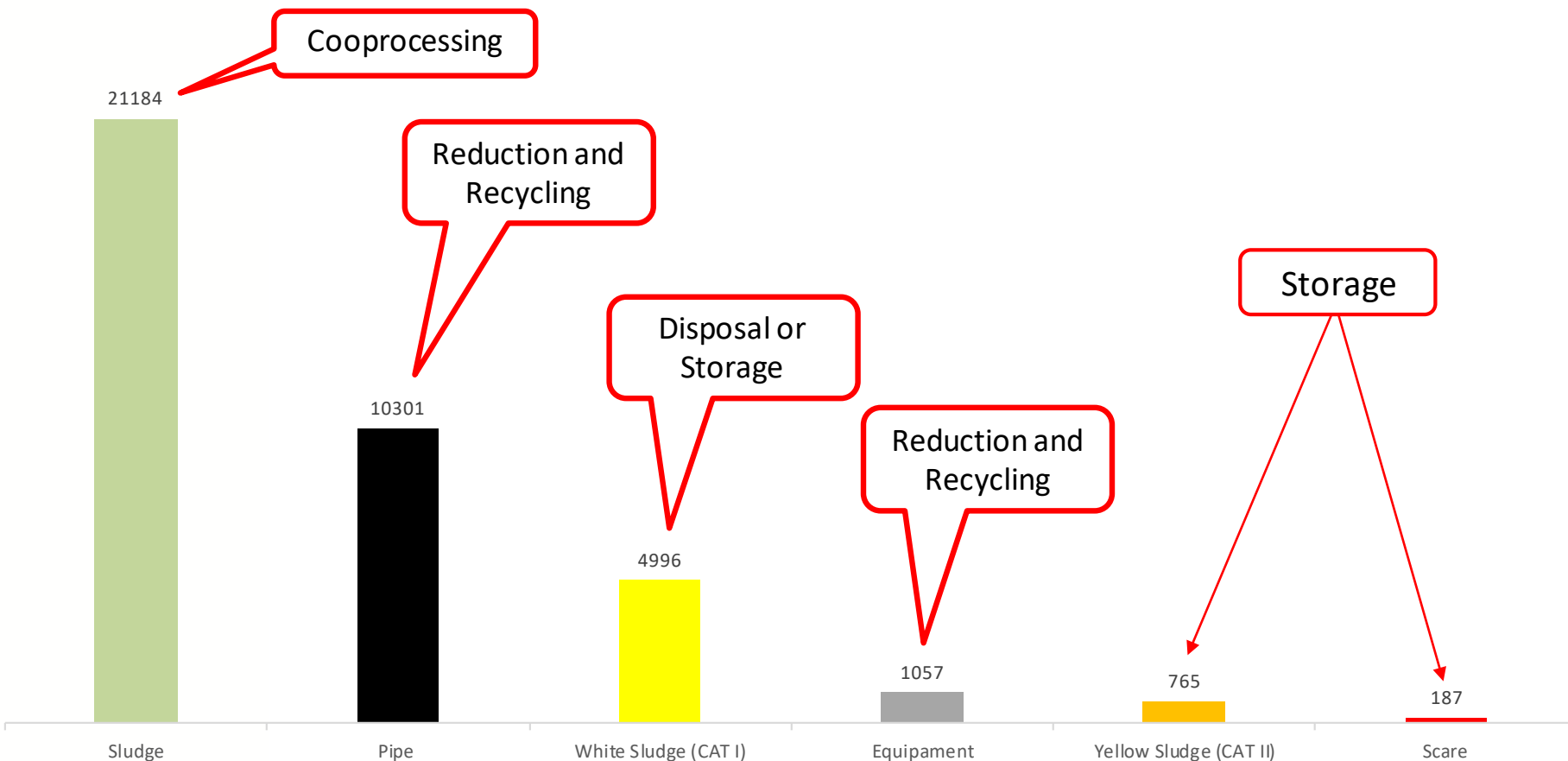
Disposal



760

Disposal of Generated Waste (2002-2018)

Ton.



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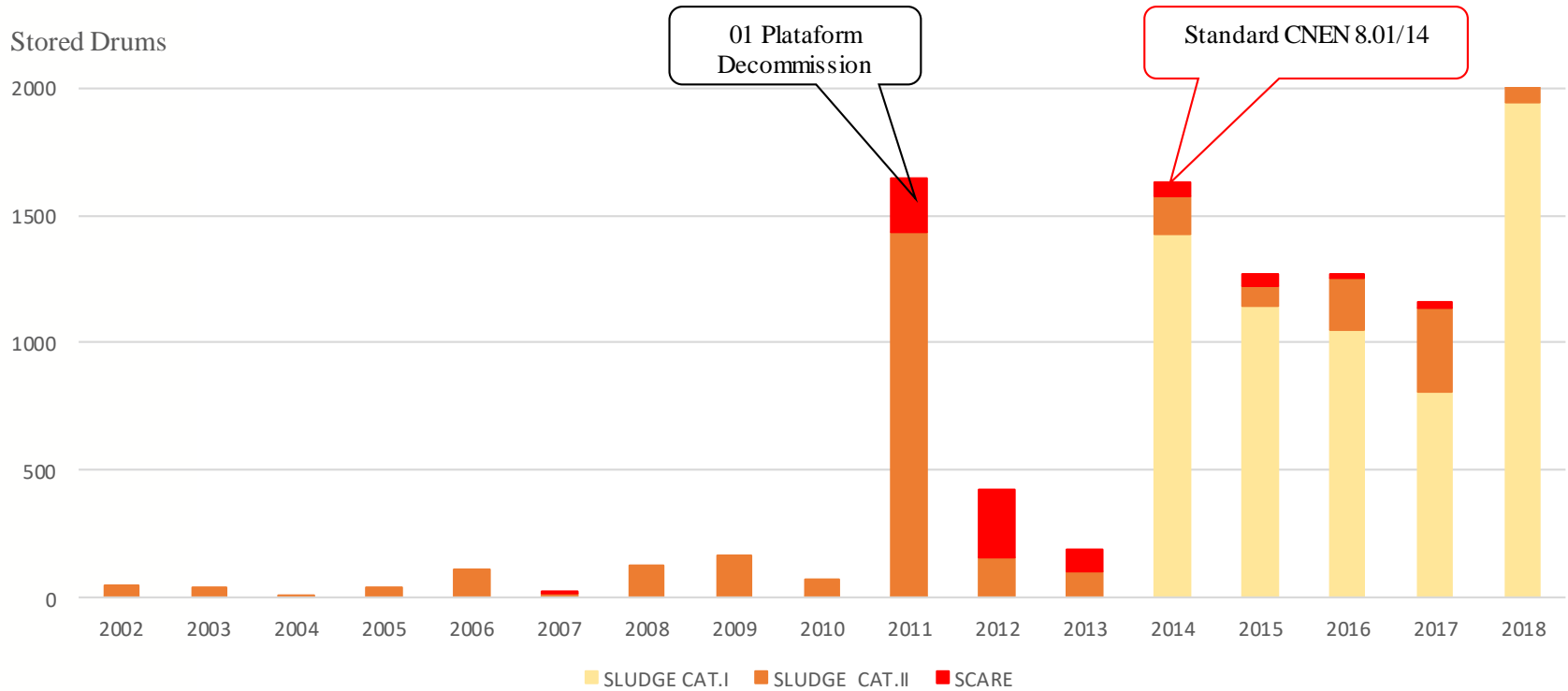
2 WASTE GENERATION

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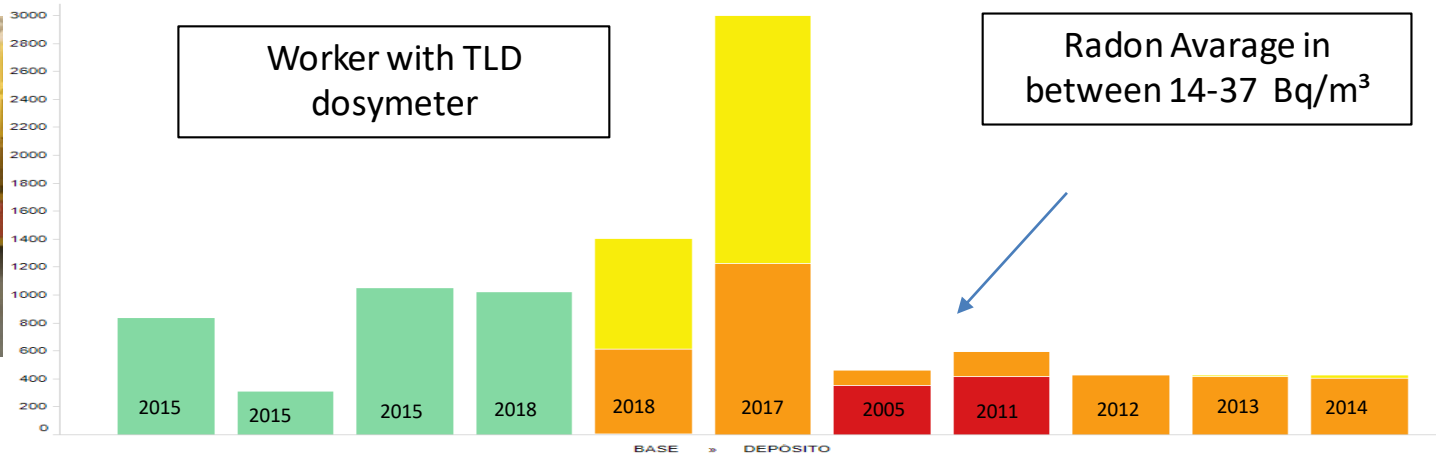
4 PROSPECT TO NORM WASTE DISPOSAL



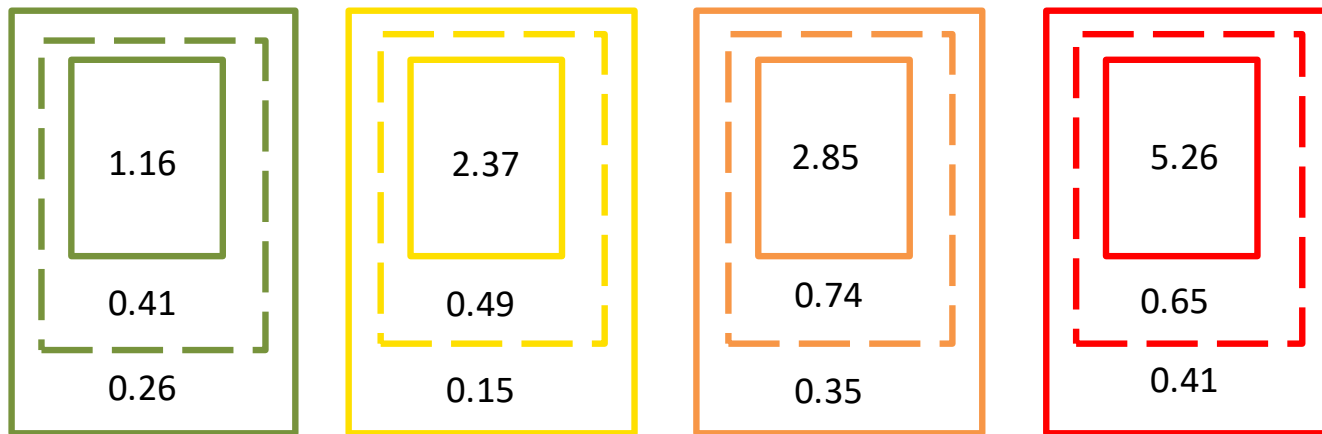
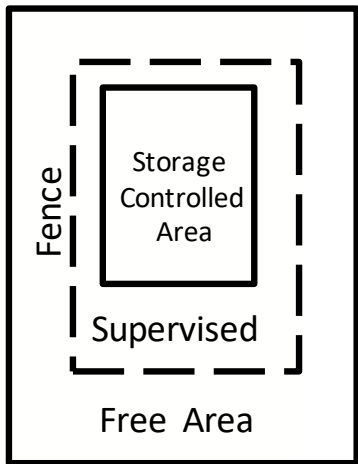
Accumulated Drums in Storage Facility



Number of drums per Storage Facility (11)

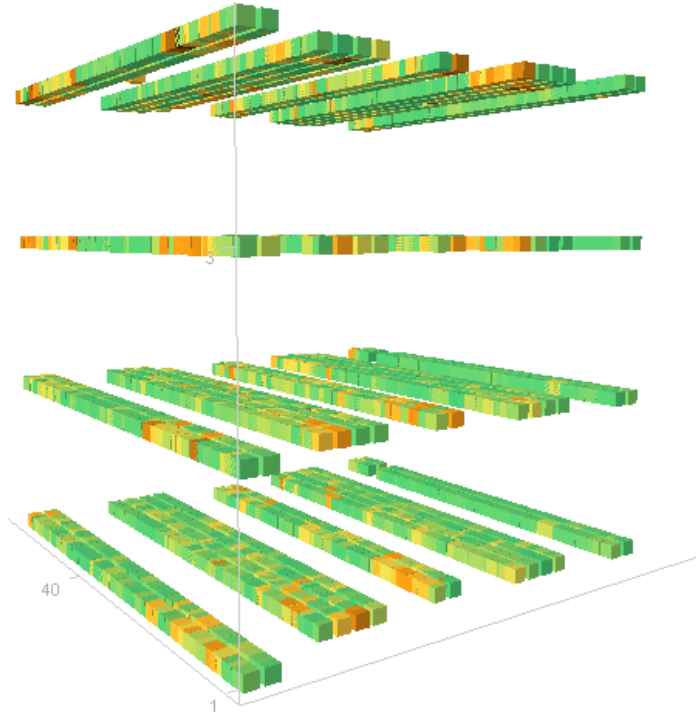


Monitoring Area



Rate Exposure ($\mu\text{S/h}$) Radeye PRD Equipment

Storage Facility Control



Rate Exposure Control by localization
Radeye PRD Equipment

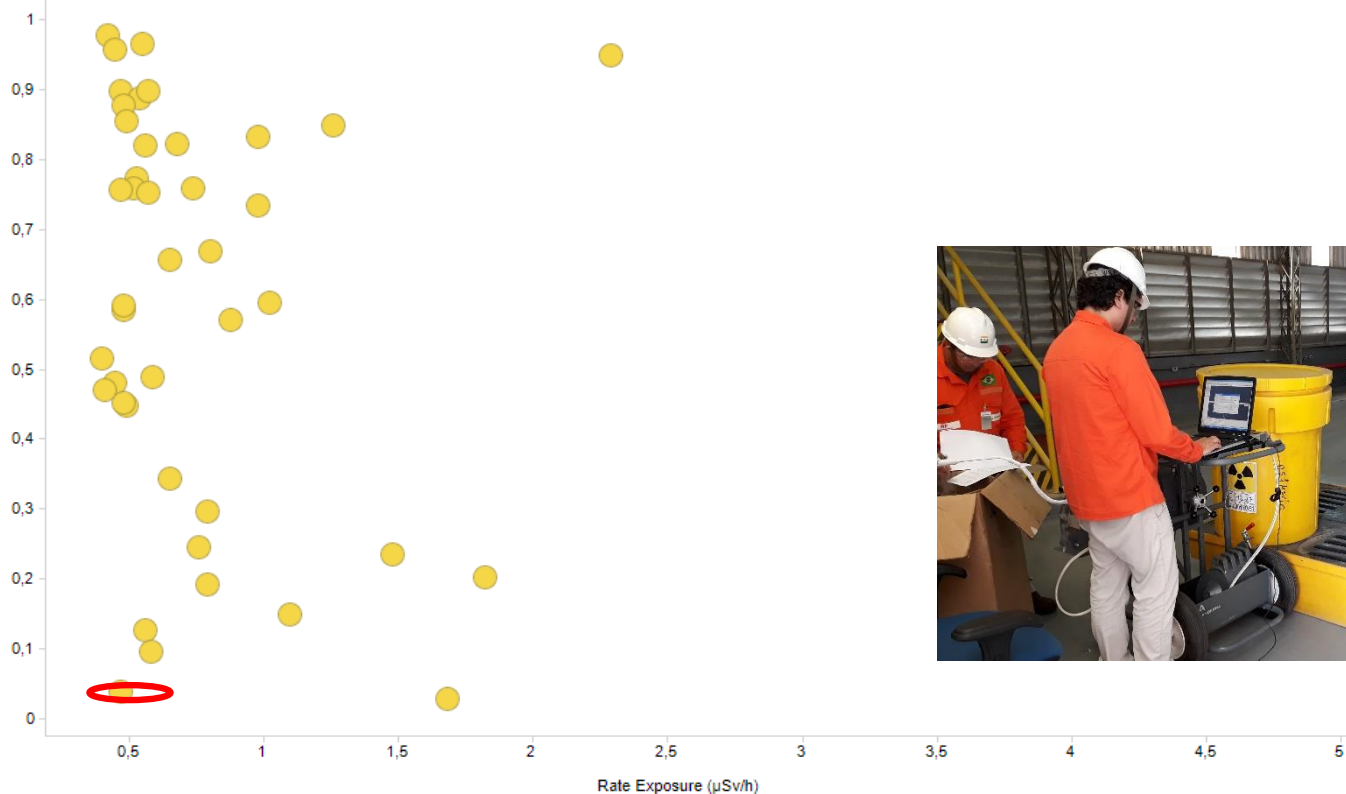
$\mu\text{S/h}$ 10 5 1

Correlation External Exposure – Activity by Waste Type

Activity Ra-226 (Bq/g) vs. Exposure Rate ($\mu\text{Sv/h}$)
Analytical Results Ra-226 (Bq/g) vs. Rate Exposure ($\mu\text{Sv/h}$)

Ra 226 Bq/g

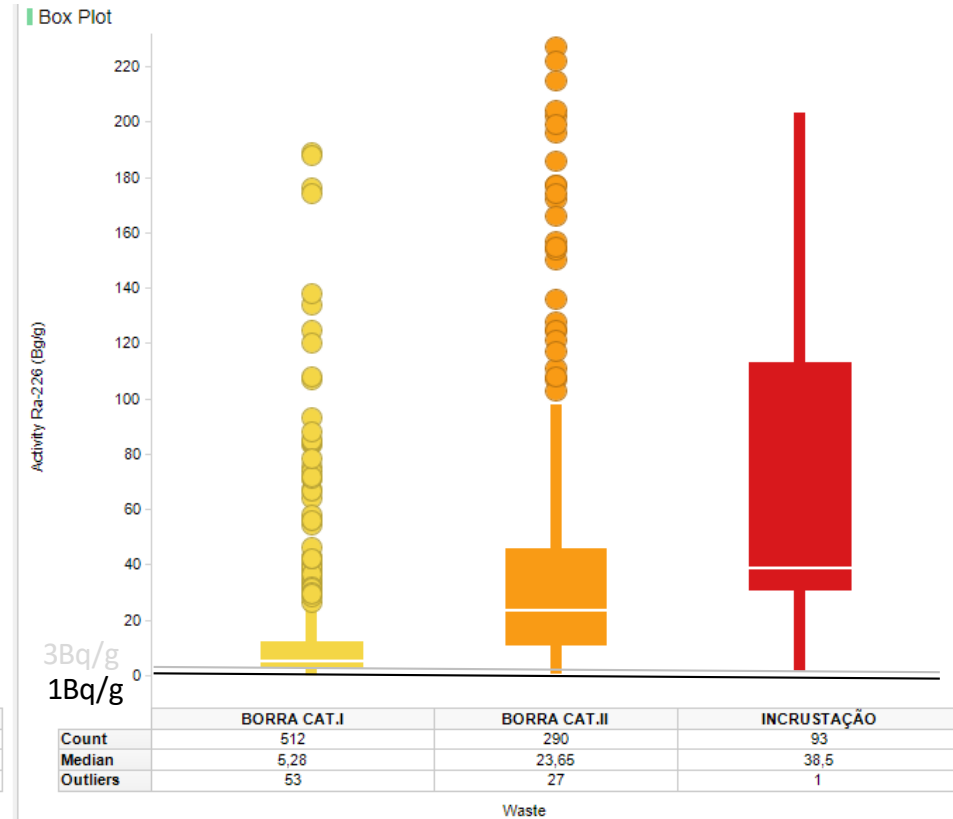
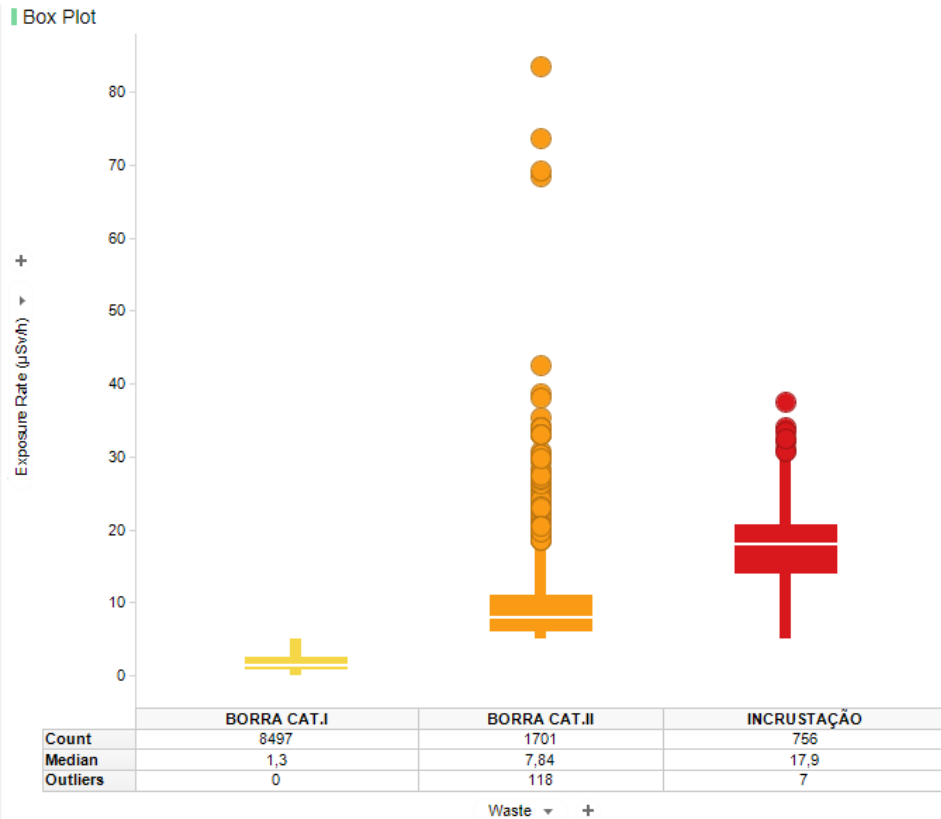
Analytical Results Ra-226 (Bq/g)



- Sludge Cat.I
- Sludge Cat.II
- scale



Exposure and Activity by Waste Type



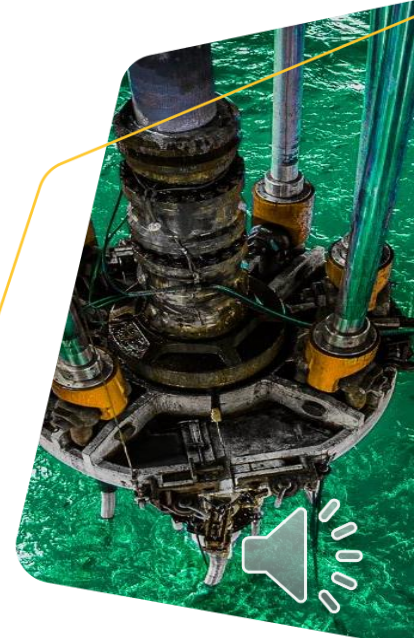
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Challenges

PRODUCTION INCREASE

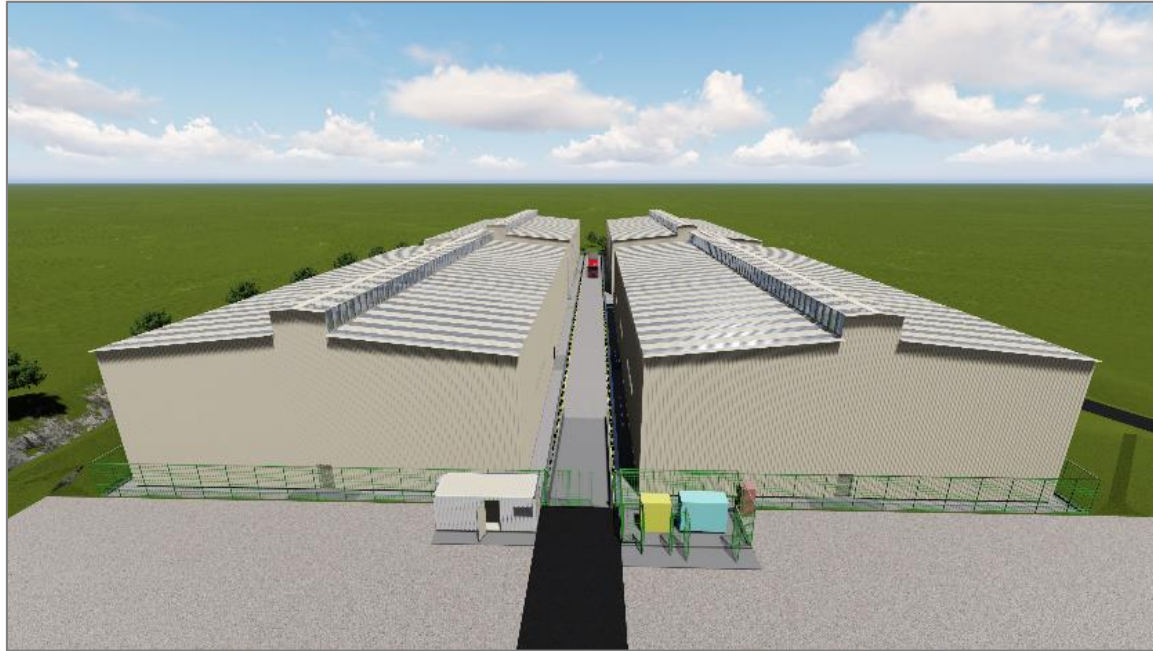
PLATAFORMAS DECOMMISSION

SAMPLING DRUM BY DRUM

BUILD AND LICENSING NEW FACILITY

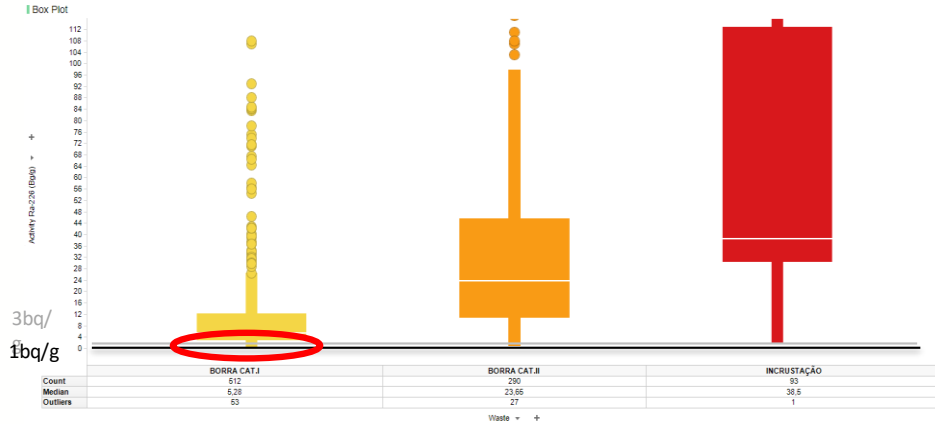
COMMERCIAL SOLUTIONS IN BRAZIL

BEST COST TO STORE

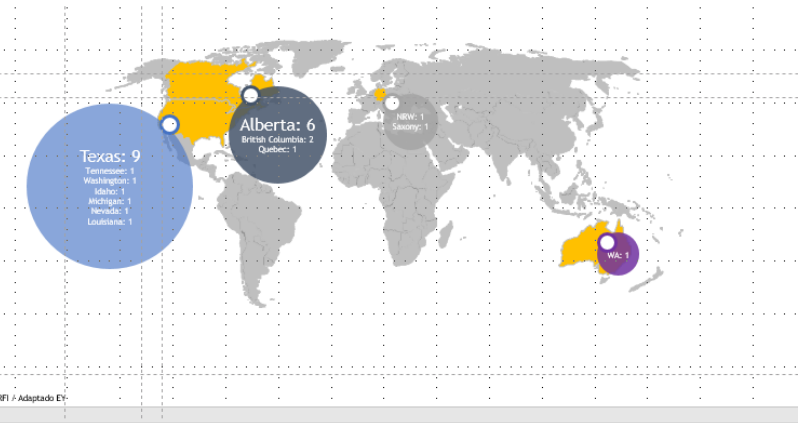
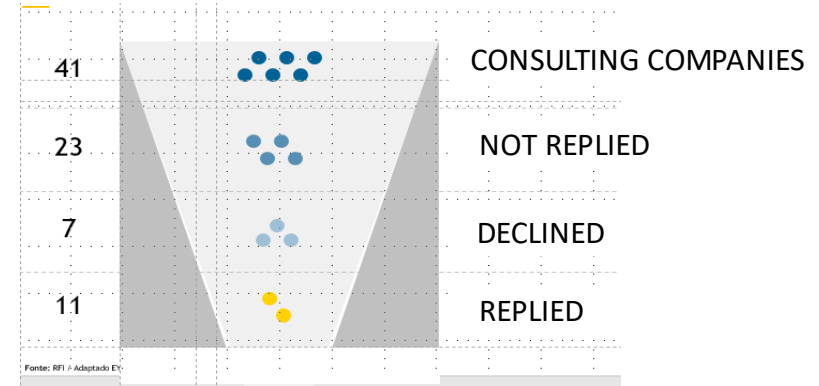


Challenges

Conditional Dispense for the lowest Activity to Ra 226 in the Sludge Category I



Exportation - RFI



Marcelo Valinhas
mvalinhas@petrobras.com.br