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

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Waste Management of NORM Rejects and Hazardous Waste

**SUMMARY**

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Oil and Gas Exploration and Production – Brazil-Campos Basin

Daily Output
2.63 million barrels of oil equivalent a day. (10th 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

Source: www.petrobras.com.br/em/our-activities
Oil and Sludge Production – Campos Basin

Oil Barrels

Source: ANP website, 2019 - One barrel equivalent to 42 US gallons or 158,987 liters

Sludge Drums (E&P)

Source: SIGRE, 2019 - One drum equivalent to 140 liters
Regulations in Brazil - Clearance Level Ra 226

**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
2. WASTE GENERATION
3. NORM WASTE STORAGE
4. CHALLENGES NORM WASTE DISPOSAL
E&P Offshore Oil – Aspects and Impact

**PRODUCTION**

**GENERATION**

**DISPOSAL**

Source: Petrobras – RT LO31/2017
Contaminated Generated Waste

- **3R Waste (85%)**
  - Sludge (55%)
  - Pipes (27%)
  - Equipments (3%)

- **Reject (15%)**
  - Sludge Cat.I (13%)
  - Sludge Cat.II (2%)
  - Scale (<1%)
Clean Service in Offshore Tanks

Clean Service

Generation

SLUDGE CAT II
(higher than 5.0 µS/h)

SLUDGE CAT I
(between 0.5 and 5 µS/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

Clean Service

Generation

Disposal

More than 79 thousand units

1,000 ton

10,000 ton

Scrap Metal without NORM

± 11,000 ton

Scale with NORM

190 ton

760

- **Sludge**: 21,184 Ton.
- **Pipe**: 10,301 Ton.
- **White Sludge (CAT I)**: 4,996 Ton.
- **Equipment**: 1,057 Ton.
- **Yellow Sludge (CAT II)**: 765 Ton.
- **Scare**: 187 Ton.

- **Coprocessing**
- **Reduction and Recycling**
- **Disposal or Storage**
- **Reduction and Recycling**
- **Storage**
Waste Management of NORM Rejects and Hazardous Waste

1. PRESENTATION
2. WASTE GENERATION
3. WASTE STORAGE
4. PROSPECT TO NORM WASTE DISPOSAL
Number of drums per Storage Facility (11)

Worker with TLD dosymeter

Radon Average in between 14-37 Bq/m³

Monitoring Area

Storage Controlled Area

Supervised Free Area

Rate Exposure (µS/h) Radeye PRD Equipment

Fence


2.37 1.16 2.85

2.37 0.41 0.49 0.15 0.74 0.35

2005 2011 2012 2013 2014

5.26 0.65 0.41

2015 2015 2015 2017 2018

2005 2011 2012 2013 2014
Storage Facility Control

Rate Exposure Control by localization
Radeye PRD Equipment

μS/h  10  5  1
Correlation External Exposure – Activity by Waste Type

- Analytical Results Ra-226 (Bq/g) vs. Rate Exposure (µSv/h)

- Sludge Cat. I
- Sludge Cat. II
- Scale

µS/h
Exposure and Activity by Waste Type
Waste Management of NORM Rejects and Hazardous Waste

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4. CHALLENGES TO NORM WASTE DISPOSAL
Challenges

PRODUCTION INCREASE

PLATFORMS 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

CONSULTING COMPANIES
NOT REPLIED
DECLINED
REPLIED
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