cenovus ENERGY

Report

West White Rose Project (WWRP)
Environmental Assessment
Drill Cuttings Amendment

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Abbreviations

CEAA 2012	*Canadian Environmental Assessment Act, 2012*
CGS	Concrete Gravity Structure
C-NLOPB	Canada-Newfoundland Offshore Petroleum Board
CWS	Canadian Wildlife Service
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
ECCC	Environment and Climate Change Canada
EEM	environmental effects monitoring
EPCMP	Environmental Protection and Compliance Monitoring Plan
FPSO	floating production, storage and offloading [vessel]
NEB	National Energy Board
OWTG	Offshore Waste Treatment Guidelines
PNEC	Predicted No Effect Concentration/Change
SARA	*Species at Risk Act*
SBM	synthetic-based mud
VC	Valued Component
WBM	water-based mud
WHP	wellhead platform
WREP	White Rose Extension Project
WWRP	West White Rose Project

1.0 Introduction

The White Rose field and satellite extensions are located in the Jeanne d'Arc Basin, 350 kilometres (km) east of Newfoundland and Labrador (NL) in approximately 120 metres (m) of water. Initial development was through excavated subsea drill centres, with flexible flowlines bringing product to a centralized floating platform, the *SeaRose* floating production, storage and offloading (*FPSO*) vessel. The White Rose field was originally developed using subsea wells in two subsea drill centres; the Central Drill Centre and the Southern Drill Centre. A third drill centre, the Northern Drill Centre, is used as an injection site for gas, stored for future use. In addition, the North Amethyst Drill Centre and the South White Rose Extension Drill Centre are tied back to the *SeaRose FPSO* for production, storage, and export to tanker.

1.1 Background

The White Rose Extension Project (WREP) underwent a federal environmental assessment (EA) of the development of the West White Rose pool using either a wellhead platform (WHP) or a subsea drill centre; it was released from the EA process in 2012. At the time, it was determined that if the WHP was selected as the development method, water-based mud (WBM) cuttings would be discharged into the marine environment and synthetic-based mud (SBM) cuttings would not be discharged into the marine environment, they would be re-injected. The West White Rose Project (WWRP; formerly the WREP) was selected to drill up to 40 wells using a WHP. In the years since the WREP EA was approved, Cenovus determined that there was no suitable re-injection site for the SBMs.

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) accepted Cenovus' reasoning; however, it identified that the EA did not contemplate the impact of discharging SBM contaminated cuttings into the sea adjacent to the WHP. Cenovus was instructed to complete appropriate modelling and amend the EA to reflect the current WWRP. In addition, Cenovus had to demonstrate that it had examined a number of available approaches for cuttings treatment and that the proposed approach is likely to provide the best practicable outcome in terms of the concentration of synthetic-on-cuttings discharged to sea rather than conformance to the minimum expectation set out in guidance.

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2.0 Project Description

2.1 Proposed Amendment to the Project Description

The original WREP EA proposed to discharge WBM cuttings and re-inject SBM cuttings. A suitable disposal formation for reinjection of cuttings was not available. As a result, cuttings from the surface hole (drilled with WBM or SBM), and the intermediate and main sections (drilled with SBM) are expected to be treated and released from two cuttings chutes on the Concrete Gravity Structure (CGS) shaft. It is anticipated that approximately 34,760 m^3 will be discharged in the drilling of the 40 wells included in the scope of the approved WWRP EA. Cuttings associated with drilling the conductor section are expected to be discharged inside the CGS and are excluded from consideration in this EA Amendment.

2.2 Review of Best Available Technologies

The C-NLOPB required Cenovus to demonstrate that it had examined a number of available approaches for cuttings treatment and that the proposed approach is likely to provide the best practicable outcome in terms of the concentration of synthetic-on-cuttings discharged to sea. SINTEF examined five different cuttings handling scenarios and, on July 25, 2019, Cenovus provided a letter to the C-NLOPB, supported by a package of information, to support its view of the best available methodology for cuttings treatment at the WWRP. The scenarios considered were:

1. Skip and Ship - After cuttings are treated to recover mud, cuttings are containerized in skips and transported to shore for processing.
2. Shaker + Dryer + Centrifuge - Cuttings are treated by passing through shaker and vertical dryer before discharge to sea, and SBM recovered from dryer is processed in centrifuges to remove solids, which are discharged to sea with the cuttings.
3. MudCube® + Dryer + Centrifuge - Cuttings are treated by passing through MudCube® and vertical dryer before discharge to sea, and mud recovered from dryer is processed in centrifuge to remove solids, which are discharged to sea with the cuttings.
4. Thermal Desorption Unit (TDU) - Cuttings are directed through a TDU with stockpiling on deck to manage throughput issues and subsequent discharge to sea after treatment.
5. Thermal Desorption Unit + Direct Discharge - Cuttings are directed through a TDU and then discharged during drilling of the 311 mm diameter section, but cuttings in excess of the TDU capacity during drilling of the 311 mm diameter section are discharged to sea, and cuttings generated during drilling of the 216 mm diameter section are discharged to sea without treatment to avoid stockpiling issues.

After a technical review of the information provided by Cenovus, as well as a review of existing environmental effects monitoring (EEM) data and a scan of related scientific literature, the C-NLOPB determined the Shaker + Dryer + Centrifuge approach, which is Cenovus's preferred option, represented the best practicable method for cuttings treatment in terms of potential benthic impacts, potential pelagic impacts, carbon footprint, and platform storage of cuttings.

2.3 Summary of Original Drill Cuttings Deposition Model

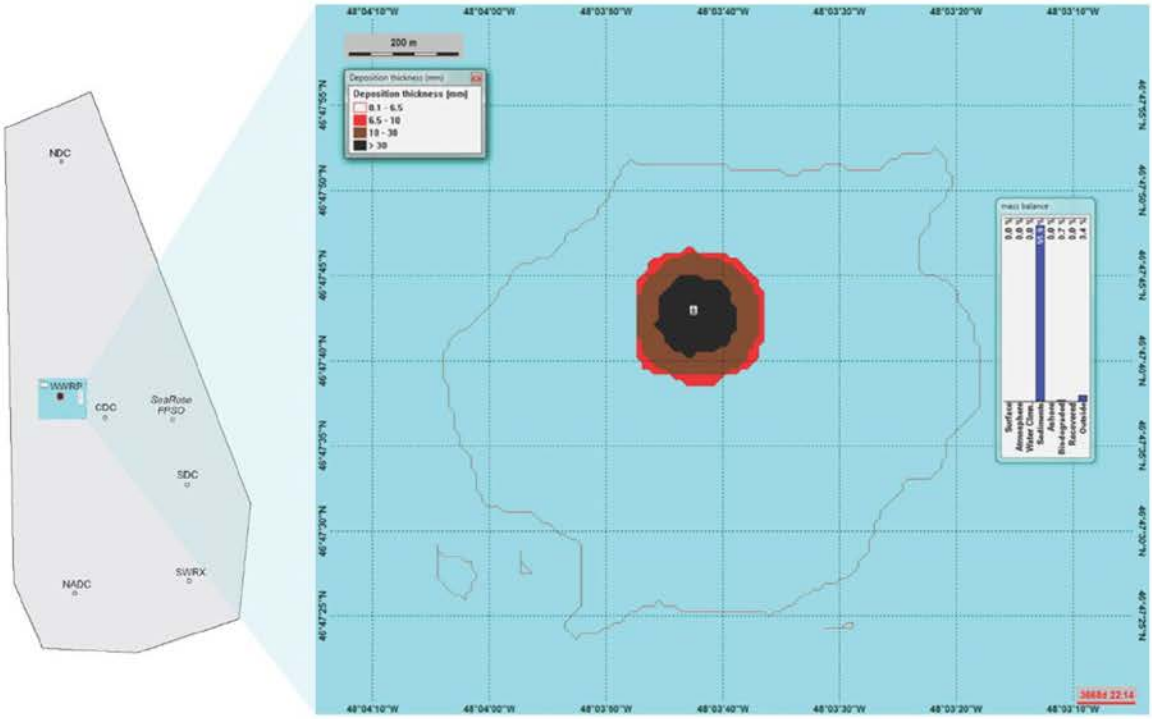
Under the original WHP scenario, cuttings from drilling the upper two well sections with WBM were to be released as per the Offshore Waste Treatment Guidelines (OWTG, NEB et al. 2010) from chutes approximately 66 and 63 m above the seabed. Therefore, there would be little time for the cuttings to be transported large distances by the ambient currents. The drift of WBM cuttings was restricted to a range generally within 2 to 4 km. The maximum extent is approximately 5 km to the southeast and northeast. Cuttings (exclusively WBM) thicknesses were 1 mm or less over these regions. Cuttings thicknesses directly under the WHP were modelled to be 1.8 m. In the immediate vicinity of the WHP, within 100 m, initial cuttings thicknesses were predicted to be 1.4 cm on average, and as high as 8.6 cm. Due to the large volume of material generated by drilling up to 40 wells, a maximum height of 1.8 m (assuming slumping of the cuttings pile, a maximum height is more likely on the order of 0.5 to 1.0 m) was predicted directly at the WHP. These would be almost exclusively the fast-settling pebbles and coarse sand (a very small percentage of the fines will drift for a time and ultimately settle near the WHP), whereas at distances greater than about 50 to 200 m, the deposits would be exclusively fines. From 100 to 200 m out from the WHP, thicknesses were predicted to be 1.9 mm on average and a maximum of 3.4 mm. From 200 to 500 m, thicknesses averaged 1.8 mm and were a maximum of 4.6 mm (AMEC 2012).

2.4 Summary of Updated Modelling

The C-NLOPB indicated that it considered the risk to the water column from drill cuttings disposal from the modelled approaches to be transitory, with a temporal scope limited to active drilling time. SINTEF also calculated CO_2 emissions and NOx emissions associated with each alternative. For the scenarios considered the atmospheric outputs were similar between the Shaker + Dryer + Centrifuge approach and the MudCube® + Dryer + Centrifuge Treatment approach. The Thermomechanical Desorption Unit approach resulted in higher energy demands and CO_2 and NOx emissions approximately six times greater that the Shaker + Dryer + Centrifuge approach. As a result, this EA Amendment focuses on the benthic impacts of the Shaker + Dryer + Centrifuge approach.

The outcome of SINTEF modelling predicted that, for SBM cuttings treated with Shaker + Dryer + Centrifuge, most (89.4%) threat to the benthos comes from oxygen depletion related to biodegradation of chemicals in areas with cuttings deposition ≥0.3 g/m² and that this effect may extend up to 1,000 m from the origin for a 40 well program.

The results of the SINTEF model are illustrated in Figure 2-1. A cross section through the deposited area shows that the area where the thickness is above the effect limit 0.65 cm is within approximately 175 m of the discharge. The largest impacted area is the 0.1 to 6.5 mm cuttings depositional thickness (the red line in Figure 2-1). The main stressor is the oxygen demand from biodegradation of the deposited chemicals, even in areas where the mass is small and the sediment has not recovered at the end of the simulation period (10 years). The affected area is limited around the discharge location within a radius of approximately 1 km. The affected area is wholly within the White Rose Safety Zone.



Source: SINTEF 2019
Note: Scenario 2, Synthetics on Cutting = 5.5%. The PNEC for deposition (burial) is 0.65 cm.
Figure 2.1 Impacted Area from Deposition of Particulate Matter (smoothed results)

3.0 Environmental Effects Assessment

3.1 Findings of the Original Environmental Assessment

The original EA (Husky Energy 2012) determined that there would be no expected interaction between deposited drill cuttings and the following Valued Components (VCs): Air Quality; Marine Birds Species at Risk; Sensitive or Special Areas; and Fisheries (the established White Rose Safety Zone offshore has restricted fish harvesting since 2005 to avoid potential interactions between fishing gear and subsea equipment). The VCs that were predicted to have an interaction with deposited drill cuttings are indicated in Table 3.1.

Table 3.1 Identified Interactions in Original WREP EA

Valued Component	Potential Environmental Effect		
	Change in Habitat Quality	Change in Habitat Quantity	Potential Mortality
Fish and Fish Habitat	■	■	■
Fish Species at Risk	■	■	
Marine Birds	■		
Marine Mammals and Sea Turtles	■		
Marine Mammal and Sea Turtle Species at Risk	■		

Direct effects on habitat availability (quantity) and quality could result from deposition of cuttings / drill muds. There can also be direct effects on prey availability from effects on lower trophic levels due to deposition of cuttings / drill muds. Effects on fish mortality, injury or health could result due to direct interactions from smothering as a result of deposition of cuttings / drill muds or indirect interactions from a change in habitat quality (i.e., degradation of habitat quality affecting fish health).

Given the depth of the WHP (approximately 120 m), it is unlikely that marine birds would interact with the drill cuttings deposited on the seabed. Drilling activities are unlikely to produce concentrations of heavy metals in muds and cuttings that are harmful to marine mammals (Neff et al. 1980, in Hinwood et al. 1994); cuttings will be discharged overboard in accordance with the OWTG. In addition, none of the marine mammals that regularly occur in the in the vicinity of the White Rose Safety Zone are known to feed on benthos in the area (Husky Energy 2012). The deposition of drill cuttings is expected to have a limited interaction with, or environmental effect on, marine mammals and sea turtles (including at risk species). As such, this EA Amendment will focus on the potential environmental effects of drill cuttings deposition on Fish and Fish Habitat VC (including fish species at risk).

3.2 Summary of Existing Conditions

The White Rose field is located in Northwest Atlantic Fisheries Organization (NAFO) Divisions 3L – Unit Area 3Lt. The White Rose EEM collects American plaice and snow crab as part of its commercial fish program. Other fish species in the vicinity of the White Rose field include: mailed, hookear, and spatulate sculpins; capelin; toad crab; Arctic alligatorfish; shrimp; sand lance; and eelpout (Husky Energy 2009). Northern, spotted, and Atlantic (striped) wolffish have occasionally been captured (and released) in the vicinity of the Safety Zone during the White Rose EEM commercial fish surveys.

Benthic species collected in the White Rose field during EEM programs include sea stars, brittle stars, bivalves, polychaetes (the most abundant benthic invertebrate), sand dollars, green sea urchins, gammarid amphipods, Cumacea, and isopod species. No habitat-forming coral species or sponges have been identified during the White Rose EE program.

3.3 Assessment of Proposed Project Modifications

While cuttings / drill muds have low toxicity and bioaccumulation effects, the potential remains that benthic communities may experience injury, mortality, and health effects due to burial, sediment alteration, and oxygen depletion (Kjeilen-Eilertsen et al. 2004; Smit et al. 2008; Neff 2010; Ellis et al. 2012; Paine et al. 2014; Tait et al. 2016; DFO 2019). However, benthic mortality rates as a result of cuttings / drill mud deposition are not predicted to result in irreversible changes to local populations due to the limited spatial extent of potential effects.

Environmental changes associated with deposition of drill muds and cuttings are detectable within a localized area. They typically subside between one to five years, and recovery starts at the edges of the deposition by colonization from larval dispersal and immigration from nearby undisturbed sediments (Kjeilen-Eilertsen et al. 2004; Ellis et al. 2012; Gates and Jones 2012; Bakke et al. 2013; IOGP 2016).

The SINTEF model indicates that the extent of the drill cuttings at 0.1 mm depth do not extend beyond the White Rose Safety Zone (i.e., approximately 1,200 m inside the White

Rose Safety Zone; see Figure 2-1). The C-NLOPB noted that the potential extent of the modelled effect is well aligned with effects noted in the 2016 White Rose EEM Program (Husky 2019), which indicated that there was evidence of decreased benthic invertebrate abundance and biomass at some stations within 1,000 m of drill centres. However, the 2016 EEM program did not find decreased benthic invertebrate abundance and biomass at all sampling stations within 1,000 m of a drill centre and there was variability in species affected. These results were borne out by the White Rose EEM Program 2018 (Husky Energy 2022), which indicated there was evidence of production effects on benthic biomass, and little evidence of effects on total abundance and richness. The relationship between total biomass and distance from active drill centres was somewhat weaker than those observed in 2012 and 2014; no threshold could be estimated in 2018, and effects were generally limited to approximately 1 km from drill centres. The relationship between total benthic abundance and distance to active drill centres was weaker in 2018 than in previous years and not statistically significant. Richness was predominantly unaffected by production activity in 2018, as in previous years.

Environmental effects of deposition of cuttings / drill muds are generally low in magnitude, of limited geographic extent and reversible. The potential residual adverse environmental effects are not considered of sufficient geographic extent, magnitude, duration, frequency and/or irreversibility to result in a decline in abundance or change in distribution of a population(s) over more than one generation. Based on planned mitigation and the nature of the environmental effects, the environmental effects of discharge of cuttings / drill muds (including SBMs) on Fish and Fish Habitat (including fish species at risk) are predicted to be not significant. The potential residual adverse environmental effects are not considered of sufficient geographic extent, magnitude, duration, frequency and/or irreversibility to result in a decline in abundance or change in distribution of a population(s) over more than one generation.

3.4 Monitoring and Follow-up

The effects of deposition of drill cuttings on the benthic habitat in the vicinity of the WHP will be monitored through Cenovus' ongoing EEM program. The 2022 program incorporated the future WHP and samples were collected from eight baseline stations (as recommended by the C-NLOPB); report preparation is ongoing. The EEM program is in the process of being redesigned to accommodate the WHP (among other proposed changes); formal submission of the new design is anticipated in Q2 2023.

3.5 Cumulative Environmental Effects Assessment

There is a potential cumulative environmental effect from the drill cuttings discharge when considered together with the other drill centres. The White Rose field has been in production since 2005. The initial three drill centres (Northern, Southern, and Central) were supplemented with the North Amethyst (2007) and South White Rose Extension (2012) drill centres. Sampling stations around each new drill centre were incorporated into the EEM program. Results from the EEM program have indicated that:

- The spatial extent of contamination is consistent with modelled predictions on the spatial extent of drill cuttings; toxicity tests continue to indicate that sediments at White Rose are predominantly non-toxic
- For most benthic indices and individual taxa, the majority of effects occurred within 0.5 to 1 km of drill centres, with more subtle and/or highly localized effects between 1 to 2 km

- Sediment contamination and effects on benthos have not translated into effects on the fisheries resources, as indicated by fish health assessment and taint tests

The 10 completed programs have repeatedly found that that environmental effects at White Rose are consistent with those anticipated in the original White Rose EA (HOOL 2000) and the satellite drill centres EA (LGL 2006) and the EA determinations that effects on fish and fish habitat were not significant.

This is consistent with the results from the first ten years of EEM at the Terra Nova field (approximately 50 km southwest of the White Rose field), which indicate that where they did occur, biological effects from ten years of development drilling are limited and highly localized (Neff et al. 2014). Based on regional data from other EEM programs (Suncor Energy 2019; EMCP 2021; HMDC 2021), drill cuttings do not have direct toxicity effects on marine fish and fish habitat.

Given that the spatial extent of drill cuttings from the WWRP is wholly within the White Rose Safety Zone and limited to a radius of approximately 1 km around the discharge location, and drill cuttings will be discharged in accordance with the OWTG, the cumulative environmental effects are localized, reversible, and not significant.

4.0 Mitigations / Commitments

Cenovus will continue to comply with regulatory requirements respecting environmental protection during offshore drilling and production operations, in accordance with the OWTG, Drilling and Production Guidelines (C-NLOPB and CNSOPB 2017), Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands (NEB et al. 2009), Environmental Protection Plan Guidelines (NEB et al. 2011), Offshore Physical Environmental Guidelines (NEB et al. 2008) and the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2019).

Cenovus' existing contingency plans will be revised to incorporate activities associated with the WWRP prior to the onset of activities. Mitigation measures to be applied to the WWRP included:

- Concentration of Synthetics-On-Cuttings monitored for compliance with the Cenovus Environmental Protection and Compliance Monitoring Plan (EPCMP)
- Compliance with *Fisheries Act* Authorization
- Adhere to *Canada Shipping Act, 2001*
- Adhere to limits established under an Operating Authorization via an EPCMP
- Solid waste disposed of properly onshore
- Use of Offshore Chemical Selection Guidelines (NEB et al. 2009)
- Use of best practices and improvement programs
- Re-use of drill mud

Offshore waste discharges and emissions associated with the WWRP will be managed in accordance with the White Rose EPCMP.

Selection and screening of chemicals to be discharged, including drill fluids, will be in accordance with Cenovus's Chemical Management Plan (CMP) which aligns with the Offshore Chemical Screening Guidelines for Drilling and Production Activities on Frontier Lands (NEB et al. 2009). The CMP requires the use of environmentally favourable chemicals for a specific application where possible, and the use of the Lowest Effective

Concentration (LEC) of a chemical slated for use in a system that is designed to discharge to the sea.

SBM drill cuttings will be returned to the WHP and treated in accordance with the White Rose EPCMP which aligns with the OWTG before being discharged into the marine environment. Excess or spent SBM that cannot be reused will be brought back to shore for disposal; no excess or spent SBM will be discharged. WBM drill cuttings will be discharged without treatment.

5.0 Conclusion

The potential residual adverse environmental effects of the discharge of SBM drill cuttings on fish and fish habitat are not considered of sufficient geographic extent, magnitude, duration, frequency and/or irreversibility to result in a decline in abundance or change in distribution of a population(s) over more than one generation.

Potential residual adverse environmental effects of the SBM drill cuttings discharge on fish and fish habitat will be mitigated. The potential residual adverse environmental effects of the SBM drill cuttings discharge on Fish and Fish Habitat are therefore predicted to be not significant and the predictions made in the original WREP EA remain valid.

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