



Shell Penguins – Non-Technical Summary (NTS) Document

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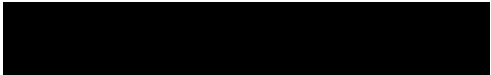
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Project Title: J75738D– PPC Permit Application Support
Document Number: 204226C-004-RT-6200-0036-1
Date: March 2024

Rev	Date	Description	Issued by	Checked by	Approved by	Client Approval
1A	16/01/2024	Issued for Internal Review				
A	19/01/2024	Issued for Client Comment				
B	12/02/2024	Issued for client Review				
0	23/02/2024	Issued for client use				
1	01/03/2024	Issued for client use				





NON-TECHNICAL SUMMARY

The Penguins Field is located in the United Kingdom Continental Shelf (UKCS) Blocks 211/13 (Penguins West) and 211/14 (Penguins East), in the northern North Sea (NNS). The field is located approximately 160 km from the Scottish coastline (Northern Shetland) and runs adjacent to the UK/Norway median line.

The existing and new developments will be produced via additional subsea infrastructure to the Penguins Sevan Floating, Production, Storage and Offloading (FPSO) facility, which is approximately 430 km from the Scottish coastline (Latitude: N 61° 34' 59.27" Longitude: E 001° 32' 47.71", WGS84). Oil will be temporarily stored and exported via tanker offload. Gas is compressed, dehydrated and exported through the gas export pipeline tied into the existing FLAGS pipeline system. Gas will also be used for gas lift, fuel gas and cargo tank blanketing. When the FPSO becomes gas deficient or is shutdown, gas can be imported from the FLAGS system. Only a low rate of water production is expected. This water will be treated and discharged overboard.

The main power supply is obtained from the three Taurus 70 Gas Turbine Generators in a 3 x 50% configuration. Normally two machines are running with the load shared. Gas compression is supplied via a Titan 130 HP gas fired compression turbine (1 x 100% configuration). Both the power generation and gas compression turbines are fitted with Solar's SoLoNO_xTM Dry Low-Emission (DLE) combustion technology, which is optimised to reduce emissions by tightly controlling the combustion temperature inside the turbine.

To reduce the emissions from the asset, a Vapour Recovery Unit (VRU) has been installed to recycle waste streams which would otherwise historically have been routed to flare. The Vapour Recovery Unit (VRU) compresses fuel gas which has been used for purging the vapour space in the oil cargo tanks and as stripping gas in the TEG regeneration unit and feeds it into the gas compression train.

There are 3 diesel driven electrical firewater pumps (FWPs) which will be ran at 100% load. When there is a demand, one firewater pump is sufficient for full FPSO coverage. The design of the FWP system enables one of the diesel engines to function as an essential generator (Fire pump A-7101A), providing power in a black start scenario, and can also serve as a back-up seawater lift pump. The emergency generator will switchover with auto synchronisation with the GTG's, to allow for changeover of from diesel to gas generation.

The efficiency of the Taurus 70 gas turbines themselves is only one of the factors of the total energy efficiency of the offshore installation. The Taurus 70 gas turbines are also fitted with Waste Heat Recovery Units (WHRUs) for heating crude oil and most of the heat duty for process equipment. At low power load, turbine controls prioritise a high exhaust gas temperature to ensure that there is enough heat recovery at the WHRUs to avoid process upsets. Variable speed drive has been used on the gas turbine driven compressor set. A trim cooler is used to control the temperature by rejecting excess heat to the sea via the cooling medium system.

Emissions of oxides of sulphur from the combustion equipment at the installation are a function of the Sulphur content of the fuels burnt. All of the gas turbines normally operate on gas minimising the emissions of SO₂ from this combustion equipment. Low Sulphur diesel (< 0.1 wt.%) is also used as a back-up fuel source for gas turbines infrequent events where enough fuel gas is not available.

Shell U.K. Limited is committed to preventing pollution, complying with legislation and improving the environmental performance. The Penguins FPSO is a new facility and has been engineered to prioritise energy efficiency. Energy consumption has been minimised by process design and equipment selection. Heat conservation insulation is provided to all process equipment operating at high temperatures and winterisation insulation is provided to all equipment susceptible to icing or freezing. This reduces the heating power required and ultimately reduces the consumption of fuel at the facility.

The equipment will be operated by technically competent operators and maintained to ensure safe and efficient operation, with planned maintenance for the single gas compression train and condition-based maintenance for power generation train. The installation of High Efficiency Particulate Arrestance (HEPA) filters to all gas turbine drivers would avoid compressor fouling and hence compressor washing. Low pressure drop exhaust systems are also fitted.

Air dispersion modelling has been undertaken to assess the impacts on air quality of emissions to atmosphere from the Penguins FPSO, as part of the Penguins Redevelopment Project Environmental Statement. The change in location of the FPSO (7.25 km Northwest of the original location) is unlikely to significantly affect the



conclusions of the modelling due to their localised impacts. Overall, there were no predicted exceedances of any of the relevant Air Quality Standards for the pollutants of concern, for any of the modelled scenarios at any location, including for the worst-case scenario where only a minor adverse impact was shown through the use of the three gas turbines generators on diesel together with an emergency flaring occurring simultaneously.