



## Application for Licence Amendment

### Part V Division 3 of the *Environmental Protection Act 1986*

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<b>Licence Number</b>	L6284/1992/10
<b>Licence Holder</b>	Santos WA Energy Limited
<b>ACN</b>	009 301 964
<b>File Number</b>	DER2013/000949-3
<b>Premises</b>	Varanus Island and East Spar Facilities CALM Act Leases 1902/100 and 2064/100 Part Reserve 33902 (Part Lot 500 on Plan 240033) (As defined by the premises maps in Schedule 1 of the revised licence) VARANUS ISLAND WA 6872
<b>Date of Report</b>	6 July 2023
<b>Decision</b>	Revised licence granted

## Table of Contents

<b>1. Decision summary</b>	<b>4</b>
<b>2. Purpose and scope of assessment</b>	<b>4</b>
2.1 Regulatory framework	4
2.2 Amendment summary	4
<b>3. Application details</b>	<b>4</b>
3.1 Background	4
3.2 Overview	5
<b>4. Legislative context</b>	<b>7</b>
4.1 Part IV of the EP Act	7
4.2 Contaminated sites	8
<b>5. Emissions modelling</b>	<b>8</b>
5.1 Air emissions	8
<b>6. Risk assessment</b>	<b>11</b>
6.1 Source-pathways and receptors	11
6.1.1 Emissions and controls	11
6.1.2 Receptors	13
6.2 Risk ratings	16
<b>7. Consultation</b>	<b>19</b>
7.1 Licence Holder comments on draft decision	20
<b>8. Decision</b>	<b>20</b>
<b>9. Conclusion</b>	<b>20</b>
9.1 Summary of amendments	20
<b>References</b>	<b>21</b>

Table 1: Power Infrastructure Changes Associated with VICPOP	6
Table 2: Existing and Proposed Power Generating Capacity at VI	6
Table 3: Relevant approvals and tenure	7
Table 4: Expected air emissions from VICPOP Infrastructure	8
Table 5: Maximum predicted ground level concentrations of NO <sub>2</sub>	8
Table 6: NO <sub>x</sub> Emission Rates from Commissioning	9
Table 7: Existing Infrastructure Exhaust Characteristics	10
Table 8: Proposed Infrastructure Exhaust Characteristics	10
Table 9: Licence holder controls	11
Table 10: Sensitive human and environmental receptors and distance from prescribed activity	14

Table 11. Risk assessment of potential emissions and discharges from the premises during construction and operation .....	17
Table 12: Consultation .....	19
Table 13: Summary of licence amendments .....	20

## 1. Decision summary

Licence L6284/1992/10 is held by Santos WA Energy Limited (licence holder) for the Varanus Island and East Spar Facilities (the premises), located about 70 km off the Pilbara coast in Western Australia.

This amendment report documents the assessment of potential risks to the environment and public health from the ongoing operation of the Varanus Island Compression Power Optimisation Project (VICPOP) infrastructure, constructed in accordance with works approval W6298/2019/1. The installed VICPOP infrastructure includes two new inlet gas compressors and a gas turbine generator. The licence holder also proposes to retire existing generators and install two gas engine alternators as replacements. As a result of this assessment, revised licence L6284/1992/10 has been granted.

The revised licence issued as a result of this amendment consolidates and supersedes the existing licence previously granted in relation to the premises.

## 2. Purpose and scope of assessment

### 2.1 Regulatory framework

In completing the assessment documented in this amendment report, the department has considered and given due regard to its regulatory framework and relevant policy documents which are available at <https://dwer.wa.gov.au/regulatory-documents..>

### 2.2 Amendment summary

On 16 March 2023, the licence holder submitted an application to the department to amend L6284/1992/10 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The following amendments are being sought:

- Inclusion of infrastructure constructed under works approval W6298/2019/1: two new Mars 100 East Spar Joint Venture (ESJV) inlet gas compressors (K-0302 and K-0402) and a Centaur C40 gas turbine generator (EG-9001).
- The installation of two additional gas engine alternators (EG-9002 and EG-9004).
- Removal of existing power generators to be retired as a result of the new infrastructure.
- An update to the emission discharge points.

Following consultation with the Licence Holder on the 6 July 2023, an administrative amendment was made at the request of the CEO to amend the expiry date of the Licence from 20 April 2032 to 16 October 2032 to allow the Licence expiry date to align with the annual fee period expiry date.

## 3. Application details

### 3.1 Background

Varanus Island (VI) is part of the Lowendal Islands and is located approximately 70km from the northwest coast of Western Australia. The Lowendal Islands are vested as a nature conservation reserve (Reserve 33092) managed by the Department of Biodiversity, Conservation and Attractions (DBCA). The Lowendal Islands are recognised as having areas of ecological significance, including marine turtle nesting beaches and mangrove protection areas, and are an important breeding site for the Wedge-tailed Shearwater. The VI hub oil and gas processing facilities are located adjacent to these areas of ecological significance.

VI is surrounded by a network of fixed offshore production platforms which feed gas, oil and condensates into the island's facilities for processing, storage and delivery or export. The licence holder (Santos WA) operates the VI hub oil and gas facilities. Gas production within the John Brookes (JB) gas field has previously been achieved using only the natural pressure of the gas formation to harvest the gas for processing. However, the natural pressure within the gas formation is declining, which, if allowed to continue un-mitigated, would ultimately result in insufficient pressure to maintain the required production flow rates. To address the declining pressure and extend the operational life of the JB gas field, the applicant was granted works approval W6298/2019/1 for the construction and commissioning of the VICPOP infrastructure, including:

- 2 x Solar Mars gas turbine driven compressors; and
- 1 x Solar Centaur 40 gas turbine driven electrical power generator.

Due to delays experienced during the construction schedule of the generator, the construction and commissioning of W6298/2019/1 was completed in two stages. Following the completion of Stage 2 commissioning on 7 March 2023, the applicant submitted an application to amend licence L6284/1992/10 accordingly.

Previous works to address the declining pressure were conducted as part of the Varanus Island Compression Project (VICP) under works approval W5518/2013/1, issued in 2013 to Apache Energy Limited (the previous operator of the VI Hub). However, the project was subsequently deferred in 2014 following partial completion of works. On 22 December 2016, works approval W5518/2013/1 expired. Planning for completion of the project recommenced in 2019 with additional scope to optimise the power supply on the island, with the project now referred to as VICPOP.

## 3.2 Overview

### **Gas Processing**

The VI Hub operations have historically relied on gas and associated liquids flowing under natural pressure from the wellhead platform, through to the onshore JB slug catcher before being directed to the inlet of the amine trains. Hydrocarbons from the JB offshore pipeline enter the processing plant via the slug catcher which separates condensate and produced water from the gas stream. The two existing ESJV gas plant processing trains have a total capacity of 240 TJ/day of saleable gas production. This includes CO<sub>2</sub> removal, dehydration, mercury removal, dewpoint control and gas compression equipment.

### **Gas Turbine Driven Compressors**

The VICPOP comprises the installation of two Solar Mars 100 gas turbine driven compressors. The compressors will compensate for the decline in reservoir pressures and allow for continued production from the ESJV gas plant. The turbine compressors incorporate dry-low NO<sub>x</sub> burners using proprietary SoLoNO<sub>x</sub> technology. The compressors will discharge process gas, then the gas stream is to be cooled before it enters the ESJV gas plants amine plant to remove entrained CO<sub>2</sub>, followed by the existing gas trains for processing to achieve sales gas specification.

### **Electric Power Generation**

The VICPOP also required the installation of a Solar Centaur 40 gas turbine driven electrical power generator to meet the increased electrical loads associated with the new compressors and their utilities. The new generator also provides additional spinning reserve to be shared with existing facilities such that the ESJV gas plant generators can effectively backup the new VICPOP generator and vice versa.

### **Proposed Additional Gas Engine Alternators**

Additional to works approval W6298/2019/1, proposed VICPOP infrastructure includes installation of two GEAs as the primary power generators. These are to be installed adjacent to the C40 generator, and once operational will allow for the retirement of the existing power generators. The total power generating capacity at VI after this installation will increase by 1.1 MW. Although there is an increase in the total power generating capacity on VI, the maximum electrical demand remains unchanged at 4 MW. The changes in infrastructure with the installation of VICPOP and the additional GEAs are shown in Table 1, with summaries of total generating capacity changes of a result of the project shown in Table 2.

**Table 1: Power Infrastructure Changes Associated with VICPOP**

Item	Tag ID	Emission Point	Main Electrical Power Source	Back-up Power Source	Status
<b>HJV Power Station</b>					
Saturn Generator	PGI-9	A14	0.765 MW Solar Saturn generator	-	To be retired when GEAs EG-9002 & EG-9004 are operational <sup>1</sup>
Saturn Generator	PGI-10	A15	0.765 MW Solar Saturn generator	-	
<b>ESJV Power Station</b>					
ES Power Generator	EG-6001	A3	0.685 MW Caterpillar gas engine generator	-	To be retired when GEAs EG-9002 & EG-9004 are operational <sup>1</sup>
ES Power Generator	EG-6002	A4	0.685 MW Caterpillar gas engine generator	-	
ES Power Generator	EG-6003	A5	3.5 MW Solar Centaur generator	-	Existing and to remain
<b>Emergency Power House</b>					
Black-start Diesel Generator	EG-1	A16 <sup>2</sup>	-	0.88 MW Caterpillar diesel generator	Existing and to remain
Black-start Diesel Generator	EG-2	A17 <sup>2</sup>	-	0.88 MW Caterpillar diesel generator	
<b>New Power Generation Infrastructure</b>					
Centaur C40 Gas Turbine Generator	G-9001	A27	3.5 MW Solar Centaur generator	-	Recently installed as part of W6298/2019/1
Gas Engine Alternator	EG-9002	A28	2 MW Cummins gas engine Generator	-	Proposed
Gas Engine Alternator	EG-9004	A29	2 MW Cummins gas engine Generator	-	Proposed

Source: Table 5-1: Power Infrastructure Changes Associated with the Install of the GEAs and VICPOP (from the Supporting Document)

**Table 2: Existing and Proposed Power Generating Capacity at VI**

	Main electrical power source (gas powered)	Back-up power source (diesel powered)	Total
Current power generating capacity <sup>3</sup>	9.9 MW	1.76 MW	11.66 MW
Generation capacity after GEA installation works	11.0 MW	1.76 MW	12.76 MW
Total change	1.1 MW	0.00 MW	1.1 MW

Source: Table 5-2: Current and Proposed Power Generating Capacity at VI (MW) (from the Supporting Document)

## 4. Legislative context

Table 3 summarises approvals relevant to the assessment.

**Table 3: Relevant approvals and tenure**

Legislation	Number	Agency	Approval
<i>Petroleum and Geothermal Energy Resources Act 1967</i>	Petroleum Lease	Department of Mines, Industry Regulations and Safety (DMIRS)	Titles for petroleum exploration and production in WA (onshore or internal waters) issued under this Act. Varanus Island Hub Operations Environment Plan (Rev. 6) dated 5/9/2014.
<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i>	EPBC 2013/6900	Department of the Environment and Energy	Project was referred by Apache Energy Limited and determined as 'not a controlled action if undertaken in a particular manner'.
	EPBC 2013/6952		
<i>Dangerous Goods Safety Act 2004</i>	Dangerous Goods Licence Exemption applicable	Apache Energy Ltd (previous occupier)	Exemption granted in 1993 - letter reference 275/9051H
<i>Part IV of the EP Act (WA)</i>	Ministerial Statement Number 134	Western Australian Environmental Protection Authority	Authorised Hadson Australia Development Pty Ltd to develop a gas field near to the Harriet Oil Field
	Ministerial Statement Number 395		Authorised the Western Mining Corporation Limited to develop the East Spar Offshore Gas Field development.
	Ministerial Statement Number 457		Authorised Apache Northwest Pty Ltd to develop the Wonnich Gas development
	Ministerial Statement Number 573		Authorised Apache Northwest Pty Ltd to construct and operate two offshore oil and gas mini platforms and an undersea pipeline bundle.
<i>Part V of the EP Act (WA)</i>	Licence L6284/1992/10	DWER	Licence for the following prescribed premises categories: <ul style="list-style-type: none"> <li>• Category 10: Oil or gas production from wells;</li> <li>• Category 34: Oil or gas refining; and</li> <li>• Category 85: Sewage facility.</li> </ul>
	Vegetation Clearing Permit CPS 7551/1	DMIRS	Approves clearing for the purpose of petroleum production and associated activities on Production Licence TL/6. Clearing permit duration is from 1 July 2017 to 31 July 2027.

### 4.1 Part IV of the EP Act

VI Hub Facilities have been previously assessed under Part IV of the EP Act:

- Ministerial Statement No. 134: Harriet Gas Field to Dampier-Wagerup Pipeline,
- Ministerial Statement No. 395: East Spar Off-shore Gas Field Development
- Ministerial Statement No. 457: Wonnich Gas Development
- Ministerial Statement No. 573: Simpson Oil Field Development

The Delegated Officer formed the view that the licence amendment application for the

installation of VICPOP infrastructure and additional generators does not require amendments to the existing ministerial statements.

## 4.2 Contaminated sites

The site has been assessed as ‘contaminated - remediation required’ under the Contaminated Sites Act 2003 (CS Act), based on contamination assessments undertaken between 1995 and 2018. Petroleum hydrocarbons and perfluoroalkyl and polyfluoroalkyl substances (PFAS) are present in soil and groundwater beneath the site and extend to areas of ecological significance.

This classification is based on advice from the auditor, documented in a Mandatory Auditor's Report dated 8 May 2018. DWER accepts the auditor's conclusion, that the site is suitable for ongoing commercial/industrial use and the auditor's recommendations for further action to progress remediation of the site.

DWER does not anticipate that the assessed amendments to L6284/1992/10 will alter the Contaminated Sites status of the site, given the nature of the additional infrastructure and their establishment within the current operational footprint of the Varanus Island Hub.

## 5. Emissions modelling

### 5.1 Air emissions

#### Air emissions modelling results

In 2013, Apache Energy Limited commissioned Pacific Environment Limited to determine the degree and significance of the change in nitrogen dioxide (NO<sub>2</sub>) emissions at the VI Hub resulting from the VICP. As the VICP infrastructure is consistent with the VICPOP infrastructure constructed under works approval W6298/2019/1, the modelling continues to be applicable.

The modelled emissions profiles of the turbines and compressor installed under W6298/2019/1 are detailed in Table 4.

**Table 4: Expected air emissions from VICPOP Infrastructure**

Source	Exit velocity (m/s)	Temperature (degrees Kelvin)	NO <sub>x</sub> (g/s)	NO <sub>x</sub> (mg/Nm <sup>3</sup> )	SO <sub>2</sub> (g/s)	Rsmog (g/s)
Solar Centaur 40 Power Generator (3.5 MW)	8.8	726	0.84	60	0	0
Solar Mars 100 Turbine Driven Compressor (10.5 MW)	16.2	772	2.27	70	0	0

The emission values depicted in Table 4 formed the basis of the air quality modelling for routine, steady state conditions in the scenarios where the VICP infrastructure was installed. It should be noted that that sulfur dioxide, unburned hydrocarbons, carbon monoxide and PM10 were not modelled due to their anticipated low levels within the turbine fuel gas. Benzene, Toluene, Ethylbenzene and Xylene (BTEX) arising as fugitive emissions were also not modelled as these potential emissions were considered negligible.

The predicted maximum ground level concentrations of NO<sub>2</sub> from the existing operations and following the installation of the VICPOP infrastructure, are compared to ground level concentration criteria contained in the NEPM in Table 5. The introduction of the additional air emission sources was predicted to result in a minor increase (<1%) in the maximum predicted 1-hour and annual ground level NO<sub>2</sub> concentrations.

**Table 5: Maximum predicted ground level concentrations of NO<sub>2</sub>**



Averaging Period	Scenario	Maximum ( $\mu\text{g}/\text{m}^3$ )	NEPM Criteria ( $\mu\text{g}/\text{m}^3$ )	Percentage of Criteria
1 - Hour	Existing	213	246	86.6%
	Expansion	214	246	87%
Annual	Existing	75.3	62	121.5%
	Expansion	75.7	62	122.1%

The model predicts maximum annual ground level concentrations of  $\text{NO}_2$  above the NEPM criteria of  $62 \mu\text{g}/\text{m}^3$  in the pre- and post-VICPOP scenarios. This is a result of the conservative assumptions used in the model. Whereby all emission sources are modelled as operating at 100% utilisation, this overstates the true anticipated utilisation of the following emission sources, as follows:

- Two existing power generators were modelled at 100% utilisation; however, these will be retired once the GEAs are operational and therefore cease to contribute to air emissions.
- The black-start diesel generators have a utilisation factor of ~ 2%.
- One of the existing gas turbines has a utilisation factor of ~ 12%.
- Two Taurus T60 Gas Turbines have a utilisation factor of ~50%.
- Three shipping pumps have a utilisation factor of ~ 2% and
- Two fire-water pumps have a utilisation factor of ~ 2%.

It should be noted that even under the conservative modelling scenario,  $\text{NO}_2$  emissions would be expected to increase by 1 and  $0.4 \mu\text{g}/\text{m}^3$  in the 1-hour and annual modelled scenarios respectively. Therefore, the project was anticipated to result in an insignificant increase in the average ground level  $\text{NO}_2$  emissions at the VI Hub. This was further confirmed by the results of commissioning for the project which demonstrated emission rates well below the conservative modelling rates.

### **Commissioning results**

The actual air emission results of the new VICPOP infrastructure resulted were provided in the Environmental Commissioning Report provided for works approval W6298/2019/1.

The average emission rate of  $\text{NO}_x$  leaving the two Solar Mars Compressors and the C40 generator exhaust stacks during the commissioning test at dry, standard temperature and pressure (STP), 15% oxygen reference conditions are shown in Table 6. The emission rates for all stacks were below the targets shown in Table 4.

**Table 6:  $\text{NO}_x$  Emission Rates from Commissioning**

Parameter	Infrastructure	Test	Unit	Result	Method	Averaging Period
Oxides of nitrogen ( $\text{NO}_x$ as $\text{NO}_2$ )	North Solar Mars 100 Turbine Driven Compressor	Average of Run 1 and 2	g/s at 15% $\text{O}_2$	0.46	USEPA Method 7E	30 minutes
	South Solar Mars 100 Turbine Driven Compressor	Average of Run 1 and 2		0.29		30 minutes
	Solar Centaur 40 Power Generator	Run 1		0.13		34 minutes

### **Air emissions from two additional generators**

Air quality modelling for the proposed installation of the GEAs demonstrates there is a net reduction in emissions, also considering the retirement of some existing infrastructure. Exhaust characteristics of the existing infrastructure include NO<sub>2</sub> emissions of 127.4 t/year at the 4 MW demand of the station, and 405.6 t/year if used at full capacity, as shown in **Error! Reference source not found.** In comparison, the proposed infrastructure including additional GEAs and retirement of some existing generators has NO<sub>2</sub> emissions of 78.2 t/year at the 4 MW demand of the station, and 352.5 t/year if used at full capacity, as shown in Table 8.

**Table 7: Existing Infrastructure Exhaust Characteristics**

Item	Tag ID	Emission Point	Stack height (m)	Internal Stack Radius (m)	Exhaust Temp (K)	Exit Velocity (m/s)	NO <sub>x</sub> (as NO <sub>2</sub> ) Emission Rate (g/s)	NO <sub>x</sub> (as NO <sub>2</sub> ) Emission Rate (mg/Nm <sup>3</sup> )	NO <sub>x</sub> (as NO <sub>2</sub> ) Emissions (t/yr)
<b>HJV Power Station</b>									
Saturn Generator	PGI-9	A14	9.2	0.55	805	30.03	0.78	80.54	24.6
Saturn Generator	PGI-10	A15	9.2	0.55	805	30.03	0.78	80.54	24.6
<b>ESJV Power Station</b>									
ES Power Generator	EG-6001	A3	5	0.15	787	9.05	1.30	5,857.0	41.0
ES Power Generator	EG-6002	A4	5	0.15	787	9.05	1.30	5,857.0	41.0
ES Power Generator	EG-6003	A5	13	0.62	726	31.16	3.28	233.2	103.4
<b>Emergency Power House</b>									
Black-start Diesel Generator	EG-1	A16	6	0.10	782	106.6	2.33	1,933.5	73.5
Black-start Diesel Generator	EG-2	A17	6	0.10	782	106.6	2.33	1,933.5	73.5
<b>Power Generation Infrastructure installed under W6298/2019/1</b>									
Centaur C40 Gas Turbine Generator	G-9001	A27	9.8	0.57	726	8.8	0.76	225.0	24.0
<b>Total NO<sub>x</sub> Emissions (all generators @ 100% utilisation)</b>									<b>405.6</b>
<b>Total NO<sub>x</sub> Emissions (@ maximum 4 MW demand)</b>									<b>127.4<sup>1</sup></b>

<sup>1</sup> NO<sub>x</sub> emissions based on EG-6003 and G-9001 being operational

Source: Table 6-4: Existing Power Generation Infrastructure and their Exhaust Characteristics (from the Supporting Document)

**Table 8: Proposed Infrastructure Exhaust Characteristics**

Item	Tag ID	Emission Point	Stack height (m)	Internal Stack Radius (m)	Exhaust Temp (K)	Exit Velocity (m/s)	NO <sub>x</sub> (as NO <sub>2</sub> ) Emission Rate (g/s)	NO <sub>x</sub> (as NO <sub>2</sub> ) Emission Rate (mg/Nm <sup>3</sup> )	NO <sub>x</sub> (as NO <sub>2</sub> ) Emissions (t/yr)
<b>ESJV Power Station</b>									
ES Power Generator	EG-6003	A5	13	0.62	726	31.16	3.28	233.2	103.4
<b>Emergency Power House</b>									
Black-start Diesel Generator	EG-1	A16	6	0.10	782	106.6	2.33	1,933.5	73.5
Black-start Diesel Generator	EG-2	A17	6	0.10	782	106.6	2.33	1,933.5	73.5
<b>New Power Generation Infrastructure</b>									
Centaur C40 Gas Turbine Generator	G-9001	A27	9.8	0.57	726	8.8	0.76	225.0	24.0
Gas Engine Alternator	EG-9002	A28	6.5	0.51	652	29.6	1.24 <sup>2</sup>	493.0	39.1 <sup>2</sup>
Gas Engine Alternator	EG-9004	A29	6.5	0.51	652	29.6	1.24 <sup>2</sup>	493.0	39.1 <sup>2</sup>
<b>Total NO<sub>x</sub> Emissions (all generators @ 100% utilisation)</b>									<b>352.5</b>
<b>Total NO<sub>x</sub> Emissions (@ maximum 4 MW demand)</b>									<b>78.2</b>

<sup>1</sup> NO<sub>x</sub> emissions based on EG-9002 and G-9004 being operational

<sup>2</sup> Estimated based on 'standard conditions' which refer to standard temperature and pressure (0 °C, 101.325 kPa) and 5% reference O<sub>2</sub>.

Source: Table 6-5: Proposed Power Generation Infrastructure and their Exhaust Characteristics (from the Supporting Document)

## 6. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guideline: Risk assessments* (DWER 2020).

To establish a risk event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

### 6.1 Source-pathways and receptors

#### 6.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premise operation which have been considered in this amendment report are detailed in Table 9 below. Table 9 also details the proposed control measures the licence holder has proposed to assist in controlling these emissions, where necessary.

**Table 9: Licence holder controls**

Emission	Potential pathways	Proposed controls
<b>Construction of additional GEAs</b>		
Light	Air dispersion	Light emissions from the construction phase will be minimised by scheduling the construction activities during daylight hours to negate the need for artificial lighting.
Dust	Air / wind dispersion	The construction activities will be short-term in nature and the following control measures will be implemented to minimise dust emissions during construction: <ul style="list-style-type: none"> <li>• Watering of unsealed roads, access tracks, work areas and soil stockpiles as required;</li> <li>• Application of approved dust control products;</li> <li>• Maintenance of low vehicle speed limits;</li> <li>• Reduction of traffic movements where possible.</li> </ul>
Noise / Vibration	Air / wind dispersion and dispersion through the ground	The construction activities will be short-term in nature and the following control measures will be implemented to minimise noise and vibration during the construction phase: <ul style="list-style-type: none"> <li>• Maintenance of mobile equipment to ensure equipment exhaust systems are operating as designed;</li> <li>• Limiting construction noise to daylight hours, to minimise disturbance to seabird and marine turtle nesting areas, since such fauna are likely to be active at night; and</li> <li>• Noise and vibration emissions are not anticipated to be significant due to the short-term nature of the construction activities and the knowledge that vibration emission sources will be limited to construction vehicles and equipment.</li> </ul>
Discharge of chemicals and hydrocarbons to the ground	Direct discharge, run-off or infiltration	<ul style="list-style-type: none"> <li>• The area the proposed GEAs will be installed is within the existing Varanus Island Hub, in which impact of discharges of chemicals and hydrocarbons to the ground surface is assessed and regulated by Licence</li> </ul>

Emission	Potential pathways	Proposed controls
		L6284/1992/10.
<b>Operation of additional compression and power generation infrastructure</b>		
Air emissions including NO <sub>x</sub> , SO <sub>2</sub> , carbon monoxide and carbon dioxide	Air/wind dispersion	<p>Management measures of the two compressors and one C40 generator (installed under W6298/2019/1):</p> <ul style="list-style-type: none"> <li>• Low sulphur fuel (&lt;8 ppm) to be used for the turbines;</li> <li>• Selection of dry-low NO<sub>x</sub> burners within each turbine using Solar Turbines proprietary SoLoNO<sub>x</sub> technology to reduce NO<sub>x</sub> (as NO<sub>2</sub>) combustion emissions;</li> <li>• Selection of rotating machinery such that the load characteristics for the machines are predominantly elevated thus facilitating performance of the SoLoNO<sub>x</sub> technology;</li> <li>• High utilisation (&gt;95% annually) for operation of the turbine powered machinery thereby reducing increased emissions that may be expected during non-steady state conditions (start-up and shut-down);</li> <li>• Selection of compressor and generator engines as turbine equipment that have intrinsically high combustion temperatures resulting in reduced CO (&lt;50 ppm), unburnt hydrocarbons (UHC) (&lt;25 ppm) and particulate emissions as flue gas;</li> <li>• Selection of electric starters for the three turbines rather than a pneumatic (i.e., fuel gas) alternative.</li> </ul>
Noise / Vibration	Air / wind dispersion and dispersion through the ground	<ul style="list-style-type: none"> <li>• The new VICPOP infrastructure is turbine powered, providing a lower vibration emissions profile in comparison to conventional reciprocating engines;</li> <li>• The turbines are fully enclosed with integral noise attenuating lagging fitted throughout each enclosure;</li> <li>• The area the proposed GEAs will be installed is within the Varanus Island Hub and designed to ensure that maximum operating noise is limited to 85 A-weighted decibels (dB(A)) at 1 m from the respective equipment;</li> <li>• The GEA containers will be sound insulated with interior sound attenuators at either end;</li> <li>• On-site management will act to ensure adherence to <i>the Environmental Protection (Noise) Regulations 1997</i>.</li> </ul>
Light emissions	Air	<p>Management measures of VICPOP infrastructure:</p> <ul style="list-style-type: none"> <li>• Only local lighting around the new equipment is provided, area flood lighting was not installed;</li> <li>• Lighting is switched off unless lights are required for routine inspections (the process facilities within the VICPOP works area will normally be unoccupied at night);</li> <li>• Lighting is limited to 50 mins total on time during operations;</li> <li>• The electrical switch room does not have windows, therefore reducing light spill.</li> </ul> <p>Specific facility lighting requirements installed under W6298/2019/1:</p> <ul style="list-style-type: none"> <li>• Manual light switches will be located to enable operators to turn lights on/off;</li> </ul>

Emission	Potential pathways	Proposed controls
		<ul style="list-style-type: none"> <li>• VICPOP facility lights are monitored with timing alarms and controlled via a constantly manned central control room;</li> <li>• The installed lights have reduced transmission of light energy in wavelengths below 560 nanometres (light in the 450 to 500 nanometre range is most visible to turtles);</li> <li>• Lights are installed horizontally to the floor to contain the light within the confines of the VICPOP works area;</li> <li>• Diffusers and shields to be fitted to lights situated in elevated locations to prevent light spill.</li> </ul> <p>Additional GEAs:</p> <ul style="list-style-type: none"> <li>• Lighting specific to the GEA scope is limited to lighting internal to the package (the package is an enclosed container with no windows);</li> <li>• There is no external area lighting relating to the GEA scope amendment;</li> <li>• The GEA's are not intended for normal operations with the doors open;</li> <li>• GEA operation with open doors will trigger a GEA fire system alarm highlighting 'operator action required';</li> <li>• Santos proposes no material lighting changes as a result of the GEA lighting design, install, operation relating to this licence amendment.</li> </ul>
Discharge of chemicals and hydrocarbons to the ground	Direct discharge, run-off or infiltration	<ul style="list-style-type: none"> <li>• Secondary containment of liquid hydrocarbons by bunds supplied with, integral to and contained within the generator packages. All skid drains will have local manual isolation valves;</li> <li>• C40 gas-turbine generator package has containment bunding on the steelwork platform under the LO cooler for secondary containment when the lube oil pipework is removed during maintenance activities;</li> <li>• GEAs will have concrete containment bunding around equipment foundation for secondary containment when the coolant pipework is removed during maintenance activities;</li> <li>• Local sumps are provided at the VICPOP utilities area for sediment retention and periodic maintenance clean out;</li> <li>• All containment bunds in and around the GEA packages will drain by gravity to these sumps, which are not connected to the old plant oily water or stormwater drain systems;</li> <li>• Drain sumps will be sized to cater for worst case 24 hr rainfall data;</li> <li>• Drain sumps are classified as non-hazardous and therefore no flammable liquids should drain to the sump;</li> <li>• Tundishes and open pipe ends will have mesh fitted to prevent vermin entering the drains.</li> </ul>

### 6.1.2 Receptors

In accordance with the *Guideline: Risk assessments* (DWER 2020), the Delegated Officer has excluded employees, visitors and contractors of the licence holder from its assessment.

Protection of these parties often involves different exposure risks and prevention strategies and is provided for under other state legislation.

Table 10 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises (*Guideline: Environmental siting* (DWER 2020)).

**Table 10: Sensitive human and environmental receptors and distance from prescribed activity**

Human receptors	Distance from prescribed activity
Barrow Island worker accommodation facility	23km southwest
Environmental receptors	Distance from prescribed activity
DBCA managed lands and waters	The Lowendal Islands are situated within the Lowendal Islands Nature Reserve (33902). This nature reserve has been established for the conservation of flora and fauna.
Threatened/Priority Fauna	<p>There are multiple reptile, bird and mammal species declared as Threatened/Priority Fauna under the Environment Protection and Biodiversity Conservation Act 1999 (Cwth) (EPBC Act) and Wildlife Conservation Act 1950 (WA) (WC Act) that are known to use the Lowendal Islands, including VI, as habitat and / or breeding areas. These faunae are listed as critically endangered, endangered and vulnerable, and include migratory birds protected under international agreements.</p> <p>VI beaches are an important nesting and breeding habitat for Hawksbill, Flatback and Green turtles which are all classified as vulnerable under the EPBC Act and the WC Act. The nearest marine turtle nesting beach is South Mangrove Beach, situated approximately 120 metres west of the works approval boundary.</p> <p>Migratory birds known to nest on VI include Wedgetailed Shearwaters, Bridled Terns, Crested Terns and Osprey. The Great Knot is listed on Schedule 1 (Fauna that is rare or is likely to become extinct) of the WC Act. The nearest Wedge-tailed Shearwater rookery is situated approximately 120 metres north of the works approval boundary.</p>
Mangrove community (high value ecosystem providing habitat and shelter for birds, fish and other marine species and breeding sites for several fish and crustaceans).	A white mangrove ( <i>Avicennia marina</i> ) community occurs along the southern portion of a sandy beach on the west coast of VI.
Barrow Island Marine Management Area (high value ecosystem)	The boundary of the Marine Management Area is located to the north, west and south of VI. At its closest point, the Marine Management Area is around 1.6km west of the VI lease area boundary
Surface and groundwater sources	<p>There are no major watercourses or water bodies on VI. The Island is well drained; stormwater predominantly infiltrates into the ground and runoff is minimal.</p> <p>The groundwater table varies across Varanus Island ranging from an elevation of 1.8m Australian Height Datum (AHD) at low tide to 2.6m</p>

	AHD at high tide. The design sub-grade level for the works area is ~9m AHD and therefore the water table is ~7m below ground level.
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## 6.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for those emission sources which are proposed to change and takes into account potential source-pathway and receptor linkages as identified in Section 6.1. Where linkages are incomplete they have not been considered further in the risk assessment.

Where the licence holder has proposed mitigation measures/controls (as detailed in Section 6.1), these have been considered when determining the final risk rating. Where the Delegated Officer considers the licence holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the licence holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 11.

The revised licence L6284/1992/10 that accompanies this amendment report authorises emissions associated with the operation of the premises.

The conditions in the revised licence have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).



**Table 11. Risk assessment of potential emissions and discharges from the premises during construction and operation**

Risk Events					Risk rating <sup>1</sup>	Conditions <sup>2</sup> of licence	Reasoning
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence holder's controls	C = consequence L = likelihood		
Installation of two additional GEAs:  Mobile and infrastructure based light sources	Light emissions	Air dispersion. Impacts include disorientation of nesting turtles and seabirds with potential disruption to breeding and reproduction		Refer to Section 6.1	C = Slight L = Unlikely <b>Low Risk</b>	17	The licence holder proposes light emissions from the construction phase will be minimised by scheduling the construction activities during daylight hours to negate the need for artificial lighting.  As the proposed control is critical for ensuring an acceptable level of risk, it will be imposed on the works section of the licence as an infrastructure installation requirement.
Installation of two additional GEAs:  Vehicle and equipment movements on unsealed access roads. Use of construction equipment to establish the proposed infrastructure.	Dust	Air / wind dispersion. No impacts identified.	Turtle nesting beaches ~120 m west. A Wedge-tailed Shearwater Rookery ~120 m north.	Refer to Section 6.1	C = Slight L = Unlikely <b>Low Risk</b>	17	The licence holder's controls are anticipated to mitigate the potential for adverse impacts from dust emissions to result from the construction of the additional GEAs.  As the watering of the unsealed roads, access tracks, work areas and soil stockpiles is critical for ensuring an acceptable level of risk, it will be imposed on the works section of the licence as an infrastructure installation requirement.
	Noise / Vibration	Air / wind dispersion and dispersion through the ground. No impacts identified.		Refer to Section 6.1	C = Slight L = Unlikely <b>Low Risk</b>	17	The licence holder's controls are anticipated to mitigate the potential for adverse impacts from noise and vibrations emissions to result from the construction of the additional GEAs.  As the proposed controls are critical for ensuring an acceptable level of risk, they will be imposed on the works section of the licence as infrastructure installation requirements.
	Discharge of chemicals and hydrocarbons to the ground	Runoff to existing surface water drainage lines and near shore waters (minimum distance to shore is ~200m). Reduction in the quality of surface water flows and near shore waters, resulting in impacts on fauna and flora.	Surface and marine waters (minimum distance to shore is ~200m)	Refer to Section 6.1	C = Slight L = Unlikely <b>Low Risk</b>	Conditions 1, 6, 7, 11, and 15	The impact of discharges of chemicals and hydrocarbons to the ground surface is assessed within the decision report for Licence L6284/1992/10 and is regulated via Conditions 1, 6, 7, 11, and 15 of this Licence. As the installation of the GEAs takes place within the existing VICPOP Works area, the Delegated Officer does not consider further assessment of these risks necessary.
Operation of two compressors and one C40 generator (installed under W6298/2019/1) and two additional GEAs	Air emissions including NOx, SO2, carbon monoxide and carbon dioxide	Air/wind dispersion. No impacts identified.	Turtle nesting beaches ~120 m west.	Refer to Section 6.1	C = Slight L = Possible <b>Low Risk</b>	Condition 4	The air emission results provided in the Environmental Commissioning Report for works approval W6298/2019/1, found the new VICPOP infrastructure to be below the target emission rates.  The modelling provided for the proposed additional GEAs demonstrated there is a net reduction in emissions, when also considering the retirement of some existing infrastructure.  Based on these outcomes, the Delegated Officer considers that the licence holder's controls for the new and proposed VICPOP infrastructure are sufficient and do not result in a significant change to ground level NO2 concentrations at the Varanus Island Hub. The Delegated Officer does not consider further assessment of this risk necessary.
	Noise / vibration	Air / wind dispersion, dispersion through the ground. No impacts identified.	A Wedge-tailed Shearwater Rookery ~120 m north.		C = Slight L = Possible <b>Low Risk</b>	17	Given the licence holder's controls, the Delegated Officer considers that the operation of the new VICPOP infrastructure will not result in a significant increase in noise and vibration emissions from the Varanus Island Hub.  As the sound insulation of the GEA containers with interior sound attenuators at either end is critical for ensuring an acceptable level of risk, it will be imposed in the works section of the licence as infrastructure design requirement.
	Light emissions	Air dispersion. Impacts include disorientation of nesting turtles and seabirds with potential disruption to breeding and reproduction.			C = Slight L = Possible <b>Low Risk</b>	17	The licence holder's controls for the new VICPOP infrastructure includes both design and management strategies to reduce the risk of light emissions that were developed in accordance with <i>Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts. No 5</i> and subjected to an independent review and assessment conducted by expert turtle consultant Pendoley Environmental. The design and management measures appear to be generally consistent with the <i>National Light</i>

Risk Events					Risk rating <sup>1</sup> C = consequence L = likelihood	Conditions <sup>2</sup> of licence	Reasoning
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence holder's controls			
							<p><i>Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds</i>, and have already been assessed under the decision report for works approval W6298/2019/1. Therefore, the Delegated Officer does not consider further assessment of these risks necessary.</p> <p>With no external lighting area relating to the proposed GEAs, lighting is limited internally within the package and enclosed within a container with no windows. The operation of the GEAs does not require the doors to be open, and operating the GEAs with the doors open will trigger a fire system alarm. Providing the proposed controls are implemented, the Delegated Officer does not consider the lighting of the additional GEAs to cause an unreasonable level of environmental risk.</p> <p>As the proposed controls for the lighting of additional GEAs are critical for ensuring an acceptable level of risk, they will be imposed in the works section of the licence as infrastructure installation requirements.</p>
	Chemical or hydrocarbon spills associated with breach of containment	Run-off to existing surface water drainage lines and near shore waters. Impacts include the reduction in quality of surface water flows and near shore waters, resulting in impacts on fauna and flora.	Surface and marine waters (minimum distance to shore is ~200m)	Refer to Section 6.1	C = Slight L = Unlikely <b>Low Risk</b>	Conditions 1, 6, 7, 11, and 15	The impact of discharges of chemicals and hydrocarbons to the ground surface is assessed within the decision report for Licence L6284/1992/10 and is regulated via Conditions 1, 6, 7, 11, and 15 of this Licence. The Delegated Officer does not consider further assessment of these risks necessary.
		Direct discharge, run-off or infiltration. Impacts include soil and groundwater contamination	Soil and groundwater beneath the premises (~7mbgl with tidal variation)				

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk assessments* (DWER 2020).

Note 2: Proposed Licence Holder's controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

## 7. Consultation

Table 12 provides a summary of the consultation undertaken by the department.

**Table 12: Consultation**

Consultation method	Comments received	Department response
Application advertised on the department's website (16 May 2023 – 6 June 2023)	None received	N/A
Local Government Authority advised of proposal (16 May 2023)	None received	N/A
Department of Mines, Industry Regulation and Safety (DMIRS) advised of proposal (16 May 2023)	None received	N/A
Department of Biodiversity, Conservation and Attractions (DBCA) advised of proposal (16 May 2023)	<p>DBCA replied on 13 June 2023 with recommendations considering that further information on the proposed light fittings of the additional GEAs is required, specifically spectral distribution curves to demonstrate that the installed fittings contain wavelengths below 560nm, and light distribution curves to provide additional information on the intensity, symmetry properties and beam angles of the installed fittings to demonstrate that the fittings generate light in a downward direction.</p> <p>DBCA recommended that management and audits of the GEA lighting, and monitoring of potential artificial light impacts on sensitive receptors, are implemented. Corrective actions should be implemented if audits and/or survey outcomes indicate that artificial light on the GEA infrastructure is impacting turtles and/or wedge-tailed shearwaters or their habitat.</p>	<p>Considering DBCA's comments, DWER requested spectral and light distribution curves from Santos regarding the proposed light fittings of the additional GEAs. However, Santos responded with proposed controls of the GEAs including no external area lighting is to be installed and that all lighting is to be enclosed within a containers with no windows, with doors to the containers to be fitted with a fire alarm system if operation of GEAs occurs with doors open.</p> <p>Regarding the controls proposed by Santos in response, the Delegated Officer does not consider distribution curves or monitoring necessary for the lighting of the additional GEAs.</p>

## 7.1 Licence Holder comments on draft decision

The Licence Holder was provided with a draft Amendment Report and draft Amended Licence on the 29 June 2023. On 5 July 2023 a request was received to correct one typographical error within Table 4 and to waive the remainder of the consultation period. The requested administrative error was to exchange emission discharge points A25 and A26.

## 8. Decision

Based on the assessment in this decision report, the Delegated Officer has determined the operation of the new VICPOP infrastructure installed under W6298/2019/1, and the installation of the additional GEAs will not pose an unacceptable risk to public health or the environment. This determination is based on the following:

- The construction activities for the installation of the additional GEAs will be short term in nature and only scheduled during daylight hours, with further controls implemented to minimise the risk of dust and noise emissions;
- The actual air emissions results from the commissioning period of the new VICPOP infrastructure were below targets based off the modelling by Pacific Environment in 2013;
- The power generating capacity at VI including the new infrastructure and installation of the additional GEAs, allowing for the retirement of some existing infrastructure, will result in only a marginal increase (1.1 MW);
- The operation of the new and proposed VICPOP infrastructure is anticipated to result in a decrease in the emissions from the Varanus Island Hub.

The Licence expiry date has been extended by approximately six months to 16 October 2032 to align with the licence fee period.

## 9. Conclusion

Based on the assessment in this amendment report, the Delegated Officer has determined that a revised licence will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

### 9.1 Summary of amendments

Table 13 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the revised licence as part of the amendment process.

**Table 13: Summary of licence amendments**

Condition no.	Proposed amendments
N/A	Licence expiry date amended from 20 April 2032 to 16 October 2032.
4	Changes to point source emissions to air to include the new and proposed VICPOP infrastructure, as well as removing the existing infrastructure that is to be retired.
Schedule 1	Changes to update the figures provided in Schedule 1, including Premises Map, Premises Layout, and Emissions to Air.
Schedule 2	Changes to the descriptions for the infrastructure and equipment for Category 10 and 34 to include the inlet gas compression infrastructure.

## References

1. The Department of the Environment and Energy (DEE) 2020, *National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds*
2. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
3. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Environmental Siting*, Perth, Western Australia.
4. DWER 2020, *Guideline: Risk Assessments*, Perth, Western Australia.
5. Environmental Protection Authority (EPA) 2010, *Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts. No 5.*