



Works Approval Number	W6117/2018/1
Works Approval Holder	BHP Billiton Nickel West Pty Ltd
ACN	004 184 598
File Number:	DER2018/000072
Premises	Kwinana Nickel Refinery 270 Patterson Road KWINANA BEACH WA 6167 Legal description – Lot 89 on Deposited Plan 411084 Certificate of Title Volume 2958 / Folio 292
Date of Report	14/04/2020
Status of Report	Final

1. Definitions and interpretation

Definitions

In this Amendment Report, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
Amendment Report	refers to this document
Category/ Categories/ Cat.	categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CEO	means Chief Executive Officer. CEO for the purposes of notification means: Director General Department administering the <i>Environmental Protection Act 1986</i> Locked Bag 10 Joondalup DC WA 6919 info@dwer.wa.gov.au
Delegated Officer	an officer under section 20 of the EP Act
Department	means the department established under section 35 of the <i>Public Sector Management Act 1994</i> and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DWER	Department of Water and Environmental Regulation
EP Act	<i>Environmental Protection Act 1986</i> (WA)
EP Regulations	<i>Environmental Protection Regulations 1987</i> (WA)
m ³	cubic metres
Premises	refers to the premises to which this Amendment Report applies, as specified at the front of this Amendment Report.
Risk Event	as described in <i>Guidance Statement: Risk Assessment</i>
Works Approval Holder	BHP Billiton Nickel West Pty Ltd

2. Application details

On 27 May 2019 the Works Approval Holder applied for an amendment to Works Approval W6117/2018/1. The amendment relates to the technical design of the works, with the biggest change (in the leach area) being the replacement of a single scrubber and single stack with four scrubbers and four stacks.

Table 2 lists the documents submitted during the assessment process.

Table 2: Documents and information submitted during the assessment process

Document/information description	Date received
Amendment application with attachments (DWERDT162676)	27 May 2019
Air emissions modelling input files (A1795006)	27 May 2019
Additional information and resubmission of amendment application supporting attachments	20 August 2019

The guidance statements that have informed the assessment and decision outlined in this Amendment Report are listed in Appendix 1.

2.1. Works Approval W6117/2018/1

The Works Approval Holder operates a nickel refinery in Kwinana. In January 2018 the Works Approval Holder applied for a Works Approval for the construction of a Powder Leach Nickel Sulfate Plant (PLNSP). The PLNSP is designed to use the refined nickel from the existing nickel refinery and produce nickel sulfate with a very high purity for the battery market. The design of the PLNSP was at the initial design stage when the Works Approval was granted on 13 July 2018, with detailed design still to be done. The main environmental aspects of the PLNSP were air emissions and noise emissions. As at the time of assessment there were some concerns regarding potential nickel impacts, the works approval includes conditions requiring ambient monitoring for nickel.

2.2. Purpose and scope of assessment

The Works Approval Holder applied for the amendment as a result of its detailed design process for the PLNSP. During this process the Works Approval Holder made several design changes to the approved configuration of the PLNSP and determined that these changes were not of a kind allowed by condition 2 of the Works Approval. Therefore the Works Approval Holder sought an amendment of the Works Approval to legalise these changes. The scope of this assessment is only focused on the environmental impact changes between the approved works and the requested amended works. As such this report is to be read in combination with the original decision report for W6117/2018/1.

Table 3 outlines the proposed amendment to the approved works under W6117/2018/1.

Table 3: Proposed amendment of works

PLNSP area	Approved works under W6117/2018/1	Requested amendment of works
Leach area	Four leach reactor vessels with combined capacity of 670m ³ Scrubber with mist eliminator Discharge stack 25m high	Four leach reactor vessels, each with: - Leach reactor vessel capacity 150m ³ - Scrubber with mist eliminator - Discharge stack 30.6m high
Aeration, filtration and ion exchange area	Leach solution surge tank with nominal capacity 360 m ³	Leach decant tank with nominal tank volume 528 m ³ (live tank volume 361 m ³)
	Sealed and enclosed aeration tanks with nominal capacity 1670 m ³	Two sealed and enclosed aeration tanks with nominal tank volume 490 m ³ (live tank volume 380 m ³)
	Scrubber bleed stream recirculated to Refinery	Scrubber bleed stream recirculated to aeration tanks or Refinery
	Ion exchange acid mixing tank, sump pump and discharge tank	Removed from PLNSP
Product handling and bagging areas	Product silo storage with nominal capacity 400 m ³	Product silo storage with nominal capacity 200 m ³
	One baghouse for product handling area discharging to 17 m high stack	One baghouse for product handling area discharging via a 17m high stack and one baghouse for product bagging area discharging via a 17 m high stack

3. Planning approvals

On 20 March 2020 the City of Rockingham issued the Development Approval for the amended works.

4. Air Emissions

As the changes to the PLNSP design mainly have an impact on air emissions the Works Approval Holder has updated its air emission modelling results reflecting the new PLNSP design.

Table 4 shows the comparison between the approved stack parameters as per the existing Works Approval (WA) and the requested amended stack parameters (WA amendment).

Table 4: Stack parameters comparison

Instrument	Stack	Emission type	Stack height	Stack diameter	Exit velocity	Maximum Modelled Emission rate
WA	Leach off-gas scrubber stack	NiSO ₄ aerosols	25m	0.7m	13.8 m/s	0.066 g/s
WA amendment	Leach off-gas 4x scrubber stacks	NiSO ₄ aerosols	30.6m (+5.6m)	0.52m (-0.18m)	15m/s (+1.2m/s)	0.0165 g/s (1/4 th of WA, so total the same)

Instrument	Stack	Emission type	Stack height	Stack diameter	Exit velocity	Maximum Modelled Emission rate
WA	Aeration tank off-gas scrubber stack	NiSO ₄ aerosols	15m	0.25m	8.5m/s	0.00012 g/s
WA amendment	Aeration tank off-gas scrubber stack	NiSO ₄ aerosols	15.6m (+0.6m)	0.08m (-0.17m)	25.2m/s (+16.7m/s)	0.00012 g/s
WA	PLNS dryer scrubber stack	NiSO ₄ aerosols and particulates	17m	0.25m	6.0m/s	0.0078 g/s
WA amendment	PLNS dryer scrubber stack	NiSO ₄ aerosols and particulates	20m (+3m)	0.63m (+0.38m)	21m/s (+15m/s)	0.0078 g/s
WA	Ni Powder dust collector (nominally 5 baghouses)	Ni metal particulates	17m	0.25m	8.5m/s	0.0034 g/s
WA amendment	2 modelled emission points: A1 and A2 (combination of 2 vents)	Ni metal particulates	17m 20m	0.38m 0.09m	13.9m/s 0.35m/s	0.0023 g/s 0.0011 g/s
WA	Product transfer conveyor dust collector	NiSO ₄ particulates	17m	0.3m	11.8m/s	0.0068 g/s
WA amendment	Product handling and bagging 2x dust collectors and stack (proposed as A9 & A10)	NiSO ₄ particulates	17m	0.3m and 0.49m	14m/s and 16.2m/s	0.0068 g/s

The overall emissions in g/s do not increase, but the way that these emissions are being emitted (leach off gas) is proposed to change. The main difference is a single stack changing into four stacks that are higher and have a greater exit velocity. Most of the other sources also have either increased stack height and/or greater exit velocity.

The ground level concentration (GLC) results of the air emission modelling for the maximum 24-hour average is shown in Table 5 as a comparison against the GLC results of the air emission modelling conducted for the original works approval. This comparison is made for the key sensitive receptor locations.

The 24-hour GLC-guideline value for nickel is 0.14 µg/m³ as set by the Department of Health (see DWER's draft Guideline Air Emissions, October 2019).

The Works Approval Holder's air emission modelling has been assessed by the Department's air quality experts. The dataset used for the amendment modelling is the same as the dataset used for the original modelling. DWER accepts that by using the same dataset for both model runs allows a comparison between the air modelling for the original works approval and the amendment application.

Table 5: maximum predicted 24-hour average results comparison under worst case scenario

Receptor	Ni metal WA	Ni metal WA % of standard*2	Ni metal WA amendment	Ni metal WA amendment % of standard	% Change	NiSO ₄ (as Ni equivalent) WA*1	NiSO ₄ (as Ni equivalent) WA % of standard*1	NiSO ₄ (as Ni equivalent) WA amendment*1	NiSO ₄ (as Ni equivalent) WA amendment % of standard*1	% Change
R1	0.0025	1.8%	0.0032	2.3%	28.00%	0.025	18.1%	0.037	26.2%	48.00%
R2	0.0026	1.8%	0.0029	2.0%	11.54%	0.026	18.7%	0.033	23.7%	26.92%
R3	0.0010	0.7%	0.0009	0.66%	-10.00%	0.010	7.1%	0.0105	7.5%	5.00%
R4	0.0009	0.6%	0.0009	0.64%	0.00%	0.0088	6.3%	0.0104	7.4%	18.18%
R5	0.0006	0.4%	0.0008	0.56%	33.33%	0.0062	4.4%	0.0071	5.0%	14.52%
R6	0.0007	0.5%	0.0006	0.43%	-14.29%	0.0065	4.7%	0.0057	4.1%	-12.31%
R7	0.0006	0.4%	0.0006	0.40%	0.00%	0.0058	4.1%	0.0056	4.0%	-3.45%

*1 NiSO₄ is expressed as Ni equivalent as there is no standard for NiSO₄ but only for Ni.

*2 standard refers to guideline value detailed in DWER Draft Guidelines: Air Emissions, dated October 2019

The percentage changes of the modelling results can partially be explained by the way the modelling software uses the changed stack heights and stack velocity and the way it handles the changed configuration of four leach off-gas scrubber stacks relatively close to each other versus a single stack with the same emission rate. Another contributing factor may be that due to the changed configuration of the stacks, stack heights and exit velocity the dispersion of the plumes are expected to change and as such different weather conditions may cause different maximum ground level concentrations.

It is noted by the Works Approval Holder that the worst-case scenario is unforeseeable as the four leach-off gas scrubber stacks have been assumed to be emitting continuously and simultaneously at their peak emission rates. However, emissions from the four leach vessels will cycle on a batch basis, with the emission rate for each stack varying on a curve between peak emissions and negligible emissions. Each cycle is expected to last approximately 24 hours. All four vessels will never be emitting at the peak rate at the same time.

Whilst it is theoretically possible for all four leach vessels to be at the same cycle point at the same time, process and operational constraints (including safety considerations) both upstream and downstream of the leach circuit will not allow this scenario to occur.

Additionally, the peak emission rate of any of the leach vessels will occur for less than one hour in any given 24-hour cycle decaying to less than one-quarter of the peak within two hours and to negligible emissions within six to eight hours. As such the model used very conservative emission figures for these stacks by using the peak emission rate as a constant.

Because of the requested change in configuration of the PLNSP, emission rates in mg/m^3 have also changed and the limits as stated in the infrastructure table have been reviewed. To establish the new emission limits for the relevant stacks, the Department used the maximum emission rates as per the modelling report and converted the g/s to mg/m^3 . Based on the modelling results the Department determined that emission limits required reassessment to take into consideration that stack testing and analysis have an error factor (varying, but generic factors depending on tests can be between 10% and 50%). The new emission limits are set at a level closer to the emission rates as provided by the Works Approval Holder in its application, compared with those previously approved in the original Works Approval. See

Table 6 for detailed calculations of the emissions from each stack and the proposed new emission limits.

Table 6 Determination of appropriate emission limits

Stack	Existing Works approval limit	WA Amendment application emission rate	Proposed limit in WA Amendment	Reasoning
Ni powder dust collector	24 mg/m ³	1.44 mg/m ³	5 mg/m ³	The original works approval application had an emission rate of 8.1mg/m ³ . However, in error, 24 mg/m ³ was applied to the works approval. Based upon provided information for the amendment and considering an error margin, 5mg/m ³ is more appropriate.
Ni powder bin vents	-	253.75 mg/m ³	-	This is a vent with very low volumetric flowrate and extremely low mass emission rates. As such it is not suitable to be tested and compliance with any limit would be hard to verify.
leach off gas scrubber stack	28 mg/m ³	5.18 mg/m ³	8 mg/m ³	Taking into consideration the split of the single stack to four stacks and a generic error margin during stack testing and analysis, 8 mg/m ³ is an appropriate limit for each individual stack.
leach off gas scrubber stack		5.18 mg/m ³	8 mg/m ³	
leach off gas scrubber stack		5.18 mg/m ³	8 mg/m ³	
leach off gas scrubber stack		5.18 mg/m ³	8 mg/m ³	
Aeration tank off-gas scrubber stack	1 mg/m ³	0.95 mg/m ³	5 mg/m ³	The Industrial Emissions Directive from the EU uses 5mg/m ³ as a lowest standard for particulate emissions.
NiSO ₄ Dryer scrubber stack	10 mg/m ³	1.19 mg/m ³	5 mg/m ³	The Industrial Emissions Directive from the EU uses 5mg/m ³ as a lowest standard for particulate emissions. In addition, the emission rate as proposed by the applicant, is very low, further confirming that 10 mg/m ³ was too liberal.
Product Transfer conveyor dust collector	24 mg/m ³	6.83 mg/m ³	10 mg/m ³	The original WA application had an emission rate of 8.2mg/m ³ , however, in error, 24 mg/m ³ was applied to the works approval. Based upon provided information for the WA amendment and considering an error margin, 10mg/m ³ is more appropriate.

5. Location and receptors

Table 7 below lists the relevant sensitive land uses in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 7: Receptors and distance from premises boundary

Residential and sensitive premises	Distance from Prescribed Premises
Residents in North Rockingham	Approximately 1.6km to the south-south west
Residents in Hillman	Approximately 2.6km to the south
Community recreation area (Wells Park)	Approximately 600m to the west – north west

6. Whole of refinery emissions impact

Concurrent with the assessment of this works approval amendment, DWER also received a works approval application for the Capacity Uplift Project from the Works Approval Holder. The Capacity Uplift Project is a whole of refinery project to increase total capacity of the refinery. As part of that application new emission modelling was submitted, using meteorological data from Kwinana, as opposed to the Swanbourne dataset that was used for both the original PLNSP works approval and the amendment application. The change in meteorological data was requested by DWER. The use of Swanbourne data was previously agreed to by DWER for the PLNSP works approval applications.

Following the Department's expert review of the Capacity Uplift Project model, a request for advice was sent to the Department of Health for a recommendation on the acceptability of the modelled results for both nickel and ammonia.

7. Department of Health advice

The Department of Health provided advice on the modelling on 7 January 2020, and subsequent clarification and amendment of the advice on 20 January 2020 and 24 January 2020. The advice concluded that given the conservative nature of the guidelines, the modelled concentrations for both nickel and ammonia are acceptable at the sensitive residential receptors. The advice also provided some clarity on the status of the recreational area Wells Park and the commercial/residential property located there. These two receptors would not be seen as sensitive receptors within a residential area but as sensitive receptors within an industrial/commercial area.

8. Risk assessment

Table 8 below describe the Risk Events associated with the amendment consistent with the *Guidance Statement: Risk Assessments*.

Table 8: Risk assessment for proposed amendments during operation (compared against original risk)

Source/ Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls	Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Original design of the PLNSP as approved under W6117	Nickel and NiSO ₄	Residents in North Rockingham and Hillman	Scrubber systems and bag filters	Minor	Possible	Medium	See Decision Report for W6117/2018/1.	Scrubber systems and bag filters prescribed, stack testing and ambient nickel monitoring
Change of the design of the PLNSP	Nickel and NiSO ₄	Wells Park and bottle-shop	Scrubber systems and bag filters	Moderate	Possible	Medium	The change in the risk assessment relates to the modelled increase of nickel concentration at sensitive residential receptors. It is predicted higher than original modelling and as such the consequence rating slightly increased. As the Department of Health did advise that the modelled impact was acceptable, the overall risk rating has been set at Medium. Which is the same as it was for the original works approval.	No additional regulatory controls required for the amendment. Administrative changes to facility the change of the design.

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the Department's *Guidance Statement: Risk Assessments (February 2017)*

9. Decision

As stated above, the Works Approval Holder has submitted a works approval application for the Capacity Uplift Project for the whole nickel refinery. Included with that application was new modelling and emission rate data from the whole refinery, including the PLNRP, which has identified potential modelled exceedances of ambient guidelines for nickel. This has necessitated a redetermination of emission limits to take into consideration the newly presented data and sampling error factors, see

Table 6 for detail.

In undertaking its assessment of the Capacity Uplift Project application, DWER has sought advice from the Department of Health, which indicates that although predicted ground level concentrations for nickel were higher than the assessment criteria, they were not deemed unacceptable given the conservative nature of the ambient guidelines.

Based on this advice, DWER will address any potential Nickel exceedance concerns at a broader whole of site level as part of that assessment instead of this works approval amendment.

For this PLNSP works approval amendment, the Delegated Officer notes that the modelled impact due to the different configuration of the stacks may slightly increase, when compared to the original design. However, the Delegated Officer considers that the air dispersion modelling for the change in design is conservative and that actual emissions and discharges from the PLNSP are not expected to significantly change due to the practical operational constraints for the plant as described in section 4.

In addition, the Delegated Officer has considered advice from the Department of Health that the modelled impacts of emissions associated with this amendment on sensitive receptors are not unacceptable.

As such, in forming the conclusion below the Delegated Officer considers that the change of design of the PLNSP does not significantly change the environmental risk as determined in the original approval. Therefore, the amendment can be approved.

10. Consultation

Table 9: Summary of consultation

Method	Comments received	DWER response
Works Approval Holder was provided with a draft amendment report and draft amended works approval on 13 February 2020.	The Works Approval Holder provided comments on the drafts on 26 March 2020. The comments were mostly of an administrative nature (wording and corrections). Comments that were more technical have been included in Appendix 2.	The Delegated Officer has reviewed the comments and accepted these administrative comments. The Delegated Officer's response to the more technical comments have been included in Appendix 2.

11. Conclusion

Based on the assessment in this Amendment Report, the Delegated Officer has determined that an Amended Works Approval will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

11.1. Summary of amendments

Table 10 provides a summary of the amendments and will act as record of implemented changes. All proposed changes have been incorporated into the Amended Works Approval as part of the amendment process.

Table 10: Works approval amendments

Condition	Proposed amendments
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No.	
Definitions	Definitions updated
5	Changes to the emission sources and the limitations/requirements for some emission sources
15	Changes to stacks and added a new map with the emission points. Stack testing requirements remain the same.
Schedule 1	Maps have changed to reflect the changes of the design of the PLNSP.
Schedule 2	Description of works has changed to reflect the design changes.

Caron Goodbourn
Manager, Process Industries

An officer delegated by the CEO under section 20 of the EP Act

Appendix 1: Relevant Guidance Statements

	Document title	In text ref	Availability
1	DER, July 2015. <i>Guidance Statement: Regulatory principles</i> . Department of Environment Regulation, Perth.	DER 2015a	accessed at www.dwer.wa.gov.au
2	DER, October 2015. <i>Guidance Statement: Setting conditions</i> . Department of Environment Regulation, Perth.	DER 2015b	
3	DER, August 2016. <i>Guidance Statement: Licence duration</i> . Department of Environment Regulation, Perth.	DER 2016a	
4	DER, February 2017. <i>Guidance Statement: Risk Assessments</i> . Department of Environment Regulation, Perth.	DER 2017b	
5	DWER, June 2019. <i>Guideline: Decision Making</i> . Department of Water and Environmental Regulation, Perth.	DWER 2019a	
6	DWER, June 2019. <i>Guideline: Industry Regulation Guide to Licensing</i> . Department of Water and Environmental Regulation, Perth.	DWER 2019b	

Appendix 2: Summary of Works Approval Holder comments

Condition	Summary of Works Approval Holder comments	DWER response
Premises legal description	The Works Approval Holder provided a correction of the legal description of the premises.	The Delegated Officer accepted this change.
5	The Works Approval Holder suggested to include emission reference points in the authorised emissions table for each point source, which are shown in the map in Schedule 1. The Works Approval Holder suggested a change in wording with regards to the stack height. The stack height itself was not changed.	The Delegated Officer accepted these changes.
5 and 15	The Works Approval Holder commented that the proposed changes to the design of the Product Handling Area baghouse and the Product Bagging Area baghouse were no longer required and that it intended to construct the already approved design under the Works Approval	The Delegated Officer accepted this change.
11	Due to the current difficulties with access to ambient monitoring locations, the Works Approval Holder requested an extension of the date in condition 9 by which the ambient monitoring plan has to be implemented. The Works Approval Holder advised that all equipment had been purchased and the two monitoring locations chosen. However, access is now restricted. The Works Approval Holder stated that the monitoring plan will be implemented as soon as possible, but that an extension to 1 January 2021 should provide adequate time.	The Delegated Officer noted the reasons for a requested date extension in condition 9 and accepted the revised date of 1 January 2021 on the expectation that the monitoring will start as soon as reasonably possible.
Schedule 1	The Works Approval Holder provided an updated map with emission points.	The Delegated Officer accepted this change.
Schedule 3	Following recent discussions between the Department and the Works Approval Holder, a location for ambient monitoring within the community has been agreed upon that was outside the ambient nickel monitoring areas as per the original works approval. As such the Works Approval Holder has requested to amend Schedule 3 and add the area in which the current proposed residential nickel monitor will be located.	The Delegated Officer accepted this change.