
From: section 78B
Sent: Thursday, 18 February 2016 6:57 AM
To:

Subject: FW: QN - 16 February - Roaster incident update
Attachments: 2016 02 16 330-1401 Roaster 1 EVD Explosion Post Incident External Damag....pdf

FYI.

Cheers.

section 78B

From: [REDACTED]@qni.com.au]
Sent: Wednesday, 17 February 2016 5:33 PM
To:
Cc:
Subject: QN - 16 February - Roaster incident update

Darren further to our discussion this morning, a summary of QN site investigation progress into the Roaster #1 event on 16/2/16 is as follows ;

- A summary engineering structural assessment has been completed today. The assessment is attached for your general review. As a result of the assessment, there has been no significant structural repairs identified as a result of the incident.
- A team has been established to investigate this incident. The investigation team includes process engineers and operations staff.
- Initial mechanical inspection of the oil burner involved in the incident indicate that the burner had a seized air flow control valve assembly. This kept the air flow addition rate at its minimum firing position irrespective of the manual adjustment of the external air flow lever. At this early stage this is being considered as a contributing factor.
- A crane will remove the existing EVD emergency vent damper from Roaster 1 tomorrow morning and replace it with a refurbished one.
- Assessments are underway of our systems and processes to ensure we do not replicate the event when bringing other roasters online in the short term.
- I have sent you a copy of the PMI bowtie 156 as requested, related to this event.
- I will meet with John Finn on Friday and go through the event in more detail onsite.
- I will continue to brief the voluntary administrators FTI with details of this event investigation.

Regards,

[REDACTED] Operations , Refinery & Port
QUEENSLAND NICKEL PTY LTD (Administrators Appointed)



1 Greenvale Street, Yabulu QLD 4818
PMB 5, Townsville QLD 4810

P >

E >

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POST-INCIDENT EXTERNAL DAMAGE SURVEY

Equipment No:	330-1401 Roaster 1	Cintellate:	INC-36529
Inspected By:		Inspection Date:	16/02/2016



1 Scope of Survey

Following an explosion within Roaster 1, a damage survey was conducted on 330-1401 Roaster 1 and 330-330-1401-EVD Roaster 1 Emergency Vent Dampener Assembly. The incident is described in Cintellate as INC-36529 "The Emergency Vent Damper has broken away from the framework," which occurred on 16/02/2016.

2 Limitations and Constraints

The condition assessments provided apply only to the external structural elements that could be safely inspected from ground level or existing platforms, and/or where the surface was not covered by material build-up or obscured by equipment.

3 General Inspection Findings

The complete list of external damage to the Roaster structure, that was either induced or exacerbated by the 16/02/2016 event, is detailed in Appendix A.

4 Conclusion

The survey identified a number of items that were either induced or exacerbated by the 16/02/2016 event. In some cases, assessment was restricted by debris accumulation, lagging or accessibility. It is recommended to obtain access to these locations.


Graduate Structural Engineer
Queensland Nickel

POST-INCIDENT EXTERNAL DAMAGE SURVEY

Appendix A

External Structural Damage Survey

POST-INCIDENT EXTERNAL DAMAGE SURVEY

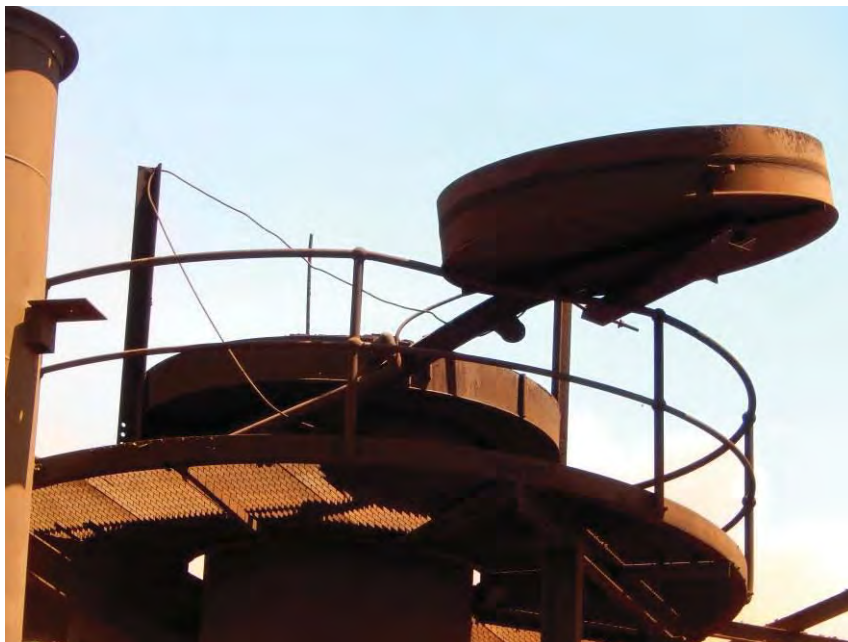
Item #	1
Asset	330-1401-EVD Roaster 1 Emergency Vent Damper Assembly
Location	E.V.D Dust Seal Cap (Lid) and Frame
Finding	



E.V.D lid no longer secured to framework and was now resting in North-West (plant) direction on the handrail

Platform level was slightly skewed downwards towards North-West direction. Immediate structural members were unable to be safely inspected at time.

Access is required for closer inspection.



Handrail deformed under load of E.V.D lid.

E.V.D lid frame structure destroyed and has jammed lid in observed position.

Deformed frame structure prevented E.V.D lid from falling further.

POST-INCIDENT EXTERNAL DAMAGE SURVEY

Item #	2
Asset	330-1401-EVD Roaster 1 Emergency Vent Damper Assembly
Location	Roaster 1 to E.V.D Vertical Duct
Finding	



Crimping of lagging due to impact was evident on northern half, East to West.



Lagging was loose in locations suggesting movement of chute.

POST-INCIDENT EXTERNAL DAMAGE SURVEY

Item #	3
Asset	330-1401-EVD Roaster 1 Emergency Vent Damper Assembly
Location	Roaster 1 to E.V.D Vertical Duct connection
Finding	



No gross damage evident.

Recommend clean and closer inspection to confirm and identify minor effects.

POST-INCIDENT EXTERNAL DAMAGE SURVEY

Item #	4
Asset	330-1401 Roaster 1
Location	Roaster Roof and Beams
Finding	



Beams did not exhibit deformation as observed by visual inspection.

Debris accumulation prevented close assessment. Removal of debris is required to allow further inspection.



POST-INCIDENT EXTERNAL DAMAGE SURVEY

Item #	5
Asset	330-1401 Roaster 1; 330-PSE1401 Roaster 1 Explosion Door
Location	Roaster Top Hatch
Finding	



Deformation of "seal" and debris accumulation. Limited reduction in integrity would be expected from this deformation.

Note: Ore is use to seal around the explosion door during operation



Explosion door latching beams deformed locally at impact points. Limited reduction in integrity would be expected from this deformation.

Framework for explosion door did not display obvious signs of damage, however attachment points to roaster roof should be cleaned free of debris to allow assessment.

POST-INCIDENT EXTERNAL DAMAGE SURVEY

Item #	6
Asset	330-1401 Roaster 1
Location	Level 8 East side
Finding	



Pre-existing crack in welds at skew band, approximately 4000mm long.

Crack may have been exacerbated by event; however this cannot be verified without further data.



POST-INCIDENT EXTERNAL DAMAGE SURVEY

Item #	7
Asset	330-1401 Roaster 1
Location	Level 5 West (Hearth 9)
Finding	



Crack 250mm long near informed point of ignition.

Crack displayed signs of pre-event existence (typical signs of internal corrosion), however indications of exacerbation was evident.



Plate has been deformed over an approximate 4 sq. m area.

POST-INCIDENT EXTERNAL DAMAGE SURVEY

Item #	8
Asset	330-1401 Roaster 1
Location	Level 2 West
Finding	



Plate section approximately 1.5 sp. m area was deformed. Unable to confirm whether induced or exacerbated.

Location is near typical hot spot of roaster and looks to be adequately braced.



POST-INCIDENT EXTERNAL DAMAGE SURVEY

Item #	9
Asset	330-1401 Roaster 1
Location	Level 1 Flare
Finding	



Circumferential "Flare" of roaster base.

It is unknown whether this flare was exacerbated by 16/02/2016 event, although this would not be expected due to informed location of ignition.

Flare is non consistent with nature of incident.



POST-INCIDENT EXTERNAL DAMAGE SURVEY

Item #	10
Asset	330-1401 Roaster 1
Location	Roaster Floor
Finding	



Roaster floor was obviously convexly bowed, particularly in the corroded locations on the southern side.

Historical photographs indicate bow was present prior to event.

The deformation seemed slightly greater than historical photographs from 2009.

To what degree (if any) the increase in bow was due to the incident is indeterminate.



From: @qni.com.au>
Sent: Wednesday, 2 March 2016 4:22 PM
To: [REDACTED]
Subject: RE: Burner operator is LEVEL2

[REDACTED]

A few things;

- Re: "Some physical training". Having spoken to [REDACTED] several times I found that he had been pretty well trained on "hows" of the task. Again, it was the Hazards knowledge (mostly from SWIs) he was missing.
- More information on Levels may be found in pay-scaling because Levels have their genesis there (i.e. pay for experience and skills).
- As for the statement > "Nowhere can I find anything that states the Trainee operator (maintainer in this case) cannot operate alone without being signed off"

As per the ICAM.

Ref: Section 4.4.1 of Training & Assessment Standard

"After training and assessment is complete employees can perform individual tasks independently without direct supervision."

Having said that site evidence suggests that assessment is a late activity that occurs well after training in individual tasks (and thus trainees often work alone "developing" skills). The approved learning guides lean that way too.

Begs the question – what would happen if we asked all areas to stop persons from acting unsupervised on tasks they are not assessed against?

regards

[REDACTED]

QUEENSLAND NICKEL PTY LTD (Administrators Appointed)

Greenvale Street, Yabulu QLD 4818

PMB 5 Townsville QLD 4810

P > [REDACTED]

E > [REDACTED]

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From: [REDACTED]
Sent: Wednesday, 2 March 2016 4:03 PM
To: [REDACTED]
Cc: [REDACTED]
Subject: RE: Burner operator is LEVEL2

You are correct in saying that the documents don not tell you that a Burner operator is Level 2. History in the area and the training department, from a practical assessment point of view shows otherwise. The last two people to be signed off where [REDACTED]; both had to complete Top operator and Burner operator assessments to be deemed competent as level 2. The level progression framework definitely looks a bit cloudy to me, which is something the sole lonely training assessor and I will be working on; in fact we already have. When going through training records and area information an operator who is working towards a higher level of competency gets given access in LMS to the higher level folders to learn. Nowhere can I find anything that stats the Trainee operator (maintainer in this case) cannot operate alone without being signed off. I think a golden opportunity presents itself by having **"THIS TASK SHALL ONLY BE COMPLETED BY A COMPETENT APPROPRIATELY TRAINED OPERATOR UNLESS BEING SUPERVISED"** on all **Critical work Instructions**

Just FYI, according to experienced operational leaders, In the past, a 330 level 1 operator was not permitted to be called on s shift "Callout" due to the fact they were not competent to work as a level 2 which is essentially a "Shift position" Granted there were far more people to choose from when those rules where in play; a luxury we don't have today.

Some physical training had been given to [REDACTED] but nothing signed off on paper, nor were WI's read. I understand where you are coming from.

Regards,

From: [REDACTED]
Sent: Wednesday, 2 March 2016 8:14 AM
To: [REDACTED]
Subject: FW: Burner operator is LEVEL2

[REDACTED]
I can't see how this document tells me Burner Operator is Level 2.
Also was any of this completed for [REDACTED]

[REDACTED]
QUEENSLAND NICKEL PTY LTD (Administrators Appointed)
Greenvale Street, Yabulu QLD 4818
PMB 5 Townsville QLD 4810
P [REDACTED]
E [REDACTED]

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From: [REDACTED]
Sent: Thursday, 25 February 2016 2:42 PM
To: [REDACTED]
Subject: Burner operator is LEVEL2

HICB File Note

Author:	section 78B
Date:	16 February 2016
File:	20160217 Update on Roaster 1 incident_QNI

QNI Discussion Following Roaster 1 Explosion.

Present

- Workplace Health and Safety Queensland
- Palmer Queensland Nickel Refinery

Discussion

reported:

Roaster 1 Integrity

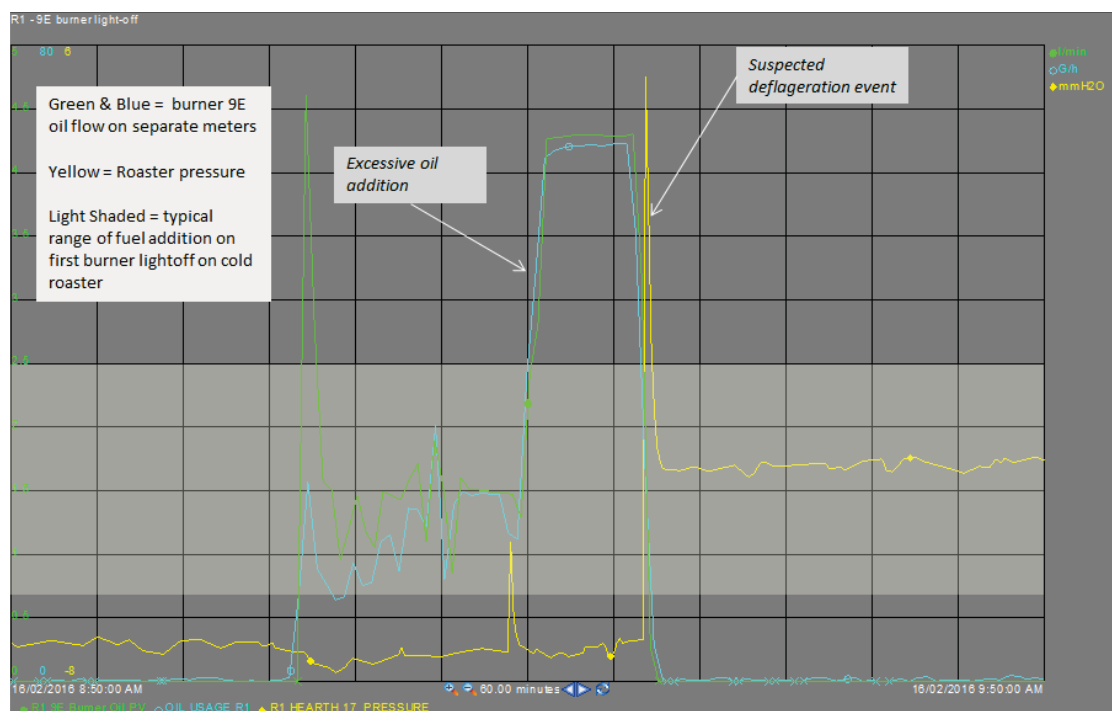
1. Preliminary investigations have commenced on Roaster 1 integrity.
2. Appears to be no apparent damage to Roaster 1 external structure.
3. Unable to confirm the condition of the internals of Roaster 1 at this stage.
4. The vessel is to have internal inspections done to assess the condition of the refractory lining- work is continuing.
5. The explosion lifted the explosion safety door and caused the emergency vent dampener (EVD to rotate approximately 180° from its normal position. Pictures of the damage were provided in emails sent during this discussion, and are presented below:



Incident Details

1. Incident occurred at 9.26am.
2. Operator was in process of starting up Roaster 1.
3. Operator was at hearth 9 (east side burner), and attempting to light up.
4. Operator made 3 attempts and eventually got the Roaster lit.
 - a. Evidence which supports the burner being lit was the detected increase in temperature being recorded inside the Roaster.
5. It appears that the Roaster burner had been operating for ~20 minutes without problem.

6. At the time of the incident, it appears that the operator was at the burner and making adjustments to oil flow into the Roaster.
 - a. This is a manual operation to adjust this oil flow rate
7. The explosion was not immediately detected by any person, including the operator starting the Roaster.
 - a. Site personnel only became aware when the control room operator noted on CCTV the EVD in a rotated state.
 - b. Further investigation found the ESD on level 9 to be open.
8. No persons were injured or in the near vicinity.
9. The operator has reportedly followed their standard operating procedure for lighting the furnace, and has assured QNI management that they had opened the EVD as per normal operating practices prior to lighting the burners, which included steaming the burners prior to start-up.
10. QNI have looked at process trends following this incident, and have found that there was unexplained increase in oil flow to the burner in hearth 9 for a period of 5-6 minutes prior to the explosion occurring. A copy of the trend is provided below.



11. A pressure transmitter located inside the Roaster detected the moment the explosion occurred.
12. The reason for the increase in oil flow to the burner is not yet known. Possible explanations include operator error and burner malfunction, including the possibility that the burner had a blockage in the oil line which then cleared itself.
13. Based on trend data it appears that an additional 20L of oil was added to the Roaster from between where the excessive oil addition started and the explosion event.

Other information:

1. This Roaster was being put on in order to maximise nickel recovery- studies onsite had found that it was better to operate all the Roasters at reduced rates, rather than a few Roasters at higher rates.
 - a. Other Roasters are planned to be put online prior to this explosion.
 - b. QNI have indicated that they are likely to delay the start of other Roasters at this stage however until they have a better understanding as to the nature of this event.

Actions

1. PC to provide update of the incident later today 17/02/2016 or early 18/02/2016.



MAJOR HAZARD FACILITIES AUDIT REPORT

PALMER QUEENSLAND NICKEL AND COBALT

Date of Visit: 18/04/2016

Audit Team Members:

Senior Safety Advisor- Major Hazards
Inspector- Research and Scientific Branch QFES
Inspector- Research and Scientific Branch QFES

Document Revision Record

Issue	Date	Description	Prepared by	Reviewed by
Rev A	10/05/2016	Draft		
Rev B	<u>29/5/2016</u>			

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1. Scope of Site Visit

A representative from Workplace Health and Safety Queensland visited the Queensland Nickel refinery as part of its ongoing surveillance activities to ensure that the hazardous chemical inventories stored continue to be managed. The audit served as an opportunity to pose some questions to former Queensland Nickel Pty Ltd (QNI) management regarding the recent release of the Administrators (FTI Consulting) report.

This visit was also attended by representatives from Queensland Fire and Rescue Services (QFES). QFES sought a better understanding of existing hazardous chemical inventories, including quantities of chemicals, the location of these chemicals, and any relevant storage and bunding arrangements unique to the site. Data collected from this visit will be used to enable QFES to update local emergency response plans and to model several potential loss of containment scenarios for the site.

Findings of the audit may not disclose all instances of non-compliance at the facility.

This report is written with the aim of improving safety at the site by providing feedback on the findings of the audit. The recommendations are for consideration by QNI to accept, vary or reject as they choose. Recommendations do not carry any legal obligation.

Company Representatives

The following company representatives participated in the audit:

Name	Title
	Former Director- QNI
	Sole Director- Queensland Nickel Sales
	Former employee- QNI
	Former employee- QNI
	Former employee- QNI
	Employee- Waratah Coal

1.1 Acronyms

Term	Meaning
Sch 3/10(1)(g) and (h)	
ERC	Emergency Response Crew
ERP	Emergency Response Procedure
OE	Operating Envelope
OEE	Operating Envelope Exception
QFES	Queensland Fire and Rescue Service
QNI	Queensland Nickel Pty Ltd
QNS	Queensland Nickel Sales Pty Ltd
WHSQ	Workplace Health and Safety Queensland

2. Executive Summary

Representatives from QFES and WHSQ attended the Queensland Nickel refinery on 18 April 2016. The purpose of this visit was to allow QFES to gain a better understanding of existing hazard chemical inventories on site. Data collected by QFES will be used to update QFES local emergency response plans.

Work continues on the site's HAZCHEM manifest in line with the closure date for notice I1001862 on 29 April 2016. Copies of the current manifest was provided to QFES and WHSQ on the day. The manifest will continue to be monitored in future WHSQ audits.

Site observations found some improvements to the management of tank/vessel bunding, and the sulphur storage area. Work had commenced on site to remove redundant gas cylinders and there appears to be an increased presence of personnel on site.

However work on site continues to be slow, with many of these observation done following the issue of notices. The site still has unresolved issues not addressed.

Previous WHSQ discussions have reported on the intent by the operator to transition the refinery into a caretaker-maintain mode. This work has not commenced, with no evidence suggesting that the plant is in a state which supports long term inactivity or evidence which supports that routine maintenance is being performed. Instead current tasks performed appear to be reactive, dealing with immediate issues arising on the day.

This delay to properly store and maintain plant will likely promote the deterioration of an already aging plant. More work and resources are needed by the refinery's operator to address this problem.

This audit also served as an opportunity for WHSQ to follow-up on a number of outstanding issues which arose this year.

2.1 Administrator's Report

On the 11 April 2016 FTI Consulting released their Administrator's report. This report made reference to several safety and maintenance issues which warranted further investigations. Allegations included:

- Ongoing maintenance issues associated with the effluent boiler (in their ammonia production circuit).
- Significant cuts to site maintenance budgets post BHP-Billiton's administration, and
- Area 320 exhaust stack on the verge of collapse.

WHSQ sought to further understand the basis of these claims. Interviews with former QNI and current QNS management were undertaken. A number of documents were request under s165 of Work Health and Safety Regulation 2011, and were provided to the inspector during this time.

Whilst the former QNI and current QNS officers refute many of the Administrator's claims, the information gathered does not necessarily support this stance.

It was identified that the effluent boiler was and remains inoperable. The failure of this boiler did not necessarily increase the refinery's offsite risk profile, but had introduced a significant business cost impost up to the time the refinery ceased operation.

The drop in maintenance spending appears to be correct. Cuts in spending were reportedly possible following numerous business reviews which removed self-imposed barriers, including BHP-Billiton legacy issues. Former QNI management maintain that there was no reduction to safety following the cuts to maintenance spending. Information gathered from previous WHSQ audits and the findings following Roaster 1's explosion in February 2016 does not support this claim.

Area 320 exhaust stack does have substantial cracking on its outer shell and appears to be in a poor state. Data quoted in the Administrator's report were sourced from an inspection report conducted internally by QNI personnel. The report was reviewed and authorised for release by the site's senior structural engineer. The report does not fully discuss how the remnant life of

the stack was calculated and does warrant further investigation. However QNI management did not perform this investigation, nor did they challenge or collaborate the reported concerns following the release of this report

The inspection report warned that the stack was “no longer viable for continued operation without notable safety and economic risk”, with a recommendation to remove and replace this stack within 24 months.

WHSQ would expect that such a warning should prompt an immediate and appropriate response. Instead this warning appears to have been dismissed, ignored or deliberately not acted on.

2.2 Roaster Incidents

WHSQ sought further information regarding two Roaster incidents. The uncontrolled release of oil into Roaster 10 whilst it was hot (01 February 2016) and the explosion during the start-up of Roaster 1 (16 February 2016). Both had the potential to escalate to major incidents.

Based on QNI's own investigation into these incidents, it ~~was found~~ appears that:

- Training processes were being bypassed, not enforced or insufficiently resourced.
- Inexperienced trainees were expected to and allowed to perform high risk activities with arguably inappropriate training or supervision.
- Routine maintenance of burners was not occurring, with 57 burners requiring servicing
- An acceptance by personnel and management to operate plant in an impeded state, and
- An increased need for supervisors to perform operator duties in order to cover the gaps in shift manning and skills.

Based on the information provided to WHSQ it appears that the root cause to these incidents is linked to QNI's decision to terminate 237 employees on 15 January 2016. QNI's own findings from these roaster incidents supports WHSQ concerns regarding these job cuts- first raised with QNI management on 29 January 2016.

2.3 Conclusions

Previous WHSQ reports have identified a deterioration of the site safety management system. Information collated during this audit, report of business changes introduced following BHP-Billiton's exit which appears to have increasingly impacted on the safety of the facility. These changes were approved and implemented by the former officers of QNI. These officers now represent the new operator, Queensland Nickel Sales Pty Ltd.

The facility is still not licensed, whilst storing hazardous chemicals above threshold quantities. As of this time, this license has not been sought by the new operator.

The delay to transition the refinery into a caretaker-maintain mode, along with the evidence found following the Administrator's report and Roaster incidents, suggests that significant work is needed before the facility can recommence operations.

These issues combined with concerns raised in other WHSQ reports raises doubt as to whether the current operator (and its officers) is suitable to exercise management or control over this major hazard facility.

As such, WHSQ will continue to monitor and assess the operator's progress to address the concerns (raised from this report) in a timely and effective way. Delays in addressing these concerns is likely to impact on future licensing decisions for the facility, and its operator.

It is likely that conditions will need to be imposed on any operator of this facility, in order to ensure that the facility is safe to operate prior to the resumption of any refining activities.

3. Safety Management System Elements Reviewed

3.1 Administrator's Report

On the 11 April 2016, FTI Consulting published their Administrators Report. This report aimed to provide QNI Creditors details of the current status of the refinery from the Administrator's perspective "in order to allow Creditors to make an informed decision when voting on resolutions that will determine the future of the Company at the Second Meeting of Creditors" (Reference: Administrator's Report).

Whilst the majority of this report is dedicated to the refinery's financial dealings and is not necessarily the focus of WHSQ investigations, the report does make references to some safety issues at the site which warrant further enquiry.

3.1.1 Failure of Effluent Boilers

The Administrator's report included some discussion regarding the maintenance difficulties experienced during their appointment. In particular, FTI Consulting reported that one of the two effluent boilers within the ammonia production circuit was out of service for several months prior to the appointment of the Administrators. It was alleged that there was no critical spares held against the prospect of such a failure which in turn impacted on the refinery's ability to meet its ammonia production requirements. The Administrators were unable to resolve this issue during their time as operator. WHSQ sought to understand as to why these repairs were delayed and establish whether this had any safety implications for the refinery.

The inspector interviewed former QNI senior management and a representative from QNS to gain their perspective of these events.

3.1.1.1 WHSQ Findings

It was confirmed that the Effluent Boiler in question remains out of service and had been down since October 2015. According to information provided to the inspector, the delay in effecting a repair to the boiler was not a self-imposed financial decision aimed at minimising maintenance spending. Rather this delay was a vendor issue and was reportedly out of QNIs control.

QNI had commissioned a local engineering company to undertake the repairs to the boiler. This company was the original fabricator and supplier of the boiler. QNI reported that they had experienced a number of delays and setbacks in employing this fabricator ('vendor'). Examples of issues encountered included:

- QNI indicated that it took approximately two months to receive a quote to repair this boiler. This delayed the commencement of repair work.
- QNI had paid an initial up-front deposit to start repair work. The amount of this deposit was not determined at this audit.
- Not long after this deposit was paid, the vendor went into receivership.
 - It was highlighted that the vendor's financial predicament was not linked to or was a result of any QNI actions or activities.

From the accounts given by former QNI senior management, QNI tried to work with the vendor's receivers to continue this repair work, given that QNI had already paid a deposit to the vendor. In an effort to facilitate this process, QNI had undertaken other measures to accelerate the repairs, including QNI:

- Purchasing and supplying necessary parts and materials on behalf of the vendor.
- Making additional wage payments to the vendor to cover any overtime payments aimed at expediting the repair.
- Making regular milestone payments to the vendor to ensure the work would progress.
- Sending their own employees to monitor and supervise the progress of all repair work being performed by the vendor at their workshop, and to ensure that any payments made to their

vendor were directly channelled to the boiler repair rather than to fund other vendor activities.

The former QNI management team emphasised that the Administrators were made fully aware of the ongoing issues with the vendor from the start of their appointment.

The failure of this effluent boiler has introduced a financial impost on to the QNI business. It was confirmed that at a cost of \$25,000 per day, QNI have been forced to purchase locally-sourced ammonia to meet the shortfall in lost ammonia production and to ensure continuous refinery operations. The inspector did not confirm what the estimated cost was to repair this boiler.

During the site inspection of the facility, the inspector was advised that generally the ammonia concentration in ammoniacal process liquors were lower. It was not established as to whether this finding could be directly attributed to this boiler failure alone.

The former QNI management team and a QNS representative highlighted that the outage of this boiler did not introduce any additional safety concerns or issues when the plant was operational. The inspector would suggest that whilst the import of ammonia to site may introduce some additional local hazards and controls, it is unlikely that this activity would significantly increase the overall off-site risk profile for the facility.

3.1.1.2 Conclusion

It appears that the outage of the effluent boiler was unlikely to have increased the offsite risk profile of the site, whilst the refinery was operational. Given the costs associated with importing ammonia to the site, it is also likely that the Administrators were aware of the issues associated with this boiler early in their tenure. In that, WHSQ agrees with the opinions of the former QNI management team.

The effluent boiler remains inoperable and will require further work to reinstate. The estimated cost for importing ammonia during the boiler repair period appears to be of the order of over \$3m currently. This cost impost to the business since October 2015 does not factor in any of repair costs for the boiler.

Reflecting on the information that has been provided and with the benefit of hindsight, it appears the decision by former QNI management to persevere with their selected vendor was not necessarily appropriate. WHSQ suspects that the forgoing of the initial paid deposit to their vendor, and the appointment of a new vendor to effect the boiler repair may have delivered a different outcome to what is present.

3.1.2 Occupational Health and Safety Maintenance

The Administrator's reported of their concerns regarding maintenance spending for the refinery. Their report highlighted the refinery is a major hazard facility, and requires extensive ongoing planned preventative and reactive maintenance.

Numerous WHSQ inspections at the refinery over the last two years have reported of an overwhelmed maintenance management program, with increases in overdue preventative maintenance activities observed, breakdown maintenance activities becoming more prevalent, and a perceived switch in maintenance philosophies to a more reactive model. WHSQ were aware of the growing financial pressures being placed on the refinery but were unaware of the refinery's maintenance spending trends in recent years.

The Administrators reported similar concerns. The Administrators identified that the refinery has significantly reduced the maintenance budget over a period of three years to \$39m per year. This in comparison to the maintenance spend of the former owner of the refinery (BHP-Billiton) of \$80m in their final year of operation in 2009. This translates to an equivalent maintenance spend of approximately \$94m, factoring in CPI growth over this time (Source: Australian Bureau of Statistics).

As a result, WHSQ sought to confirm whether the information provided by FTI Consulting was factual and to try to better understand how the former QNI management balanced their safety, maintenance and budgetary obligations.

Discussions with former QNI senior management and QNS representatives do not dismiss the claims regarding the differences in maintenance spending between QNI and BHP-Billiton nor dispute the budgetary data provided by FTI Consulting.

Instead it was reported that QNI underwent a number of significant reviews and changes within the business following the sale from BHP-Billiton management which facilitated the reduction in site expenditure. Of note, QNI began to heavily scrutinise their site spending and business cost approximately three years ago. One set of reviews performed targeted maintenance.

3.1.2.1 Legacy Issues

It was identified by QNI management that the maintenance spend on the refinery at the time following BHP-Billiton's administration was excessively high and unwarranted. These excessive costs were reportedly due to significant administrative overheads, and a tendency to over service plant equipment. These problems were seen largely as being a legacy issue by the new operator.

QNI's new management believed that they could deliver an equivalent level of maintenance to the refinery, but do it much quicker and cheaper than previous administration by removing unnecessary overheads. The example of servicing and overhauling a Roaster in Area 330 was used to try and demonstrate this point, where it was reported that current management was able to reduce overhaul costs from \$2.7m to \$1.8m and was able to perform similar work in less time. No specifics were discussed during this audit as to how this reduction in spending or time allocation was achieved.

QNI also started to look at the maintenance and inspection frequencies of their plant. Inspection and refurbishment frequencies of plant were reviewed and extended where possible. The example of the Roaster was again used, where the Roasters under BHP-Billiton ownership were being overhauled every three years. It was reported that the recent work done by QNI enabled them to extend the life of the Roaster to the current service life of approximately 5½ years.

The extension of maintenance and inspection frequencies is a valid maintenance strategy provided appropriate assessments are done which supports the decision for delaying or prolonging some work. Such assessment should be defensible and include safety, operational, maintenance, and any other relevant business considerations. They should also include appropriate signatories by competent persons approving of the change. It was not established whether the changes to inspection and maintenance reviews were formally assessed, documented or authorised via previously reported QNI processes.

QNI implemented further business reviews and changes.

3.1.2.2 Increased Scrutiny

QNI indicated that they implemented an expenses review committee. All expenses which exceeded \$500 was required to be assessed by a review panel which consisted of the following personnel:

1. (Owner)
2. (Managing Director- Queensland Nickel)
3. section 78B (Managing Director- Operations)
4. (Director- Operations)
5. (Director- Maintenance), and
6. (Director- Procurement)

It was reported that the final sign-off and approval of these expenses then fell to and This arrangement reportedly allowed for all businesses expenses to be better scrutinised by the QNI leadership team, and has assisted in reducing maintenance spending.

3.1.2.3 Task and Role Reviews

The refinery employed a significant number of contractors to perform specialised maintenance whilst under BHP-Billiton. QNI had started to review this practice and had decided approximately three years ago to implement two measures aimed at managing costs.

The first was to review the role of contractors at the refinery.

QNI management decided to reduce the need for contractors by bringing much of this contracted work back in-house. It does not appear that a formal management of change review was completed to assess the risk and impacts associated with such a change in management philosophy.

To facilitate this decision, the refinery was required to develop their own systems to ensure the competency of its personnel to perform these additional roles. It does not appear that any additional personnel were employed to manage or undertake this increased workload following the reduction in contractors.

An example provided referred to changes to emergency response training. QNI had traditionally employed a contractor to undertake and manage the training requirements of their Emergency Response Crew (ERC). The decision to bring this work in-house required the refinery to develop its own training modules and systems, and its own training centre. As a result, the information and systems developed for training the ERC is now reportedly tailored to meet QNI's requirements and had resulted in an overall reduction in costs. No extra workers were employed to achieve this outcome.

Another mechanism to reduce costs over time was through natural employee attrition. Site manning numbers reduced from approximately 1000 employees to 800 employees over several years following BHP-Billiton's exit- a 20% reduction in overall numbers. It does not appear that any management of change or other review processes were applied to assess the risk impact, including any effect on maintenance management systems. The reduction in site manning numbers has reportedly resulted in an estimated business saving of \$2m per week.

The uncontrolled attrition of employees and the reduction of contractors employed, appears to align with WHSQ first observations of QNI's maintenance management system being under stress.

A review of employee roles on site was also used to reduce worker numbers and costs. As part of this review, QNI reported that they starting looking at where the business could benefit from multi-skilling its workforce. Initial work done at QNI's port facility supported the evolution of operator-only roles into becoming a dual maintainer-operator role. This change reduced the need to rely on additional maintenance support staff to supplement and assist the port operations. This change was reportedly a success according those interviewed, and was in the process of being implemented further throughout the business.

This change introduced further savings to maintenance budgets, since part of the costs attributed to employing maintenance personnel was offset to other QNI cost centres (namely operations).

As has been reported in recent WHSQ inspections, the former QNI management had rolled-out a similar program just days prior to the appointment of FTI Consulting as voluntary administrator of the QNI. This change resulted in the reduction of 237 employees, and installation of maintainer-operators in roles formerly held by operators. As was identified by WHSQ's (27 January 2016) visit following this change, a formal management of change process was not used prior to implementing this change. This topic is further discussed in [Section 3.3](#) of this report.

3.1.2.4 Supplier and Inventory Review

QNI undertook a review of their supplier arrangements, and their current spares inventory list several years ago.

This work incorporated a stocktake of all inventories onsite to determine the amount of spare parts current stored and to determine what parts were required to be retained. This review identified approximately \$40m of stock not included in existing inventory records, as well as identifying parts which were deemed non-critical. Inventory records were updated and adjusted

accordingly to meet the business's needs. This adjustment reportedly enabled further maintenance cost savings over several years. QNI's sourcing policy of parts, equipment and materials was also overhauled. Traditionally these types of items were sourced from local third-party suppliers. The use of these vendors introduced convenience but at a cost, with each including their own pricing mark-ups in all items supplied. The decision was made by QNI to change this practice to instead go directly to source manufacturers and suppliers.

Prior to the cessation of QNI as operator, the site had reportedly started to source many of its parts, plant and equipment from Chinese manufacturers directly resulting in further cost reduction in maintenance spending.

3.1.2.5 Operating Envelope Exceptions (OEE)

The Administrator's report made reference as to how the reduced maintenance spending on site was "reflected in increasing trends of safety non-compliance" due to the failure to maintain spare parts and for not committing to the provision of capital expenditure to rectify defects. The administrators allege that this led to the refinery to operate with an unacceptably high number of OEEs based on site based metrics and standards.

Therefore the inspectors sought to confirm whether the FTI Consulting claims were correct and to determine whether there were any changes to this system since the verification audit.

The inspector has investigated the refinery process for monitoring OEE during the April 2015 license verification audit. At the time of this audit, it was reported that OEE process appeared to be an effective tool for ensuring safe operations, albeit the consideration of additional opportunities for improvement which were provided at the time.

At this inspection, it was explained that former QNI management had a number of concerns with FTI Consulting's approach to governance. Of particular note was how FTI Consulting attempted to set-up their performance metrics for the site. The inspector was informed that FTI Consulting had attempted to set up a number of new metrics for the site, to demonstrate their effect on site, and to show their creditors (and workforce) that the Administrators were maintaining or had improved site operations since their appointment.

The former QNI management reported that they were not convinced that the metrics chosen by FTI Consulting were appropriate, suggesting that they had taken a "textbook approach" to managing the refinery during their tenure. No information was provided to the WHSQ inspector to support these claims or to dismiss the allegations forwarded by FTI Consulting regarding the increase in OEEs.

The inspector sought confirmation as to how many OEEs were in effect presently, and what was the accepted performance limits placed on OEEs. The former QNI management team nor representatives from QNS were able to provide this information on the day of audit. Instead it was indicated that these persons needed to conduct their own review to confirm the current OEE status. The inspector has asked for results from this review to be provided once this review has been completed.

3.1.2.6 WHSQ Conclusion

It appears that the allegations made in the Administrator's Report regarding the drop in maintenance expenditure may be correct.

Former QNI management have explained how this reduction in maintenance spending has been achieved. A series of internal reviews and the adoption of their recommendations led to changes in the way the refinery managed its maintenance program, post the refinery's change of ownership in 2009.

WHSQ suspects that the initiatives described and implemented by the former QNI management team may yield cost savings to maintenance budgets. The decision to delay, defer, or extend service lives of maintenance activities in particular has the ability to significantly reduce spending in the short term.

The former QNI senior management team have maintained that there has not been a reduction to safety resulting from the major cuts in maintenance spending following BHP-Billiton's exit.

This is contrary to what has been reported by the Administrators.

Reference was made to the number of OEEs currently open in order to support their argument. The former QNI management team dispute this finding, but were unable to provide any evidence to counteract or contradict the Administrator's claims.

Instead the escalation in notifiable events reported at the refinery and findings from a number of WHSQ audits appear to support the Administrators claims, with:

- An increased tendency to postpone, defer or cancel preventative maintenance and inspections;
- A growing need to cannibalise existing plant for spare parts;
- An unassessed contraction of the workforce; and
- The move to a more reactive maintenance management strategy;

being recorded over the last three years.

3.1.3 Area 320 Exhaust Stack

The Administrator's Report provided the example of the Area 320 Exhaust Stack to highlight their concerns regarding the immediate risks posed by the refinery. Specifically, the Administrators allege the exhaust stack is at risk of collapse, with an unacceptable risk of moderate to severe internal and external failure within 3-4 years. An exclusion zone had been presently set-up around the base of the stack to prevent persons being impacted by potential falling bricks.

The inspector sought to gain further evidence from the former QNI management team and the current operators as to the validity of these claims.

3.1.3.1 Inspector Observations

The inspector conducted a visual inspection of the Area 320 Exhaust Stack. It was observed that an exclusion zone had been set up around the stack as has been reported by the Administrators (Figures 2 and 3). A number of barrier warning tags were sighted on the barricade (Figure 2). The tags were heavily faded suggesting that the tags had been present for some time. However the inspector noted that the information "Poor Condition of the Stack" was etched onto one of the tags sighted.

From outside the exclusion zone, the inspector sighted numerous vertical cracks around the outer shell of the stack. The size of these cracks varied, with some cracks ranging up to an estimated 20-30m in length (Figure 1). A small pile of bricks were observed at the base of the stack at an inspection door (Figure 2). It was reported that those bricks were from the internals and were removed to facilitate the internal stack inspection.

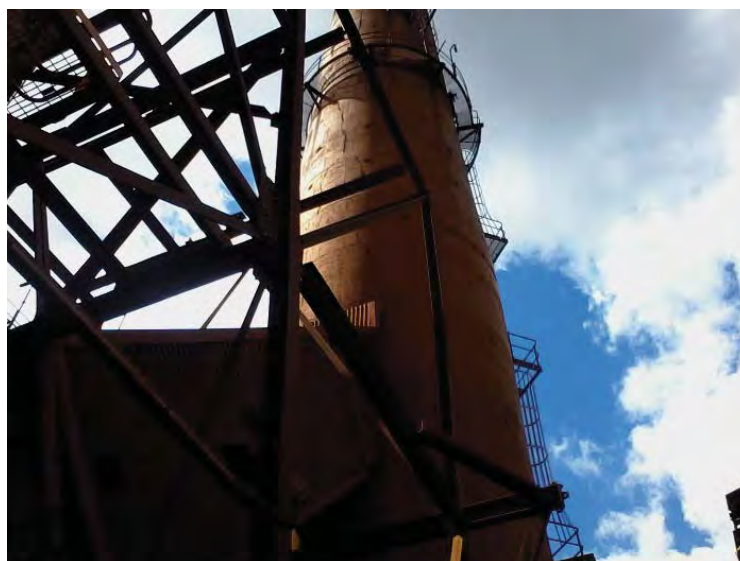


Figure 1: Visible cracks sighted on outer concrete shell of the 320 Exhaust Stack



Figure 2: Bricks lie at entrance of the stack



Figure 3: Temporary barricading surrounds the stack

3.1.3.2 Exhaust Stack Inspection Report

The inspector requested a copy of the stack inspection (condition) report as referenced by the Administrators report, along with any other evidence which may be relevant to this investigation. The inspector's request extended to include any information which may support the claims provided during WHSQ's interview (reference [Section 3.1.3.3](#)).

This request was made to the current operator, Queensland Nickel Sales. The Area 320-1404 Concrete Stack Condition Assessment Report was provided the day following this site visit. WHSQ appreciates the prompt response to this request.

The Area 320-1404 Exhaust Stack inspection report was done on the 09 October 2015. According to this report, the inspection was coordinated by a former QNI Graduate Structural Engineer section 78B . It was noted that the report was reviewed by who was the lead structural and asset integrity engineer at QNI during this time.

According to the report, a condition assessment of the exhaust stack was developed utilising the results from the February 2015 unmanned aerial vehicle (UAV) external survey and the October 2015 internal inspection. These inspections were done in-house by QNI personnel, and focussed on the condition of the reinforced concrete shell and internal firebrick lining.

The methodology used a camera mounted to a series of helium balloons, to photograph the stack. This method was chosen based on cost. The financial saving gained whilst performing this work came at a cost, with the author of this report recognising that higher quality inspection photographs would have been obtained if other methods were adopted.

The report itself identifies it should not be considered comprehensive. Time, cost and equipment limitations appear to have hampered efforts to examine and record shell and brickwork integrity.

It was reported that the top 30m of the concrete stack is in a very poor state, with extensive cracking of the shell evident, and of seepage of acidic materials through the cracks. It was estimated that stack will be rendered unserviceable within four years, due to this acidic attack causing a full or partial collapse of the concrete shell.

This report does not disclose how the time to failure estimates were arrived at. Further information may therefore be required to confirm the reported stack failure rate quoted (i.e. four years) due acidic material corroding the reo framework. This finding is in agreement with the claims made by former QNI and current QNS management representatives ([Section 3.1.3.3](#)).

It was estimated that approximately 30 cubic metres of dislodged firebrick lining and fines debris had accumulated in the base of the stack. Twenty percent of this debris was estimated to be brickwork. Estimates of ten percent of the stack's internal lining surface was reported as failed and accumulated in this debris.

It was estimated that a moderate to severe event where the stack or multiple inlet ducts are rendered unserviceable will occur within 3 years, with a 20% likelihood that this failure will occur within one year. This potential failure is reportedly due to the ongoing issue of the internal firebrick lining dislodging.

This report does not disclose how these time to failure estimates were arrived at. Further information would therefore be required to confirm the reported stack failure rate due to the loss of the internal lining (i.e. three years). This finding is in agreement with the claims made by former QNI and current QNS management representatives ([Section 3.1.3.3](#)).

The inspection report identifies that the dislodgement of the firebrick lining and the fall of internal brickwork has occurred at least three times in the last seven years. The accumulation of 30 cubic metres of debris in the stack base also suggests that loss of the internal lining may continue to occur regularly if not addressed. This in turn introduces some doubt as to whether the stack could ever be safely returned to service in future.

Recommendations were made in the inspection report which included the development of a demolition plan for the existing stack and design for a replacement. Work on this was considered to be essential, highlighting the need to commence this work immediately such that the original stack is demolished and removed within 24 months. The failure not to act reportedly placed "personnel safety and Queensland Nickel's production at risk".

3.1.3.3 QNI Interviews

The inspector interviewed former QNI and current QNS representatives in order to gain their perspective regarding the Administrator's allegations. It was reported that an inspection of the exhaust stack had occurred in late 2015 using drones (or equivalent). Photographs were taken to assess the health of the inner brick lining inside the stack, and to inspect the status of cracks on the outer concrete shell.

It was reported that the concrete structure/shell had developed some small cracks, which enabled moisture to enter. This moisture contacted and started to corrode the reinforced steel support (reo) within the concrete stack. This in turn propagated the outer cracks and made some larger enabling further moisture to enter and accelerate the corrosion of the reo support.

The stack inspection report, as quoted by the Administrators in their report, was reportedly done by a graduate engineer. Whilst the former QNI workers interviewed did not dismiss this inspection report outright, the inspector was informed that the report may suffer due to the limited knowledge and experience of this engineer. Those interviewed were concerned that some assumptions made in the report were not supported by the data collected at the time of inspection. The inspection report had also provided failure rates without defining how this estimate was determined.

It was recognised by [section 78B](#) that the cracks may not be superficial, and that further review of the stack's inspection report may be warranted. However it is believed that the problems associated with this stack was in hand and being managed.

3.1.3.4 WHSQ Conclusions

The inspector sought to investigate safety allegations made by FTI Consulting, regarding the state of 320-1404 exhaust stack. Former QNI and current QNS officers dispute these allegations, claiming that the Administrators were misrepresenting the stack issues.

The inspector found the following evidence during their own investigations:

- The stack failure rates (as quoted by FTI consulting) came from an internally-generated inspection report in October 2015.
- A graduate QNI engineer was commissioned to perform this inspection work. QNI's former senior structural and asset integrity engineer appears to have overseen these inspection activities performed and reviewed the final inspection report before its release.
- The inspection report provided estimated failure rates without defining how this data was determined. Therefore further work may be warranted to confirm that the stack has an estimated remnant life of 3-4 years only.
- The QNI report makes the clear point that it should not be considered comprehensive. A review of the report suggests that time, cost, and equipment limitations hampered and potentially delayed stack inspection activities.

- The inspector's own observations found significant cracks in the outer shell of the stack, evidence of debris outside the base of the stack, and temporary barricading in place around its perimeter. The observed cracks in the outer shell were numerous and ranged in length up to 20-30m.

Whilst further enquiry quantifying the remaining stack life may be warranted, it appears that the claims made by the Administrator's Report regarding the risk posed by the 320 exhaust stack should not be dismissed and may be valid. It also appears that QNI may have had an opportunity to explore the issues associated with the exhaust prior to the appointment of the Administrators but had failed to do so.

The 2015 QNI stack condition report stated in its summary that:

"As the structural degradation is advanced, the stack is considered unfeasible to repair without large sections requiring rebuild, at a minimum. In its current condition, the concrete stack should no longer be considered viable for continued operation without notable safety and economic risk.

To ensure continued safe production, it is recommended technical proposals are obtained for the development of a replacement design, and a demolition plan made for the existing stack. This process is recommended to commence immediately with the original stack demolished completely (or to a structural sound extent) within 24 months...

Each of Queensland Nickel's concrete stacks are recommended to undergo this process...

Under no circumstances is it recommended that obtaining of technical proposals for a replacement stack be delayed pending another inspection in the aim to retrieve contradictory data."

This warning of an impending stack failure as was presented in this condition report was unambiguous and should have warranted immediate action by QNI in November 2015.

At the very least WHSQ suggests that as a minimum a formal review of this report should have immediately occurred, and the sourcing of a suitable second opinion to challenge or confirm the report findings was demanded. No evidence was provided which suggests that these actions had occurred. Instead it appears that this report (and its subsequent warning) was ignored or not acted upon.

S19 of the Work Health and Safety Act reports on the primary duty of care requirements of all persons conducting a business or undertaking (PCBU). This includes the provision and maintenance of a safe work environment without risks to health and safety, and the provision and maintenance of safe plant and structures.

S27 of the Work Health and Safety Act also reports on the duty of officers. An officer of the PCBU must exercise due diligence to ensure that the PCBU complies with that duty or obligation. Due diligence includes (but is not limited to) taking reasonable steps to acquire and keep up-to-date knowledge of work health and safety matters, and to ensure that the PCBU has appropriate processes for receiving, and considering information regarding incidents, hazards and risks and responding in a timely way to that information.

It would appear that the response following the completion of the stack inspection report was grossly inadequate and a potential breach of s19 and s27 by the former officers of Queensland Nickel Pty Ltd.

WHSQ will continue to monitor the situation with this stack whilst the refinery enters into a caretaker mode. An extension of current area perimeter restrictions may be sought in the interim to ensure that personnel remain safe. Improvement notices may also be issued in future visits to ensure ongoing safety is maintained whilst the site is dormant.

The inspector recommends that the operators of the refinery must demonstrate that the stack is safe to operate prior the resumption of activities in this area. The inspector recommends additional conditions be imposed on the facility as a result:

Recommended MHF License Condition:

The operator must conduct a full structural inspection by an accredited third party of all concrete stacks on site prior to the resumption of active refining activities, in order to ensure that they are in sound condition and are safe to operate.

3.2 Hazardous Materials Manifest

The site's manifest of hazard materials was inspected by WHSQ officers on the 25 March 2016. A number of deficiencies were found with the manifest, prompting the issue of the notice I 1001862 on the 31 March 2016 to Queensland Nickel Sales Pty Ltd. As a follow-up to this notice, the inspector sought to understand QNS progress with complying with this order.

A current copy of the refinery's manifest was provided to the inspector, and to QFES personnel in attendance during the day of audit. As has been acknowledged by the current operator, the manifest requires further work but has been recently updated to provide updates in current chemical inventories. Details from the new manifest provided that is of note include:

- It was identified that Queensland Nickel Sales Pty Ltd was the occupier.
 - This suggest that QNS is control of the site, and is likely to be the current operator and PCBU
- Manifest was last amended on the 12 April 2016
- The emergency contact details for _____ (Managing Director) and _____ (Managing Director- Operation)
 - This suggests that QNS has appointed _____ as a new employee to the business
 - It was not established at this audit as to whether _____ was also an officer of the PCBU- confirmation of this finding may be warranted at future site visits
- The manifest has reported that bagged sulphur is stored onsite within Area 450.
 - Actual tonnage of bagged sulphur is not documented however
- The manifest includes some updates to chemical inventories stored on site which were not reportedly present in the manifest found on 25 March 2016, including for the following areas:
 - Area 342 Ammonia refrigeration
 - Area 355 Nickel ASX
 - Area 367 Cobalt ASX
- The manifest reports that further updates are being planned currently and will include:
 - The Australian Dangerous Goods (ADG) Shipping Name is to be included along with the ADG Class and Division, Subsidiary Risk(s) and Packing Group
 - Actual (approximate) inventories within site containers
 - Clarification of liquid inventories within the Ammonical Solvent Extraction (ASX) plant areas (Areas 355, 356 and 367) to include updated details of the organic extractant used and quantities stores
 - Updates to all maps which shows the location of containers and chemical inventories, major drains, power isolation points, and fuel isolation points for the refinery

QNS have reported that the manifest will be updated each fortnight, once the manifest is fully compliant.

The WHSQ inspector agrees that the manifest is still a work in progress. The manifest in its current form is not necessarily user friendly, and is likely to require further review to improve how information is presented. However WHSQ does acknowledge the attempts made by QNS appointed personnel to meet the requirements and intent of this improvement notice. This notice is due on 29 April 2016. WHSQ inspectors will continue to monitor the refinery's progress in delivering a suitable manifest and to comply with this improvement notice.

3.3 Roaster Incidents

The inspector requested all available details regarding two known incidents which had occurred in the Area 330 Roaster area. Roaster 10 and 1 incidents had both occurred in Q1-2016. It appeared that these events occurred during voluntary administration period. These incidents were of interest to WHSQ since both had the potential to escalate to become major incidents.

3.3.1 Roaster 10

Limited information was provided to WHSQ following the investigation of this incident. It appears that on 01 February 2016 that there was approximately 1000 litres of heavy oil discharged in to the paddle mixer for No. 10 Roaster, which subsequently entered the hot offline roaster. There was no report of injuries or plant damage following this event. This incident had the potential to generate an explosive/flammable atmosphere (carbon monoxide) inside the roaster chamber, in the event that oxygen entered the chamber.

According to the Cintellate report provided to WHSQ, this event appears to have been the result of operator error following a roaster trip. The PMO (paddle mixer oil) controller appears to have gone into its safe state setting of "manual" and "zero output" status following the trip. It appears that the operator restarted the paddle mixer oil flow without first understanding why the oil flow tripped or confirming that status of roaster at that time (i.e. tripped- offline).

The incident investigation fails to explore what caused the operator error, including potential competency, supervision, miscommunication, workload, fatigue, or manning issues.

3.3.2 Roaster 1

A higher consequence event occurred within Roaster 1 on the 16 February 2016 when an explosion occurred during its start-up, resulting in some equipment damage. No injuries were recorded, however personnel were in the vicinity of the roaster at the time of the explosion.

3.3.2.1 Chain of Events

The inspector was provided the chain of events report which was completed by QNI following this incident. The following details were extracted from this report:

1. The trainee operator was not sufficiently experienced in their role, aware of the hazards involved with working in the area, and was not supervised.
 - a. The reduction in site manning levels appears to have impacted on operations during this time, and may have "led to exposure of trainees to high hazard roles". The operator involved in this incident was a trainee.
 - b. The entry level roles for the lead operator and day crew operators in Area 330 had been removed, resulting in overall crew size reductions and the abandonment of traditional training practices. This included reduced supervision opportunities for new trainees via the "buddy" system, and entry level operators starting their training at a traditional Level 2 Operator level- an advanced role typically performed by "process experienced people".
 - c. A business restructure had facilitated and compelled the trainee to be trained in this new role. No risk assessment was completed for the organisational change imposed by the business restructure.
2. Team leaders were increasingly forced to do the duties normally assigned to their crew due to the reduction in competent operators available to sustain plant operations. This need removed these persons from performing their normal duties of plant supervision and training oversight.
3. The Roaster had been offline for several weeks. QNI reported that this may have contributed to the burner for 9E being in a poor state prior to use.
 - a. Roaster 1 appeared to have been used to supply spare parts to other roaster.
 - b. No evidence had been supplied which suggests that all scavenged parts from Roaster 1 had been replaced or returned prior to bringing the roaster online.

4. The Roaster was operating under an impaired state.
 - a. It was identified that chamber 9E did not have a thermocouple which was operating at the time. The thermocouple is used for confirming whether the burner/chamber was within its operating envelope.
 - b. The control room operator advised the trainee that a risk assessment for running 9E chamber without the thermocouple had been done- it is not confirmed as to whether the trainee was aware of the risk assessment details however.
 - c. The manual air adjustment slide to the burner on 9E chamber was inoperable on the day of the incident. The grub screw on the air lever handle which operated the slide was damaged, and the adjustment slot was clogged with clinker material. Movement of the handle was only achievable by hitting it with a steel pipe.
 - d. The decision to use a burner is discretionary and assigned to the operator who lights the burner. No formal process has been developed to assess the health of a burner prior to its use. The trainee decided to persevere with the faulty burner due to issue with spare burners being available.
 - e. There were no spare burners available on the day of the incident. QNI reported that 56 other burners in Area 330 were in need of servicing at this time, however no personnel had been assigned the role of refurbishing or maintaining burners.
 - f. QNI attributed the burner refurbishment issue to the resignation of their regular burner maintainer. QNI reported that they were experiencing some difficulties with finding a suitable replacement. The reduction in site manning levels reportedly impacted negatively on maintenance in the plant also.
5. Immediately prior to the explosion, the trainee was in the process of lighting the burner in chamber 9E of Roaster 1. After several failed attempts to light, the trainee reported the 9E chamber was "heating up OK" to the control room operator.
 - a. QNI report that other experienced crew members were on a break and were monitoring burner light-up progress via their two-way radios. These persons were not aware of the team leader's expectations for them to assist the trainee in lighting the roaster burner.
 - b. The team leader was unavailable to supervise the trainee during the burner light-up due to being called into a meeting with their manager at that time.
6. The trainee proceeded to adjust the oil flow to the burner on 9E chamber and to establish a "stable" flame. This resulted in the operator establishing a highly reducing flame to be created within the roaster chamber (i.e. high oil-low oxygen atmosphere) at this time.
 - a. The trainee had been advised to light the burner in a slight reduced mode initially and then to switch it over to an oxidising mode once it was lit.
 - b. The trainee was unable to maintain a stable flame due to the faulty burner, and instead left the burner in a reduced setting.
 - c. The trainee was aware that the burner was set to a reducing flame but failed to report this to the team leader or control room operator.
7. The trainee had not read nor followed the work instruction for lighting the burner. The work instruction is reportedly not consistently used during training or assessing competency, with a reliance on the trainee being shown how to perform the role by another operator. No testing of acquired knowledge was undertaken prior to allowing the trainee to light the burner.
 - a. The trainee does not appear to have been signed off as competent to light the burner. The trainee had limited knowledge of what they were doing, of potential major incidents which can occur in the area and the required operating settings for lighting the burner.
 - b. The trainee failed to monitor oil flow into the burner at any time.
 - c. The team leader, control room operator and two other persons had witnessed the trainee start up the roasters a handful of times, and had considered the trainee to be ready to perform this role unsupervised and unassisted.

- d. The trainee was equally confident of being able to perform this task, and did not necessarily seek assistance.
8. There were no alarm or controls to monitor oil flow, air flow, oxygen levels, or burner stoichiometry in place which could prevent an explosive mixture forming in the roaster chamber
 - a. No automated burner management system in effect for any of the roasters in Area 330.
9. The burner was left in a reducing setting enabling the generation of a combustible gas mixture inside the roaster chamber. Additional settings on the roaster was setup by the control room operator to enable air to be drawn into the vessel.
 - a. The control room operator failed detect the warning signs of an impending explosion inside the roaster, based on evidence available to them. This included the failure to note a sooty emission from the roaster vents via surveillance camera footage available, and low oxygen readings detected in the chamber up to 10 minutes prior to the explosion.
 - b. The control room operator appears to have been distracted due to other process issues with feed systems to multiple roasters at the time, and ongoing discussions with the process engineer.
10. The undetected combustible gas-air mixture inside the roaster reached auto-ignition temperature and subsequently ignited, resulting the explosion.

3.3.2.2 Other Evidence Provided

Additional information collected as part of QNI's own incident investigation has been provided to WHSQ, and is summarised below:

- QNI found that none of the site's work instructions specify the need for personnel to be signed-off as being competent prior to its use. A recommendation was made to include in all critical work instructions the statement "this task shall only be completed by a competent appropriately trained operator unless being supervised".
- The Administrators (FTI Consulting) contacted representatives from QNI expressing their concerns as early as 01 February 2016, regarding a high volume of enquiries from current employees. These employees reported of a perceived lack of training for people that had moved into new areas. These employee reports had come from both new operator-maintainers and other employees.
- The Administrators requested a list of employee names of personnel who believed that they had not received appropriate training from their Team Leader. This request was put to operations management on the 01 February 2016.
- The HR Department reminded all Area Team Leaders and the Director- Operations that trainees are to complete applicable area inductions, and commence operational training as per the current training packages on the 01 February 2016.
 - The request was made to remind operation work teams to commence and document an appropriate training plan for the newly appointed operator-maintainers.
- The air adjustment on the burner to 9E chamber was seized on its minimum air setting.
- Witness statements confirms:
 - The trainee had witnessed approximately 5-6 roaster start-up prior to the event- he was supervised during these times.
 - The trainee confirmed that they had not read the work instruction for lighting the burner.

3.3.3 WHSQ Conclusions

The investigations from the Roaster 1 and 10 incidents appear to suggest that the site was operating at an elevated and potentially unacceptable level of risk. QNI's own investigations into these incidents found that:

- Training processes appeared to be bypassed, not enforced or sufficiently resourced.
- Inexperienced personnel (trainees) were expected to and allowed to perform high risk activities without appropriate training or supervision.
- Routine maintenance activities such as refurbishing burners was not occurring.
- There was an acceptance by personnel and management to operate plant in an impeded state.
- There was an increasing need for supervisors to become operators in order to cover losses to shift manning and skill capabilities.

These incidents occurred during the Administrator's tenure. However WHSQ suspects that the initiator to each of these incidents occurred prior to their appointment. Instead it appears that the decision to cull 237 QNI employees on the 15 January 2016 may be the common root cause.

The cut in worker numbers were approved and implemented by the officers of QNI at the time. It appears that these officers represent Queensland Nickel Sales Pty Ltd currently.

No risk assessments or formal management of change processes were completed prior to or following this restructure. This appears to breach Section 534 of the Work Health and Safety Regulation. No structured process appears to have been implemented to facilitate the newly adopted organisational model.

WHSQ inspectors had highlighted their concerns as to whether safe operations could be maintained during their 27 January 2016 visit. Assurances at the time were made by QNI, suggesting that WHSQ concerns were in hand. The chain of events from the roaster explosion appears to suggest otherwise.

At present Area 330 along with all operational areas at the refinery is shutdown indefinitely. As such it is improbable for a similar major incident to occur within the Roasters, until such a time that the refinery decides to resume operations.

If the decision is made to recommence refinery operations, it is suggested that additional conditions be imposed on to the operators in order to prevent a reoccurrence of these types of incidents. These conditions are:

Recommended MHF License Condition:

The refinery shall formally risk assess and establish the minimum manning levels required to ensure safe operations in each designated plant area. This work shall be completed prior to the resumption of active refining operations in the area, and must consider emergency response, maintenance, training and operational requirements.

Recommended MHF License Condition:

The refinery shall formally assess and establish the minimum competency/skill requirements for each work team. This includes (but is not limited to) emergency response, maintenance, training and operational roles. This work must be completed prior to the resumption of active refining operations in each designated plant area.

Recommended MHF License Condition:

The refinery shall notify HICB of all reported near miss, business process and process safety incidents.

4. Site Inspection

The inspector conducted a surveillance audit of the refinery in order to assist the QFES team assigned to better understand the remaining hazardous chemical inventories present stored on site. In particular, this inspection sought to confirm whether the QFES's knowledge of chemical inventories is consistent with current amounts stored.

Data acquired on the day is to be used by QFES personnel to model risk and consequence contours of remaining hazardous chemical inventories remaining on site, and will feed in to Local Emergency Action and Contingency Plans.

The following observations were made during this time, as a follow-up to WHSQ's 23 and 25 March 2016 surveillance audits.

4.1 Area 355 ASX

The surveillance audits on the 23 and 25 March 2016 reported of the presence of black viscous-looking liquid which had filled the ASX bund areas. It was reported by WHSQ that this material had been cleaned up from the bund by the 28 March 2016, with the lost material being recovered in IBC's and subsequently pumped into a nearby storage tank.

Inspection of this area found that the bund in the ASX plant free of any liquid accumulates. The bund is lined in a black oily residue, which appears to a legacy issue from the previous ASX loss of containment issue. Whilst the immediate hazard has been removed from this area, consideration should be given to the secondary hazard which still remains. The residue itself poses as a potential slip and hygiene hazard for any persons required to inspect or work within the area. Consideration should be given to barricade the area initially with the intention of cleaning the remaining residue as soon as is reasonably practicable.

WHSQ recommends that access to Area 355 ASX bund be restricted for entry.

WHSQ recommends the residue lining the Area 355 ASX be removed as soon as is reasonably practicable.

A number of IBC containers were sighted outside the ASX bund area. It appeared that these containers were storing some of the organic extractant which was recovered as part of the recent clean-up operations. These materials did not appear to be stored in an appropriately bunded area.

WHSQ recommends the IBC's be relocated and stored in an appropriate bund.

4.2 Sulphur Prill Storage

Previous WHSQ inspections reported large FIBC inventories of sulphur prill being open to the weather. The state of the bags themselves showed evidence of degradation due to sun exposure. The inspector was advised that QNS had made significant efforts to replace tarpaulins covering existing prilled sulphur stockpile in an attempt to minimise weather exposure.

On inspection of the area it was confirmed that sulphur stockpile had new tarpaulins covering the remaining sulphur stockpile. The inspector was advised that the area is now routinely monitored by personnel working under the direction of QNS. It was not identified as to whether these persons were directly employed by QNS, or through a third-party.

A request was made on the day for a copy of area inspection records confirming that regular area inspections were being performed. Whilst representatives working on behalf of QNS agreed to provide this information, this information was not provided prior to the completion of this report.

The inspector was advised that QNS have started to look for parties who may be interested in purchasing the remaining sulphur inventory. Whilst not confirmed, QNS have indicated that they may have found a potential buyer for the remaining stock. WHSQ welcomes this news and will continue to monitor QNS progress with this action.

4.3 AHS Sphere

Sch 3/10(1)(g) and (h)

It did not appear that any formal management of change process had been followed in this instance. WHSQ did not establish as to whether other similar operational changes had occurred elsewhere within the refinery since its shutdown.

WHSQ is concerned that without formal processes in place to formally track and assess changes in operating parameters, newly adopted operating conditions and parameters may eventually become the new norm.

WHSQ recommends QNS ensures suitable processes for the recording and risk assessment of any introduced changes to operating conditions are in place and are effective.

4.4 Plant Integrity Concerns

The refinery shutdown all process operations in February 2016. The decision to stop operations was imposed on the site due to a number of previously-reported reasons, including a lack of available ore to feed existing manufacturing activities. This shutdown initially assumed a short turnaround, with operations planned to be fully resumed by mid-March 2016. Plant and equipment had not left in a state which supported long term or indefinite inactivity, as is increasingly the case now.

Recent audits have reported of QNS's aim to place the refinery in a caretaker and maintainer mode for the immediate foreseeable future until such as a time as the refinery can be safely reopened and is financially viable. Initial information provided by QNS suggested that the refinery was to be placed into hibernation until July-2016. Recent media reports have since suggested that the resumption of operations is unlikely to occur before the end of 2016.

Limited resources have been employed currently by this new operator, with current manning appearing to be dedicated to addressing immediate problems which arise daily. It does not appear that any activities designed to transition the refinery into a dedicated caretaker-maintainer mode has commenced.

Concerns have been previously raised in other recent WHSQ reports regarding the failure to place the boilers and cooling towers into a dedicated caretaker-maintainer mode. These additional observations were noted on the day of this audit:

- 360-1917 Special Product Liquor Aeration/Storage Tank 2: there appeared to be a leak from the floor of the tank. A bright green deposit was found around the perimeter of the vessel (Figure 6), with several noted damp spots found on the concrete berm supporting the tank (Figure 5). It does not appear that this issue had been detected prior to this audit.
- 355-1961 Raffinate After-Settler (Coalescer): a notable hole appeared to have developed between the floor plate of this tank and its supporting berm, with sighted evidence suggesting that this plate had corroded (Figure 4). It was not determined at this audit as to whether there were any contents within this tank presently.

- 342-Evaporative Coolers: Area 342 is current offline, with all water recirculation pumps on all coolers offline also. There were evident water leaks on the ground from the recirculation water pumps.
- Area 420: parts of the gas plant continue to remain open, and exposed to the weather.



Figure 4: Significant signs of corrosion sighted in the floorplate of 355-1961



Figure 5: Damp spots found on the concrete berm of 360-1917



Figure 6: A bright green deposit was found around the perimeter of 360-1917

The delay in placing the refinery into a suitable caretaker/maintainer state in a timely manner will continue to promote the deterioration of the remaining plant, and will likely be detrimental to any attempts made by the current operators to recommence refinery operations in future.

4.5 Other Findings

The following observations were noted during WHSQ surveillance of the refinery:

- The sulphuric acid storage tank 360-1908 was found isolated at the tank, with bund empty. This is an improvement to previous observations made on the 23 and 25 March 2016.
- Ammonia odours detected on site did not exceed 3ppm during WHSQ time on site. This is also an improvement to other recent WHSQ inspections.
- Previous issues raised with the accumulation of materials in bunds generally appeared to be in hand, with little to no liquids/rainfall found in bunds sighted.
- There are still a number of portable compressed gas cylinders present on site. The inspector was advised that there is still of the order of 500-1000 cylinders

scattered on site. These cylinders are being slowly gathered and removed from site.

- An increase in manning numbers was noted, when compared to the observations made on the 23 and 25 March 2016 surveillance audits.

5. Acknowledgement

The inspector wishes to thank Queensland Nickel Sales Pty Ltd for their cooperation and assistance in the performance of this audit.

From: [REDACTED]@qni.com.au>
Sent: Wednesday, 17 February 2016 11:44 AM
To: Darren Bown
Subject: explosion door level 9 -- roaster 1 event - popped up as it should
Attachments: photo l9.jpg

photo l9

This photo depicts the explosion door working as per design on level 9. The reset involves lowering the door back into position.



From: [REDACTED]@qni.com.au>
Sent: Wednesday, 17 February 2016 11:26 AM
To:
Subject: FW: 20160216_093615.jpg

Attached reference photo

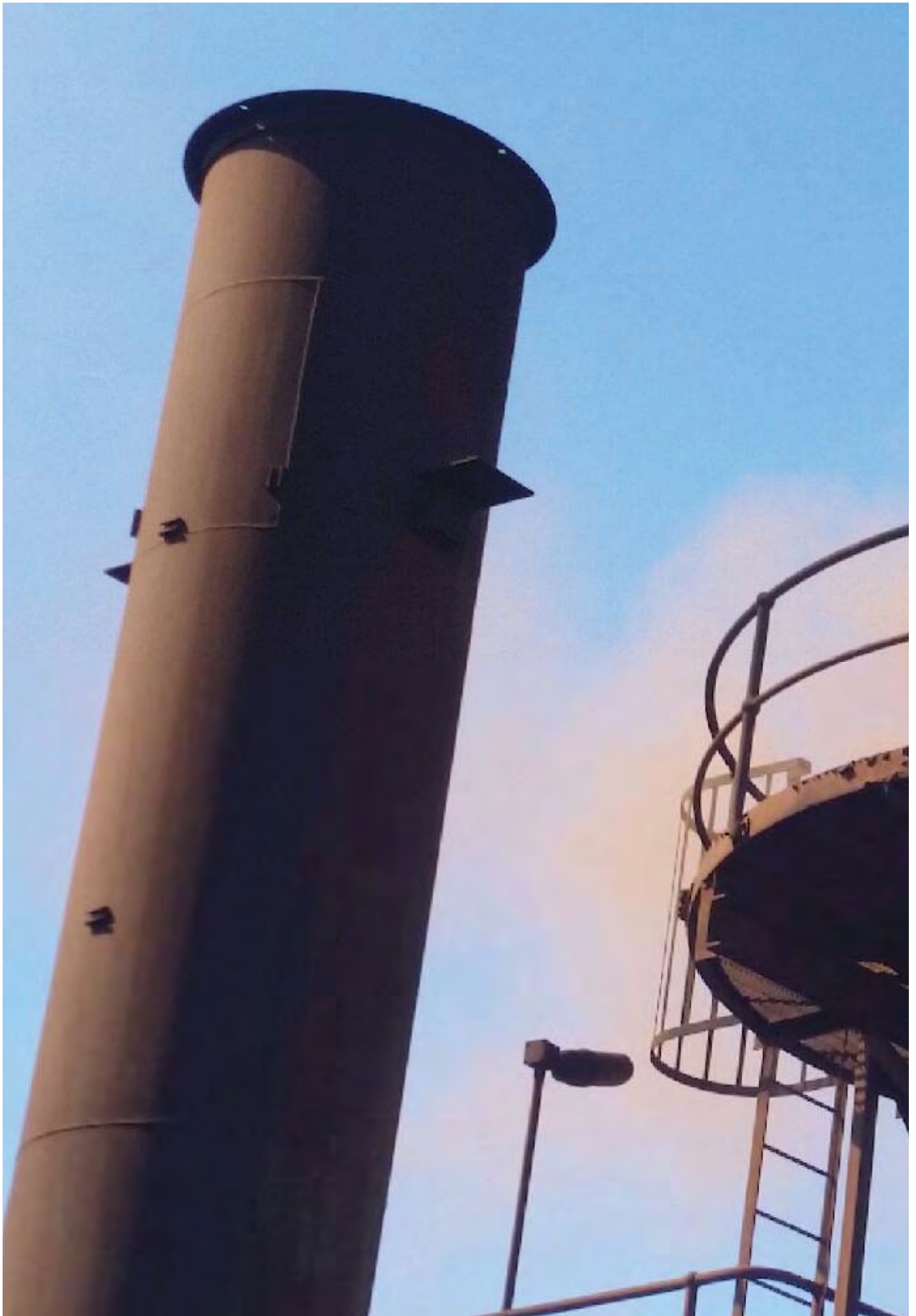
[REDACTED] – Operations , Refinery & Port
QUEENSLAND NICKEL PTY LTD (Administrators Appointed)



1 Greenvale Street, Yabulu QLD 4818
PMB 5, Townsville QLD 4810
P [REDACTED]
E [REDACTED]

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From: [REDACTED]
Sent: Tuesday, 16 February 2016 10:19 AM
To: [REDACTED]
Subject: 20160216_093615.jpg



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From: [REDACTED]@qni.com.au>
Sent: Wednesday, 17 February 2016 11:34 AM
To:
Subject: FW: Roaster 1 burner 9E incident
Attachments: image001.png

Begin forwarded message:

From: [REDACTED]l@qni.com.au>
Date: 16 February 2016 3:54:08 pm AEST
To: [REDACTED] @qni.com.au>
Subject: Roaster 1 burner 9E incident

Good afternoon [REDACTED]

As you know at 9:26am today the 16th February 2016 a significant overpressure event, suspected to be a deflagration, occurred inside Roaster 1. The explosion lifted the explosion safety door on level 9 and caused the emergency vent valve to rotate approximately 180 degrees from its normal open position. No one was injured.

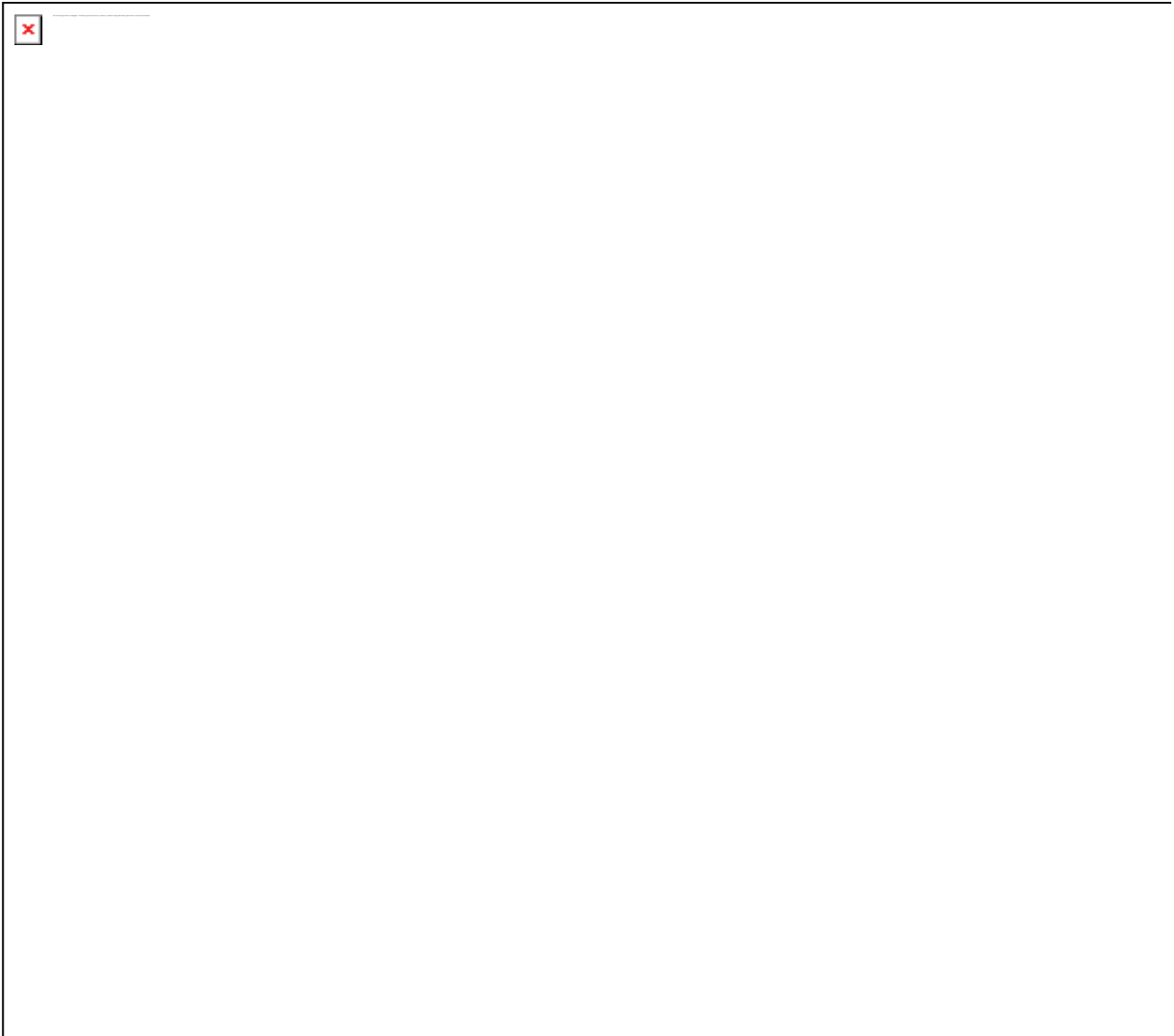
The event coincided with start-up activities on Roaster 1 and occurred approximately 20 minutes after the first burner (hearth 9 east side burner) was lit and before any other burners were lit.

As you have heard the burner operator was not aware of the significance of the event even though he was adjusting the burner at the time and was also looking through a peephole into the roaster. This suggests that the explosion was a deflagration and occurred remote from the burner chamber.

Preliminary investigations have revealed that the burner oil flow between 13 and 18 minutes after ignition was well above normal firing rates for a roaster cold start. This, coupled with possible lower than normal air flows, created a mix of combustible vapours in the roaster. These vapours likely mixed with air inside the roaster (it was under suction) to form a mix capable of ignition. From this point either a subsequent burner adjustment, or another event, ignited the mixture and caused the deflagration.

The reason for the excessive oil addition period is not yet known. Operator error and/or burner malfunction are being investigated. The burner trend from the incident is shown below (Figure 1).

Figure 1: Burner 9E incident trend



Regards

[Redacted]

QUEENSLAND NICKEL PTY LTD (Administrators Appointed)

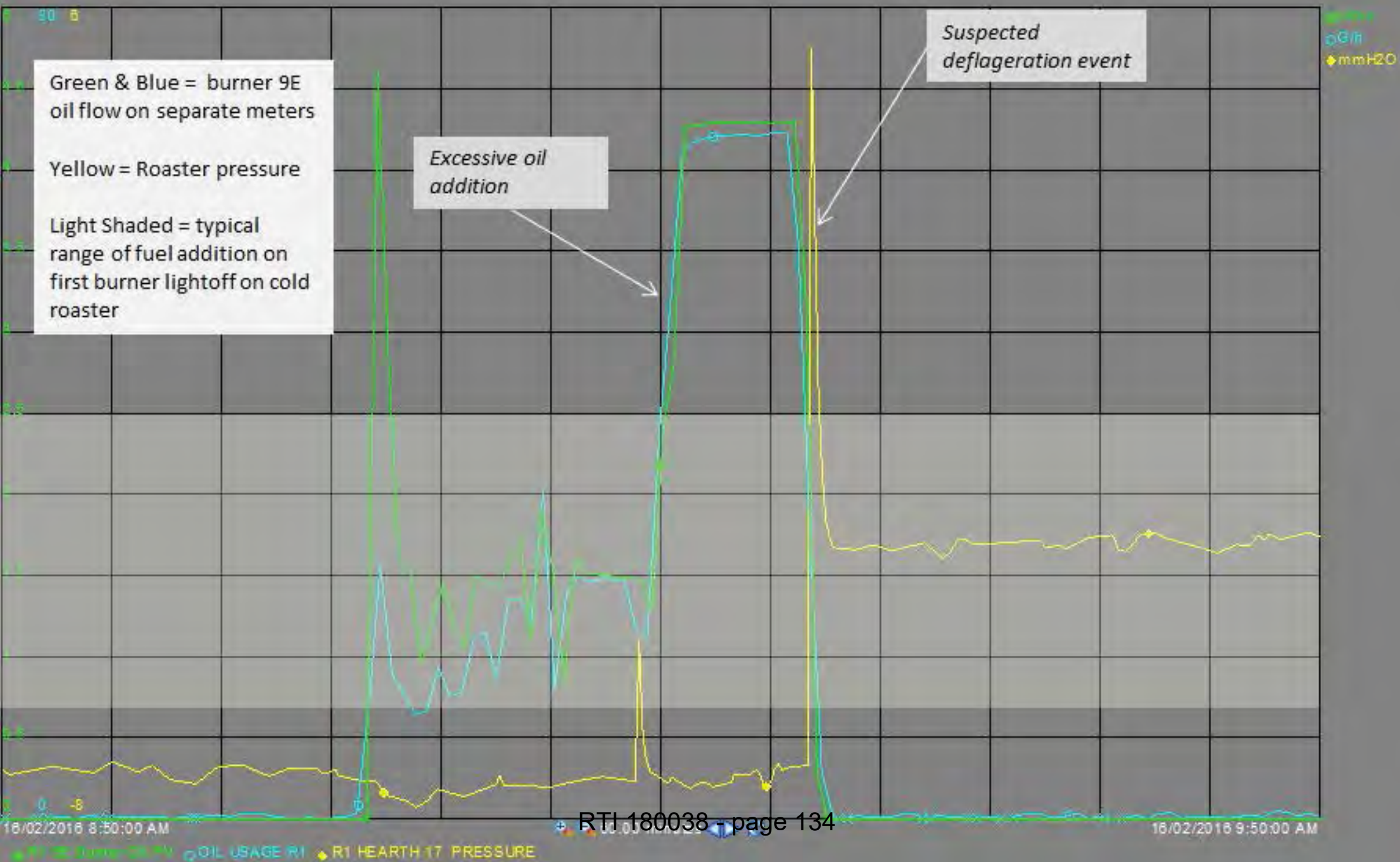
Greenvale Street, Yabulu QLD 4818

PMB 5 Townsville QLD 4810

P

E [Redacted]

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From: HICB
Sent: Tuesday, 16 February 2016 4:17 PM
To:
Subject: FW: TOWNSVILLE Notification of RECORDING of EVENT : 224565

Follow Up Flag: Follow up
Flag Status: Flagged

-----Original Message-----

From:
Sent: Tuesday, 16 February 2016 3:58 PM
To: HICB <hicb@justice.qld.gov.au>
Subject: TOWNSVILLE Notification of RECORDING of EVENT : 224565

RECORDING of Event logged in CIS:
Event: 224565
Priority: 3 - Complaints regarding significant risk
Classification: Critical event
District: TOWNSVILLE
HS Licensed Work: NO

Registered Major Hazard Facility

Type : WHS Dangerous Event
AAA Reference: Incident 42429 Incident Allocation: REGIONAL RESPONSE

Event Date: 16-FEB-2016
Notify Date: 16-FEB-2016
Desc : 4C - SMF - RR - Note: This incident has been reported to HICB verbally on 16 February.

An explosion occurred within Roaster 1. The incident is believed to have occurred from accumulation of un-combusted hydrocarbons during an oil burner light-off sequence and follows a period where the roaster was shut down.

Standard operating procedures were in use as the roaster was brought back into operation.
The minor explosion was fully contained using pressure release mechanisms designed into the roaster. Notifier is notifying on behalf of : Not Stated - Workplace Controller : Not Stated

Employer: QUEENSLAND NICKEL PTY. LTD. Role: EMP ABN: 85009842068 Address : PALMER NICKEL AND COBALT REFINERY, GREENVALE ST, YABULU 4818 QLD
T/A : QUEENSLAND NICKEL PTY LTD
Contact : NO DETAILS GIVEN Tel: Fax: Mob: Email:

Incidents

IncidentId: 122170 Address: PALMER NICKEL & COBALT REFINERY, GREENVALE ST, YABULU 4818 QLD Inc Type: DIRHS Complaints
16-FEB-2016 15:57:56

From: [REDACTED]@qni.com.au>
Sent: Wednesday, 17 February 2016 5:33 PM
To: section 78B RTI Act
Cc:
Subject: QN - 16 February - Roaster incident update
Attachments: 2016 02 16 330-1401 Roaster 1 EVD Explosion Post Incident External Damag....pdf

Darren further to our discussion this morning, a summary of QN site investigation progress into the Roaster #1 event on 16/2/16 is as follows ;

- A summary engineering structural assessment has been completed today. The assessment is attached for your general review. As a result of the assessment, there has been no significant structural repairs identified as a result of the incident.
- A team has been established to investigate this incident. The investigation team includes process engineers and operations staff.
- Initial mechanical inspection of the oil burner involved in the incident indicate that the burner had a seized air flow control valve assembly. This kept the air flow addition rate at its minimum firing position irrespective of the manual adjustment of the external air flow lever. At this early stage this is being considered as a contributing factor.
- A crane will remove the existing EVD emergency vent damper from Roaster 1 tomorrow morning and replace it with a refurbished one.
- Assessments are underway of our systems and processes to ensure we do not replicate the event when bringing other roasters online in the short term.
- I have sent you a copy of the PMI bowtie 156 as requested, related to this event.
- I will meet with John Finn on Friday and go through the event in more detail onsite.
- I will continue to brief the voluntary administrators FTI with details of this event investigation.

Regards,

[REDACTED] – Operations , Refinery & Port
QUEENSLAND NICKEL PTY LTD (Administrators Appointed)



1 Greenvale Street, Yabulu QLD 4818
PMB 5, Townsville QLD 4810
P [REDACTED]
E [REDACTED]

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MAJOR HAZARD FACILITIES AUDIT REPORT

YABULU NICKEL AND COBALT REFINERY

1 Greenvale Street; Yabulu Qld 4818

Date of Audit: 14 September 2017

Date of audit report submission: 29/09/2017

Audit Team Members

Name	Position	Organisation
	Safety Advisor (Major Hazards)	Workplace Health and Safety Queensland
	Senior Safety Advisor (Major Hazards)	Workplace Health and Safety Queensland

Document Revision History

Revision	Date	Description	Prepared by	Reviewed by
A	29/09/2017	Draft		
B	26/10/2017	Final		

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1. Audit Scope

Representatives from Workplace Health and Safety Queensland (WHSQ) visited the Yabulu site as part of its ongoing surveillance activities to ensure the hazardous chemical inventories stored at the facility continues to be managed appropriately.

Findings of the audit may not disclose all instances of non-compliance at the facility. This report is written with the aim of improving safety at the site by providing feedback on the findings of the audit.

2. Company Representatives

Name	Title	Company
	Director- Facility Operations	Queensland Nickel Sales Pty Ltd
	Safety and Risk	Waratah Coal Pty Ltd
	Safety and Environment	Waratah Coal Pty Ltd
	Facilities Management	Waratah Coal Pty Ltd

3. Abbreviations and Acronyms

Abbreviations / Acronyms	Full term
AHS	Ammonium Hydrosulphide
ASX	Ammoniacal Solvent Exchange
CMMS	Computerised Maintenance Management System
HICB	Hazardous Industries and Chemicals Branch
IMT	Incident Management Team
MHF	Major Hazard Facility
QCH	Queensland Casual Hire Pty Ltd
QFES	Queensland Fire and Emergency Service
QNI	Queensland Nickel Pty Ltd
QNS	Queensland Nickel Sales Pty Ltd
RPEQ	Registered Professional Engineer Queensland
SCBA	Self-Contained Breathing Apparatus
SMS	Safety Management System
WHSQ	Workplace Health and Safety Queensland

4. Executive Summary

There were positive indications sighted during this visit which suggests that QNS are attempting to comply with their legislative obligations under the *Work Health and Safety Act and Regulation 2011*. Example of activities undertaken by QNS since April 2017, includes:

- A significant amount of work has been done to repair plant and infrastructure in 352 Tailings Treatment Area, which has been previously identified by WHSQ inspectors as being in an extremely poor state.
- Significant upgrades to the detection and mitigation measures in place for the ammonium hydrosulphide sphere, and its contents.
- The removal of 514-2602 and 514-2603 Coal Bunkers, with plans to remove the final coal silo from the boiler area (namely 514-2601 Coal Bunker).
- Repairs to the Brine Dam are nearly complete. Plans to transfer the remaining ammoniacal solution from plant areas to this dam is expected to commence shortly once the dam repairs are complete.

WHSQ commends QNS for their recent activities, and encourages QNS to continue this work.

Surveillance activities on site identified two concerns with regards to the storage of ASX organic solvents in the 356 Area which requires urgent attention by QNS. It appears that the vessel used to store the remaining organic solvents on site are incorrectly labelled and are not isolated as per QNS's licence conditions. No new improvement notices were issued during this audit, however WHSQ officers will continue to follow-up and aim to address these findings with QNS in a timely manner.

Finally this surveillance audit served as an opportunity for WHSQ inspectors to review QNS's investigation into a recently reported dangerous event at the facility, where a sheet of asbestos-containing (AC) material fell to the ground (from height) during a high wind event. No injuries were reported. The AC sheet (and associated debris) have now been removed. Following this incident, QNS have reported of a number of preventative activities proposed to occur to ensure this event is not repeated during the upcoming (summer) storm season in North Queensland. WHSQ welcome this finding.

Guidance notes for the facility regarding recommendations:

The recommendations listed below are categorised under three priority ratings; **C** (compliance) **P1** and **P2**. **C** corresponds to the likely contravention of a regulation, while **P1** and **P2** reflect the relative importance of a recommendation for improvement with **P1** being of higher importance.

Further context for each recommendation can be found on the report page referenced in the tables below. HICB's expectation is that;

- **C** items are acted upon as soon as reasonably practicable to address the likely contravention of a regulation. Normally, verbal direction will be given at the time of audit or shortly after via telephone or email. Failure to comply within an agreed time frame may cause an inspector to issue a notice. In the case that **C** items are addressed by the facility prior to the issue of this report, this will be noted in the report.
- **P1** items are considered and acted upon so far as reasonably practicable and if no action is taken the facility should justify why no action was taken.
- **P2** items are considered and acted upon as the facility sees fit.
- Written evidence should be provided as to the action taken regarding **C** and **P1** items within an agreed time frame. Where no action is taken a brief written justification should be provided. The aforementioned information could be provided in a report, emails, spreadsheet or other format as convenient to the facility.

C and **P1** items will be tracked by HICB through future enquiries and audits. Actions taken with respect to **C** and **P1** items will be noted in the audit report as HICB receives evidence that they have been completed.

5. Table of regulatory compliance requirements

C 1: Ensure 356-19200 and 356-19201 are appropriately placard as per Schedule 13 requirements.....	9
C 2: Ensure 356-19200 and 356-19201 are appropriately isolated by double block and bleed, lock closed drain point and lock closed as close as possible to the source whilst the facility is not manufacturing.	9

6. Table of P1 Recommendations

P1 RECOMMENDATION 1: QNS consideration whether additional gas detection is required at the spill containment bund.....	5
P1 RECOMMENDATION 2: QNS confirm the minimum oil reserves required within 450-1909 Oil Tank, and ensure that these minimum levels are maintained	5
P1 RECOMMENDATION 3: QNS implement further controls to prevent personnel from accessing plant areas not in use.	8
P1 RECOMMENDATION 4: Remove the incorrect "empty" marking on 356-19200 and 356-19201.	8
P1 RECOMMENDATION 5: Ensure all loose infrastructure, including but not limited to cladding, sheeting, and insulation, are removed or secured prior to commencement of the upcoming (summer) storm season.	10

7. Table of P2 Recommendations

None issued.

8. Site Inspection

The inspectors conducted a brief surveillance audit of the facility. The information provided in this report are key observations made during this visit.

8.1 Ammonium Hydrosulphide (AHS) Sphere

Significant progress has been made to improve the management of the ammonium hydrosulphide sphere and its contents, particularly in the event of an emergency situation. Repairs to the existing concrete bund immediately beneath the sphere (and the brick bund walls) have been completed.

Recent investigative work by local staff identified that the existing spill containment bund was not sized to capture a full loss of containment event from the sphere. As a result, work has commenced to excavate and expand the existing containment bund (Figure 8.4). Work on the bund is expected to continue for the next 6-8 weeks. Work proposed includes the lining of the bund wall with an impervious coating.

The oil dump system mounted to the ammonium hydrosulphide spill containment bund has now been automated (Figure 8.2). Local fixed gas detectors (mounted on the bund walls surrounding the sphere) are set to detect any rouge hydrogen sulphide emissions within the area. It was noted that there are no gas detectors located within close proximity of the spill containment bund itself. WHSQ suggests that further consideration be given as to whether additional gas detection is required at the spill containment bund.

P1 RECOMMENDATION 1: QNS consideration whether additional gas detection is required at the spill containment bund.

In the event that hydrogen sulphide readings exceed 16ppm at any of the gas detectors, a signal will be sent to the dump valve on 450-1909 Oil Tank. Oil from this vessel will then be dumped automatically, forming a protective oil covering over the top of the spill containment bund (Figure 8.3). It was not determined during this audit as to whether there continues to be enough oil within the 450-1909 Oil Tank to adequately coat the surface of the newly expanded spill containment bund during an emergency. Further work must be done by QNS to confirm the minimum oil reserves required within 450-1909 Oil Tank, and ensure that these minimum levels are maintained.

P1 RECOMMENDATION 2: QNS confirm the minimum oil reserves required within 450-1909 Oil Tank, and ensure that these minimum levels are maintained

An SMS alert will automatically be texted to various personnel including to all IMT members, the shift team leader and the nearby power station. An audible alarm (which can be heard from the gatehouse) will activate, warning the remaining site-based personnel that the oil dump system has been activated.

The auditors sighted and were provided additional evidence showing that the sphere has been positively isolated via the use of blinds and spool piece removal (Figure 8.1). Pipelines no longer in use have now been decontaminated downstream of the sphere isolations. These findings overall are welcomed by WHSQ.

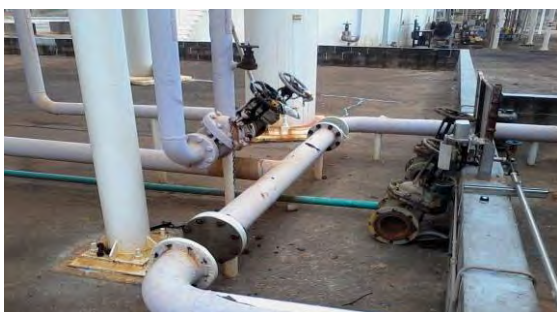


Figure 8.1: AHS Sphere positively isolated via spool piece removal



Figure 8.2: Installation of automated dump valve on 450-1909 Oil Tank

8.2 352-Tailings Treatment and Disposal

Over an 18 month period, WHSQ audits have raised numerous concerns regarding structural integrity within the 352 Area. This led to WHSQ inspectors issuing numerous improvement notices on vessels which appeared to pose the most significant risk to personnel safety.

Following the issue of these notices QNS have progressively acted to address these structural integrity concerns. It was observed at this audit that QNS have made significant repairs to the skirt and shell a number of vessels in this area, including 352-1111 Absorber Column (Figure 8.6), and all Tailing (Figure 8.5) and Magma Stills (Figure 8.7). The scope of the work done to repair these vessels appears to be beyond the requirements stipulated in the notices issued.

It was also identified that QNS have recently commenced work to repair other infrastructure in this area, such as walkways and stairs (Figure 8.8). WHSQ welcomes these findings.



Figure 8.5: Example of repairs made to 352 Tailing Stills



Figure 8.6: Repairs made to 352-1111 Absorber Column



Figure 8.7: Example of repairs made to 352 Magma Stills

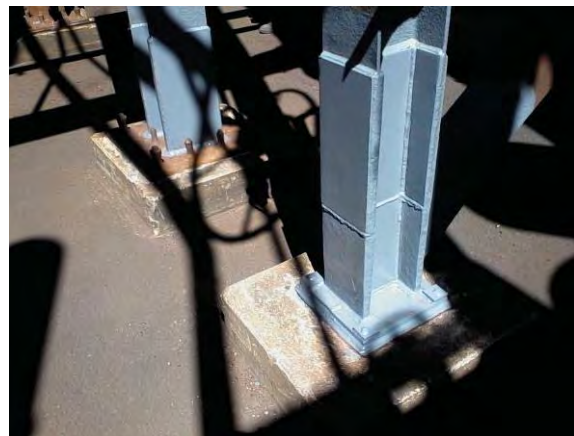


Figure 8.8: Recent repairs to infrastructure supporting walkways at 352 Tailings Still Area

8.3 Brine Dam

It was reported that work to the Brine Dam is nearing completion, with repairs expected to be complete by the end of September 2017. The auditors observed the installation of a PVC lining within the Brine Dam (Figure 8.9). Once the lining to the Brine Dam is fully installed, QNS plans to commence the transfer of ammoniacal solutions from the Area 340 Thickener area to the Brine Dam. WHSQ welcomes this action.



Figure 8.9: Repairs to Brine Dam

Preliminary commitments made early 2017, suggested that all remaining site-based ammoniacal solutions would be transferred to the pond before November 2017 (i.e. the start of cyclone season). Due to unforeseen delays in the repair of the Brine Dam, it appears likely that the transfer of ammoniacal solutions to the dam will not be complete by this time. QNS were unable to provide a schedule for draining the remaining ammoniacal solutions at this stage, but have committed to undertake this activity at a timely rate with minimal impact to their neighbours.

8.4 340-Thickeners

The auditors noted no significant change to the status or condition of the 340 Thickeners, when compared to WHSQ's April 2017 findings. The top of all thickener vessels are barricaded to prevent unauthorised access.

The thickeners will be drained in the near future. The order for draining will be based on the ammonia concentration within each vessel, with those thickeners containing solutions with the highest ammonia concentration being drained first. Recent testing by QNS has indicated that the thickeners containing the highest ammonia concentration is presently in Thickener 5, followed by Thickeners 4, 1, 2 and 8. Refer to [Section 8.3](#) for further information.

8.5 514-Coal Bunkers

The auditors noted that 514-2602 and 514-2603 Coal Bunker had been fully removed since their last visit to site. All improvement notices relating to the coal bunkers have been closed out. QNS have reported that they intend to do further work in this area. Scaffolding is currently being installed around the last remaining coal bunker silo (514-2601). Once the scaffolding is in place, QNS plans to remove this vessel also from site. This work is expected to be complete within the next 2-3 months. WHSQ welcome these findings.

8.6 330- Roaster Building

QNS reported that the work to clean the Roaster building has continued and is near completion. Structural inspections of the Roaster Building have recently been completed by a RPEQ accredited engineer. It was reported that repairs are required to some structural beams and supports. QNS are planning to undertake this repair work once the activities at the Brine Dam are complete. WHSQ welcomes QNS's commitment to undertake structural repairs to the Roaster building. No further details of what work is required or planned was provided during this audit.

8.7 Plant Not In Use

QNS's 2017 safety case outline submission reported on the asset management strategies to be implemented whilst the site remains caretaker-maintainer mode. Routine maintenance activities for plant areas no longer in use have been suspended, with unauthorised access into these areas now prohibited. Utilities, such as power and water, to plant areas not in use have also been isolated.

Some of the quarantined plant areas have known structural issues and hazards. These plant areas are presently barricaded to prevent unauthorised access. Other plant areas not in use and without any known imminent hazards do not appear to be barricaded at this time. As the facility continues to lay idle indefinitely, it is likely that those plant areas without known imminent hazards will eventually deteriorate and may introduce new hazards for the site.

Section 207 of the *Work Health and Safety Regulation 2011* requires the person with management or control of plant at a workplace to ensure, so far as is reasonably practicable, that plant not in use is left in a state that does not create a risk to health and safety of any person.

There are only limited markers and signs which identifies the areas which are out of bounds for general staff, visitors and contractors within the facility at this time. There is no other means for site personnel, visitors or contractors to identify where the quarantined areas are located on site, such as via the use of "mud-maps" or marked site drawings. As a result it may be possible for (unauthorised) personnel to access quarantined plant areas that are not in use.

To support QNS's asset management strategy to suspend routine maintenance activities in plant areas no longer in use, WHSQ recommends further work be undertaken by QNS to prevent personnel from accessing plant areas no longer in use.

P1 RECOMMENDATION 3: QNS implement further controls to prevent personnel from accessing plant areas not in use.

8.8 ASX Organic Solvent Storage

The 2017 QNS safety case outline reports that the organic solvent used in the 355 and 367 ASX circuits had been consolidated into two storage tanks in the 356 and 367 areas of the plant. It was identified at this audit that the organic solvent from the 356 and 367 ASX units are being stored within vessels 356-19200 and 356-19201.

On inspection of these vessel, it was identified that both vessels were marked as being "empty" (Figures 8.10 and 8.11). This was not the case. QNS representatives committed to removing the incorrect "empty" marking of these vessels immediately. No notices were issued based on this commitment.

P1 RECOMMENDATION 4: Remove the incorrect "empty" marking on 356-19200 and 356-19201.



Figure 8.10: Incorrect marking on 356-19201



Figure 8.11: Incorrect marking on 356-19201

There were no markings on either 356-19200 or 356-19201 to identify that these vessels were storing organic solvent. The organic solvent appears to be a schedule 11 (hazardous) chemical, namely a category 4 flammable liquid. The amount in these vessels appears to be in quantities which exceed placard thresholds.

Section 350 of the *Work Health and Safety Regulation 2011* requires a person conducting a business or undertaking at a worksite to ensure that a placard is prominently displayed at the workplace if the quantity of a (or a group of a) schedule 11 hazardous chemical exceeds the placard quantity. The placard must comply with Schedule 13.

The issue regarding labelling of these vessels was identified post this audit. As a result no notices have been issued at this time. WHSQ will continue to pursue to address this issue with QNS, which may lead to issue of improvement notices in future.

C 1: Ensure 356-19200 and 356-19201 are appropriately placard as per Schedule 13 requirements.

It was noted that both storage tanks were not fully isolated as close as possible to the tank itself (Figure 8.12). A pump which was connected and opened to 356-19201 was found to be leaking organic solvent (Figure 8.13).

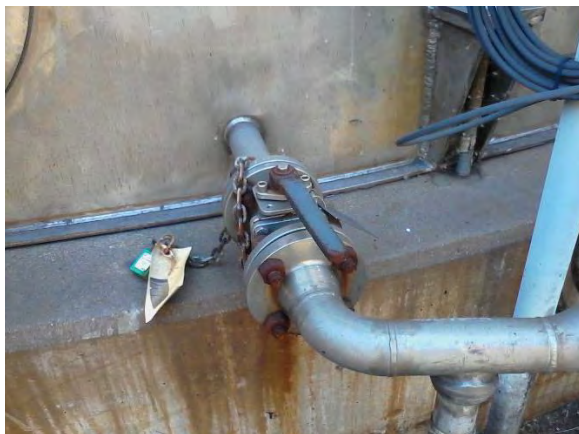


Figure 8.12: 356-19201 not isolated at tank



Figure 8.13: Leaking organic solvent from pump connected to 356-19201

Existing site conditions require all tanks and vessels containing hazardous chemicals remain isolated by double block and bleed, lock closed drain point and lock closed as close as possible to the source whilst the facility is not manufacturing. This observation appears to be a breach of this condition. A commitment was made to rectify this non-conformance by the close of business that day, and as such no notices were issued.

C 2: Ensure 356-19200 and 356-19201 are appropriately isolated by double block and bleed, lock closed drain point and lock closed as close as possible to the source whilst the facility is not manufacturing.

It is again worth reminding QNS at this stage that one of the considerations that the Regulator must be satisfied with before issuing an MHF license under sections 580 and 581 of the *Work Health and Safety Regulation 2011*, is that the operator can comply with any conditions imposed. The failure to comply with conditions, even during the determination period, can impact on whether the Regulator can or should issue a major hazard facility license to an operator.

9. 320-2661 Coal Bunker 1 Dryer Incident

A notifiable event was recently reported at the Yabulu site. An asbestos-containing (AC) sheet fell from height at the 320-2661 Coal Bunker 1 Dryer building. No persons were in the area at the time of the incident. The sheet, which was approximately 800 mm long and 300 mm high, broke up when impacting the ground. To make the area safe the broken sheeting (including any remnants) were collected, bagged and sealed. A barricade was placed to prevent further access to the area. A licensed removalist was reportedly deployed to perform the clean-up operation.

The auditors surveyed the area where this incident occurred as part of their audit activities. It was reported that the loss of the AC sheeting from the building was due to a recent strong wind event at the site. QNS have reported that this event prompted a number of corrective actions.

Further AC sheeting was cut and removed from 320-2661 Coal Bunker 1 Dryer building as it was deemed probable that a similar wind event would result in further sheeting from the building to be dislodged. The area beneath the dryer building remains barricaded from general entry. QNS have reportedly commissioned an RPEQ accredited structural engineer to review their asbestos register in order to identify relevant plant areas that continues to house asbestos containing materials. Inspection of these areas containing asbestos has commenced to identify whether it is possible for other AC sheeting or materials to become dislodged or mobilised in a high wind event. Preliminary findings suggest that the building which houses the 320 Ball Mill will require further attention. QNS has reported that they will undertake all necessary repairs once the proposed inspection work for the site is complete.

Other plant area currently identified as being vulnerable to losing non-asbestos containing cladding, insulation and/or sheeting during high wind events have also been identified following this event. Areas such as the 514 Boilers have now been barricaded to prevent unauthorised access until such a time that repair work to remove loose materials can be completed. HICB welcomes this work, but urges QNS to complete all repairs prior to the upcoming (summer) storm season.

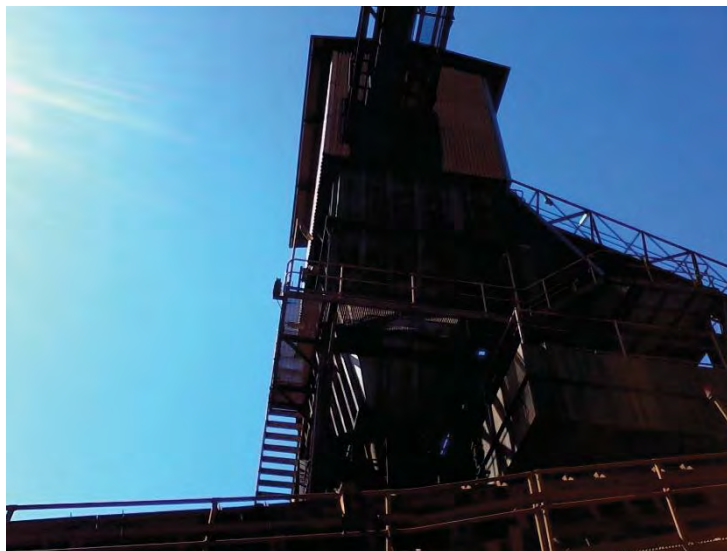


Figure 8.14: 320-2661 Coal Bunker 1 Dryer Building

P1 RECOMMENDATION 5: Ensure all loose infrastructure, including but not limited to cladding, sheeting, and insulation, are removed or secured prior to commencement of the upcoming (summer) storm season.

Facility Yabulu Nickel Refinery
CON Number 14128
Author



10. Acknowledgement

The audit team wishes to thank QNS and their associates for their cooperation and assistance in the performance of this audit.



MAJOR HAZARD FACILITIES AUDIT REPORT

QUEENSLAND NICKEL SALES PTY. LTD

1 Greenvale St Yabulu QLD

Date of Audit: 05/02/2018

Date of audit report submission: 28 / 02 / 2018

Audit Team Members

Name	Position	Organisation
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	Lead Inspector	WHSQ

Document Revision History

Revision	Date	Description	Prepared by	Reviewed by
A	21/02/2018	Draft		
B	2/03/2018	Final		

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Audit Scope

Representatives from Workplace Health and Safety Queensland (WHSQ) visited the Yabulu site as part of its ongoing surveillance activities. The primary purpose of the visit was to ensure the hazardous chemical inventories stored at the facility continues to be managed appropriately and check compliance with the *Work Health and Safety Act and Regulation 2011*.

Findings of the audit may not disclose all instances of non-compliance at the facility. This report is written with the aim of improving safety at the site by providing feedback on the findings of the audit.

Company Representatives

Name	Title	Company
	Director- Facility Operations	Queensland Nickel Sales Pty Ltd
	Safety and Environment	Waratah Coal Pty Ltd
	Facilities Management	Waratah Coal Pty Ltd

Executive Summary

The status of the refinery was found to be stable. A number of improvements have been made to further reduce the inventory of hazardous chemicals and address general health and safety matters. These improvements include:

- Replacement of the pipe rack and repairs to a number of footings of structural supports in the Tailing Still area.
- Repairs to 352-1111 Absorber support.
- The removal of the third coal bunker from the site.
- Draining all thickeners which contained ammoniacal solutions.

The site inspection showed that a number of basic and essential occupational safety and health requirements have not been maintained in operational areas and where the bulk inventories of hazardous chemicals were stored.

Examples were:

- Fire extinguishers had not been maintained for almost two years. An Improvement Notice was issued.
- A number of emergency showers were disconnected from a water source.
- The fire risk from vegetation around the site, critically in the vicinity of the bulk inventories of hazardous chemicals, had not been managed.
- Loose cladding and materials needs attention as a part of preparation for cyclones. This issue had been flagged in the previous WHSQ site visit.

Compliance with conditions

One condition of the Operator's determination as a Major Hazard Facility is to provide an Improvement Plan to ensure the firefighting systems are and will continue to be effective on demand. The aim of this condition is to address all identified non-conformances of the firefighting systems with relevant Australian Standards. The due date of this condition was 1 December 2017. QNS has

Facility Queensland Nickel Sales Pty Ltd.

File / Record 14128

Author



failed to fulfil their obligation under the determination conditions since no evidence has been presented to WHSQ to date.

It should be noted that the content of this report is by exception and not a detailed account of all that was audited and observed during the visit. Therefore the report primarily contains commentary and recommendations on areas where potential improvements have been identified. Recognition is provided where it was observed that the facility has made substantial improvements or where a site practice was observed to be noteworthy.



Guidance notes for the facility regarding recommendations:

The recommendations listed below are categorised under three priority ratings; **C** (compliance) **P1** and **P2**. **C** corresponds to the likely contravention of a regulation, while **P1** and **P2** reflect the relative importance of a recommendation for improvement with **P1** being of higher importance.

Further context for each recommendation can be found on the report page referenced in the tables below.

HICB's expectation is that;

- **C** items are acted upon as soon as reasonably practicable to address the likely contravention of a regulation. Normally, verbal direction will be given at the time of audit or shortly after via telephone or email. Failure to comply within an agreed time frame may cause an inspector to issue a notice. In the case that **C** items are addressed by the facility prior to the issue of this report, this will be noted in the report.
- **P1** items are considered and acted upon so far as reasonably practicable and if no action is taken the facility should justify why no action was taken.
- **P2** items are considered and acted upon as the facility sees fit.
- Written evidence should be provided as to the action taken regarding **C** and **P1** items within an agreed time frame. Where no action is taken a brief written justification should be provided. The aforementioned information could be provided in a report, emails, spreadsheet or other format as convenient to the facility.

C and **P1** items will be tracked by HICB through future enquiries and audits. Actions taken with respect to **C** and **P1** items will be noted in the audit report as HICB receives evidence that they have been completed.

Table of P1 Recommendations

P1 RECOMMENDATION 1: QNS should revise the “reorder” labels on the pressure and level gauges of the nitrogen tank at the AHS sphere as per the existing operational need to reflect when nitrogen should be reordered.	7
P1 RECOMMENDATION 2: QNS should ensure the secondary bund associated with the AHS sphere is sufficiently impervious to retain spillage as per the S5.8.3 of Australian Standard AS 1940:2017.	7
P1 RECOMMENDATION 3: QNS should ensure bund valves associated with tanks and containers of hazardous chemicals, are maintained in a closed position when not being actively monitored.	8
P1 RECOMMENDATION 4: QNS should ensure the bunded areas associated with tanks and containers of hazardous chemicals are kept in a state that will ensure sufficient capacity in the event of a failure of the primary containment.	8
P1 RECOMMENDATION 5: QNS should not issue any confined space entry permit unless the rescue plans for any confined space permit issued on-site are proportionate to the risks involved and fit the existing site response capabilities. QNS should revise rescue plans accordingly.	9
P1 RECOMMENDATION 6: QNS should ensure that loose plant and materials including but not limited to cladding, insulation and scaffolds are removed or secured in a planned fashion for cyclone preparation.	10
P1 RECOMMENDATION 7: QNS should justify why the inventories of hazardous chemicals in non-operational areas had not been removed from the site. If the case is justified, QNS should ensure inventories of the hazardous chemicals e.g. Classes 2 and 3 stored in the non-operational are being inspected routinely to confirm containers are intact and the risk is managed to so far as reasonably practicable.	10
P1 RECOMMENDATION 8: QNS should ensure vegetation around the facility is controlled to minimise a risk of fire.	10
P1 RECOMMENDATION 9: QNS should ensure that relevant employees are adequately trained in the confined space entry permit system, breathing apparatus and first aid prior engaging in the relevant activities.	11

Table of regulatory compliance requirements

C 1: QNS must ensure bulk inventory of hazardous chemicals e.g. Tank 356-19202 (contained organic solvent) and the LPG tank are positively isolated i.e. air gap or double block, bleed and spade or single block, bleed and spade or as close as possible to sources whilst the facility is not producing.9	
C 2: QNS must ensure adequate number of trained first aid officers are available in each shift as per the requirements of <i>S42 (2) of WHSQ Regulation 2011</i>	11

Site Inspection

The following matters were identified:

Ammonium Hydrosulphide Sphere:

- There were no changes made to the condition of the Ammonium Hydrosulphide (AHS) sphere when compared to the recent WHSQ audits. The sphere remained isolated from plant by the use of blinds and spools removal.



Photos of the AHS sphere positively isolated

- Minor to moderate corrosion was identified on the structural supports of the spheres during the recent visual inspection by the contracted RPEQ engineer. QNS representatives told the auditors that repairs have been conducted to address the defects. Confirmation of this claim has been sought from QNS and will remain pending until the provision of the requested reports and evidence of repairs have been supplied to the Regulator.
- The seal on the rupture disk of AHS sphere was recently replaced.
- The gas detectors at the initial bund were showing zero ppm of gas. In response to the WHSQ's query (HICB recommendation no.1- September 17) on adding extra gas detectors at the secondary bund, the QNS representative stated that there was no current plan to do so.
- The required nitrogen inventory is now much lower due to elimination of the catalyst and the non-operational status of plant. The QNS representative stated that nitrogen inventory will be reordered if the pressure of the nitrogen tank drops down to 300 kPa. It was noted that the "reorder" labels (which were based on the former operational need) on the level and pressure gauges of the nitrogen tank were no longer applicable and did not reflect when nitrogen should be reordered.



Photo of the gauges on the nitrogen tank- AHS sphere

P1 RECOMMENDATION 1: QNS should revise the “reorder” labels on the pressure and level gauges of the nitrogen tank at the AHS sphere as per the existing operational need to reflect when nitrogen should be reordered.

- Smoke from an overheated UPS battery bank in the Substation 540 activated the fire panel of the HV switch room on 4/02/2018. As a result, the site power tripped and activated the emergency system which included the oil dump system at the AHS sphere which dumped oil in the expanded bund. It was noted that the dumped oil covered the surface of the bund. It appeared that the oil dump system functioned as per its design intent.
- The QNS representatives reported that the oil tank is refilled and this was confirmed by the auditors.



Photo of the oil dumped in the newly extended bund- AHS sphere

- The auditors sighted that the expanded part of the earthed bund had not been lined with any impervious coating as committed by QNS in the last WHSQ visit. It was unclear when work will be commenced to address the matter. Section 5.8.3 of Australian Standard AS 1940:2017, “The storage and handling of flammable and combustible liquids” recommends that bunds shall be sufficiently impervious to retain spillage and to enable recovery of such spillage.

P1 RECOMMENDATION 2: QNS should ensure the secondary bund associated with the AHS sphere is sufficiently impervious to retain spillage as per the S5.8.3 of Australian Standard AS 1940:2017.

Fire Fighting System:

- The facility has been determined as a Major Hazard Facility (MHF) with a set of conditions attached to the determination. One of the conditions is to provide an improvement plan to ensure the firefighting systems are and will continue to be effective on demand with the aim of addressing all identified non-conformances of the firefighting systems with relevant Australian Standards. The due date of this condition was 1st of December 2017. No improvement plan has been provided to the Regulator to the date to fulfil this condition.
 - The QNS representative stated that the improvement plan had been drafted and was awaiting for final review. WHSQ requested the final improvement plan and flagged that the condition had not been met and was more than two months overdue.
 - The QNS representatives explained that the firefighting systems have been tested by QFES and confirmed that they will be operative on demand. WHSQ requested QNS to provide a written confirmation from QFES to support this claim.

- It was noted that in the operational zones and the areas with inventories of hazardous chemicals, the inspection tags of the firefighting extinguishers showed that the equipment had not been inspected and tested for approximately two years. Examples of locations where fire extinguishers were observed to be overdue for inspection were: in the vicinity of the waste oil tank and the flammable cabinets in the 420 area both contained flammable and combustible chemicals, Substation 540, and the 360 maintenance workshop. *S359 (1) (c) of the WHS Regulation 2011* requires firefighting equipment be properly tested and maintained. WHSQ issued an Improvement Notice no. I1002712 in this regard.
- A gap on the guarding of the electric fire pump 520-1501 which did not appear to provide adequate protection against the spinning shaft and the rotating parts was identified. WHSQ did not issue any Improvement Notice on the ground that evidence of the guarding replacement was provided.

Area 420 Oil Delivery Area:

- When the auditors tested the bund valve associated with a tank containing waste oil in the 420 area, it did not appear to be of a “normally closed” type. It sprang back to open. In an event of a chemical leak from the tank, an opened bund valve defeats the purpose of the bund.
- Rainwater was accumulated in the bund of the tank. It should be noted that WHSQ has issued Improvement Notices to QNS for ensuring bunds are empty in the previous site inspections. However, on this occasion, the amount of water did not materially impact the bund capacity and therefore, was not deemed to be an imminent risk. It is not good practice and should be emptied promptly.



Photo of the Waste Oil Tank

P1 RECOMMENDATION 3: QNS should ensure bund valves associated with tanks and containers of hazardous chemicals, are maintained in a closed position when not being actively monitored.

P1 RECOMMENDATION 4: QNS should ensure the bunded areas associated with tanks and containers of hazardous chemicals are kept in a state that will ensure sufficient capacity in the event of a failure of the primary containment.

Area 340 Thickeners

- All thickeners were emptied. The manholes of some were opened for entry preparation and decontamination. QNS stated it will take a couple of months to decontaminate all thickeners. Any

entry to the thickeners will be managed under confined entry permits. WHSQ flagged that rescue plans of confined space permits need to be thoroughly assessed and revised to reflect the site existing capabilities to respond to such events.

P1 RECOMMENDATION 5: QNS should not issue any confined space entry permit unless the rescue plans for any confined space permit issued on-site are proportionate to the risks involved and fit the existing site response capabilities. QNS should revise rescue plans accordingly.

- The roof of the thickeners were found to be in a poor state due to significant corrosion and holes in the rooves. No assessment of the condition of the tank rooves had been conducted since the operation of the plant had ceased and QNS could not provide assurance that there was no danger to health and safety (primarily a fall from height) for a person accessing the roof. Access to the roof was not prohibited as per the HICB 2017 recommendation. QNI provided photographic evidence showing that access to the roof of all thickeners have now been barricaded.

ASX Organic Solvent Storage

- Tank 356-19202 contained organic solvent (combustible chemical) was isolated only by single block. Tank 356-19201 was isolated by single block, spade and lock closed drain points. The auditors queried the inconsistency in the isolation practice.
- A condition on the determination of the facility was that all bulk inventories of hazardous chemicals were to be positively isolated. QNS complied with this condition and the condition was removed. Post the removal of this condition, it appears that the hazardous material has been transferred into these vessels. The existing isolation arrangement in place does not appear to be in line with the industry good practice to reduce the risk to so far as reasonably practicable. Failure to comply with this requirement may result in re-instating the condition. This matter will be followed-up in the next WHSQ site visit.

C 1: QNS must ensure bulk inventory of hazardous chemicals e.g. Tank 356-19202 (contained organic solvent) and the LPG tank are positively isolated i.e. air gap or double block, bleed and spade or single block, bleed and spade or as close as possible to sources whilst the facility is not producing.

- In the 2017 HICB audit, it was identified that two storage tanks 356-19200 and 356-19201 were wrongly marked as “empty” even though they contained organic solvent. The “empty” labels on the both tanks had been removed.

514 Coal Bunkers

- There were scaffolds around the coal bunkers for re-work on the bunkers. The QNS representatives stated to the WHSQ auditors that all scaffolds were inspected by a licenced scaffolder every thirty days. Evidence of the scaffold inspections have been provided to WHSQ post the audit.
- The third Coal bunker had been removed from the facility.

Emergency Showers

- It was identified that the emergency shower at the firefighting pump station was disconnected from a water source. A similar issue was identified in the area that workers were doing hot work where the emergency showers were found to have no water supply. QNS representatives explained that there were portable eyewash kits available. QNS provided photographic evidence

showing that the emergency shower at the firefighting pump station and in other plant areas were reconnected to a water source. WHSQ did not issue any Improvement Notice.

Cyclone preparation

- The cladding around the boilers in 514 Area appeared to be damaged and in a poor condition. The auditors were concerned that loose and damaged parts on cladding could be vulnerable in high winds. QNS indicated that they were aware of the issue but did not provide any commitment to remove or tightened up the cladding for the cyclone season. It was proposed by the QNS representatives that the likely scenario at this point in time would be that this activity would only be attempted once a cyclone warning had been issued. WHSQ are concerned that the scope of the work is more extensive than what could be realistically completed in the short timeframe once a cyclone has been forecast and that attempting to perform this task under such a high stress environment could lead to its own safety issues. This issue is also applicable to the scaffold around the Coal Bunkers. WHSQ re-iterate this matter to the attention of QNS.

P1 RECOMMENDATION 6: QNS should ensure that loose plant and materials including but not limited to cladding, insulation and scaffolds are removed or secured in a planned fashion for cyclone preparation.

Hazardous Chemicals Inventory:

- Inventories of Class 3, flammable liquid were stored in the flammable cabinets across the site in non-operational areas of the refinery. It appeared that the inventories have not been inspected routinely to ensure conditions of the containers remained sound. Similar issues were detected at the LPG tank which was no longer in service but contained gas. An improvement Notice was not issued because the location of the LPG gas (located in the non-operational area), did not pose an imminent risk.

P1 RECOMMENDATION 7: QNS should justify why the inventories of hazardous chemicals in non-operational areas had not been removed from the site. If the case is justified, QNS should ensure inventories of the hazardous chemicals e.g. Classes 2 and 3 stored in the non-operational are being inspected routinely to confirm containers are intact and the risk is managed to so far as reasonably practicable.

Vegetation Control

- The vegetation around the bulk inventories of hazardous chemicals, e.g. in the vicinity of the Organic Solvent Tanks, appeared to be a fire risk.

P1 RECOMMENDATION 8: QNS should ensure vegetation around the facility is controlled to minimise a risk of fire.

320-1404 Concrete Stack

- The barricaded area around the stack was maintained.
- The stack was inspected in January 2018. No significant change has been detected to the existing condition of the stack. A routine monitoring of the cracks condition and progression was recommended on an annual basis as per the RPEQ engineer's report.

Site Manning

- The level of the site manning remained steady. It was noted on the shift board that there was at least one the Emergency Response Team member available in each shift.

Training and competency

- The first aid certificates of the majority of the operational shifts were expired and had not been refreshed. WHSQ highlighted that first aid may not be provided when it is needed. It is a legislative requirement to ensure an adequate number of workers are trained to administer first aid or workers have access to an adequate number of other persons who have been trained to administer first aid as per *S42 (2) of WHSQ Regulation 2011*. WHSQ will check compliance with this issue in the next site visit.
- The majority of the shift operators have not been retrained in the confined space entry permit and Breathing Apparatus training modules approximately since 2010 and 2012 according to the training matrix. Given that entry and decontamination of the thickeners are proposed to be managed under confined space entry permits soon, operators should be given adequate information to deliver their responsibilities safely under the permit system.

C 2: QNS must ensure adequate number of trained first aid officers are available in each shift as per the requirements of *S42 (2) of WHSQ Regulation 2011*.

P1 RECOMMENDATION 9: QNS should ensure that relevant employees are adequately trained in the confined space entry permit system, breathing apparatus and first aid prior engaging in the relevant activities.

Safety Case discussion

- The Safety Case (S/C) of the facility is due on 18/05/2018. One of the staff with a background in chemistry and environment has been assigned to develop the S/C since the previous S/C custodian has left the business.
- The process of the S/C assessment was discussed. WHSQ highlighted that when the S/C is submitted to WHSQ, it is considered a final official application and there is limited opportunity to alter or modify it in order to address any deficiency post the submission.
- The WHSQ auditors explained that the conditions of the facility were legislative requirements additional to operator's duties under the legislation. Compliance with the facility's conditions does not exempt QNS from their obligations under the *WHSQ Regulation 2011*.

Acknowledgement

The audit team wishes to thank all participants for the contribution to the audit.

From: [REDACTED]@qni.com.au>
Sent: Tuesday, 19 April 2016 9:08 PM
To:
Subject: QN Area 320 stack report attached
Attachments: 2015 10 09 320-1404 Concrete Stack Condition Assessment.pdf; ATT00001.htm

Follow Up Flag: Follow up
Flag Status: Flagged

attached as discussed today , a stack assessment report from October / November 2015.

A few points for discussion in due course on this report prepared by one of our previous graduate engineers no longer onsite are as follows ;

The executive summary contains some data that seems to be in the media.

1.The executive summary quotes `percentage risk of failure` over specified durations. The report contains assumptions and estimates, and does not elaborate in detail on how these approximate numbers were arrived at.This should be further quantified to demonstrate how these estimations in the report were arrived at.I will ask this question of onsite staff tomorrow to clarify whether there is any background calculation document associated with this report .

As discussed today the asset reliability engineering team at QN reported through to [REDACTED] and there may be other documents associated with this stack inspection I am not aware of.

2. The report does not mention operational factors and how these potentially would accelerate or reduce the likelihood of any failure mode .

Given the plant is offline with no flue gas entering the stack and thus less potential for condensation to affect the stack or affect any perceived corrosion rate, it would be prudent to re-quantify the estimated likelihood of projected failure in the years ahead again , given the plant is now offline.

Regards,

[REDACTED]

The information recorded in this transmission (which includes all attachments and linked documents) is intended for and is confidential to the addressee. If you are not the intended recipient , or if you have received this transmission in error , please inform me immediately and delete the transmission (including any attachments) and destroy any hard copy. You may not use, rely upon, disclose or reproduce (or any part of it) in any way.

CONDITION ASSESSMENT REPORT

Equipment No:	320-1404 Concrete Stack	Work Order No:	83065824
Inspected By:	Sch 4/3/3	Inspection Date:	09 / 10 / 2015
Reviewed By:		Review Date:	11/ 11 / 2015



Figure 1: 320-1404 Concrete Stack

1 EXECUTIVE SUMMARY

The condition assessment of the 320-1404 Concrete Stack has been developed utilising the February 2015 UAV external survey and the October 2015 internal inspection. These inspections focused on the condition of the reinforced concrete shell and internal firebrick lining respectively.

An inspection to gain an appraisal of the internal firebrick lining had not been conducted since October 2004. To achieve this inspection, a camera was raised inside the stack from the base to a height of approximately 65 metres via the use of helium balloons. The methodology is described in Section 4 of this report and in Appendix C where a discussion is provided regarding the learnings during and post inspection.

The top 30m of the concrete stack was considered to be in a very poor condition. Extensive cracking of the concrete shell was identified. The seepage of acidic material through these cracks, as observed in the 2015 UAV external survey, indicates a number of these cracks are of full thickness and acidic attack is advanced. In addition, the internal firebrick lining for this area exhibits large sections of loss and evidence of sagging.

It is expected a moderate to severe failure of internal firebrick lining will occur within 3 years, and a 20% probability to occur within 1 year. A moderate to severe failure of the concrete shell is expected within 4 years, and a 15% probability to occur within 1 year. In the event of these failures occurring, and if repairs are possible, the stack would be offline for a period up to 1 month to allow for assessment and the "make-safe" repairs before a limited return to service, if possible. Such damage may be considered economically unfeasible to repair, or incapable of being "made-safe." The design and construction of a new 320-Area stack is expected to require a minimum of 9 months to complete.

CONDITION ASSESSMENT REPORT

The internal inspection identified the firebrick lining was dislodged around the northern duct inlet, likely due to the vibration effects induced by the duct operation. Due to the extent of damage in this location, and the history of issues on records, the probability of a dislodged section of brickwork damaging the ID fans and duct within 1 year is considered 50%. The clean-up and repair required after this failure event would likely require a shutdown of the concrete stack for 3 to 14 days.

To ensure continued safe production, it is recommended technical proposals are obtained for the development of a replacement design, and a demolition plan made for the existing stack. It is recommended to commence this process immediately with the original stack demolished completely (or to a structural sound extent) within 24 months. ME Notification 76006812 has been raised for this task.

CONDITION ASSESSMENT REPORT

2 REFERENCES

2.1 Drawings

- 320-01404-00009 (See Appendix E)

2.2 Reports

- 2005 06 20 Structural Audit for 320 Dryer Stack
- 2015 UAV External Shell Survey– Crack Network
- 2015 07 24 320-1404 Concrete Stack Current Situation and Rec Actions

3 DESCRIPTION OF CONCRETE STACK DESIGN

The 320-1404 Concrete Stack was constructed of an external concrete shell with an internal firebrick lining. The stack is utilised to transfer fan force waste heat gas from the Area's ore dryers fed into the stack via three steel inlet ducts. The stack was designed in 1973 making the structure approximately 42 years old.

To combat the acidic effects of the cooled gas' condensation, a 100 to 200 mm air gap was designed to ventilate the inner surface of the reinforced concrete. This was to be achieved through the ventilation created by the 4 inch diameter vents around the concrete shell. Figure 2 displays the cross-section of the stack construction at a mid-height corbel. The drawing excerpt details the use of fibreglass packing and lead sheeting, intended to prevent the entry of fines into the air gap.

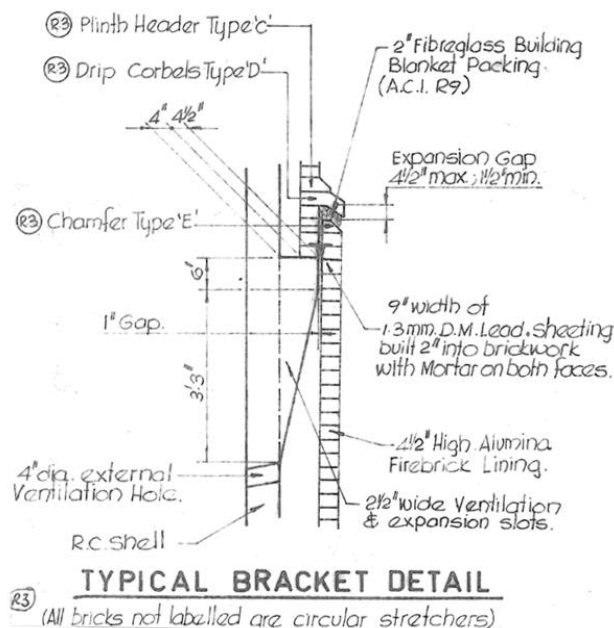


Figure 2: Excerpt of 320-01404-00009

4 METHODOLOGY, LIMITATIONS AND CONSTRAINTS OF INTERNAL INSPECTION

Personnel access to the internal of the stack was off-limits due to confined space regulations and concern with the brick lining condition. The ideal scenario of lowering camera equipment from the top of the stack via crane would have provided an increased quality of photography due to the ability to include additional lighting and cameras, and the increased control over the movement of the device. However, this method was found to be significantly more expensive in comparison.

The implemented method was limited by the ability to only control elevation and rate at which it increased or decreased. There was minimal control over where the equipment moved horizontally, or spun in the stack. The successful inspection was conducted using only one camera. This reduced the field of vision obtained, whereas multiple cameras or multiple inspection runs would have mitigated this

CONDITION ASSESSMENT REPORT

issue. Unfortunately a failed previous test run on the same occasion destroyed the original arrangement with multiple cameras and the battery life available did not allow multiple inspection runs in the timeframe allocated.

The issues identified in this inspection report should not be considered as comprehensive, as the arrangement of equipment was limited in its field of view and coverage of brickwork area.

5 TYPES OF DAMAGE OBSERVED

5.1 Debris at Base

Approximately 30 cubic metres of dislodged firebrick lining and fines debris has accumulated at base of stack. 20% of this volume is estimated to be brickwork, referring to approximately 100 square metres of lining, equivalent to approximately 10% of the total firebrick lining as failed and accumulated at base of stack.

The last internal inspection, conducted in 2004, noted the accumulation was to a height of 600mm from the base of stack. The 2015 internal inspection recorded the accumulation to be at approximately 1600mm. Over the past 11 years, this growth refers to an approximate increase of 5% total brick lining failure, at a minimum. It is unknown whether the accumulation was removed after the 2004 inspection.

5.2 Concentration of Acidic Material

5.2.1 Typical Damage Locations

The concentration of acidic material is more likely to occur at higher elevations due to the greater potential for condensation. Seepage of this material, as evidenced by apparent "wet patches" in the fines, was observed between Corbels 4 and 6. The crack network of the outer shell is a direct relation to the acidic material build-up (as described in Section 5.2.3) and was noted as more extensive from Corbels 4 and above. The seepage of acidic material could also be seen leaking through these cracks in some locations.

5.2.2 Causes of Damage

The acidic material build-up is a result of the flue gases cooling as they elevate up the stack. The designed air gap between the firebrick lining and outer shell was intended to mitigate the concentration of this material occurring on the inside face of the concrete. The accumulation of ore fines in this air gap prevents ventilation and promotes the concentration of acidic material. The loss of firebrick lining removes a protective barrier for the concrete shell and further increases probability for acidic attack.

5.2.3 Consequences of Damage

In reference to "2015 07 24 320-1404 Concrete Stack Current Situation and Rec Actions," the potential failure events as a result of the concentration of acid material can be classified as:

- "Failure Event B" - Dislodgement of external concrete shell, or
- "Failure Event C" - Significant structural collapse of concrete stack.

The concentrated presence of acidic material on the poorly resistant concrete shell will cause acidic attack on the steel reinforcement. Once initiated, this attack is expected to advance quickly and render the affected reinforcement ineffective. The advancement of acidic attack is considered advanced at the time of inspection, as evidenced by the extensive crack network in the concrete shell (an indication of inadequate remaining reinforcement). This observation is further validated by the presence of seepage leaking through the cracks, suggesting full-thickness cracks and reinforcement attack.

As a result of the damage identified, the structural integrity of the concrete shell is reduced, particularly in its capability to resist forces induced by strong wind events. Failure of the concrete shell may result in the loss of small fragments or partial to complete collapse of the stack. A collapse event will render the stack unserviceable with a return to service uncertain to be possible, or economically feasible.

CONDITION ASSESSMENT REPORT

In the event a section of concrete shell dislodges, the stack would likely become offline for one to four weeks, until the failure area is assessed and make-safe contingencies are put in place. It is expected the design and construct of a replacement would require a minimum of 9 months. In the event the concrete stack is incapable of being "made-safe" post failure event, Queensland Nickel may not have a 320 Area stack for this period; if sourcing a replacement had not begun by the time.

5.2.4 Timing for Future Failures

A failure event resulting in the loss of a small fragment of concrete shell, or up to partial or complete collapse, may occur at any time due to the presumed reinforcement loss and observed crack network. The structure is particularly vulnerable to strong wind events and a partial to complete collapse of the concrete shell is a high possibility to occur during such time.

Based on the damage identified as a result of acidic attack on the steel reinforcement and concrete shell, a moderate to severe failure event where the stack is rendered unserviceable is expected to occur within 4 years. The probability for such a failure to occur within 1 year is considered 15%.

5.3 Partial or Complete Dislodgement of Firebrick Lining

5.3.1 Typical Damage Locations

Partially dislodged brickwork was identified throughout the stack height and on the upper sides of the corbels. Brickwork around the northern inlet duct was dislodged and rested against the concrete shell in locations. The complete dislodgement of large areas of brickwork was identified above Corbels 6 and 7, and between Corbels 4 and 5. The missing brickwork in these locations refers to an approximate 6% total loss of the internal firebrick lining.

5.3.2 Causes of Damage

The accumulation of fines in the air gap induces lateral pressures onto the firebrick lining, similar to those typically resisted by a retaining wall. To prevent entry of the fines into the air gap, a fibreglass "filter" was installed under each corbel. The entry of fines in the air gap indicates the filter has failed. The lateral forces were likely not included in the design and in combination with the degradation of firebrick lining; the brickwork has protruded in sections.

The thermal expansion of fines in the air gap will induce additional lateral pressures on to the firebrick lining. The lateral pressures induced by the expansion will induce protrusions in the lining. The displacement caused by expansion will not reverse when the loads are released and hence, the brickwork is "jacked" out of place over time.

Dislodgement of the firebrick lining near the northern inlet duct can be attributed to the vibration induced by the operation of the duct. The vibration effects have likely deteriorated the brickwork and mortar, resulting in the damage identified. A combination of lateral loads induced by debris accumulation and vibration effects is also likely to have occurred.

Dislodgement at higher elevations is likely to induce further follow-on damage to lower protruding sections, namely the corbels. The impact of a failed section on a partially dislodged location would be likely to induce further dislodgement.

5.3.3 Consequences of Damage

In reference to "2015 07 24 320-1404 Concrete Stack Current Situation and Rec Actions," the potential failure events as a result of the firebrick lining dislodgement material can be classified as:

- "Failure Event A" - Fall of internal brickwork, or
- "Failure Event B" - Dislodgement of external concrete shell, or
- "Failure Event C" - Significant structural collapse of concrete stack.

Failure Event B, and to a lesser degree Failure Event C, is a result of the concrete shell remaining unprotected by the missing firebrick lining, as described in Section 5.2. A structural collapse may

CONDITION ASSESSMENT REPORT

occur if the dislodged section detrimentally damages the outer concrete shell as it falls or impacts the corbels at a lower elevation. If a failed section falls and impacts a lower loose location, it is likely to induce further follow-on damage and dislodgement, increasing the area of missing firebrick lining.

The dislodgement of firebrick lining and the fall of internal brickwork may cause damage to the ID fans and duct inlets, rendering them inoperable. Records on file state this has happened at least 3 times in the last 7 years. The clean-up and repair required after this failure event would likely require a shutdown of the concrete stack for 3 to 14 days.

Complete dislodgement of the firebrick lining results in inadequate support for the above brickwork and is likely to induce sagging, as discussed in Section 5.4.

The damage sustained to Corbels 6 and 7, and the section between Corbels 4 and 5, was calculated to be account for approximately 3% of the total brickwork failure each.

5.3.4 Timing for Future Failures

A failure event resulting in the loss of a small area of firebrick lining, without immediate damage to the stack, inlet ducts or ID fans is almost certain to occur on multiple occasions within a year. The probability of duct or ID fan damage, resulting in the loss of one inlet, occurring due to firebrick dislodgement is considered a 50% probability to occur within 1 year.

Based on the damage identified as a result of the firebrick lining dislodgement, a moderate to severe failure event where the stack or multiple inlet ducts are rendered unserviceable is expected to occur within 3 years. The probability for such a failure to occur within 1 year is considered 20%

5.4 Sagging of Firebrick Lining

5.4.1 Typical Damage Locations

Sagging of the firebrick lining occurred in locations where a large section of brickwork was missing. Notable missing sections causing sagging of above lining were identified above Corbels 6 and 7. Corbel 8 was unable to be inspected.

5.4.2 Causes of Damage

Sagging of the firebrick lining was a result of the inadequate remaining support after a section of brickwork had dislodged (as per Section 5.3).

5.4.3 Consequences of Damage

In reference to "2015 07 24 320-1404 Concrete Stack Current Situation and Rec Actions," the potential failure events as a result of the concentration of acid material can be classified as:

- "Failure Event A" - Fall of internal brickwork, or
- "Failure Event B" - Dislodgement of external concrete shell, or
- "Failure Event C" - Significant structural collapse of concrete stack.

Failure of the sagging firebrick lining is likely to involve widespread area of loss and near certain loss of stack function. The follow-on effects of this event would include damage to the ID fans and inlet ducts, and damage to lower brickwork, corbels and concrete shell, resulting in one to four weeks shutdown for debris cleanout, duct and ID fan repairs and "make-safe" arrangements. Operation of the stack would then on be limited strictly. The failure of a large sagging brickwork section is likely to cause significant damage that may be economically unfeasible to refurbish.

5.4.4 Timing for Future Failures

Based on the location and extent of observed damages, a moderate to severe failure event resulting in the loss of stack function is expected to occur within 3 years. The probability of such an event occurring within 1 year is considered 20%.

CONDITION ASSESSMENT REPORT

6 EXTERNAL CRACK NETWORK AND INTERNAL BRICK LINING CONDITION SUPERPOSITION

Following the 2015 UAV Inspection, an external crack network plot was produced. In conjunction with the internal inspection findings, the areas of vulnerabilities for the concrete stack were identified. A general trend emerged where the external cracking reduced, the condition of the firebrick lining improved. This is expected due to the greater likelihood of condensation at higher elevations. In general, the most severe cracking was observed to the southern direction of the concrete shell. A number of these cracks travel approximately 40 metres vertically, indicating the damage to the concrete shell is not to be considered localised and a partial to complete collapse is a feasible failure scenario.

6.1 Corbel 1 to Corbel 2

Contradictory to the general trend mentioned above, the external crack network did not identify any notable concrete cracking between Corbels 1 and 2, yet the firebrick lining was considered very poor. The dislodgement of lining around the northern duct inlet can be attributed to the vibration effects induced by duct operation and in addition to the lateral pressures applied by the fine material accumulation.

6.2 Corbel 4 to Corbel 5

The internal firebrick lining between Corbels 4 and 5 was identified to have a large section missing and hence, the concrete shell was exposed to acidic attack. This is evident by the observed moist locations in the fine debris.

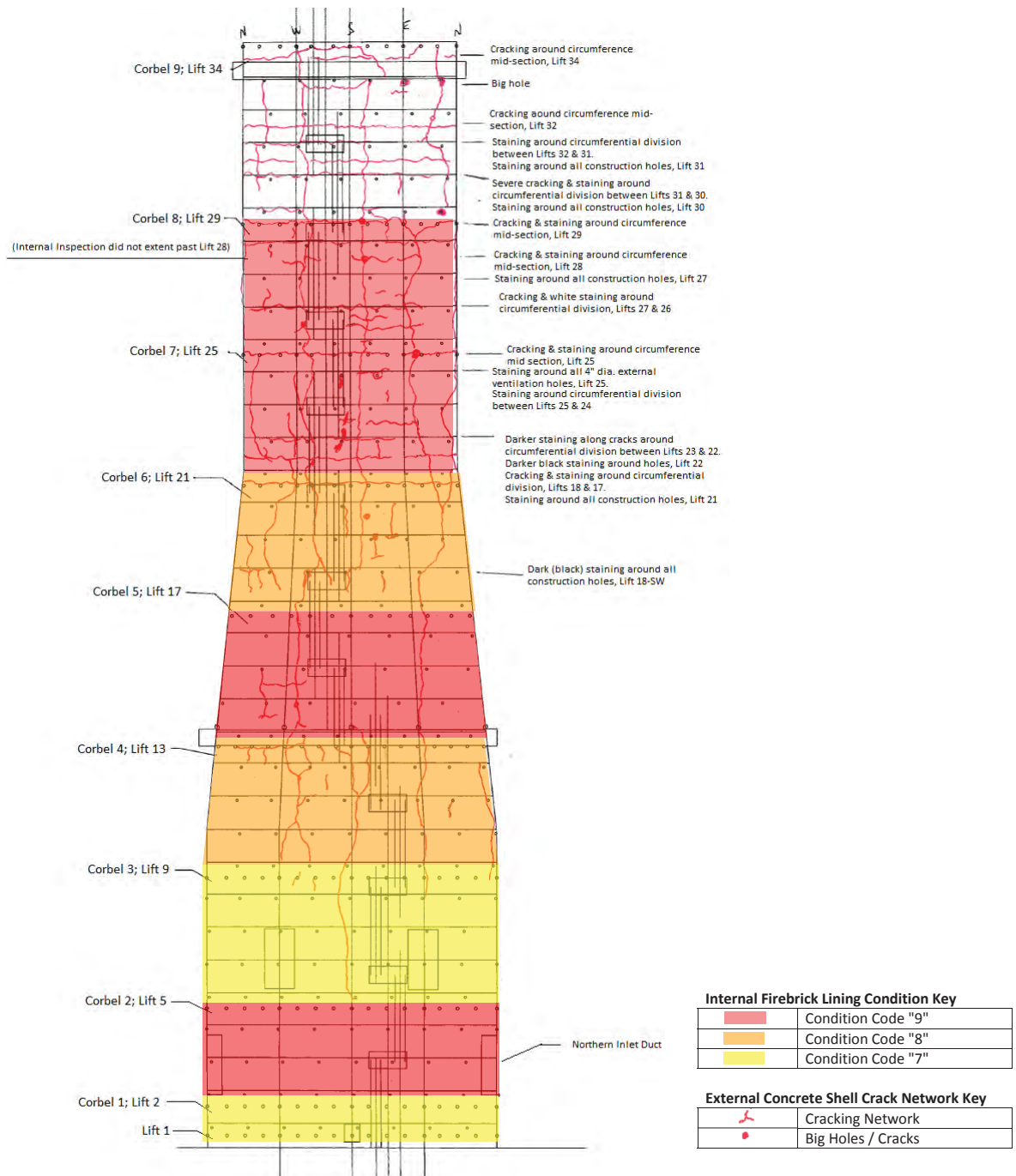
The extent of the cracking network in this location is noted to be lesser than locations above. As the flue gas is likely to have cooled further up the stack, the condensation between Corbels 4 and 5 may not have been as extensive. Furthermore, the internal face of the concrete shell was not included on the crack network and hence, the full extent of degradation is not known. However, a number of cracks identified in the crack network exhibited signs of seepage, indicating some cracks are of full thickness and the acidic attack on steel reinforcement is advanced.

6.3 Corbel 6 and Above

The section above Corbel 6 displays significant cracking and seepage on the outer shell. Seepage through the cracks indicates they are of full thickness and the steel reinforcement is exposed to advanced acidic attack. At this elevation, the flue gas is likely to have cooled to the point of condensation, detrimental to the areas of exposed concrete shell. Due to the large sections of completely dislodged and missing firebrick lining, there is no layer of protection for the concrete from the acidic environment.



CONDITION ASSESSMENT REPORT



Notes:

1. Crack network drawn from UAV photographs, current as of 24/02/2015
2. Internal firebrick lining condition as per 09/10/15 inspection findings

Figure 3: Crack Network and Internal Lining Condition

CONDITION ASSESSMENT REPORT

7 SUMMARY OF 320-1404 CONCRETE STACK CONDITION

In addition to the UAV external survey, the internal inspection was conducted utilising helium balloons to raise a camera arrangement up the inside of the 320-1404 Concrete Stack. The successful inspection was conducted utilising only one camera as opposed to a multiple camera arrangement. As the data retrieved by the internal inspection was limited by the quantity and field of vision of the photography, the inspection should not be considered wholly comprehensive, as the stack is likely to exhibit areas of degradation not noted in this report.

The top 30m of the concrete stack was considered to be in a very poor condition. Extensive cracking of the reinforced concrete was identified. The seepage of acidic material through these cracks, as observed in the 2015 UAV external survey, indicates a number of these cracks are of full thickness and acidic attack is advanced. In addition, the internal firebrick lining for this area exhibits large sections of loss and evidence of sagging.

A failure event where the stack is no longer in a condition to operate is likely to originate from this location. It is expected a moderate to severe failure of internal firebrick lining is expected to occur within 3 years, and a 20% probability to occur within 1 year. A moderate to severe failure of the concrete shell is expected within 4 years, and a 15% probability to occur within 1 year. In the event of these failures occurring, and if repairs are possible, the stack would be offline for a period up to 1 month to allow for assessment and the "make-safe" repairs before a limited return to service. Such damage may be considered economically unfeasible to repair, or incapable of being "made-safe."

The firebrick lining was dislodged around the northern duct inlet, likely due to the vibration effects induced by the duct operation. Due to the extent of damage in this location, and the history of issues on records, the probability of a dislodged section of brickwork damaging the ID fans and duct within 1 year is considered 50%. The clean-up and repair required after this failure event would likely require a shutdown of the concrete stack for 3 to 14 days.

The internal inspection indicated the firebrick lining and designed air gap were crucial to the ongoing integrity of the concrete stack. Due to the accumulation of fines in the air gap, and the lateral pressures applied to the lining as a result, the brickwork was missing or partially dislodged in multiple locations. This damage has led to the concrete becoming poorly protected to the acidic attack.

The accumulation of debris at the base of the stack was calculated to be around 30 cubic metres. The fraction of brickwork estimated to be included in this volume is equivalent to approximately 100 square metres of firebrick lining. This corresponds to a total lining loss of around 10%.

The damage sustained to Corbels 6 and 7, and the section between Corbels 4 and 5, was calculated to account for approximately 3% of the total brickwork failure each. Since the 2004 internal inspection the debris accumulation has grown, suggesting a further 5% total brickwork lining loss over the past 11 years, assuming the debris was not removed since the last inspection.

CONDITION ASSESSMENT REPORT

8 RECOMMENDATIONS FOLLOWING INSPECTION

Due to the advanced degradation of the internal brick lining and outer concrete shell (as observed during the 2015 UAV inspection), the 320-1404 Concrete Stack is considered in very poor condition. Failure is likely to render the stack out of service permanently or for a very significant amount of time. Causes for failure are likely to originate from the failure of a section within the top 30 metres of the stack, as the lining in this location is in a very poor condition and exhibiting signs of movement already. A moderate to severe failure of the stack is expected to occur within 3 years. The probability of such a failure event occurring within one year is considered 20%.

As the structural degradation is advanced, the stack is considered unfeasible to repair without large sections requiring rebuild, at a minimum. In its current condition, the concrete stack should no longer be considered viable for continued operation without notable safety and economic risk.

To ensure continued safe production, it is recommended technical proposals are obtained for the development of a replacement design, and a demolition plan made for the existing stack. This process is recommended to commence immediately with the original stack demolished completely (or to a structural sound extent) within 24 months. ME Notification 76006812 has been raised for this task.

Due to the relative success of inspection method and ease of use, it is recommended future shutdown opportunities are utilised to reinspect the internal brick lining. This will enable QN Fixed Plant Engineers to continually monitor degradation and remaining integrity of the stack. Each of Queensland Nickel's concrete stacks are recommended to undergo this process.

Under no circumstances is it recommended that obtaining of technical proposals for a replacement stack be delayed pending another inspection in the aim to retrieve contradictory data. The results from this inspection identified locations detrimental to the structure and these are only expected to worsen, placing personnel safety and Queensland Nickel's production at risk.



QUEENSLAND NICKEL PTY LTD

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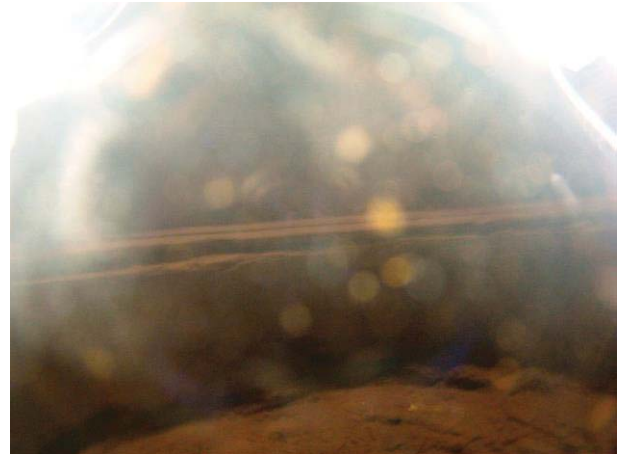
APPENDIX A

Structural Condition Report

CONDITION ASSESSMENT REPORT

Item: 1
Location: Ground to Corbel 1
Condition Code: 7
Observation:

- Deterioration of brickwork observed on all three faces of access door, resulting in loose sections.
- Partial dislodgement of bricks observed on corbel above access door.
- Acidic salt build up has developed in the fine material and close to the walls.
- 30 cubic metres of debris accumulation at base of stack included fine material and portions of the firebrick lining.
- Firebrick lining within 1.6 metres of base of stack was not surveyed due to debris accumulation.



CONDITION ASSESSMENT REPORT

Item: 2
Location: Corbel 1 to Corbel 2
Condition Code: 8
Observation:

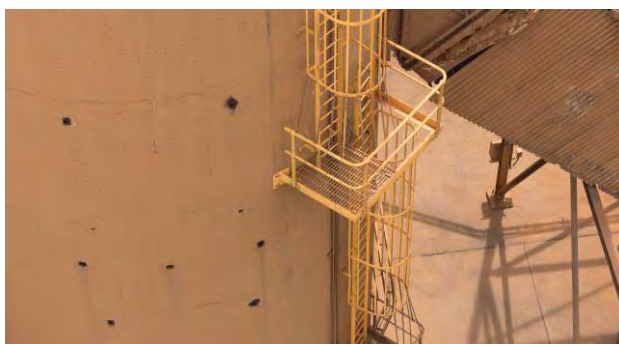
- Partial dislodgment and protrusion of firebrick lining observed.
- Complete dislodgement of brickwork identified around northern inlet duct.
- Remaining bricks are loose and at risk of falling.
- Corbel 2 was damaged and loose sections remain.
- Cracking of concrete shell was minimal.



CONDITION ASSESSMENT REPORT

Item: 3
Location: Corbel 2 to Corbel 3
Condition Code: 7
Observation:

- Partial dislodgement of firebrick lining observed, notably around inlet duct.
- Lining sections were identified to be protruding due to dislodgment,
- Cracking of concrete shell is minimal.



CONDITION ASSESSMENT REPORT

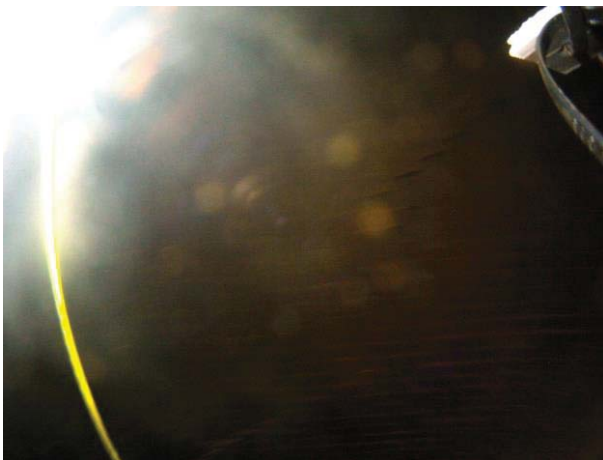
Item: 4

Location: Corbel 3 to Corbel 4

Condition Code: 7

Observation:

- Partial dislodgement of firebrick lining observed.
- Lining sections were identified to be protruding due to dislodgment.
- Loose fragments identified on Corbel 3.
- Cracking of concrete shell was dominant on southern half, with some seepage of acidic material through the cracks noted.

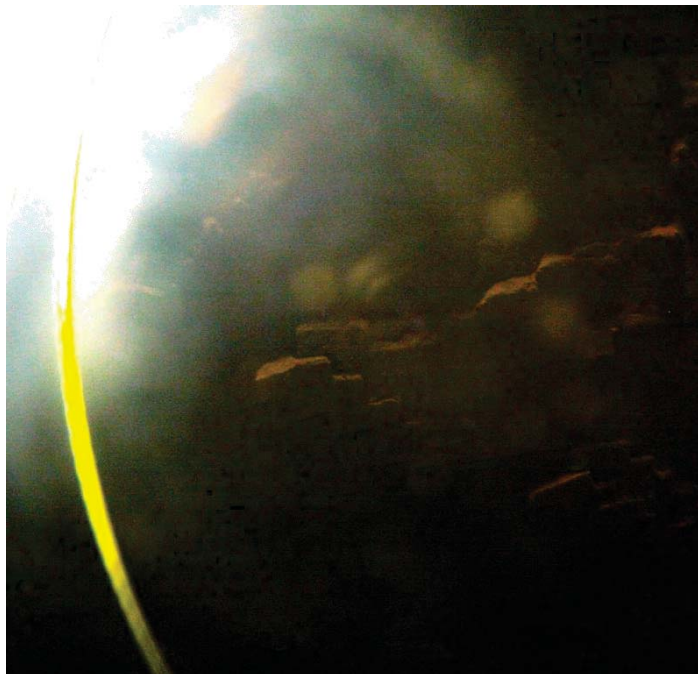
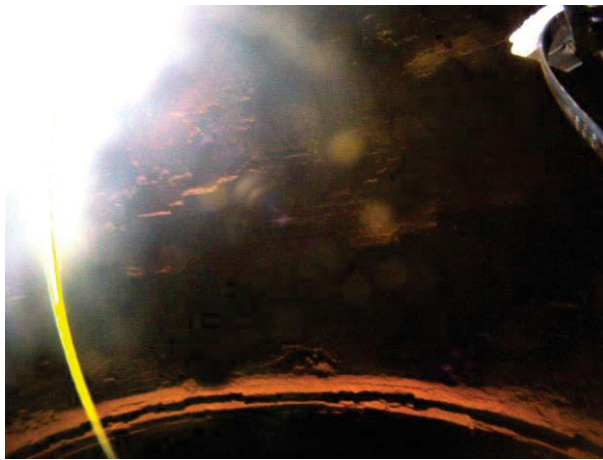




CONDITION ASSESSMENT REPORT

Item: 5
Location: Corbel 4 to Corbel 5
Condition Code: 9
Observation:

- Complete dislodgement of firebrick lining observed, exposing concrete shell to acidic environment.
- Approximately 3% total firebrick lining area is missing from this area of dislodgment.
- Remaining brickwork is loose in locations
- Loose fragments identified on Corbel 4.
- Concentrated locations of acidic material present in fines accumulation, as evident by the “moist” look of fines.
- Cracking of concrete shell was dominant on eastern and western faces, with seepage of acidic material through the cracks noted.



CONDITION ASSESSMENT REPORT

Item: 5
Location: Corbel 4 to Corbel 5
Condition Code: 9



CONDITION ASSESSMENT REPORT

Item: 6
Location: Corbel 5 to Corbel 6
Condition Code: 8
Observation:

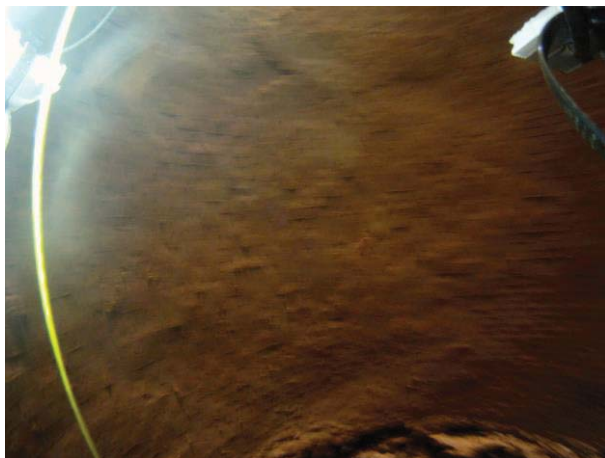
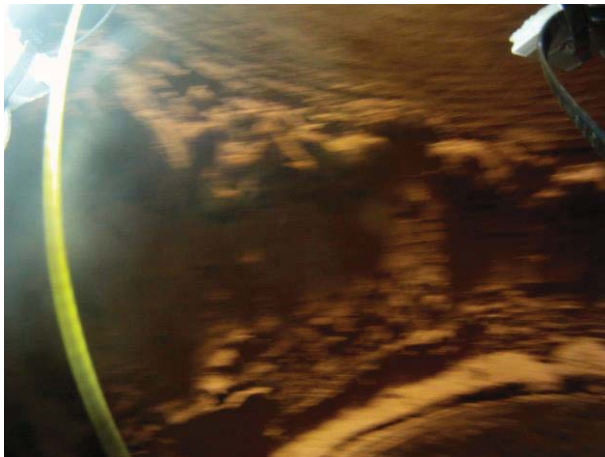
- Partial dislodgement of firebrick lining observed, resulting in the protrusion of sections.
- Loose fragments identified on Corbel 5.
- Concentrated locations of acidic material present in fines accumulation, as evident by the “moist” look of fines.
- Cracking of concrete shell was dominant on southern face, although was observed all around with seepage of acidic material through the cracks noted.



CONDITION ASSESSMENT REPORT

Item: 7
Location: Corbel 6 to Corbel 7
Condition Code: 9
Observation:

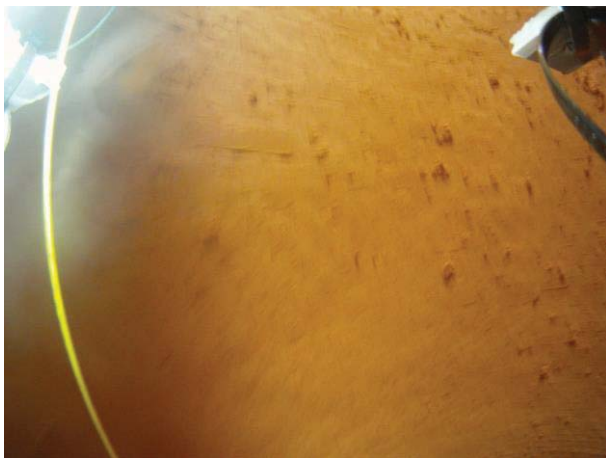
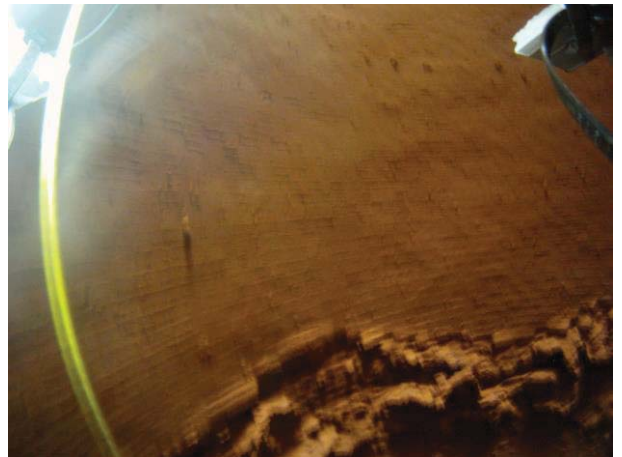
- Complete dislodgement of firebrick lining (of approximately 1.5 m height) observed above Corbel 6.
- Dislodged section equates to approximately 1.5% of total firebrick lining missing.
- Large sections of firebrick lining appear to be sagged, likely due to inadequate support as a result of the missing section.
- Cracking of concrete shell was dominant on southern face, although cracks were observed all around with seepage of acidic material through the cracks noted.



CONDITION ASSESSMENT REPORT

Item: 8
Location: Corbel 7 to Corbel 8
Condition Code: 9
Observation:

- Complete dislodgement of firebrick lining (of approximately 1.5 m height) observed above Corbel 7.
- Dislodged section equates to approximately 1.5% of total firebrick lining missing.
- Large sections of firebrick lining appear to be sagged, likely due to inadequate support as a result of the missing section.
- Cracking of concrete shell was dominant on southern face, although cracks were observed all around with seepage of acidic material through the cracks noted.



CONDITION ASSESSMENT REPORT

Item: 9
Location: Corbel 8 to Corbel 9 (Top)
Condition Code: Cannot provide
Observation:

- No internal photographs taken for this location.
- Cracking of concrete shell was dominant on southern face, although cracks were observed all around with seepage of acidic material through the cracks noted.



CONDITION ASSESSMENT REPORT

APPENDIX B

Priority Numbering System

CONDITION ASSESSMENT REPORT

Priority	Condition	Condition Description	Action Required	Actions Time Frame	Consequence of No Action
1	Near New	A near new asset with no visible signs of deterioration.	Nil	No Action	None
2	Excellent	An asset in excellent overall condition. There would be only very slight condition decline but it would be obvious that the asset was no longer in new condition.	Nil	No Action	None
3	Very Good	An asset in very good overall condition but with some early stages of deterioration evident, but the deterioration still minor in nature and causing no serviceability problems.	Minor Repairs	Within 3 years	Minor additional future repair cost
4	Good	An asset in good overall condition but with some obvious deterioration evident.	Minor Repairs	Within 3 years	Moderate additional future repair cost
5	Fair	An asset in fair overall condition. Deterioration in condition would be obvious.	Moderate Repairs	Within 2 years	Significant additional future repair cost
6	Fair to Poor	An asset in fair to poor overall condition. The condition deterioration would be quite obvious.	Moderate Repairs	Within 1 year	Significant additional future repair cost, minor injury
7	Poor	An asset in poor overall condition. Deterioration would be quite severe.	Major Repairs	Within 9 months	Local failure, serious injury
8	Very Poor	An asset in very poor overall condition with serviceability now being heavily impacted upon by the poor condition.	Refurbishment, replacement possible	Within 6 months	Local collapse, serious injury
9	Extremely Poor	An asset in extremely poor condition with severe serviceability problems and needing rehabilitation immediately. Could also be a risk to remain in service.	Replacement	Within 3 months	Local collapse, death or serious injury
10	Unusable	An asset that has failed, is no longer serviceable, and should not remain in service.	Replacement, immediately remove from service	Immediate – less than 30 days	Catastrophic collapse, death or serious injury

CONDITION ASSESSMENT REPORT

APPENDIX C

Discussion - Internal Inspection Methodology

CONDITION ASSESSMENT REPORT

C1 GENERAL COMMENTS

The internal inspection methodology during the October 2015 shutdown was generally considered suitable for the task. The original inspection run was lost due to failure of the camera arrangement, resulting in two cameras being destroyed and SD Cards being lost. A second arrangement was constructed utilising the remaining camera, and the inspection successfully completed. To further improve efficiency, quality and to minimise costs, a number of alterations are recommended to be made in the future.

Upon completion of the inspection, the lack of history in regards to inspection was noted. The most recent internal inspection was conducted in 2004, leaving an 11 year timespan of no information recorded on the concrete stack. Due to this lack of data, a detailed progression of deterioration was unable to be constructed.

C2 ELEVATION METHOD

To conduct the inspection, an arrangement of camera equipment and lighting was raised from the base of the stack using helium balloons. Seven balloons were used to raise two cameras and lighting equipment during the first run, and five for the second run, which included one camera with additional protective equipment. The elevation was controlled by a fishing line tether and reel. There was minimal control over movement towards the walls in addition to spinning on occasion. This limited the field of view the cameras could achieve and total data gathered.

The first inspection run was considered more successful due to an observed reduced horizontal movement during use and minimal draft within the stack at the time (morning). However once the balloons were located near the top of the stack, the wind rapidly affected the equipment resulting in the braid tether breaking and camera arrangement falling to the ground, being destroyed. No data was retrieved from this inspection run due to this occurrence. The second arrangement, utilising the one remaining camera, was not elevated within the top 10 metres of the stack outlet and produced the photos for this report.

The arrangement was also extremely weight sensitive due the small lift capacity of each balloon (inflated to the maximum size possible to fit through the access door). The limited weight allowance restricted the availability of lighting, number of cameras and protective arrangements.

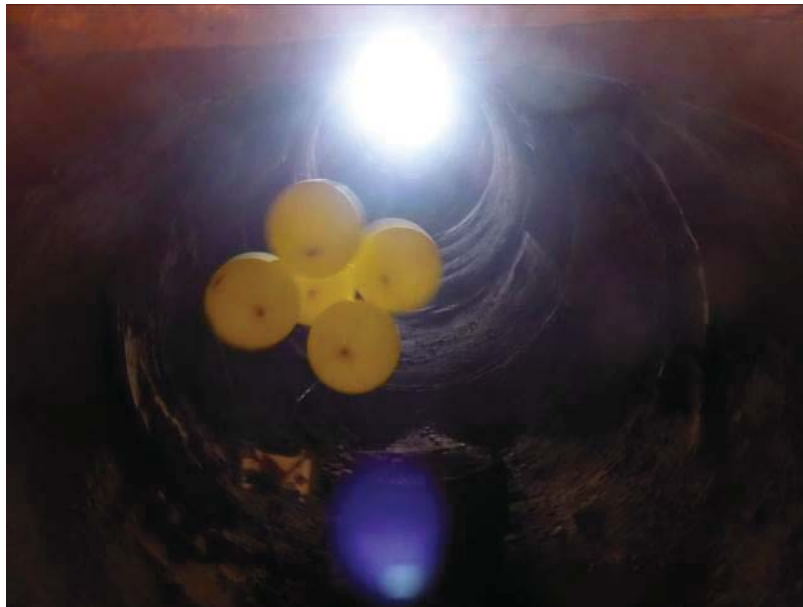


Figure 4: Inspection equipment in use

The method for elevating the inspection equipment via helium balloon was chosen over lowering the equipment from the top of stack from a crane as it appeared to be a cost-effective alternative. The crane method was calculated to be approximately 50 times more expensive than the helium balloon method; however such a method would not have restricted the weight of equipment and allowed for a higher quality of inspection photography.

CONDITION ASSESSMENT REPORT

C2.1 Benefits of Helium Balloon Method

- Significantly cheaper than lowering equipment via crane.
- Equipment was relatively easy to acquire and construct on short notice.
- Minimal labour was required to construct equipment arrangement and conduct inspection.
- Minimal mobilisation and demobilisation time was required.

C2.2 Negatives of Helium Balloon Method

- Total height of the stack was not able to be surveyed due to risk of losing equipment.
- Limited control was achievable over spinning and horizontal movements - the equipment was very sensitive to the draft within the stack.
- Weight restrictions minimised the number of cameras used, lighting and protective arrangements - the quality of photographs was reduced and the field of vision limited.

C2.3 Recommendations for future inspections

- An ideal scenario for a complete internal inspection would be one conducted via the use of a crane lowering the equipment from the top of the stack, as this would allow for greater control over equipment and the use of better lighting or cameras.
- In the event of using the helium balloon method again, the following recommendations are to be implemented:
 - Stronger braid - 20lb was not sufficient - Recommend 40lb or more.
 - Consider use of weaker braid for "sacrificial" balloons that would break off first and hence equipment would descend without significant damage or loss.
 - Increase number of balloons to allow for an increased number of cameras and lighting arrangements.
 - Complete inspections in the morning, where wind and draft is minimal.

C3 EQUIPMENT ARRANGEMENT

The original arrangement excluded the protective casing around the cameras due to weight restrictions. Two cameras were placed back to back on a lightweight board with two 12v LED lights. The camera platform was levelled with the braid tether in an arrangement to reduce spin. The cameras were set on a 5-second time-lapse photography schedule as this was the best combination of quality, quantity and battery life.

Due to the failed first inspection run, a second arrangement was constructed using the last remaining camera, including a protective case. This arrangement weighed similar to the two-camera arrangement, although only resulted in half the field of view. The second arrangement included two LED lights however, one of these was identified as faulty (or wiring was poor) and the other interacted with the protective case, affecting quality of photography. Trial runs did not identify these issues.

The Kogan Full HD Action Cameras were considered suitable for the task, as they provided good quality photography at a low price compared to those of similar specifications. However, it was identified that adequate lighting was crucial to the quality of photography, and more than that provided during these inspections would be beneficial.

CONDITION ASSESSMENT REPORT

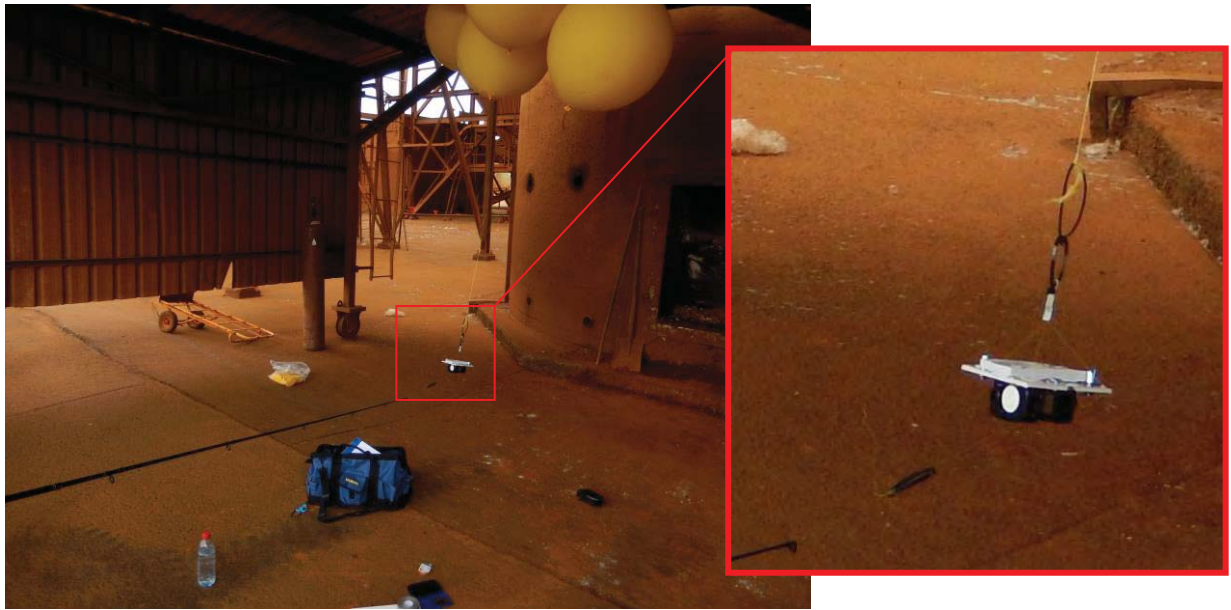


Figure 5: Inspection equipment prior to deployment (first run)



Figure 6: Inspection equipment prior to deployment (second run)

C3.1 Recommendations for future equipment arrangements

- Fabricate a dedicated equipment holster to minimise weight, include the use of three cameras, provide adequate protection and ensure continued lighting operation.
- Future inspections are recommended to include the use of one or more flood lights at the base of the stack to provide adequate lighting and improve photography quality. Note: Pencil beam lights tend to disrupt photography further.
- It is recommended future inspections include a "dry run" with similar weighted equipment to determine maximum height achievable without damaging cameras, or utilise a small leading balloon.

CONDITION ASSESSMENT REPORT

C4 CLEANOUT OF DEBRIS ACCUMULATION AT BASE OF STACK

Although discussed in initial meetings with the Area and Planner prior to the inspection, suitable equipment was not used by the Area to remove the debris at the base of the stack, and hence the material was not removed sufficiently. The small attempt at a cleanout was conducted by shovels and rakes. However, due to confined space restrictions and concerns with the brick work lining, this method was not appropriate for the task, or time efficient. In response to the material not being removed to a sufficient degree, the airbag bag intended to be placed at the base of the stack was not installed, as it was determined the remaining space available with the air bag in place would interfere the placement of inspection equipment.



Figure 7: Accumulation of debris at base of stack

C4.1 Benefits of Cleanout (If conducted)

- The airbag may have reduced the impact from fall, potentially saving the cameras.
- In the event the impact still damaged the cameras, the airbag may have been deflated and removed with the camera components retrieved.
- The accumulation of debris prevented the inspection of brickwork at the base of the stack. If the debris was removed, the condition of the brickwork in this location could have been determined.
- Cleanout would have allowed greater accessibility for inspection equipment.

C4.2 Recommendations for future inspections

- Although a complete cleanout would require additional labour and equipment, it is recommended to be conducted in preparation for future inspections.

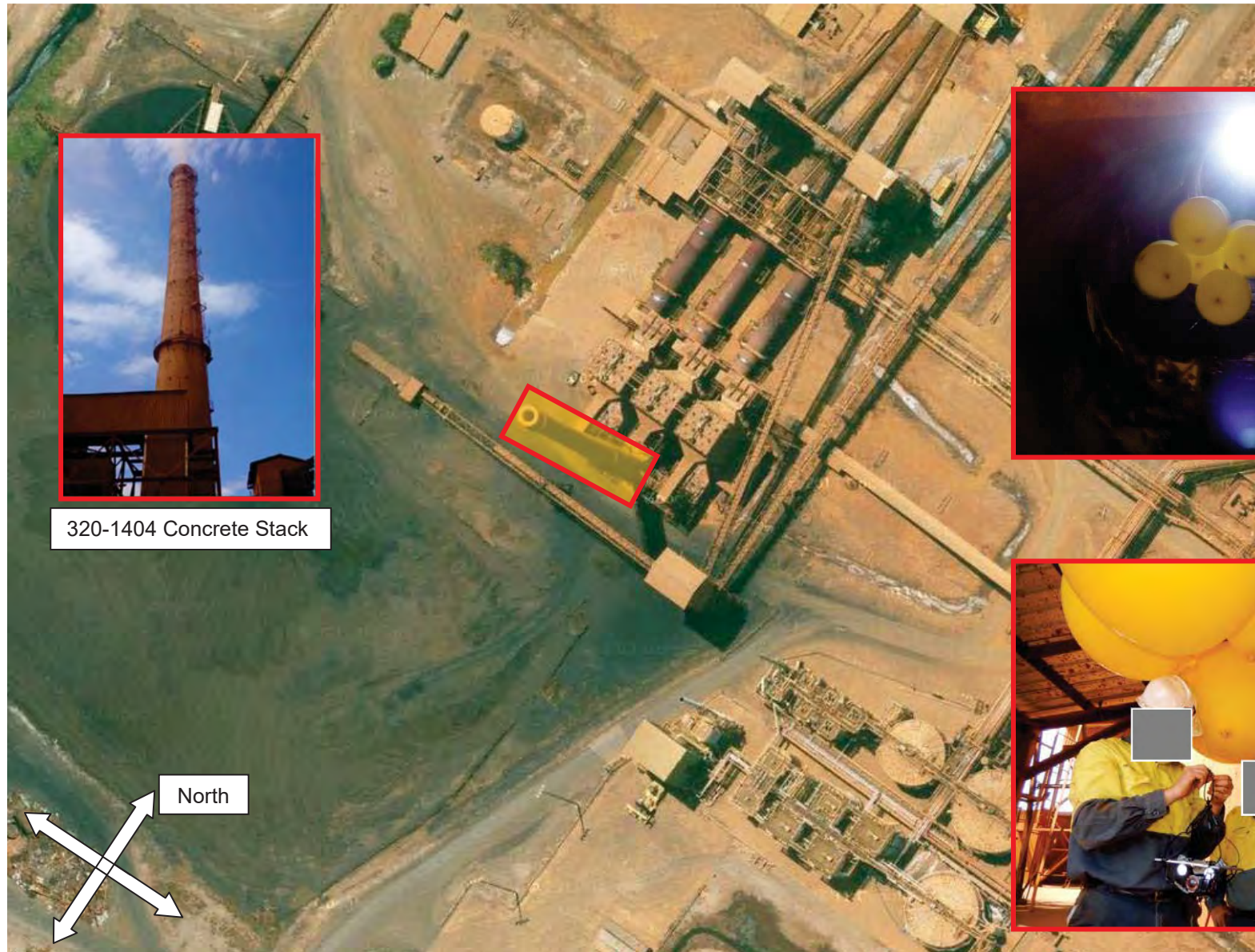
CONDITION ASSESSMENT REPORT

APPENDIX D

Photograph Locations



CONDITION ASSESSMENT REPORT



CONDITION ASSESSMENT REPORT

APPENDIX E

320-01404-00009



CONDITION ASSESSMENT REPORT

Functional Location:	320-1404 Concrete Stack	Work Order No:	TBC
Inspected By:		Inspection Date:	07/01/2018
Scope of Inspection:	External Condition Assessment		



320-1404 Concrete Stack



CONDITION ASSESSMENT REPORT

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CONDITION ASSESSMENT REPORT

1 Executive Summary

Current inspection performed from ground level by taking sectional photographs from five (5) constant predetermined locations around the Stack. The photographs from this inspection were then visually compared with those from preceding inspections, identifying any change in characteristics or condition.

The inspection has identified numerous pre-existing crack locations exhibited seepage, predominantly on the upper half of the stack. Such seepage is an indicator of full thickness cracking and increases concern of acid attack on the steel reinforcement. However, external inspection conducted on Dec 2016, where the concrete was excavated at a number of locations, revealed that the majority of the cracks that were tested are not full depth cracks and not as advanced as previously assumed. Throughout this inspection it was evident that there is no significant change in the condition of the pre-existing crack network. Since the previous inspection, the stack was offline and as a result, the contributing factor to the propagation of the existing cracks, being the thermal condition, has been eliminated.

Due to the existing condition of the concrete shell and the fact that stacks are a specialised area of expertise, it is highly recommended to obtain a thorough assessment of the concrete stack by an expert. Such an assessment would include an inspection of the internal brick lining, external concrete shell and computer modelling and analysis.

2 References

2.1 Drawings

2.1.1 QN drawing No. 320-01404-00009 General Arrangement

2.1.2 QN drawing No. 320-01404-00005 Shell Reinforcement Lifts 11-34

2.2 Prior Inspection Reports

2.2.1 2016 12 10 320-1404 Concrete Stack Condition Assessment Report.pdf

2.2.2 2016 10 08 Concrete Stack Monthly Photographic Monitoring Report.pdf

3 Methodology

The condition assessment incorporates the following steps:

3.1 Method of Inspection

Sectional photographs were taken from five (5) constant predetermined locations around the Stack at ground level, as shown in Figure 1 below, to monitor crack and seepage progression and potentially provide warning on imminent failures. The photographs from this inspection were then visually compared with those from preceding inspections, identifying any change in characteristics or condition.

3.2 Identifying the Asset Condition:

Structural elements visible or accessible from pedestrian or elevated work platform access of the building, machine or structure are assessed for degradation or defects which typically fall under the following classes; corrosion, cracking, protective coating condition, weld condition, bolt condition, mechanical damage and concrete condition.

3.3 Actions and Priorities:

Depending on the condition of a structural element, an action (or remedial work required to render the element safe or to comply with the requirement of a particular standard or code) is specified. These actions range from ongoing monitoring of the condition of the item to significant repair or replacement. A priority is then assigned to the item that stipulates the urgency of the required action. Priorities are numbered 1 to 10, where 10 indicates that the action should be carried out immediately and 1 indicates the condition of the element is not critical and should be monitored as part of a planned maintenance schedule. Appendix C outlines the priority numbering system.

CONDITION ASSESSMENT REPORT



Figure 1: Photograph Locations around the Stack

4 Limitations and Constraints

This report covers an external inspection only, where the assessment apply only to the structural elements that could be safely and sufficiently inspected from ground level, and/or where the surface was not covered by foreign material build-up or obscured by equipment.

5 Previous Assessment

The last thorough external inspection of the stack was conducted on 10 December 2016 to assess the stack structural integrity and determine the extent of the cracks and acidic attack on the steel reinforcement in the cracks. Inspection findings are summarised below:

- The inspection revealed that although cracks are stained, the majority of the cracks that were marked and inspected were not full depth cracks and are not as advanced as previously assumed. Concrete surrounding the cracks appeared to be solid and intact.
- Reinforcement bars demonstrate local corrosion and thickness loss with moderate to advanced level of corrosion (up to 30% thickness loss) to both vertical and horizontal bars.
- Some vent holes were blocked with fine ore material.

Previous report concluded that the level of thickness loss to reinforcement increases concern for acid attack on steel reinforcement and therefore compromises the structural integrity of the Stack. As concrete stacks are a specialised area of expertise, it is highly recommended to obtain an expert assessment of the stack. An expert assessment should incorporate a comprehensive stack maintenance plan to ensure reliability and safety of QN operations in the long term.

6 Assessment Findings & Recommendations

The following section outlines the general findings of the inspection and the recommended remedial action to be carried out on the structure. For specific details of individual inspection items and the comparison with previous inspections, refer to the inspection summary in Appendix A.



CONDITION ASSESSMENT REPORT

6.1 Structural Integrity & Stability

Current inspection of the external concrete shell has identified numerous crack locations exhibited seepage, predominantly on the upper half of the stack. Such seepage is an indicator of full thickness cracking and increases concern of acid attack on the steel reinforcement. However, external inspection conducted on Dec 2016, where the concrete was excavated at a number of locations, revealed that the majority of the cracks that were tested are not full depth cracks and not as advanced as previously assumed. Throughout this inspection it was evident that there is no significant change in the condition of the crack network. Since the previous inspection, the stack was offline and as a result, the contributing factor to the propagation of the existing cracks, being the thermal condition, has been eliminated.

Due to the existing condition of the concrete shell and the fact that stacks are a specialised area of expertise, it is highly recommended to obtain a thorough assessment of the concrete stack by an expert. Such an assessment would include an inspection of the internal brick lining, external concrete shell and computer modelling and analysis.

6.2 Crack Monitoring

No perceptible change in crack length or width in the pre-existing crack network and stack section connections was observed. It is recommended to continue monitoring the cracks condition and progression on an annual basis.


Queensland Nickel Pty Ltd



CONDITION ASSESSMENT REPORT

Appendix A

Condition Summary



CONDITION ASSESSMENT REPORT

ID 1

Item Structure Integrity & Stability

Location Throughout

Finding

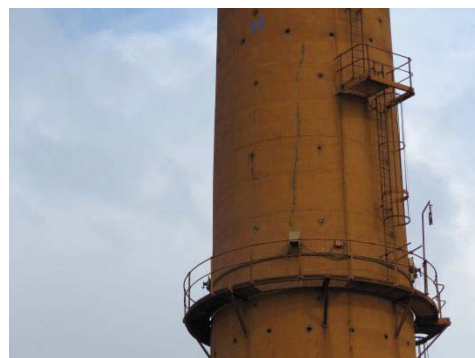
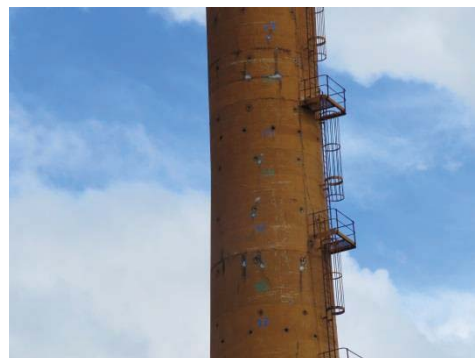
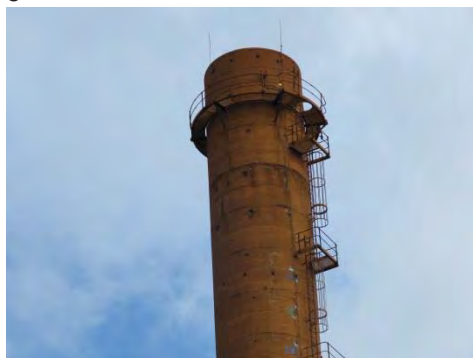
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Recommendation

Due to the existing condition of the concrete shell and the fact that stacks are a specialised area of expertise, it is highly recommended to obtain a thorough assessment of the concrete stack by an expert. Such an assessment would include an inspection of the internal brick lining, external concrete shell and computer modelling and analysis.

Priority

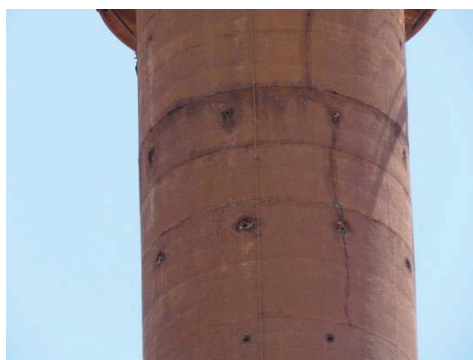
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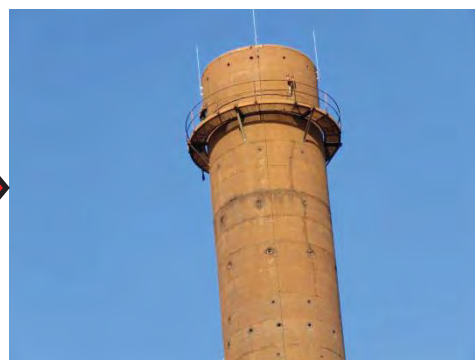


CONDITION ASSESSMENT REPORT

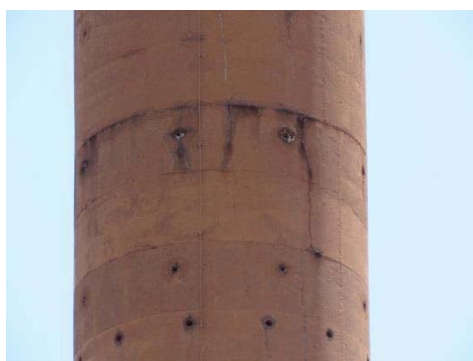
ID	2
Item	Cracks Monitoring – Location 1
Location	Throughout
Finding	No perceptible change in crack length or width in the pre-existing crack network and stack section connections was observed.
Recommendation	It is recommended to continue monitoring the cracks condition and progression on an annual basis.



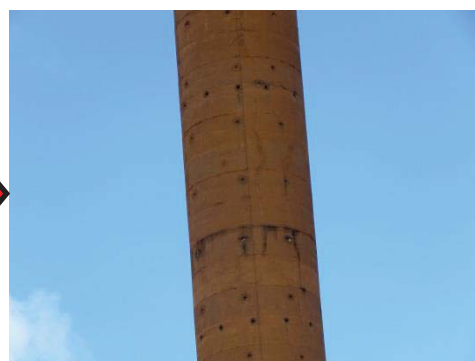
Oct 2016



Jan 2018



Oct 2016

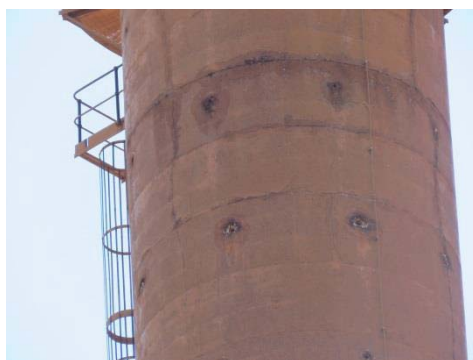


Jan 2018

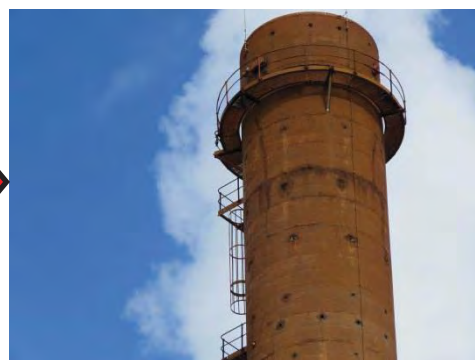


CONDITION ASSESSMENT REPORT

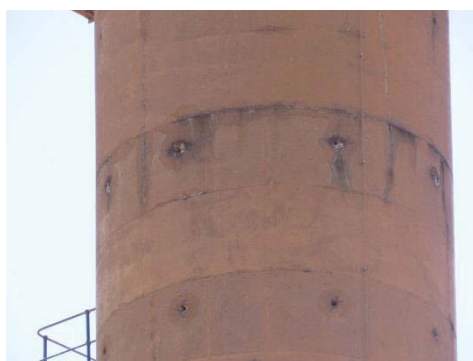
ID	3
Item	Cracks Monitoring – Location 2
Location	Throughout
Finding	No perceptible change in crack length or width in the pre-existing crack network and stack section connections was observed.
Recommendation	It is recommended to continue monitoring the cracks condition and progression on an annual basis.



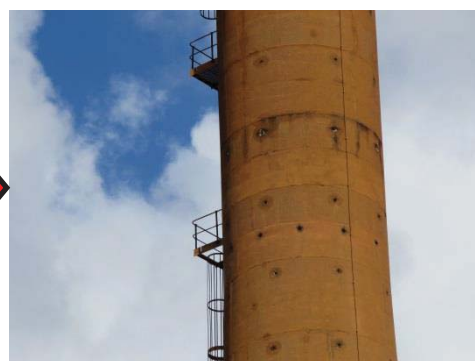
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Oct 2016

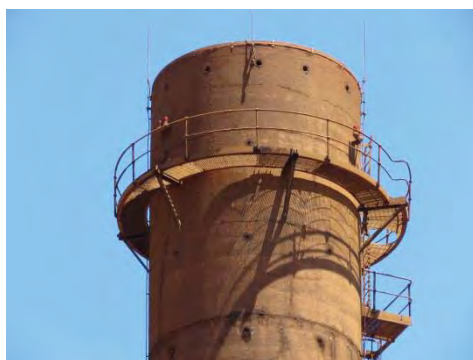


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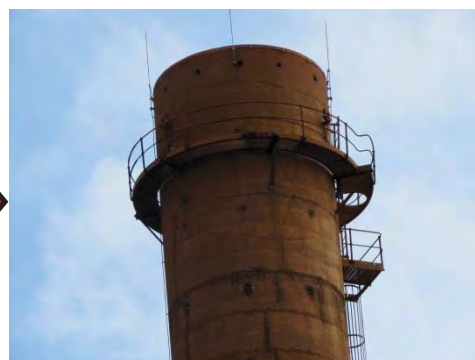


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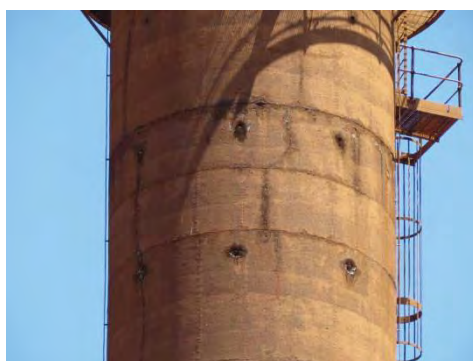
ID	4
Item	Cracks Monitoring – Location 3
Location	Throughout
Finding	No perceptible change in crack length or width in the pre-existing crack network and stack section connections was observed.
Recommendation	It is recommended to continue monitoring the cracks condition and progression on an annual basis.



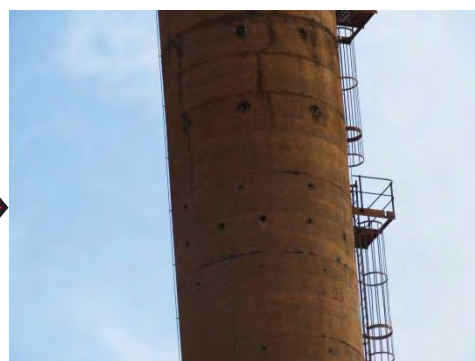
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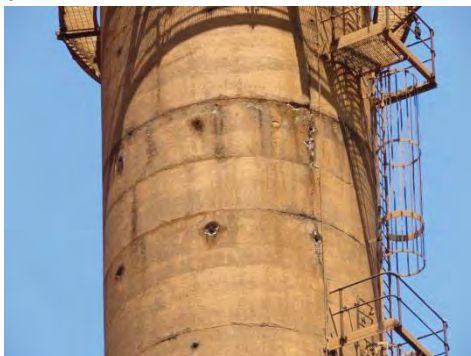
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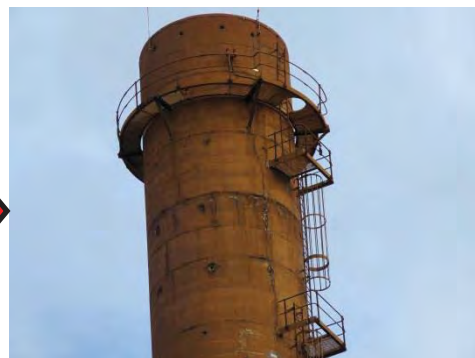
CONDITION ASSESSMENT REPORT

ID	5
Item	Cracks Monitoring – Location 4
Location	Throughout
Finding	No perceptible change in crack length or width in the pre-existing crack network and stack section connections was observed.
Recommendation	It is recommended to continue monitoring the cracks condition and progression on an annual basis.

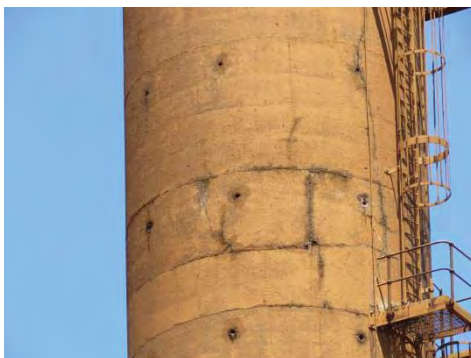
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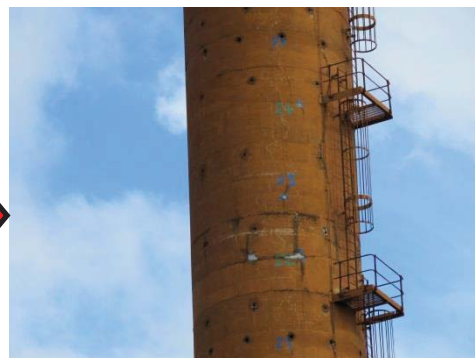
Oct 2016



Jan 2018



Oct 2016

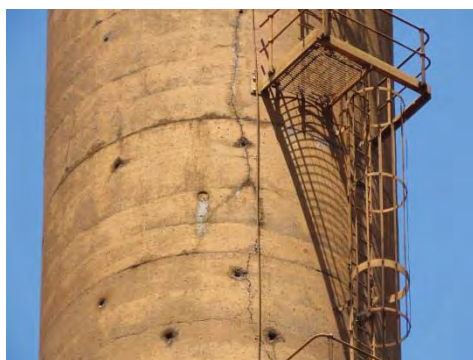


Jan 2018



CONDITION ASSESSMENT REPORT

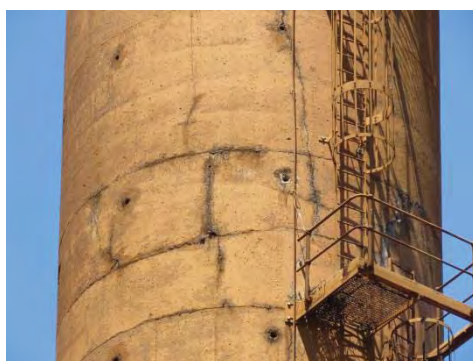
ID	6
Item	Cracks Monitoring – Location 5
Location	Throughout
Finding	No perceptible change in crack length or width in the pre-existing crack network and stack section connections was observed.
Recommendation	It is recommended to continue monitoring the cracks condition and progression on an annual basis.



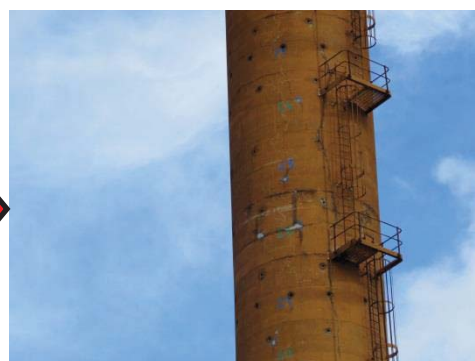
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Jan 2018



CONDITION ASSESSMENT REPORT

Appendix B

Priority Numbering System



CONDITION ASSESSMENT REPORT

Priority	Condition	Condition Description	Action Required	Actions Time Frame	Consequence of No Action
1	Near New	A near new asset with no visible signs of deterioration.	Nil	No Action	None
2	Excellent	An asset in excellent overall condition. There would be only very slight condition decline but it would be obvious that the asset was no longer in new condition.	Nil	No Action	None
3	Very Good	An asset in very good overall condition but with some early stages of deterioration evident, but the deterioration still minor in nature and causing no serviceability problems.	Minor Repairs	Within 3 years	Minor additional future repair cost
4	Good	An asset in good overall condition but with some obvious deterioration evident.	Minor Repairs	Within 3 years	Moderate additional future repair cost
5	Fair	An asset in fair overall condition. Deterioration in condition would be obvious.	Moderate Repairs	Within 2 years	Significant additional future repair cost
6	Fair to Poor	An asset in fair to poor overall condition. The condition deterioration would be quite obvious.	Moderate Repairs	Within 1 year	Significant additional future repair cost, minor injury
7	Poor	An asset in poor overall condition. Deterioration would be quite severe.	Major Repairs	Within 9 months	Local failure, serious injury
8	Very Poor	An asset in very poor overall condition with serviceability now being heavily impacted upon by the poor condition.	Refurbishment, replacement possible	Within 6 months	Local collapse, serious injury
9	Extremely Poor	An asset in extremely poor condition with severe serviceability problems and needing rehabilitation immediately. Could also be a risk to remain in service.	Replacement	Within 3 months	Local collapse, death or serious injury
10	Unusable	An asset that has failed, is no longer serviceable, and should not remain in service.	Replacement, immediately remove from service	Immediate – less than 30 days	Catastrophic collapse, death or serious injury



CONDITION ASSESSMENT REPORT

Appendix C

Asset Location



CONDITION ASSESSMENT REPORT





Yabulu Nickel Refinery

Stack and Structures Site Visit Report

6 July 2016

Level 3, 60 Albert St
Brisbane QLD 4000
Australia

401310-13682-REP0001

www.advisian.com



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WorleyParsons Group

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Project No: 401310-13682-REP0001 – Yabulu Nickel Refinery: Stack and Structures Site Visit Report

Rev	Description	Author	Review	Advisian Approval	Date
A	Issued for Internal Review	<u> </u> A Nielsen	<u> </u> A Lopes	<u> </u>	5 July 2016
B	Issued for Client Review	<u> </u> A Nielsen	<u> </u> A Lopes	<u> </u> P Brooks	6 July 2016
		<u> </u>	<u> </u>	<u> </u>	
		<u> </u>	<u> </u>	<u> </u>	

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Executive Summary

Workplace Health and Safety Queensland ("WHSQ") commissioned WorleyParsons to provide the services of a structural engineer to; conduct a visual inspection of the Area 320 Concrete Exhaust Stack and other structures, review the available reports held by WHSQ and provide a report to WHSQ on the reasonable practical steps that should be taken to ensure the safety of workers and other persons.

A site visit was conducted on the 20th and 21st of June 2016 to complete a visual inspection of the Yabulu Nickel Refinery. The WHSQ inspection team consisted of a Process Engineering officer and a Mechanical Engineering officer from WHSQ along with a structural engineer from WorleyParsons. The WHSQ officers primarily focused on Process safety and chemical storage including the mechanical pumps, valves, vessels and pipelines respectively.

The WHSQ inspection team were escorted around the site by a representative of Queensland Nickel ("QN") and generally followed the process flow. At the time of the inspection the refinery was shut-down.

The Yabulu Nickel Refinery structures inspected consistently displayed high to severe levels of corrosion and deterioration. In addition high levels of chemical spillage were observed at several locations on the ground and high levels of chemical residue and leakage had accumulated over several structures and equipment.

A general pattern of severe corrosion was observed, around those areas exposed to high levels of Sulphur (Coal Handling, Coal Furnace, Heavy Fuel Oil Furnace, and Molten Sulphur Handling Shed) exhibiting extremely severe structural steel corrosion and concrete cancer. Areas exposed to high levels of Ammonia (Ammonia Aerator tanks, Ammonia Stripper tanks) also displayed severe structural steel corrosion and concrete deterioration. Finally, areas subject to high levels of Carbon Dioxide (CO₂) exhibited moderate to high levels of concrete cancer (Area 320-1404 Concrete Exhaust Stack).

In November 2015, the QN Maintenance and Engineering team produced a Structural Inspection Report of the Area 320-1404 Concrete Stack. The report was based on an external survey in February 2015 using an Unmanned Aerial Vehicle (UAV). Eight months later in October 2015 an internal inspection using Helium balloons was conducted. The external inspection revealed extensive cracking of the concrete shell and the internal inspection revealed widespread cracking and failure of the internal firebrick lining exposing the concrete shell to CO₂.

These results are discussed in detail in the QN Maintenance and Engineering team report. The conclusion of the QN Maintenance and Engineering report is that the 320-1404 Concrete Stack presents a safety hazard to personnel working at the site. The report recommends in the final paragraph of the executive summary that: *"to ensure continued safe production, it is recommended technical proposals are obtained for the development of a replacement design, and a demolition plan made for the existing stack. It is recommended to commence this process immediately with the original stack demolished completely (or to a structural sound extent) within 24 months."*



Currently the stack is barricaded off to prevent people accessing the stack, but the barricades still allow access to within approximately 10 metres. At the time of the WHSQ inspection access was restricted to a visual inspection with the naked eye from the ground behind the barricades. Based off of this limited visual inspection the conclusions and recommendation of the QN Maintenance and Engineering report appear appropriate.

A list of reasonable practical steps that could be taken to ensure the safety of workers and other persons whilst the refinery is shut down is provided in section 1.3.



1 Yabulu Nickel Refinery

1.1 Introduction

Workplace Health and Safety Queensland ("WHSQ") commissioned WorleyParsons to provide the services of a structural engineer to assist in assessing the risks associated with the Area 320 Concrete Exhaust Stack and other structures at the Yabulu Nickel Refinery.

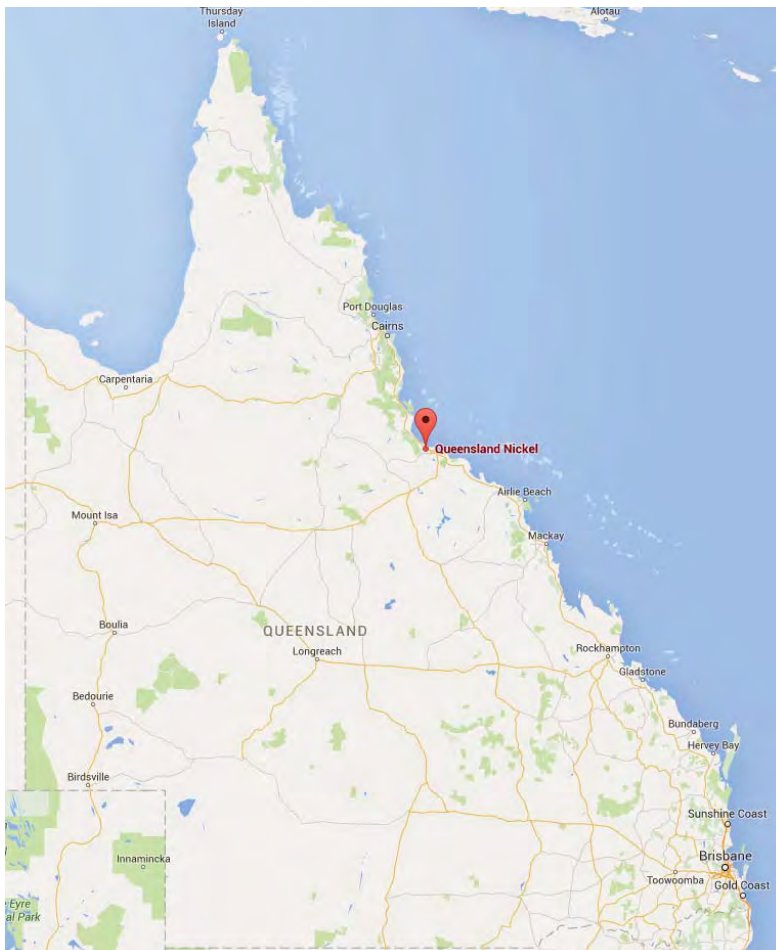
1.1.1 Scope

The scope of the services WorleyParsons was commissioned to provide is as follows:

- Conduct a visual inspection of the Area 320 Concrete Exhaust Stack and other structures
- Review the available reports held by WHSQ
- Provide a report to WHSQ on the reasonable practical steps that should be taken to ensure the safety of workers and other persons

1.1.2 Location

The Yabulu Nickel Refinery site is located in the North-East Dry-Tropics of Queensland and is sheltered from the Coral Sea by the Great Barrier Reef giving a low corrosion rate of only 15µm/yr for the Townsville locality (AS2312, App.B – Table B2).





The refinery site is about 25km North West of Townsville near the suburbs of Yabulu and Saunders Beach.



The refinery site covers approximately 100 hectares and sits about 4km from the coast line and close to 10m above sea level. The Tailings dams cover approximately another 230 hectares and sits between the refinery and the coast.





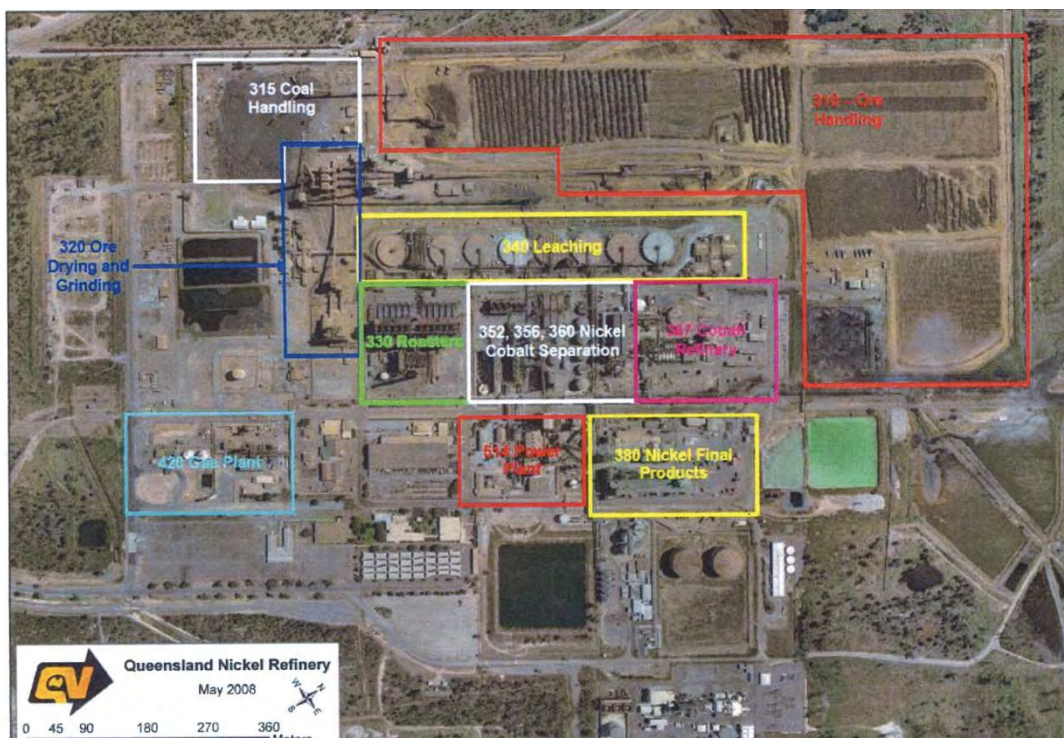
1.1.3 History

The original Refinery was commissioned in circa 1973 / 1974 and has seen approximately 42 years of service. There is evidence of recent additions to the refinery since the early 2000s built by the then owner BHP Billiton. BHP Billiton sold Yabulu Nickel Refinery to Queensland Nickel (QN) in mid 2009 which has operated the refinery until recently.

1.1.4 Refinery Layout

As can be seen below the Refinery comprises the following areas:

1. Area 315 Coal Handling and Area 310 (Nickel) Ore handling, where the rare materials are received and stockpiled
2. Area 320 Ore Drying and Grinding
3. Area 330 Roasters
4. Area 340 Leaching
5. Area 352,356,360 Nickel Cobalt Separation
6. Area 367 Cobalt Refinery
7. Area 380 Nickel Final Products
8. Area 420 Gas Plant
9. Area 514 Power Plant





In addition there is a Heavy Fuel Oil Tank Farm and Fire Water Pumping Station and Fire Water Pond to the South East of the site and a rail 'balloon' loop to the North-West of the site.

1.1.5 Site Visit

A WHSQ site visit was conducted on the 20th to 21st of June 2016 to complete a visual inspection of the refinery. The WHSQ inspection team consisted of two officers from the WHSQ along with an employee of WorleyParsons. The WHSQ officers included a Process Engineer and a Mechanical Engineer who focused on Process safety and chemical storage and the mechanical pumps, valves, vessels and pipelines respectively. The WorleyParsons employee is an RPEQ Structural engineer and focused on the structural aspects of the Area 320 Concrete Exhaust Stack and other structures around the Refinery.

The WHSQ inspection team were escorted around the site by a representative of QN and generally followed the refinery's process flow. At the time of the inspection the refinery was shut-down.

1.1.6 Observations

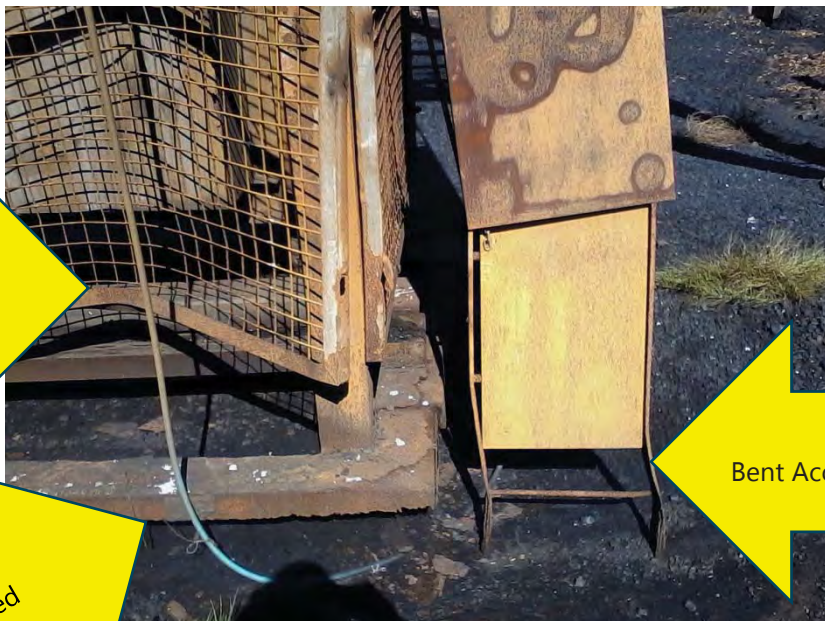
The following is a record of photographic observations of some of the more severe examples of structural issues encountered during the Yabulu Nickel Refinery site visit.

1.1.6.1 Area 310 Ore Handling

Only a cursory inspection of the ore handling area was performed mostly focusing on the Rail Receival Shed. There were no obvious structural issues noted.

1.1.6.2 Area 315 Coal Handling

The coal handling area exhibited signs of hard use and high corrosion levels as can be seen in the photos below.



Bent Gravity Take Up
guard frame

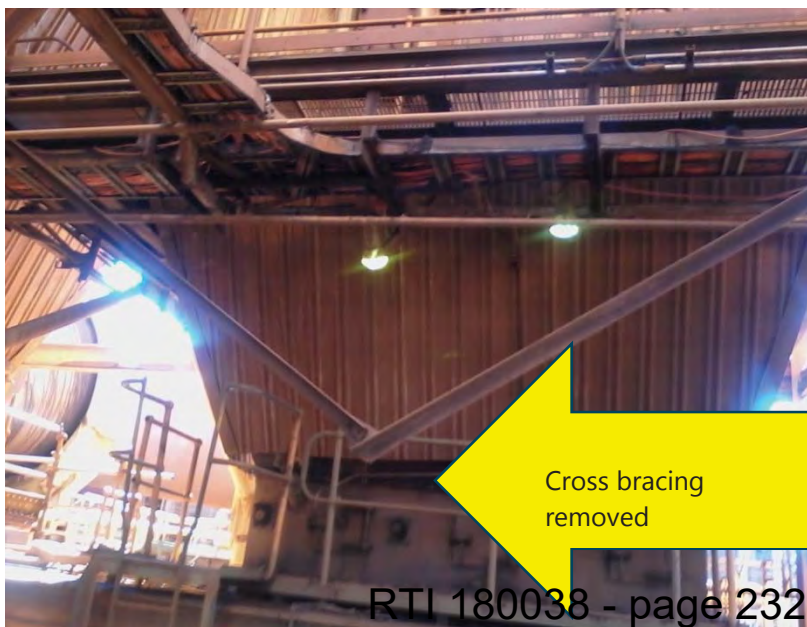
Bent Access Ladder stiles

Severely corroded
member



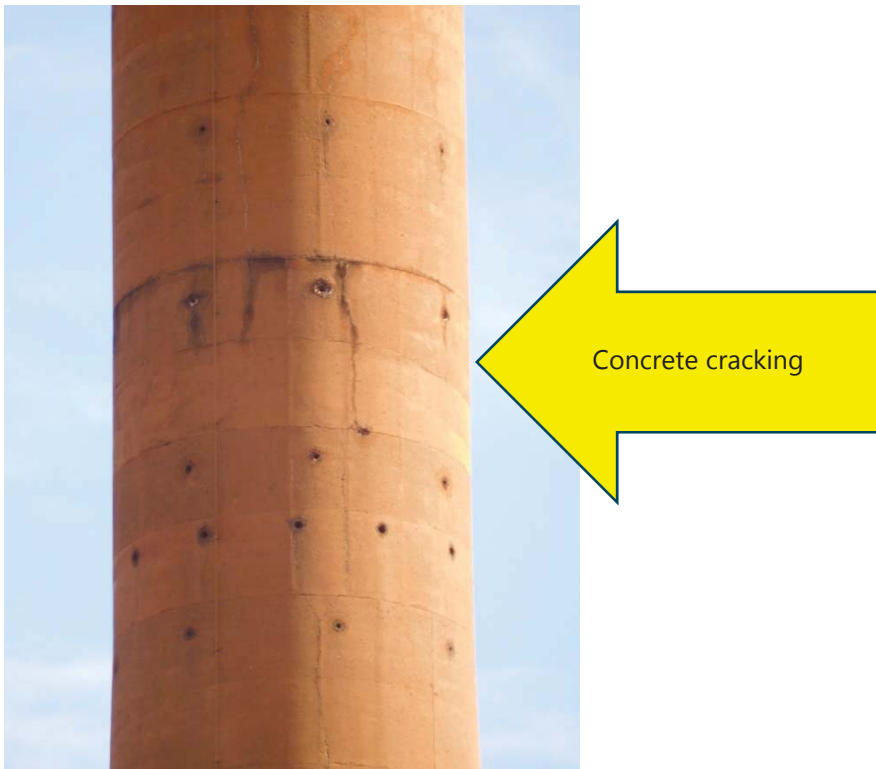
1.1.6.3 Area 320 Ore Drying and Grinding

The Ore Drying and Grinding area displayed moderate corrosion levels to the structural steel but extremely severe degradation of the concrete plinths particularly around the Ball Mill area. It was noted that a couple of structural bracing members had been removed to allow access to various equipment. These should be reinstated.



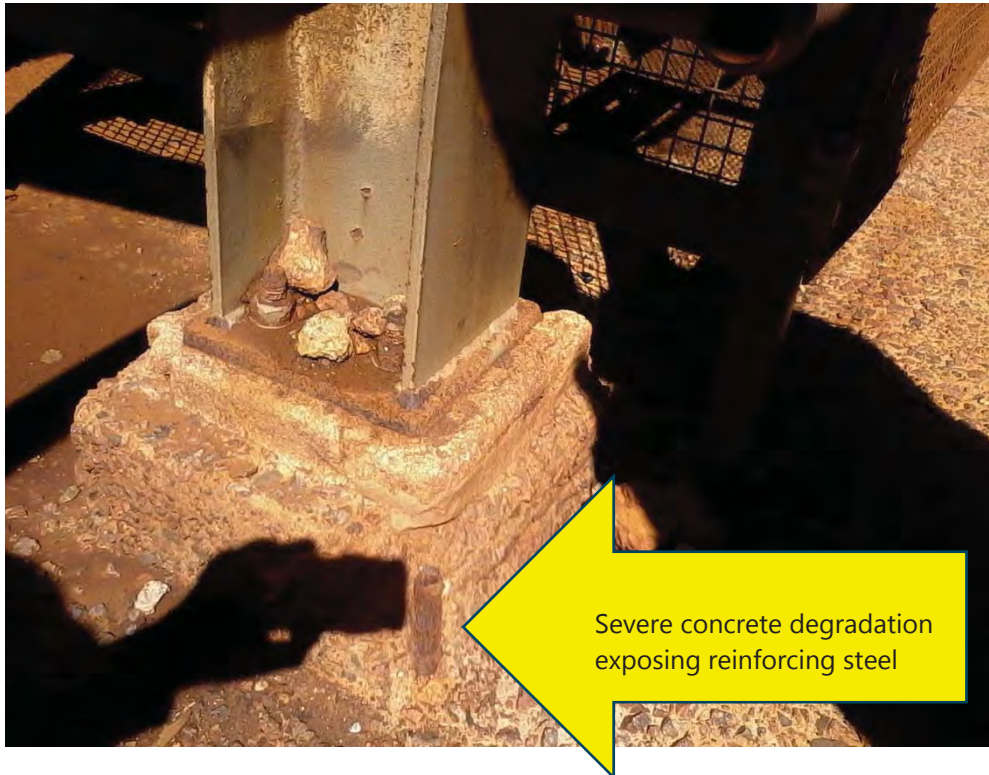


Secondly, the Ore Drying and Grinding area includes the 320-1404 concrete exhaust stack which is the subject of an internal QN Condition Assessment Report. (This report will be addressed later in section 1.2 of this report). Access to the 320-1404 concrete exhaust stack has been restricted and only the external surface could be visually inspected from the ground from a distance of approximately 10 m.



Signs of multiply cracks were evident across the surface of the 320-1404 Concrete Exhaust Stack.





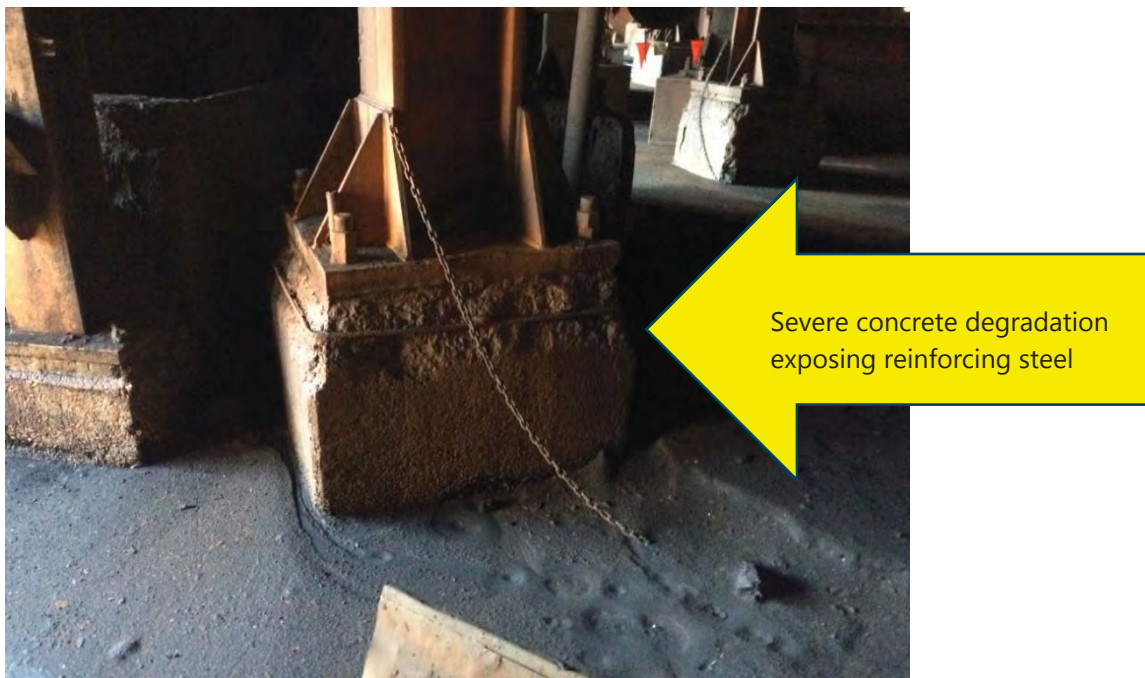
The corrugated asbestos roof sheeting of the Ball Mill had failed in several locations dropping asbestos fragments onto the floor area and allowing weather and rain to penetrate and water to pond within the building.





1.1.6.4 Area 330 Roasters

The Roasters area also exhibited examples of extremely severe concrete degradation exposing reinforcing steel to corrosion as shown in the following photos.





The upper levels of the Roaster building were not inspected.

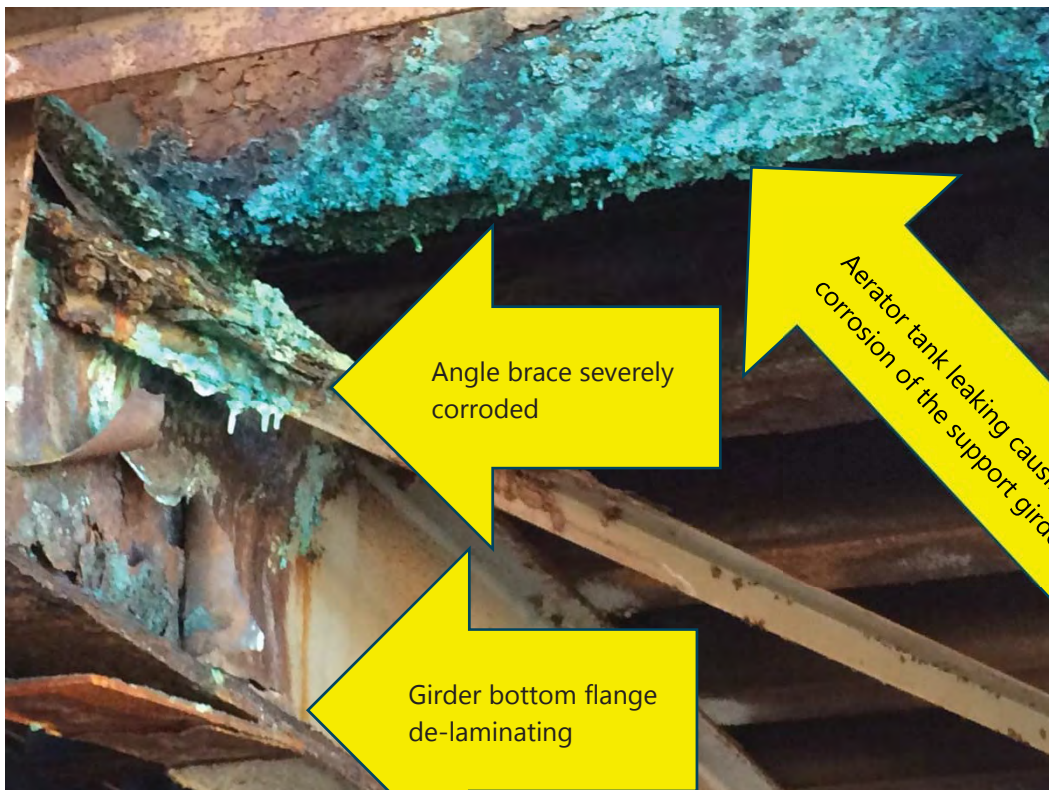
1.1.6.5 Area 340 Leaching

Area 340 Leaching particularly the Aerator tank farm displayed some of the worst corrosion and neglect seen at the Yabulu Refinery. Structural steel members have been entirely corroded through portions of their cross-section such as their web or flanges as can be seen in the following photos.





Both stair stringer cleats removed. Stair is only supported by grated stair tread



Angle brace severely corroded

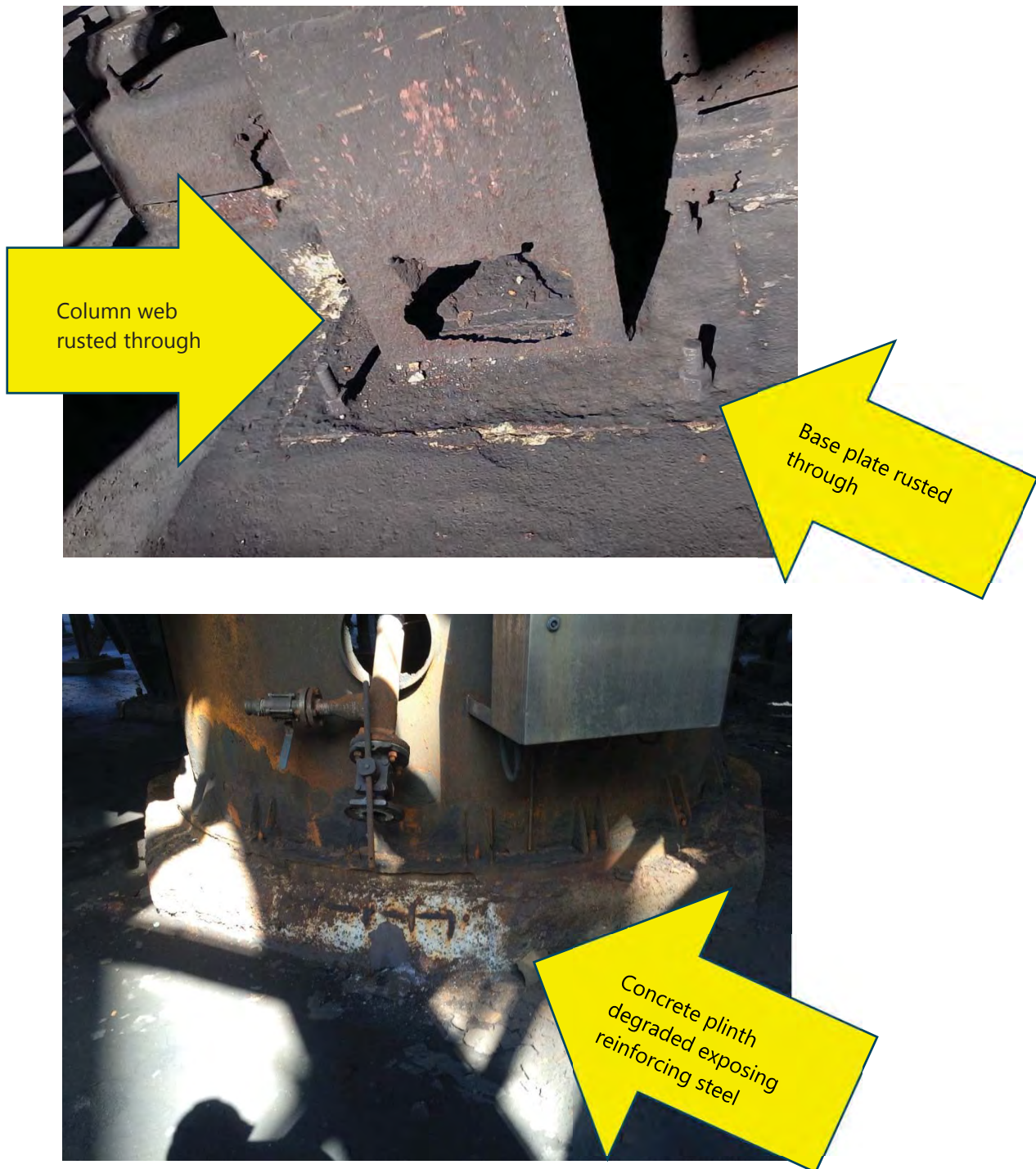
Aerator tank leaking causing corrosion of the support girder

Girder bottom flange de-laminating



1.1.6.6 Area 352, 356,360 Nickel Cobalt Separation

This area also exhibits severe corrosion of the structural steel and severe degradation of the concrete plinths and bunds.





1.1.6.7 Area 367 Cobalt Refinery

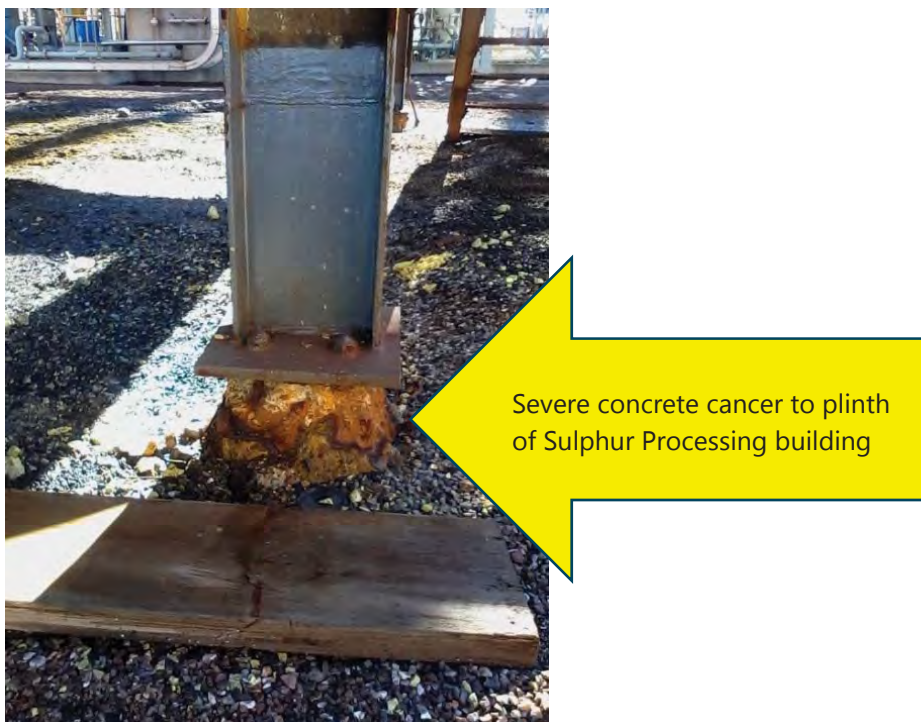
The Cobalt refinery was not inspected.

1.1.6.8 Area 380 Nickel Final Products

The Nickel Final products area was relatively new and also in a relatively good condition no obvious defects were recorded.

1.1.6.9 Area 420 Gas Plant

Structural deterioration of the gas plant structures was significant in areas exposed to the sulphur handling and the 420-2507 stair tower.





1.1.6.10 Area 514 Power Plant

The Power plant was in relatively good condition overall. The Coal Furnace and Heavy Fuel Oil Furnace showed relatively higher levels of deterioration.



Severe corrosion of
structural members and

1.1.6.11 Area 530 Water Purification Area

The water purification area also showed signs of severe concrete cancer and high levels of chemical residue build-up over the equipment.



Concrete cancer
to plinths

Severe concrete
cancer to plinth



1.1.7 Summary of Observations

The Yabulu Nickel Refinery structures visually inspected consistently displayed high to severe levels of corrosion and deterioration. In addition, high levels of chemical spillage were observed at several locations on the ground and high levels of chemical residue and leakage had accumulated over several structures and equipment.

A general pattern of severe corrosion was observed, around those areas exposed to high levels of Sulphur (Coal Handling, Coal Furnace, Heavy Fuel Oil Furnace, and Molten Sulphur Handling Shed) exhibiting extremely severe structural steel corrosion and concrete cancer. Areas exposed to high levels of Ammonia (Ammonia Aerator tanks, Ammonia Stripper tanks) also displayed severe structural steel corrosion and concrete deterioration. Finally areas subject to high levels of Carbon Dioxide (CO₂) exhibited moderate to high levels of concrete cancer (Area 320-1404 Concrete Exhaust Stack).

1.2 Internal QN Structural Assessment Report

In November 2015, the QN Maintenance and Engineering team produced a Structural inspection report of the Area 320-1404 Concrete Stack. The report was based on an external survey in February 2015 using an Unmanned Aerial Vehicle (UAV). Eight months later in October 2015 an internal inspection using Helium balloons was conducted. The external inspection revealed extensive cracking of the concrete shell and the internal inspection revealed widespread cracking and failure of the internal firebrick lining exposing the concrete shell to CO₂.

These results are discussed in detail in the QN Maintenance and Engineering team report. The conclusion of the QN Maintenance and Engineering report is that the 320-1404 Concrete Stack presents a safety hazard to personnel working at the site. The report recommended in the final paragraph of the executive summary that *"to ensure continued safe production, it is recommended technical proposals are obtained for the development of a replacement design, and a demolition plan made for the existing stack. It is recommended to commence this process immediately with the original stack demolished completely (or to a structural sound extent) within 24 months."*

Currently the stack is barricaded off to prevent people accessing the stack, but the barricades still allow access to within approximately 10 metres. At the time of the WHSQ inspection access was restricted to a visual inspection with the naked eye from the ground behind the barricades. Based off this limited visual inspection the conclusions and recommendation of the QN Maintenance and Engineering report appear appropriate.



1.3 Recommendations of reasonable practical steps that should be taken to ensure the safety of workers and other persons

In the current “shut-down” state, risks to workers and other persons remain.

Following is a list of reasonable practical steps that should be taken to ensure the safety of workers and other persons whilst the refinery is “shut-down”:

- A comprehensive assessment of all structures and equipment including an audit of all chemicals stored on site
- Remove and dispose of all stored gases under pressure and leave the vessels empty and at atmospheric pressure
- Remove and dispose of all stored liquids from tanks and vessels and leave the tanks and vessels empty and at atmospheric pressure
- Secure all loose items, equipment, machinery and materials around the refinery in preparation for Cyclone Season
- Remove or cover all open containers to prevent the collection of rainwater and conduct a spraying programme to prevent the breeding of mosquitos
- Keep all weeds and vegetation under control to prevent vermin infestations
- Secure refinery perimeter to prevent unauthorised access to the refinery by members of the public
- Barricade off all structures at risk and secure an appropriate exclusion zone around structures identified as being at risk. Example of such structures would be the 320-1404 Concrete Stack, and the Ammonia Aerator tanks
- Limit access to other areas until a thorough and detailed inspection and assessment of all structures is conducted and a full risk assessment is completed

Our Ref: F0000001579, R0000008836



Office of
Industrial Relations

29 Sep 2017

Queensland Nickel Sales Pty Ltd

Queensland Treasury

@qni.com.au

Dear

I refer to your letter to dated 19 September 2017.

As you are aware, on 15 March 2017, I made a determination under section 542 of the *Work Health and Safety Regulation 2011* (WHS Regulation), determining the Yabulu refinery at 1 Greenvale Street, Yabulu, Queensland 4818 (Yabulu refinery), operated by Queensland Nickel Sales Pty Ltd (QNS), as a major hazard facility (MHF) (the determination). Under section 544 of the Regulation, I imposed conditions on the determination (the conditions).

By letter dated 19 September 2017, QNS refers to QNS's application in the Queensland Civil and Administrative Tribunal (QCAT) (case number GAR090-17) and proposes a number of amendments to the conditions attached to the determination which 'relate to a reduction in the area (footprint) to which the MHF Conditions will apply, together with revisions to the Conditions'.

The application in QCAT seeks to review the decision to determine the Yabulu refinery as a MHF. However, as mentioned above, your letter dated 19 September 2017 suggests a number of amendments to the conditions attached to the determination.

It is appropriate that I point out that my consideration of QNS's request to amend the conditions is distinct from, and entirely separate to:

- the decision to determine Yabulu refinery as a MHF on 15 March 2017; and
- the proceedings currently on foot in QCAT.

I have considered QNS's proposed amendments to the conditions received on 19 September 2017, and as further amended by QNS on 28 September 2017 - see section 544 of the WHS Regulation and section 24AA of the *Acts Interpretation Act 1954*. I enclose for QNS's consideration, amended conditions to attach to the determination.

The amended conditions will apply from 1 November 2017. QNS is invited to submit any objections or modifications to the amended conditions within 14 days.

Level 11, 1 William Street Brisbane
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WorkSafe +61 7 3247 4711
Wageline +61 7 3225 2299
Website www.worksafe.qld.gov.au
www.business.qld.gov.au
ABN 13 846 673 994

If you have any queries in relation to this matter, please contact
Director, Hazardous Industries and Chemicals Branch, Workplace Health and Safety
Queensland, Office of Industrial Relations on (07) 3874 7580.

Yours sincerely

**Deputy Director-General
Office of Industrial Relations**

Encl.

**DEPUTY DIRECTOR-GENERAL,
OFFICE OF INDUSTRIAL RELATIONS**

SUBJECT

Responding to Queensland Nickel Sales' (QNS) proposal to amend conditions attached to the Yabulu refinery Major Hazard Facility (MHF) determination

RECOMMENDATION

That you **sign** the letter (**Attachment 1**) outlining changes to the conditions attached to QNS's MHF determination.

KEY ISSUES

It is noted that your consideration of QNS's request to amend the conditions is entirely separate to the decision to determine Yabulu refinery as a MHF on 15 March 2017 and the proceedings currently on foot in the Queensland Civil and Administrative Tribunal (QCAT).

On 19 September 2017, QNS wrote to the Regulator suggesting that the application of their MHF determination be reduced in size/footprint (**Attachments 4**). If accepted, this would deviate from the current interpretation that a determination applies to the area under the control of the operator of the facility. It would also introduce unacceptable risks of activities incompatible with MHF operations being conducted adjacent to a MHF, without the protection afforded by the *Sustainable Planning Act 1997* and State Planning Policy.

In its letter, QNS requests amendments to the conditions applying to the storage of hazardous chemicals (**Attachment 4**). The amendments reflect the reduction and consolidation of hazardous chemicals, progress in negotiations with the Queensland Fire and Emergency Service (QFES) relating to the use of the fire-protection systems, and a change in the declared nature of the "care and maintenance" activity of the site.

QCAT has directed that QNS advise in writing if it decides to withdraw its application to review the Regulator's determination by 4pm, 29 September 2017, after discussions surrounding the conditions and application of the determination.

BACKGROUND

The risks to the community have been reduced and contained at the Yabulu refinery site. QNS have:

- completed all outstanding notices
- removed all accessible chemicals of security concern
- drained, purged and isolated pipe-work
- inspected or isolated electrical equipment
- consolidated hazardous chemical storage to four areas
- repaired bunds and vessels storing hazardous chemicals
- reduced the likelihood of an extended toxic gas cloud by increasing the size of the overflow pit, automated the addition of oil to the pit on detection of gas, and ensured workers and the power-station are alerted. QFES will be alerted via '000'.

The removal of ammonia solution in the clarifiers has slowed to control possible nuisance emissions. When completed, the ammonium hydrosulphide in the sphere will present the only off-site impact. The sphere complies with current codes and has been maintained. It should be suitable storage for the short term.

You refreshed the determination of the Yabulu refinery as a MHF on 15 March 2017. The notice of determination, including the original conditions imposed as part of the determination, is provided at **Attachment 2**.

QNS has sought an administrative review in QCAT of the Regulator's determination of the facility as a MHF. QNS believes they should not be determined as a MHF because they sold the sphere on the site, and as a result they fall below the threshold quantity of Schedule 15 chemicals. A compulsory conference was held on 24 August 2017 between QNS and the Regulator. QCAT directed QNS to advise in writing if it decides to withdraw its application by 4pm, 29 September 2017, and listed the matter for a directions hearing on 19 October 2017 (**Attachment 3**).

The Director of Hazardous Industries and Chemicals Branch (HICB) attended the Yabulu site on 14 September 2017 to discuss the principles behind any possible amendments to the conditions. On 19 September 2017, QNS submitted a letter to the Office of Industrial Relations (OIR) with proposed amendments (**Attachments 4**).

Engineers from OIR and Advisian considered the effect of the proposed amendments on the risk management of the facility on 25 September 2017. A risk assessment report prepared by Advisian is provided at **Attachment 5**. QNS were supplied a draft of the minutes of the meeting between OIR and Advisian.

On 27 September 2017, QNS sought clarification on an acceptable exclusion zone distance for structures, and electrical isolation requirements. A revised list of suggested conditions was received by OIR from QNS on 28 September 2017 (**Attachment 6**).

Ach 3/7

FINANCIAL & RISK IMPLICATIONS

A withdrawal of the QCAT matter by QNS would avoid legal and administrative costs. QNS has been directed to consider withdrawing its application by 4pm, 29 September 2017.

The risks associated with each amendment to the conditions has been considered by a multidisciplinary group of engineers from HICB and Advisian. The minutes of this review were used by QNS as the basis for later revisions to the proposal.

Prepared by:

Endorsed by:

Director
Hazardous Industries and Chemicals Branch
Tel:

Executive Director - Safety, Policy and
Worker's Compensation Services
Tel:

Date: 28 September 2017

Date: 28 September 2017

Recommendation Approved:.....

Date:

..... 29/9/17

Amended conditions

Condition 1 is reaffirmed, with update of date as agreed with QNS:

1. QNS must provide an Improvement Plan to ensure fire-fighting protection systems are and will continue to be effective on demand and be proportionate to the major incident risks. The Improvement Plan must address all identified non-conformances with relevant Australian Standards in any installed Special Fire Services¹ and firefighting protection systems for the facility, including but not limited to:
 - a) firefighting water hydrants and plant deluge systems;
 - b) firefighting water supply pumps;
 - c) firefighting water ring mains; and
 - d) ancillary firefighting equipment such as extinguishers, hoses and reels.

This Plan must be developed to the reasonable satisfaction of the Regulator and be submitted to the Regulator by COB 1 December 2017 for approval. QNS must comply with the approved Improvement Plan. Variations to the Improvement Plan must be approved by the Regulator.

Condition 2 is reaffirmed, as agreed with QNS:

2. QNS must ensure all tanks and vessels containing hazardous chemicals remain isolated by double block and bleed, alternatively by lock-closed (drain point), or by lock-closed (as close as possible to the source) whilst the facility is not manufacturing.

Condition 3 has been renegotiated to ensure that chemical storage areas remain safe. Areas not storing hazardous chemicals and not reasonably foreseeable to threaten hazardous chemical storages are not subject to specific obligations to monitor and maintain. Other sections of the work health and safety laws may apply.

3. QNS must provide evidence on request to the Regulator² that hazardous³ chemical storage areas are monitored and maintained to ensure:
 - a) building structures and supports;
 - b) plant area footings, bunds, plinths and supports;
 - c) process tanks and vessels; and
 - d) pumps and pipework

remain in a structurally stable state. Structures (outside the hazardous chemical storage areas) which may impact⁴ on the hazardous chemical storage areas must be included in the monitoring (and associated Improvement Plans). Any items which require replacement, repair or reconstruction are to be subject to an Improvement Plan to be approved by the Regulator.

¹ As detailed in the *Sustainable Planning Regulation 2009*, Schedule 8

² The evidence must be provided in a timely manner but not later than 1 month from the date of the Regulator's request.

³ Hazardous chemical storage areas are any vessels, containers and bunds that contain (or may contain in the event of a leak) hazardous chemicals

⁴ Impact distance is defined as 1.5 times the height of the structure.

A copy of the Improvement Plan must be provided to the Regulator within 4 weeks of QNS's receipt of any report which identifies the remedial action required. The approved Improvement Plan must be complied with and any variations to the Improvement Plan shall be reported to the Regulator immediately.

Condition 4 is reaffirmed, as agreed with QNS:

4. QNS must immediately notify the Regulator of the following events or conditions, in addition to the notification requirements specified in the *Work Health and Safety Act 2011*:
 - a) any near miss dangerous event⁵, whether or not a person was exposed to imminent risk;
 - b) any process excursion outside the designated operating envelope as determined by the equipment design;
 - c) any activity which requires operation materially outside the standards espoused in the safety management system⁶;
 - d) any change in operations status on site, including but not limited to:
 - i. the decision to commission/re-commission or use of equipment for any manufacturing operations at the refinery;
 - ii. the receipt of any bulk hazardous chemicals or dangerous goods to the site boundary (including, but not limited to, nitrogen and ore/ore concentrates); and
 - iii. the dispatch of any bulk hazardous chemicals or dangerous goods from the site boundary (including, but not limited to, anhydrous ammonia, sulphur, ammonium hydrosulphide, hydrogen peroxide, asbestos containing products, and metal ores, powders and concentrates).

For the purposes of this condition, bulk hazardous chemicals or dangerous goods refers to quantities equalling to, or exceeding, 1 tonne.

Condition 5 has been reframed to ensure that any risk associated with recommissioning, or any new in-situ use of plant and land is appropriately managed. It also precludes any activity incompatible with the safe storage of ammonium hydrosulphide.

5. QNS must provide evidence to the Regulator that the facility is safe to operate prior to the recommissioning or commencement of any manufacturing activities or transfer activities through the heavy fuel oil pipeline to the site. The Regulator must be reasonably satisfied with this evidence before QNS can recommence activities outside of care and maintenance and/or recommissioning/manufacturing.

⁵ 'Near miss dangerous event' means any sudden event that, apart from mitigating effects, actions or systems, could have escalated to a major incident.

⁶ As required by s 558 of the *Work Health and Safety Regulation 2011*.

Evidence to support this requirement may include, but is not limited to:

- a) training records of workers;
- b) operating procedures and work instructions;
- c) applicable risk and safety assessments;
- d) performance standards;
- e) developed operating envelopes;
- f) plant/equipment datasheets;
- g) employee rosters;
- h) minimum manning studies;
- i) plant/equipment maintenance records and schedules;
- j) integrity surveys and assessments of structures and supports;
- k) corrosion surveys and assessments of building structures and supports, process tanks and vessels, pipelines, pumps and pipework; and
- l) any other evidence which supports a safety management system is in place and will remain effective in ensuring the continual safety of workers, plant and community.

Condition 6 has been amended to reflect the recent approval of the safety case outline, which addresses security issues.

- 6. QNS must meet or exceed the security measures contained in the approved Safety Case Outline.

Condition 7 has been amended to reflect the requirements of the care and maintenance state, and ensure that the issue is addressed prior to re-start.

- 7. QNS must provide the Regulator with evidence the asbestos register for the facility has been revalidated prior to a restart of the refinery. High risk asbestos locations are to be reviewed on an annual basis by a qualified person and a report provided to the Regulator.

The following conditions have been removed as the purpose has been, or substantially been, achieved:

- Independent assessments by competent persons (original condition 2), has been reframed as a restart condition (5), reflecting the combined effect of assessments conducted to date (notably of the stacks), the removal of chemicals and completion of various notices. The residual risk is largely managed via exclusion of personnel. The fuel oil pipeline has been visually inspected and is deemed a limited environmental risk.
- The storage arrangements for the sphere have been significantly improved, meeting original condition 3.
- Evidence has been collected/provided that demonstrates that QNS have taken steps to manage the risks associated with the plant in its current state (the intent of the original condition 5).
- Accessible chemicals of security concern have been removed, negating the need for inventory management (original condition 8).

Our Ref: 3673162

15 MAR 2017

General Manager
Queensland Nickel Sales Pty Ltd
PMB 5
TOWNSVILLE QLD 4818



Office of
Industrial Relations

Queensland Treasury

Dear

Notice under section 545 of the *Work Health and Safety Regulation 2011*

On 15 March 2017, I made a determination under section 542 of the *Work Health and Safety Regulation 2011* (WHS Regulation) confirming the refinery at 1 Greenvale Street, Yabulu QLD 4818 to be a major hazard facility with Queensland Nickel Sales Pty Ltd (QNS) as the operator.

The date of effect of the determination is 12 April 2017, that is, 28 days after the date of this notice (section 545 of the WHS Regulation).

The following conditions shall apply to the determination of the major hazard facility, within the area depicted in Map 1, and to the heavy fuel oil pipeline operated by QNS.

1. QNS must provide an improvement plan to ensure fire-fighting protection systems are and will continue to be effective on demand and be proportionate to the major incident risks. The improvement plan must address all identified non-conformances with relevant Australian Standards in any installed Special Fire Services¹ and firefighting protection systems for the facility, including but not limited to:
 - a. Firefighting water hydrants and plant deluge systems;
 - b. Firefighting water supply pumps;
 - c. Firefighting water ring mains; and
 - d. Ancillary firefighting equipment such as extinguishers, hoses and reels.

This plan must be developed to the reasonable satisfaction of the Regulator and be submitted to the Regulator by COB 12 April 2017 for his approval. QNS must comply with the approved improvement plan. Variations to the improvement plan must be approved by the Regulator.

¹ As detailed in the Sustainable Planning Regulation 2009, Schedule 8

2. QNS must engage competent persons² to conduct assessments and reports for all plant, vessels, tanks, pipework and buildings located at the refinery and the heavy fuel oil pipeline to the port to demonstrate these items are structurally stable, suitable for storage or manufacturing loads, duty and service, and will not collapse during service, storage or high wind load events. These assessments shall include, but are not limited to:
 - a. Integrity surveys and assessments of all concrete structures and supports within the refinery, including but not limited to:
 - i. Area 320 and 514 concrete stacks (see Map 1); and
 - ii. Building and plant area footings, bunds, plinths and supports.

Unless the Regulator has given prior written approval of a person to be an assessor, these assessments must be completed by a competent person who is an independent third party. The assessments and report must be completed by COB 1 May 2017. QNS must address any recommendations in a timely manner but not later than COB 1 October 2017.

- b. Corrosion surveys and assessments of all fixed infrastructure, including but not limited to:
 - i. building structures and supports;
 - ii. process tanks and vessel;
 - iii. pumps and pipework; and
 - iv. pipelines.

Unless the Regulator has given prior written approval of a person to be an assessor, this assessment must be completed by a competent person who is an independent third party. This assessment and report must be completed by COB 1 May 2017. QNS must address any recommendations in a timely manner but not later than COB 1 October 2017.

² All references to competent persons refer to WHS Regulation, Schedule 19, definition of 'competent person' paragraph (g) or otherwise specified under applicable law. Note the Professional Engineers Act 2002 requires any professional engineering service to be provided by or under the supervision of a Registered Professional Engineer of Queensland. See: section 115. A professional engineering service includes the identification of relevant standards and assessment criteria where not prescribed by law. In some instances, the inspections or repairs must be carried out by licenced persons.

- c. An interim assessment and report of priority infrastructure³ (vessels and tanks containing hazardous chemicals) must be completed by 1 May 2017 and provided to the Regulator. The final assessment and report must be completed by 1 July 2017 or prior to restart of the refinery, whichever is the earliest. The competency of the assessors must be agreed by the Regulator⁴.
- d. Inspection of all electrical equipment in service on site. Electrical equipment not in service must be isolated.

An interim assessment and report by competent persons agreed to by the Regulator based on high risk zones (hazard x use) and public safety must be completed by 1 October 2017. A full assessment and report must be completed by 1 May 2018 or prior to restart of the refinery, whichever is the earliest. The competency of the assessors must be agreed to by the Regulator.

- e. Inspection of the heavy fuel oil pipeline against the requirements of AS2885. An interim visual assessment and report must be completed by COB 1 October 2017. A full assessment and report, including the use of an "Intelligent PIG", must be completed by 1 November 2017 or prior to the restart of the refinery, whichever is the earliest. Alternatively, if the above is not complied with, an acceptable outcome is the removal of hazardous chemical inventories from this pipeline.

A copy of the reports detailed in condition 2 items a-e, must be provided to the Regulator within 5 days of being completed by QNS. All additional reports pertaining to this condition which are not directly covered in condition 2 items a-e must be provided to the Regulator by 1 January 2018 or prior to restart of the refinery, whichever is the earliest.

Any installations determined not to be able to withstand loads associated with storage or manufacturing, duty and service, or considered at risk of collapse shall be isolated from workers such that any failure of the structure and subsequent impact to adjacent structures is taken into consideration.

³ The matters to fall within the meaning of 'priority infrastructure' are to be agreed with the Regulator.

⁴ The competency of the assessor must be agreed by the Regulator, despite the definition of 'competent person' in Schedule 19 of the WHS Regulation.

Any infrastructure requiring exclusion zones shall be reported to the Regulator immediately.

Following assessments conducted under condition 2 (including items a-e), any items which require replacement, repair or reconstruction are to be subject to an Improvement Plan to be approved by the Regulator. A copy of the Improvement Plan must be provided to the Regulator within 4 weeks of QNS's receipt of the report which identifies the remedial action required. The approved Improvement Plan must be complied with and any variations to the Improvement Plan shall be reported to the Regulator immediately.

3. By 1 July 2017, QNS must provide a report to the Regulator demonstrating that QNS has and can continue to manage the risks associated with the storage of hazardous chemicals. Demonstration must include the implementation of appropriate control and mitigation measures to manage risks to health and safety so far as is reasonably practicable. Additional controls which must be included are:
 - a. Provide automatic activation of the deluge system via gas detection, with alarms reported to an occupied central location and QFES, for the ammonium hydrosulphide sphere; and
 - b. Provide, for hazardous chemicals with off-site risk potential, a monitoring and response system with alarms reported to an occupied central location and QFES.

Evidence of actions taken to reduce risk must be provided in a summary within four weeks of that assessment and a final report provided to the Regulator within six months of the assessment. If the above is not complied with, an alternative acceptable outcome is the removal of hazardous chemical inventories with offsite risk.

4. QNS must ensure all tanks and vessels containing hazardous chemicals remain isolated by double block and bleed, lock closed drain point and lock closed as close as possible to the source whilst the facility is not manufacturing.
5. QNS must supply evidence on request to the Regulator that the facility is monitored and maintained to ensure that:
 - a. building structures and supports;
 - b. plant area footings, bunds, plinths and supports;

- c. process tanks and vessels; and
 - d. pumps and pipework,
- remain in a state that does not create a risk to the health and safety of any person.

This evidence may include, but is not limited to, a plan which provides a scope of work to be done, with a proposed timeline, to maintain the above items a-d. The plan shall document the required resources (financial and workers) to conduct the activities. Evidence of work being conducted shall be provided in written reports or documentation which support the work activities and/or photographs of work completed. This evidence must be provided by 1 October 2017.

6. QNS must immediately notify the Regulator of the following events or conditions, in addition to the notification requirements specified in the *Work Health and Safety Act 2011*:
 - a. Any near miss dangerous event⁵, whether or not a person was exposed to imminent risk;
 - b. Any loss of a chemical of security concern⁶;
 - c. Any process excursion outside the designated operating envelope as determined by the equipment design;
 - d. Any activity which requires operation materially outside the standards espoused in the safety management system⁷;
 - e. Any change in operations status on site, including but not limited to:
 - i. the decision to commission/re-commission or use of equipment for any manufacturing operations at the refinery;
 - ii. the receipt of any bulk hazardous chemicals or dangerous goods to the site boundary (including, but not limited to, nitrogen and ore/ore concentrates); and
 - iii. the dispatch of any bulk hazardous chemicals or dangerous goods from the site boundary (including, but not limited to, anhydrous ammonia, sulphur, ammonium hydrosulphide, hydrogen peroxide, asbestos containing products, and metal ores, powders and concentrates).

⁵ 'Near miss dangerous event' means any sudden event that, apart from mitigating effects, actions or systems, could have escalated to a major incident.

⁶ As covered by the National Code of Practice for Chemicals of Security Concern published by the Attorney-General's Department, Canberra and available on www.nationalsecurity.gov.au

⁷ As required by s 558 of the *Work Health and Safety Regulation 2011*.

For the purposes of this condition, bulk hazardous chemicals or dangerous goods refers to quantities equalling to or exceeding 1 tonne.

7. QNS must provide evidence to the Regulator that the facility is safe to operate prior to the commencement of any manufacturing activities in any operational areas depicted in 'Map 1', and/or transfer activities through the heavy fuel oil pipeline to the site. The Regulator must be reasonably satisfied with this evidence before QNS can recommence any manufacturing activities.

Evidence to support this requirement may include, but is not limited to:

- a. training records of workers;
 - b. operating procedures and work instructions;
 - c. structural, equipment and/or asset integrity reports;
 - d. applicable risk and safety assessments;
 - e. performance standards;
 - f. developed operating envelope parameters;
 - g. plant/equipment datasheets;
 - h. employee rosters;
 - i. minimum manning studies;
 - j. plant/equipment maintenance records and schedules, and
 - k. any other evidence which supports that a safety management system is in place and will remain effective in ensuring the continual safety of workers, plant, and community.
8. QNS must provide confirmation to the Regulator on request that security measures and security fencing surrounding the site is sound and is fit for purpose. A number of the hazardous chemicals on site are identified in the National Code of Practice for Chemicals of Security Concern and the list of ninety six chemicals assessed as potential security concern.

QNS must provide evidence on request to the Regulator that Chemicals of Security Concern⁸ are securely stored to reduce the likelihood of them being stolen or diverted (see condition 3). This includes regular inventory checks, maintenance of the security fencing or other suitable barriers for securing Chemicals of Security Concern.

⁸ See "National Code of Practice for Chemicals of Security Concern" and "Ninety-six chemicals assessed as a potential security concern" published by the Attorney-General's Department, Canberra and available on www.nationalsecurity.gov.au

9. By 1 October 2017, QNS must provide the Regulator with evidence that the asbestos register for the facility has been revalidated. QNS must also by this time provide confirmation to the Regulator that the asbestos located on site (including any ore remaining or to be brought into the site) does not pose a health risk to any persons, including employees and the community.

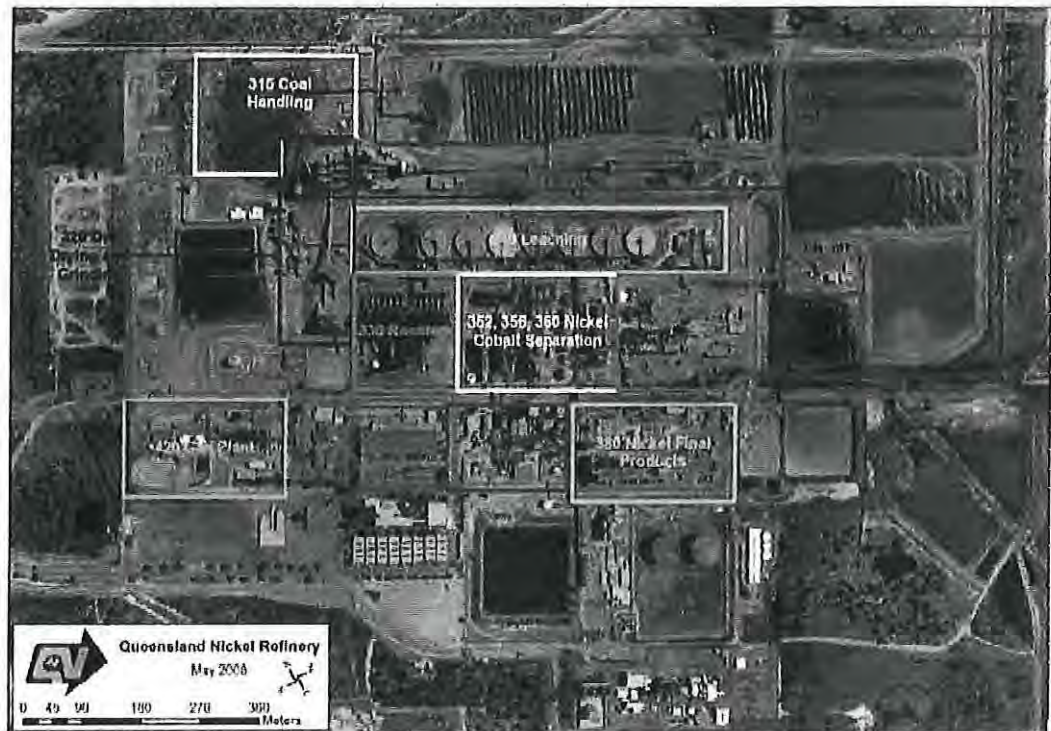


Figure 4-1: Facility and Main Processing / Storage Areas

Map 1: Operational areas - heavy fuel oil pipeline not shown

Reasons for determination

I have determined the facility as a tier 1 major hazard facility because the operational circumstances and management of the existing major hazard facility have materially changed. QNS was appointed as the operator of the facility, and activities at the facility are currently limited to storage and maintenance.

On 19 July 2016, QNS notified as the new operator of a determined major hazard facility in accordance with s 536 of the WHS Regulation.

Prior to March 2016, the facility was determined as a tier 3 major hazard facility processing schedule 15 chemicals into other products using multiple and complex processes. Post March 2016, the major hazard facility is better described as a tier 1 major hazard facility, conducting only a storage function. This change in activity has been communicated and confirmed during multiple visits by Workplace Health and Safety Queensland (WHSQ) inspectors.

The tier classification reflects the assessment complexity and the fees charged under section 583A of the WHS Regulation.

The facility still meets the definition of a major hazard facility because:

- (a) the quantity and combination of schedule 15 chemicals present or likely to be present at the facility exceed the threshold quantity, and
- (b) there is a potential for a major incident affecting the surrounding community should there be a loss of containment of schedule 15 chemicals at the facility.

Response to proposed conditions

You were provided a copy of the proposed conditions by letter dated 17 February 2017 and QNS was requested to make any formal submission on the proposed conditions by 3 March 2017 for consideration by the Regulator.

On the basis of advice that my letter dated 17 February 2017 was not received until the week of 27 February 2017, I extended the deadline to make a formal submission to 10 March 2017.

On 13 March 2017, your solicitors section 78B wrote to me regarding the proposed determination and proposed conditions. In this letter, QNS submits that the quantity of schedule 15 chemicals present or likely to be present at the facility does not exceed the threshold quantity and there is no basis for the determination. The letter also provides a submission on each of the proposed conditions.

It is my view that to date QNS has not provided sufficient evidence as to why a determination should not be made. I also consider there to be a lack of evidence provided by QNS to support any changes to the determination conditions.

Next steps

The determination takes effect on 12 April 2017 at which time QNS, as the operator of the facility, is required to comply with the requirements of Part 9.3 of the WHS Regulation and prepare a safety case in order to apply for a major hazard facility licence.

If QNS does not agree with the determination, application may be made to the Queensland Civil and Administrative Tribunal (QCAT) for an external review of the decision. The review should be applied for within 28 days of the notice of the decision.

If QNS does not agree with any or all of the conditions, application may be made to QCAT for an external review of the decision to impose any or all of the conditions. The review should be applied for within 28 days of the notice of the decision. Further information on applying for a review of an administrative decision is available on the QCAT web page at www.qcat.qld.gov.au.

QNS is further advised the following milestones must be met as the facility proceeds towards being licensed.

Licence milestone dates

- Safety case outline: <+3 months from 12 April 2017
- Licence application date: <+24 months from 12 April 2017

Further information

General information on the obligations under the WHS Regulation, including the requirements of Chapter 9 Major hazard facilities, are available at www.worksafe.qld.gov.au or by calling the WHSQ Infoline on 1300 362 128.

If you have any questions regarding this matter, please contact the Hazardous Industries and Chemicals Branch on telephone (07) 3874 7579 and ask for a Major Hazard Facilities Advisor, who will be pleased to assist you.

Yours sincerely

**Deputy Director-General
Office of Industrial Relations**



Queensland Nickel Sales Pty Ltd

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Director, Hazardous Industries and Chemicals Branch
Workplace Health and Safety Queensland
Office of Industrial Relations
Queensland Treasury

By email:

19 September 2017

“Without prejudice”

Dear ,

re: Queensland Civil and Administrative Tribunal (QCAT) Case No. GAR090-17

I refer to the proceeding of 24 August 2017 before Member Olding (QCAT) involving Queensland Nickel Sales Pty Ltd (applicant) and the Director-General, Office of Industrial Relations (respondent). It was decided during this compulsory conference the parties would seek to amend the application and scope of the Major Hazard Facility determination and its Conditions.

The subsequent meeting on 14 September 2017 in Townsville at the Yabulu refinery between representatives of QNS and OIR established grounds for reaching an agreement and this has resulted in these proposed amendments being submitted by QNS to OIR for its consideration (attached). Fundamentally, the amendments relate to a reduction in the area (footprint) to which the MHF Conditions will apply, together with revisions to the Conditions.

It is understood this proposal is the product of discussions between QNS and OIR; however, further iterations may be required to finalise the exact amendments. With this in mind, and the Directions from QCAT which specify 29 September 2017 as the date for the respondent to withdraw its application, it is requested a prompt response from OIR is provided to QNS.

If you seek further information or clarification of the documentation, please do not hesitate to contact me.

Yours sincerely,

For Queensland Nickel Sales Pty Ltd

Proposed Revised Conditions – QNS v.1

1. QNS must provide an Improvement Plan to ensure fire-fighting protection systems are and will continue to be effective on demand and be proportionate to the major incident risks. The Improvement Plan must address all identified non-conformances with relevant Australian Standards in any installed Special Fire Services¹ and firefighting protection systems for the facility, including but not limited to:
 - a) Firefighting water hydrants and plant deluge systems;
 - b) Firefighting water supply pumps;
 - c) Firefighting water ring mains; and
 - d) Ancillary firefighting equipment such as extinguishers, hoses and reels.

This Plan must be developed to the reasonable satisfaction of the Regulator and be submitted to the Regulator by COB 1 December 2017 for approval. QNS must comply with the approved improvement plan. Variations to the Improvement Plan must be approved by the Regulator.

2. QNS must ensure all tanks and vessels containing hazardous chemicals remain isolated where possible by double block and bleed, alternatively by lock-closed (drain point) or lock-closed (as close as possible to the source) whilst the facility is not manufacturing.
3. QNS must provide evidence on request to the Regulator that hazardous chemical storage areas are monitored to ensure
 - a) building structures and supports;
 - b) plant area footings, bunds, plinths and supports;
 - c) process tanks and vessels; and
 - d) pumps and pipework

remain in a structurally stable state unable to impact on the hazardous chemical storage locations. Any items which require replacement, repair or reconstruction are to be subject to an Improvement Plan to be approved by the Regulator. A copy of the Improvement Plan must be provided to the Regulator within 4 weeks of QNS's receipt of the report which identifies the remedial action required. The approved Improvement Plan must be complied with and any variations to the Improvement Plan shall be reported to the Regulator immediately.

4. QNS must immediately notify the Regulator of the following events or conditions, in addition to the notification requirements specified in the *Work Health and Safety Act 2011*:
 - a) Any near miss dangerous event², whether or not a person was exposed to imminent risk;
 - b) Any process excursion outside the designated operating envelope as determined by the equipment design;
 - c) Any activity which requires operation materially outside the standards espoused in the safety management system³;
 - d) Any change in operations status on site, including but not limited to:

¹ As detailed in the Sustainable Planning Regulation 2009, Schedule 8.

² 'Near miss dangerous event' means any sudden event that, apart from mitigating effects, actions or systems, could have escalated to a major incident.

³ As required by s 558 of the *Work Health and Safety Regulation 2011*.

- i. the decision to commission/re-commission or use of equipment for any manufacturing operations at the refinery;
- ii. the receipt of any bulk hazardous chemicals or dangerous goods to the site boundary (including, but not limited to, nitrogen and ore/ore concentrates); and
- iii. the dispatch of any bulk hazardous chemicals or dangerous goods from the site boundary (including, but not limited to, anhydrous ammonia, sulphur, ammonium hydrosulphide, hydrogen peroxide, asbestos containing products, and metal ores, powders and concentrates).

For the purposes of this Condition, bulk hazardous chemicals or dangerous goods refers to quantities equaling to or exceeding 1 tonne.

5. QNS must provide evidence to the Regulator the facility is safe to operate prior to the commencement of any manufacturing activities in any operational areas depicted in 'Map 1', and/or transfer activities through the heavy fuel oil pipeline to the site. The Regulator must be reasonably satisfied with this evidence before QNS can recommence any manufacturing activities.

Evidence to support this requirement can include, but is not limited to:

- a) Training records of workers;
- b) Operating procedures and work instructions;
- c) Structural, equipment and/or asset integrity reports
- d) Applicable risk and safety assessments;
- e) Performance standards
- f) Developed operating envelopes
- g) Plant/equipment datasheets;
- h) Employee rosters;
- i) Minimum manning studies;
- j) Plant/equipment maintenance records and schedules; and
- k) Any other evidence which supports that a safety management system is in place and will remain effective in ensuring the continual safety of workers, plant and community.

6. QNS must provide confirmation to the Regulator on request that security measures and security fencing surrounding the site is sound and is fit for purpose.
7. QNS must provide the Regulator with evidence the asbestos register for the facility has been revalidated prior to a restart of the refinery.
8. The areas at the refinery to which these Conditions applies are restricted to:

- 420 Gas Plant
- Fire water reservoir and pumping system
- Primary and secondary tailings pumps and overflow containment pits.

These are depicted on Map 1.



Map 1: Areas depicted (green) are those to which these Conditions apply.



Yabulu Nickel Refinery and Heavy Fuel Oil Pipeline

Risk Assessment Report

27 September 2017

Level 31, 12 Creek St
Brisbane QLD 4000
Australia

42574-REP-0001

www.advisian.com



Advisian

WorleyParsons Group



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Project No: 42574-REP-0001 – Yabulu Nickel Refinery and Heavy Fuel Oil Pipeline: Risk Assessment Report

Rev	Description	Author	Review	Advisian Approval	Date
A	Issued for Review				27 Sep 2017

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1 Summary

A Risk Assessment was conducted to review the proposed Queensland Nickel Sales (QNS) conditions [2] received in response to the conditions issued by the Queensland Government (Office of Industrial Relations) for Yabulu Nickel Refinery and the heavy fuel oil pipeline operated by QNS [1]. The workshop was held at the Advisian Office, 12 Creek Street, Brisbane on the 25th of September 2017. The workshop attendees had an understanding of the site current conditions and activities, and full awareness of the industry, regulatory and health, safety and security expectations.

The main outputs of the workshop are the minutes and the associated amendments raised for the QSN proposed conditions, provided in Appendix 1. The workshop reviewed a total of thirteen (13) QNS proposed conditions [2]. In summary the review of the proposed conditions concluded:

- Five (5) would potentially increase Major Accident Event (MAE) risk whereas the other eight (8) would not; and
- Five (5) were accepted, seven (7) were rejected and amendments suggested.



2 Introduction

2.1 Background

Upon determination of the major hazard facility for Yabulu Nickel Refinery and the heavy fuel oil pipeline operated by QNS, the Queensland Government (Office of Industrial Relations) issued a letter and a list of conditions that shall be accommodated by QNS on the 17th of February 2017 [1]. However, QNS responded on the 19th of September 2017 with a list of amended conditions [2]. Some amendments are related to removal of the original conditions proposed by the Queensland Government (Office of Industrial Relations) whereas others are related to changing the areas of application. The conditions proposed by both the Queensland Government (Office of Industrial Relations) and QNS are provided in Appendix 2.

2.2 Scope of the Document

The purpose of this document is to present the results of the Risk Assessment conducted to review the proposed QNS conditions received in response to the conditions issued by the Queensland Government (Office of Industrial Relations) for Yabulu Nickel Refinery and the heavy fuel oil pipeline operated by QNS.

2.3 Abbreviations / Definitions

In this document, the following apply:

Abbreviations	Meaning
HICB	Hazardous Industries and Chemicals Branch
MAE	Major Accident Event
QNS	Queensland Nickel Sales
WHSQ	Workplace Health and Safety Queensland



3 Risk Assessment Objectives

The prime objectives of the Risk Assessment were to review the proposed QNS conditions received in response to the conditions issued by the Queensland Government (Office of Industrial Relations) for the Yabulu Nickel Refinery; and to identify the technical effects of each QNS conditions.



4 Risk Assessment Scope

The Risk Assessment scope included the conditions proposed by both the Queensland Government (Office of Industrial Relations) and QNS for Yabulu Nickel Refinery and the heavy fuel oil pipeline operated by QNS [1, 2]. These conditions are provided in Appendix 2.



5 Risk Assessment Details

5.1 Meeting Details

The Risk Assessment was held at the Advisian Office, 12 Creek Street, Brisbane on the 25th of September 2017. The workshop team consisted of a range of experienced personnel. The signed attendance sheet is provided in Appendix 3.

The workshop team is listed as follow.

Name	Role	Company
	Director, Hazardous Industries and Chemicals Branch (HICB)	WHSQ
	Safety Advisor	WHSQ
	Civil / Structural Engineering Manager	Advisian
	Hydrocarbon Studies Manager	Advisian
	Materials Engineer	WorleyParsons
	Facilitator	Advisian
	Scribe	Advisian

5.2 Reference Materials

The following reference materials were available for review during the Risk Assessment and are included in Appendix 2.

Number	Date	Title
1	17 February 2017	Letter from Queensland Government (Office of Industrial Relations) to QNS and the associated Proposed Conditions for QNS
2	19 September 2017	Proposed Revised Conditions – QNS v.1



6 Risk Assessment Methodology

The Risk Assessment was carried out as follow:

- 1) Review the proposed conditions from the Queensland Government (Office of Industrial Relations) and the amended conditions from QNS.
- 2) Identify amended conditions by QNS.
- 3) Assess if the amendments are acceptable for both the Non-Chemical Storage Areas and the Chemical Storage Areas.
- 4) Assess if the amendments could increase MAE risk.
- 5) Assess if the amendments are acceptable.
- 6) Suggest amendments to the conditions which are not acceptable.
- 7) Record comments if necessary.

6.1 Minutes

The minutes were recorded using a Microsoft Excel Spreadsheet and were projected onto a screen to enable all participants to review them during the Risk Assessment.

6.2 Amendments and Close-out

The amendments raised in the Risk Assessment will be addressed and closed out by the Workplace Health and Safety Queensland (WHSQ) project team.



7 Summary of Findings

A Risk Assessment was conducted to review the proposed Queensland Nickel Sales (QNS) conditions [2] received in response to the conditions issued by the Queensland Government (Office of Industrial Relations) for Yabulu Nickel Refinery and the heavy fuel oil pipeline operated by QNS [1]. The workshop attendees had an understanding of the proposals, site current conditions and activities, and full awareness of the industry, regulatory and health, safety and security expectations.

The main outputs of the workshop are the minutes and the associated amendments raised for the QSN proposed conditions, provided in Appendix 1. The workshop reviewed a total of thirteen (13) QNS proposed conditions [2]. In summary the review of the proposed conditions concluded:

- Five (5) would potentially increase MAE risk whereas the other eight (8) would not; and
- Five (5) are accepted, seven (7) are rejected and amendments suggested.



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Queensland Government
Yabulu Nickel Refinery and Heavy
Fuel Oil Pipeline
Risk Assessment Report



Queensland Government

Appendix 1 HAZID Minutes



Proposed Condition No. (QNS No.)	Acceptable Non Chemical Areas	Acceptable Chemical Areas	Increase in MAE Risk	Accept/Reject/Amendment	Comment
No. 1 (1) Fire-Fighting Protection Systems Changes: Date from April 2017 to December 2017	Yes	Yes	No	Accept - date change only	
No 2a Integrity Surveys and Assessments Change: Has been excluded.	No	No	Yes	Rejected - Amend condition to include, "Integrity survey and assessment must be completed on all structures and supports prior to operations or uses (excluding current caretakers activities) or recommissioning of any area." Review the need to complete cyclone assessment on yearly basis prior to cyclone season.	
No 2b Corrosion Surveys and Assessments Change: Has been excluded.	No	No	Yes	Rejected - Amend condition to include, "Corrosion survey and assessment must be completed on all structures and supports prior to operation or uses (excluding current caretaker activities) or recommissioning of any area."	
No 2c Interim Assessments Change: Has been excluded.	No	No	Yes	Accept - Intent covered under condition 5.	Abandon
No 2d Electrical Equipment Change: Has been excluded.	No	No	Yes	Rejected - Amend condition to include, "provide evidence of electrical isolation."	
No 2e Heavy Fuel Oil Pipeline Change: Has been excluded.	Yes	Yes	Yes	Accept - Given the fluid conditions within the pipeline is no longer an MAE risk and is an environmental risk.	
No 3 Controls and Mitigation Measures Change: Has been excluded.	N/A	Yes	Yes	Accept - Condition has been completed. Automated activation of the deluge system via the gas detection provided. ERP updated.	Remove - has been completed - Automated activation of the deluge system via the gas detection provided. - Emergency respond plan updated



Proposed Condition No. (QNS No.)	Acceptable Non Chemical Areas	Acceptable Chemical Areas	Increase in MAE Risk	Accept/Reject/Amendment	Comment
No 4 (2) Isolation Changes: No change				Accept - no change	
No 5 (3) Monitoring and Maintenance Changes: From facility to hazardous chemical storage areas only	Yes	Yes	No	Rejected - Amend statement as "QNS must provide evidence on request to the Regulator that hazardous chemical storage areas are monitored and maintained to ensure: a) building structures and supports; b) plant area footings, bunds, plinths and supports; c) process tanks and vessels; and d) pumps and pipework remain in a structurally stable state. Structures (outside the hazardous chemical storage areas) that may impact on the hazardous chemical storage areas must be included in these monitoring and improvement plans. Any items which require replacement..."	
No 6 (4) Changes: Item b removed	Yes	Yes	No	Accept - Chemicals of security concern have been removed from the facility with the exception of Ammonium Hydrosulphide. Loss of Ammonium Hydrosulphide from sphere is covered: - Dangerous event if unplanned. - If planned is covered in item 6.e.iii (4.d.iii).	
No 7 (5) Changes: Map 1 modified - proposal is that conditions apply to only 4 areas containing hazardous materials	No	No	Yes	Rejected - Amend condition to include, "QNS must provide evidence to the Regulator that the facility is safe to operate prior to the commencement of any manufacturing activities in any operational areas", and/or transfer activities through the heavy fuel oil pipeline to the site. The Regulator must be reasonably satisfied with this evidence before QNS can recommence any manufacturing activities..."	1. Condition of other areas (outside the four nominated) is a concern. These areas need to be made safe before any change of use is made. 2. Potential for an incident in non chemical areas and escalation leading to MAE needs to be assessed.
No 8 (6) Security Measures and Security Fencing Changes: Statement in regards to the chemical of security concern removed.	No	No	Yes	Rejected - Amend condition to include, "QNS must meet or exceed the security measures contained in the Safety Case outline."	Chemicals of Security Concern covered by 6.e.iii (4.d.iii).

Proposed Condition No. (QNS No.)	Acceptable Non Chemical Areas	Acceptable Chemical Areas	Increase in MAE Risk	Accept/Reject/Amendment	Comment
No 9 (7) Asbestos Register Changes: Revalidation requirement removed.	No	No	No	Rejected - Amend condition to include, "High risk locations are to be reviewed on an annual basis by qualified person and report provided to the Regulator."	



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Queensland Government
Yabulu Nickel Refinery and Heavy
Fuel Oil Pipeline
Risk Assessment Report



Queensland Government

Appendix 2 Reference Materials



Office of
Industrial Relations

Our Ref: 3644353

17 FEB 2017

Queensland Treasury

General Manager
Queensland Nickel Sales Pty Ltd
1 Greenvale Street
YABULU QLD 4818

Dear

I refer to my letter to you advising that no determination was validly made on 19 August 2016 and that my letter to you dated 25 August 2016 is of no effect and the conditions contained in that letter do not apply.

As a result, I propose to make a fresh determination under section 542 of the *Work Health and Safety Regulation 2011* (the WHS Regulation).

The information provided to my office by Queensland Nickel Sales Pty Ltd (QNS) on 19 July 2016 confirmed that the Yabulu refinery is a facility at which schedule 15 chemicals are present in a quantity that exceeds the threshold quantity. I understand minor quantities of schedule 15 chemicals have subsequently been removed from the facility. However, the quantity of chemicals remaining onsite still exceed threshold quantities.

I propose to make a fresh determination decision and impose conditions as part of this determination. The proposed conditions on the fresh determination are enclosed for your review. The conditions are similar to those contained in my letter dated 25 August 2016. However, I note in respect to the proposed conditions as follows:

- Condition 1 now requires QNS to provide an improvement plan;
- Condition 2(a)(i) no longer includes Area 330;
- Condition 2(b) now requires an assessment to be completed by a competent person unless the Regulator approves another person as assessor;
- Condition 3, as contained in my letter dated 25 August 2016, has been removed; and
- Condition 4 no longer requires QNS to validate and provide proof (photographs and marked up P&IDs) of the isolations.

Level 11, 1 William Street Brisbane
Queensland 4000 Australia
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Queensland 4001 Australia
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WorkSafe +61 7 3247 4711
Wageline +61 7 3225 2299
Website www.worksafe.qld.gov.au
www.business.qld.gov.au

QNS should of course satisfy itself regarding the changes to the conditions and that the proposed conditions are suitable.

I will consider QNS's submissions, if any, when making my decision under section 542 and when making my decision as to the appropriateness of any conditions to be imposed under section 544. I request that any formal submission on the proposed conditions be submitted to me by 3 March 2017. The notice of determination, including final conditions, must be given within 14 days of the making of the determination decision: see section 545 of the WHS Regulation.

As the operator of the facility, QNS is eligible to apply for an external review of the decision to determine and/or impose a condition. The application for review must be made to the Queensland Civil and Administrative Tribunal. Decisions made under chapter 9 of the WHS Regulation are not eligible for internal review, and are not automatically stayed: see section 677 of the WHS Regulation.

From the date of effect of the determination, QNS is required to comply with part 9.3 of the WHS Regulation and prepare to apply for a major hazard facility licence within 24 months after the determination: see section 549 of the WHS Regulation.

Should you have any queries in relation to this matter, please contact
Executive Director, Safety, Policy and Workers' Compensation Services, Office of Industrial Relations, on (07)

Yours sincerely

**Deputy Director-General
Office of Industrial Relations**

Encl.

Proposed Conditions for QNS:

The following conditions shall apply to the determination of the major hazard facility, within the area depicted in Map 1, and to the heavy fuel oil pipeline operated by QNS.

1. QNS must provide an improvement plan to ensure fire-fighting protection systems are and will continue to be effective on demand and be proportionate to the major incident risks. The improvement plan must address all identified non-conformances with relevant Australian Standards in any installed Special Fire Services¹ and firefighting protection systems for the facility, including but not limited to:
 - a. Firefighting water hydrants and plant deluge systems;
 - b. Firefighting water supply pumps;
 - c. Firefighting water ring mains; and
 - d. Ancillary firefighting equipment such as extinguishers, hoses and reels.

This plan must be developed to the reasonable satisfaction of the Regulator and be submitted to the Regulator by COB 12 April 2017 for his approval. QNS must comply with the approved improvement plan. Variations to the improvement plan must be approved by the Regulator.

2. QNS must engage competent persons² to conduct assessments and reports for all plant, vessels, tanks, pipework and buildings located at the refinery and the heavy fuel oil pipeline to the port to demonstrate these items are structurally stable, suitable for storage or manufacturing loads, duty and service, and will not collapse during service, storage or high wind load events. These assessments shall include, but are not limited to:
 - a. Integrity surveys and assessments of all concrete structures and supports within the refinery, including but not limited to:
 - i. Area 320 and 514 concrete stacks (see Map 1); and
 - ii. Building and plant area footings, bunds, plinths and supports.

Unless the Regulator has given prior written approval of a person to be an assessor, these assessments must be completed by a competent person who is an independent third party. The assessments and report must be completed by COB 1 May 2017. QNS must address any recommendations in a timely manner but not later than COB 1 October 2017.

- b. Corrosion surveys and assessments of all fixed infrastructure, including but not limited to:

¹ As detailed in the Sustainable Planning Regulation 2009, Schedule 8

² All references to competent persons refer to WHS Regulation, Schedule 19, definition of 'competent person' paragraph (g) or otherwise specified under applicable law. Note the Professional Engineers Act 2002 requires any professional engineering service to be provided by or under the supervision of a Registered Professional Engineer of Queensland. See: section 115. A professional engineering service includes the identification of relevant standards and assessment criteria where not prescribed by law. In some instances, the inspections or repairs must be carried out by licenced persons.

- i. building structures and supports;
- ii. process tanks and vessel;
- iii. pumps and pipework; and
- iv. pipelines.

Unless the Regulator has given prior written approval of a person to be an assessor, this assessment must be completed by a competent person who is an independent third party. This assessment and report must be completed by COB 1 May 2017. QNS must address any recommendations in a timely manner but not later than COB 1 October 2017.

- c. An interim assessment and report of priority infrastructure³ (vessels and tanks containing hazardous chemicals) must be completed by 1 May 2017 and provided to the Regulator. The final assessment and report must be completed by 1 July 2017 or prior to restart of the refinery, whichever is the earliest. The competency of the assessors must be agreed by the Regulator⁴.
- d. Inspection of all electrical equipment in service on site. Electrical equipment not in service must be isolated.

An interim assessment and report by competent persons agreed to by the Regulator based on high risk zones (hazard x use) and public safety must be completed by 1 October 2017. A full assessment and report must be completed by 1 May 2018 or prior to restart of the refinery, whichever is the earliest. The competency of the assessors must be agreed to by the Regulator.

- e. Inspection of the heavy fuel oil pipeline against the requirements of AS2885. An interim visual assessment and report must be completed by COB 1 October 2017. A full assessment and report, including the use of an "Intelligent PIG", must be completed by 1 November 2017 or prior to the restart of the refinery, whichever is the earliest. Alternatively, if the above is not complied with, an acceptable outcome is the removal of hazardous chemical inventories from this pipeline.

A copy of the reports detailed in condition 2 items a-e, must be provided to the Regulator within 5 days of being completed by QNS. All additional reports pertaining to this condition which are not directly covered in condition 2 items a-e must be provided to the Regulator by 1 January 2018 or prior to restart of the refinery, whichever is the earliest.

Any installations determined not to be able to withstand loads associated with storage or manufacturing, duty and service, or considered at risk of collapse shall be isolated from workers such that any failure of the structure and subsequent impact to adjacent structures is taken into consideration. Any infrastructure requiring exclusion zones shall be reported to the Regulator immediately.

³ The matters to fall within the meaning of 'priority infrastructure' are to be agreed with the Regulator.

⁴ The competency of the assessor must be agreed by the Regulator, despite the definition of 'competent person' in Schedule 19 of the WHS Regulation.

Following assessments conducted under condition 2 (including items a-e), any items which require replacement, repair or reconstruction are to be subject to an Improvement Plan to be approved by the Regulator. A copy of the Improvement Plan must be provided to the Regulator within 4 weeks of QNS's receipt of the report which identifies the remedial action required. The approved Improvement Plan must be complied with and any variations to the Improvement Plan shall be reported to the Regulator immediately.

3. By 1 July 2017, QNS must provide a report to the Regulator demonstrating that QNS has and can continue to manage the risks associated with the storage of hazardous chemicals. Demonstration must include the implementation of appropriate control and mitigation measures to manage risks to health and safety so far as is reasonably practicable. Additional controls which must be included are:
 - a. Provide automatic activation of the deluge system via gas detection, with alarms reported to an occupied central location and QFES, for the ammonium hydrosulphide sphere; and
 - b. Provide, for hazardous chemicals with off-site risk potential, a monitoring and response system with alarms reported to an occupied central location and QFES.

Evidence of actions taken to reduce risk must be provided in a summary within four weeks of that assessment and a final report provided to the Regulator within six months of the assessment. If the above is not complied with, an alternative acceptable outcome is the removal of hazardous chemical inventories with offsite risk.

4. QNS must ensure all tanks and vessels containing hazardous chemicals remain isolated by double block and bleed, lock closed drain point and lock closed as close as possible to the source whilst the facility is not manufacturing.
5. QNS must supply evidence on request to the Regulator that the facility is monitored and maintained to ensure that:
 - a. building structures and supports;
 - b. plant area footings, bunds, plinths and supports;
 - c. process tanks and vessels; and
 - d. pumps and pipework,

remain in a state that does not create a risk to the health and safety of any person.

This evidence may include, but is not limited to, a plan which provides a scope of work to be done, with a proposed timeline, to maintain the above items a-d. The plan shall document the required resources (financial and workers) to conduct the activities. Evidence of work being conducted shall be provided in written reports or documentation which support the work activities and/or photographs of work completed. This evidence must be provided by 1 October 2017.

6. QNS must immediately notify the Regulator of the following events or conditions, in addition to the notification requirements specified in the *Work Health and Safety Act 2011*:

- a. Any near miss dangerous event⁵, whether or not a person was exposed to imminent risk;
- b. Any loss of a chemical of security concern⁶;
- c. Any process excursion outside the designated operating envelope as determined by the equipment design;
- d. Any activity which requires operation materially outside the standards espoused in the safety management system⁷;
- e. Any change in operations status on site, including but not limited to:
 - i. The decision to commission/re-commission or use of equipment for any manufacturing operations at the refinery;
 - ii. the receipt of any bulk hazardous chemicals or dangerous goods to the site boundary (including, but not limited to, nitrogen and ore/ore concentrates); and
 - iii. the dispatch of any bulk hazardous chemicals or dangerous goods from the site boundary (including, but not limited to, anhydrous ammonia, sulphur, ammonium hydrosulphide, hydrogen peroxide, asbestos containing products, and metal ores, powders and concentrates).

For the purposes of this condition, bulk hazardous chemicals or dangerous goods refers to quantities equalling to or exceeding 1 tonne.

7. QNS must provide evidence to the Regulator that the facility is safe to operate prior to the commencement of any manufacturing activities in any operational areas depicted in 'Map 1', and/or transfer activities through the heavy fuel oil pipeline to the site. The Regulator must be reasonably satisfied with this evidence before QNS can recommence any manufacturing activities.

Evidence to support this requirement may include, but is not limited to:

- a. training records of workers;
- b. operating procedures and work instructions;
- c. structural, equipment and/or asset integrity reports;
- d. applicable risk and safety assessments;
- e. performance standards;
- f. developed operating envelope parameters;
- g. plant/equipment datasheets;
- h. employee rosters;
- i. minimum manning studies;

⁵ 'Near miss dangerous event' means any sudden event that, apart from mitigating effects, actions or systems, could have escalated to a major incident.

⁶ As covered by the National Code of Practice for Chemicals of Security Concern published by the Attorney-General's Department, Canberra and available on www.nationalsecurity.gov.au

⁷ As required by s 558 of the *Work Health and Safety Regulation 2011*

- j. plant/equipment maintenance records and schedules, and
 - k. any other evidence which supports that a safety management system is in place and will remain effective in ensuring the continual safety of workers, plant, and community.
8. QNS must provide confirmation to the Regulator on request that security measures and security fencing surrounding the site is sound and is fit for purpose. A number of the hazardous chemicals on site are identified in the National Code of Practice for Chemicals of Security Concern and the list of ninety six chemicals assessed as potential security concern.
- QNS must provide evidence on request to the Regulator that Chemicals of Security Concern⁸ are securely stored to reduce the likelihood of them being stolen or diverted (see condition 3). This includes regular inventory checks, maintenance of the security fencing or other suitable barriers for securing Chemicals of Security Concern.
9. By 1 October 2017, QNS must provide the Regulator with evidence that the asbestos register for the facility has been revalidated. QNS must also by this time provide confirmation to the Regulator that the asbestos located on site (including any ore remaining or to be brought into the site) does not pose a health risk to any persons, including employees and the community.



Figure 4-1: Facility and Main Processing / Storage Areas

Map 1: Operational areas - heavy fuel oil pipeline not shown

⁸ See "National Code of Practice for Chemicals of Security Concern" and "Ninety six chemicals assessed as a potential security concern" published by the Attorney-General's Department, Canberra and available on www.nationalsecurity.gov.au

Proposed Revised Conditions – QNS v.1

1. QNS must provide an Improvement Plan to ensure fire-fighting protection systems are and will continue to be effective on demand and be proportionate to the major incident risks. The Improvement Plan must address all identified non-conformances with relevant Australian Standards in any installed Special Fire Services¹ and firefighting protection systems for the facility, including but not limited to:
 - a) Firefighting water hydrants and plant deluge systems;
 - b) Firefighting water supply pumps;
 - c) Firefighting water ring mains; and
 - d) Ancillary firefighting equipment such as extinguishers, hoses and reels.

This Plan must be developed to the reasonable satisfaction of the Regulator and be submitted to the Regulator by COB 1 December 2017 for approval. QNS must comply with the approved improvement plan. Variations to the Improvement Plan must be approved by the Regulator.

2. QNS must ensure all tanks and vessels containing hazardous chemicals remain isolated where possible by double block and bleed, alternatively by lock-closed (drain point) or lock-closed (as close as possible to the source) whilst the facility is not manufacturing.
3. QNS must provide evidence on request to the Regulator that hazardous chemical storage areas are monitored to ensure
 - a) building structures and supports;
 - b) plant area footings, bunds, plinths and supports;
 - c) process tanks and vessels; and
 - d) pumps and pipework

remain in a structurally stable state unable to impact on the hazardous chemical storage locations. Any items which require replacement, repair or reconstruction are to be subject to an Improvement Plan to be approved by the Regulator. A copy of the Improvement Plan must be provided to the Regulator within 4 weeks of QNS's receipt of the report which identifies the remedial action required. The approved Improvement Plan must be complied with and any variations to the Improvement Plan shall be reported to the Regulator immediately.

4. QNS must immediately notify the Regulator of the following events or conditions, in addition to the notification requirements specified in the *Work Health and Safety Act 2011*:
 - a) Any near miss dangerous event², whether or not a person was exposed to imminent risk;
 - b) Any process excursion outside the designated operating envelope as determined by the equipment design;
 - c) Any activity which requires operation materially outside the standards espoused in the safety management system³;
 - d) Any change in operations status on site, including but not limited to:

¹ As detailed in the Sustainable Planning Regulation 2009, Schedule 8.

² 'Near miss dangerous event' means any sudden event that, apart from mitigating effects, actions or systems, could have escalated to a major incident.

³ As required by s 558 of the *Work Health and Safety Regulation 2011*.

- i. the decision to commission/re-commission or use of equipment for any manufacturing operations at the refinery;
- ii. the receipt of any bulk hazardous chemicals or dangerous goods to the site boundary (including, but not limited to, nitrogen and ore/ore concentrates); and
- iii. the dispatch of any bulk hazardous chemicals or dangerous goods from the site boundary (including, but not limited to, anhydrous ammonia, sulphur, ammonium hydrosulphide, hydrogen peroxide, asbestos containing products, and metal ores, powders and concentrates).

For the purposes of this Condition, bulk hazardous chemicals or dangerous goods refers to quantities equaling to or exceeding 1 tonne.

5. QNS must provide evidence to the Regulator the facility is safe to operate prior to the commencement of any manufacturing activities in any operational areas depicted in 'Map 1', and/or transfer activities through the heavy fuel oil pipeline to the site. The Regulator must be reasonably satisfied with this evidence before QNS can recommence any manufacturing activities.

Evidence to support this requirement can include, but is not limited to:

- a) Training records of workers;
- b) Operating procedures and work instructions;
- c) Structural, equipment and/or asset integrity reports
- d) Applicable risk and safety assessments;
- e) Performance standards
- f) Developed operating envelopes
- g) Plant/equipment datasheets;
- h) Employee rosters;
- i) Minimum manning studies;
- j) Plant/equipment maintenance records and schedules; and
- k) Any other evidence which supports that a safety management system is in place and will remain effective in ensuring the continual safety of workers, plant and community.

6. QNS must provide confirmation to the Regulator on request that security measures and security fencing surrounding the site is sound and is fit for purpose.
7. QNS must provide the Regulator with evidence the asbestos register for the facility has been revalidated prior to a restart of the refinery.
8. The areas at the refinery to which these Conditions applies are restricted to:

- 420 Gas Plant
- Fire water reservoir and pumping system
- Primary and secondary tailings pumps and overflow containment pits.

These are depicted on Map 1.



Map 1: Areas depicted (green) are those to which these Conditions apply.



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Queensland Government
Yabulu Nickel Refinery and Heavy
Fuel Oil Pipeline
Risk Assessment Report



Queensland Government

Appendix 3 Attendance



Meeting Attendance Record

Date 25/09/2017
Meeting topic Yabulu Nickel Refinery and Heavy Fuel Oil Pipeline Risk Assessment
Facilitated by
Venue Level 31, 12 Creek St, Diversity Room

NAME	SIGNATURE	POSITION	COMPANY / EMAIL
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DISTRIBUTION

- | | |
|--|---|
| <input type="checkbox"/> Personnel Manager | <input type="checkbox"/> Other (please specify) |
| | <input type="checkbox"/> Other (please specify) |

Proposed Conditions – QNS Review v3:

1. QNS must provide an Improvement Plan to ensure fire-fighting protection systems are and will continue to be effective on demand and be proportionate to the major incident risks. The Improvement Plan must address all identified non-conformances with relevant Australian Standards in any installed Special Fire Services¹ and firefighting protection systems for the facility, including but not limited to:
 - a) firefighting water hydrants and plant deluge systems;
 - b) firefighting water supply pumps;
 - c) firefighting water ring mains; and
 - d) ancillary firefighting equipment such as extinguishers, hoses and reels.

This Plan must be developed to the reasonable satisfaction of the Regulator and be submitted to the Regulator by COB 1 December 2017 for approval. QNS must comply with the approved Improvement Plan. Variations to the Improvement Plan must be approved by the Regulator.

2. QNS must ensure all tanks and vessels containing hazardous chemicals remain isolated by double block and bleed, alternatively by lock-closed (drain point), or by lock-closed (as close as possible to the source) whilst the facility is not manufacturing.
3. QNS must provide evidence on request to the Regulator that hazardous chemical storage areas are monitored and maintained to ensure:
 - a) building structures and supports;
 - b) plant area footings, bunds, plinths and supports;
 - c) process tanks and vessels; and
 - d) pumps and pipework

remain in a structurally stable state. Structures (outside the hazardous chemical storage areas) which may impact² on the hazardous chemical storage locations must be included in the monitoring and Improvement Plans. Any items which require replacement, repair or reconstruction are to be subject to an Improvement Plan to be approved by the Regulator. A copy of the Improvement Plan must be provided to the Regulator within 4 weeks of QNS's receipt of the report which identifies the remedial action required. The approved Improvement Plan must be complied with and any variations to the Improvement Plan shall be reported to the Regulator immediately.

4. QNS must immediately notify the Regulator of the following events or conditions, in addition to the notification requirements specified in the Work Health and Safety Act 2011:
 - a) any near miss dangerous event³, whether or not a person was exposed to imminent risk;
 - b) any process excursion outside the designated operating envelope as determined by the equipment design;
 - c) any activity which requires operation materially outside the standards espoused in the safety management system⁴;

¹ As detailed in the Sustainable Planning Regulation 2009, Schedule 8

² Impact distance is defined as 1.5 times the height of the structure.

³ 'Near miss dangerous event' means any sudden event that, apart from mitigating effects, actions or systems, could have escalated to a major incident.

⁴ As required by s 558 of the *Work Health and Safety Regulation 2011*.

d) any change in operations status on site, including but not limited to:

- i. the decision to commission/re-commission or use of equipment for any manufacturing operations at the refinery;
- ii. the receipt of any bulk hazardous chemicals or dangerous goods to the site boundary (including, but not limited to, nitrogen and ore/ore concentrates); and
- iii. the dispatch of any bulk hazardous chemicals or dangerous goods from the site boundary (including, but not limited to, anhydrous ammonia, sulphur, ammonium hydrosulphide, hydrogen peroxide, asbestos containing products, and metal ores, powders and concentrates).

For the purposes of this condition, bulk hazardous chemicals or dangerous goods refers to quantities equalling to, or exceeding, 1 tonne.

5. QNS must provide evidence to the Regulator that the facility is safe to operate prior to the recommissioning or commencement of any manufacturing activities and/or transfer activities through the heavy fuel oil pipeline to the site. The Regulator must be reasonably satisfied with this evidence before QNS can recommence activities outside of care & maintenance and/or recommissioning/manufacturing.

Evidence to support this requirement may include, but is not limited to:

- a) training records of workers;
- b) operating procedures and work instructions;
- c) applicable risk and safety assessments;
- d) performance standards;
- e) developed operating envelopes;
- f) plant/equipment datasheets;
- g) employee rosters;
- h) minimum manning studies;
- i) plant/equipment maintenance records and schedules;
- j) integrity surveys and assessments of structures and supports
- k) corrosion surveys and assessments of building structures and supports, process tanks and vessels, pipelines, pumps and pipework; and
- l) any other evidence which supports a safety management system is in place and will remain effective in ensuring the continual safety of workers, plant and community.

6. QNS must meet or exceed the security measures contained in the Safety Case Outline.
7. QNS must provide the Regulator with evidence the asbestos register for the facility has been revalidated prior to a restart of the refinery. High risk asbestos locations are to be reviewed on an annual basis by a qualified person and a report provided to the Regulator.



Yabulu Nickel Refinery and Heavy Fuel Oil Pipeline

Risk Assessment Report

3rd October 2017

Level 31, 12 Creek St
Brisbane QLD 4000
Australia

42574-REP-0001

www.advisian.com



Advisian

WorleyParsons Group



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Project No: 42574-REP-0001 – Yabulu Nickel Refinery and Heavy Fuel Oil Pipeline: Risk Assessment Report

Rev	Description	Author	Review	Advisian Approval	Date
0	Issued for Use				3rd Oct 2017

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1 Summary

A Risk Assessment was conducted to review the Queensland Nickel Sales (QNS) proposed amendments [2] to conditions issued by the Queensland Government (Office of Industrial Relations) for Yabulu Nickel Refinery and the heavy fuel oil pipeline operated by QNS [1]. The workshop was held at the Advisian Office, 12 Creek Street, Brisbane on the 25th of September 2017. The workshop attendees had an understanding of the site current conditions and activities, and full awareness of the industry, regulatory and health, safety and security expectations.

The main outputs of the workshop are the minutes and the associated amendments raised for the QNS proposed conditions, provided in Appendix 1. The workshop reviewed a total of thirteen (13) QNS proposed conditions [2]. In summary the review of the proposed conditions concluded:

- Five (5) would potentially increase Major Accident Event (MAE) risk whereas the other eight (8) would not; and
- Five (5) were accepted, seven (7) were rejected and amendments suggested.

It was identified during the review that some of the proposed changes suggested by QNS are consistent with the original conditions stipulated during the determination process of the Yabulu refinery, with the exception in some instances of new dates being set mandating when the conditions must be met by. This was applicable to Conditions 1 and 4(2). In these instances, the review team deemed the proposed QNS changes to the conditions to be acceptable and unlikely to significantly increase potential risk to site personnel or the community.

The review team also agreed with QNS's proposal to remove other conditions on the basis that:

- QNS had completed relevant activities which appeared to meet the intent of the original condition (Condition 3, 6(4)).
- The pipeline is unlikely to generate an MAE (Condition 2e).

However the remaining proposed changes to the conditions put forward by QNS were assessed and rejected due to their potential to introduce an unacceptable MAE risk. Suggested amendments to QNS's proposed conditions were developed as part of this review, included in Appendix 1.



2 Introduction

2.1 Background

The Queensland Government (Office of Industrial Relations) issued a letter on the 17th of February 2017 [1] to QNS, reporting that the Yabulu Nickel Refinery and the heavy fuel oil pipeline were determined as a major hazard facility. This letter also provided a list of conditions that shall be accommodated by QNS, as operator of this site. QNS responded on the 19th of September 2017 with a list of amended conditions [2]. Some amendments are related to removal of the original conditions proposed by the Queensland Government (Office of Industrial Relations) whereas others are related to changing the areas of application. The conditions proposed by both the Queensland Government (Office of Industrial Relations) and QNS are provided in Appendix 2.

2.2 Scope of the Document

The purpose of this document is to present the results of the Risk Assessment conducted to review the proposed QNS conditions received in response to the conditions issued by the Queensland Government (Office of Industrial Relations) for Yabulu Nickel Refinery and the heavy fuel oil pipeline operated by QNS.

2.3 Abbreviations / Definitions

In this document, the following apply:

Abbreviations	Meaning
HICB	Hazardous Industries and Chemicals Branch
MAE	Major Accident Event
QNS	Queensland Nickel Sales
WHSQ	Workplace Health and Safety Queensland



3 Risk Assessment Objectives

The prime objective of the Risk Assessment was to review the proposed QNS amendments against the conditions issued by the Queensland Government (Office of Industrial Relations) for the Yabulu Nickel Refinery and included the assessment of technical effects introduced in the event that the QNS proposals are accepted.



4 Risk Assessment Scope

The Risk Assessment scope included the conditions proposed by both the Queensland Government (Office of Industrial Relations) and QNS for Yabulu Nickel Refinery and the heavy fuel oil pipeline operated by QNS [1, 2]. These conditions are provided in Appendix 2.



5 Risk Assessment Details

5.1 Meeting Details

The Risk Assessment was held at the Advisian Office, 12 Creek Street, Brisbane on the 25th of September 2017. The workshop team consisted of a range of experienced personnel. The signed attendance sheet is provided in Appendix 3.

The workshop team is listed as follow.

Name	Role	Company
	Director, Hazardous Industries and Chemicals Branch (HICB)	WHSQ
	Senior Safety Advisor (Major Hazards)	WHSQ
	Civil / Structural Engineering Manager	Advisian
	Hydrocarbon Studies Manager	Advisian
	Materials Engineer	WorleyParsons
	Facilitator	Advisian
	Scribe	Advisian

5.2 Reference Materials

The following reference materials were available for review during the Risk Assessment and are included in Appendix 2.

Number	Date	Title
1	17 February 2017	Letter from Queensland Government (Office of Industrial Relations) to QNS and the associated Proposed Conditions for QNS
2	19 September 2017	Proposed Revised Conditions – QNS v.1



6 Risk Assessment Methodology

The Risk Assessment was carried out as follow:

- 1) Review the proposed conditions from the Queensland Government (Office of Industrial Relations) and the amended conditions from QNS.
- 2) Identify amended conditions by QNS.
- 3) Assess if the amendments are acceptable for both the Non-Chemical Storage Areas and the Chemical Storage Areas.
- 4) Assess if the amendments could increase MAE risk.
- 5) Assess if the amendments are acceptable.
- 6) Suggest amendments to the conditions which are not acceptable.
- 7) Record comments if necessary.

6.1 Minutes

The minutes were recorded using a Microsoft Excel Spreadsheet and were projected onto a screen to enable all participants to review them during the Risk Assessment.

6.2 Amendments and Close-out

The amendments raised in the Risk Assessment will be addressed and closed out by the Workplace Health and Safety Queensland (WHSQ) project team.



7 Summary of Findings

A Risk Assessment was conducted to review the proposed Queensland Nickel Sales (QNS) conditions [2] received in response to the conditions issued by the Queensland Government (Office of Industrial Relations) for Yabulu Nickel Refinery and the heavy fuel oil pipeline operated by QNS [1]. The workshop attendees had an understanding of the proposals, site current conditions and activities, and full awareness of the industry, regulatory and health, safety and security expectations.

The main outputs of the workshop are the minutes and the associated amendments raised for the QSN proposed conditions, provided in Appendix 1. The workshop reviewed a total of thirteen (13) QNS proposed conditions [2]. In summary the review of the proposed conditions concluded:

- Five (5) would potentially increase MAE risk whereas the other eight (8) would not; and
- Five (5) are accepted, seven (7) are rejected and amendments suggested.

It was identified during the review that some of the proposed changes suggested by QNS are consistent with the original conditions stipulated during the determination process of the Yabulu refinery, with the exception in some instances of new dates being set mandating when the conditions must be met by. This was applicable to Conditions 1 and 4(2). In these instances, the review team deemed the proposed QNS changes to the conditions to be acceptable and unlikely to significantly increase potential risk to site personnel or the community.

The review team also agreed with QNS's proposal to remove other conditions on the basis that:

- QNS had completed relevant activities which appeared to meet the intent of the original condition (Condition 3, 6(4)).
- The pipeline is unlikely to generate an MAE (Condition 2e).

However the remaining proposed changes to the conditions put forward by QNS were assessed and rejected due to their potential to introduce an unacceptable MAE risk. Suggested amendments to QNS's proposed conditions were developed as part of this review, included in Appendix 1.



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Appendix 1 HAZID Minutes



Proposed Condition No. (QNS No.)	Acceptable Non Chemical Areas	Acceptable Chemical Areas	Increase in MAE Risk	Accept/Reject/Amendment	Comment
No. 1 (1) Fire-Fighting Protection Systems Changes: Date from April 2017 to December 2017	Yes	Yes	No	Accept - date change only	
No 2a Integrity Surveys and Assessments Change: Has been excluded.	No	No	Yes	Rejected - Amend condition to include, "Integrity survey and assessment must be completed on all structures and supports prior to operations or uses (excluding current caretakers activities) or recommissioning of any area." Review the need to complete cyclone assessment on yearly basis prior to cyclone season.	
No 2b Corrosion Surveys and Assessments Change: Has been excluded.	No	No	Yes	Rejected - Amend condition to include, "Corrosion survey and assessment must be completed on all structures and supports prior to operation or uses (excluding current caretaker activities) or recommissioning of any area."	
No 2c Interim Assessments Change: Has been excluded.	No	No	Yes	Accept - Intent covered under condition 5.	Abandon
No 2d Electrical Equipment Change: Has been excluded.	No	No	Yes	Rejected - Amend condition to include, "provide evidence of electrical isolation."	
No 2e Heavy Fuel Oil Pipeline Change: Has been excluded.	Yes	Yes	Yes	Accept - Given the fluid conditions within the pipeline is no longer an MAE risk and is an environmental risk.	
No 3 Controls and Mitigation Measures Change: Has been excluded.	N/A	Yes	Yes	Accept - Condition has been completed. Automated activation of the deluge system via the gas detection provided. ERP updated.	Remove - has been completed - Automated activation of the deluge system via the gas detection provided. - Emergency respond plan updated



Proposed Condition No. (QNS No.)	Acceptable Non Chemical Areas	Acceptable Chemical Areas	Increase in MAE Risk	Accept/Reject/Amendment	Comment
No 4 (2) Isolation Changes: No change				Accept - no change	
No 5 (3) Monitoring and Maintenance Changes: From facility to hazardous chemical storage areas only	Yes	Yes	No	Rejected - Amend statement as "QNS must provide evidence on request to the Regulator that hazardous chemical storage areas are monitored and maintained to ensure: a) building structures and supports; b) plant area footings, bunds, plinths and supports; c) process tanks and vessels; and d) pumps and pipework remain in a structurally stable state. Structures (outside the hazardous chemical storage areas) that may impact on the hazardous chemical storage areas must be included in these monitoring and improvement plans. Any items which require replacement..."	
No 6 (4) Changes: Item b removed	Yes	Yes	No	Accept - Chemicals of security concern have been removed from the facility with the exception of Ammonium Hydrosulphide. Loss of Ammonium Hydrosulphide from sphere is covered: - Dangerous event if unplanned. - If planned is covered in item 6.e.iii (4.d.iii).	
No 7 (5) Changes: Map 1 modified - proposal is that conditions apply to only 4 areas containing hazardous materials	No	No	Yes	Rejected - Amend condition to include, "QNS must provide evidence to the Regulator that the facility is safe to operate prior to the commencement of any manufacturing activities in any operational areas", and/or transfer activities through the heavy fuel oil pipeline to the site. The Regulator must be reasonably satisfied with this evidence before QNS can recommence any manufacturing activities..."	1. Condition of other areas (outside the four nominated) is a concern. These areas need to be made safe before any change of use is made. 2. Potential for an incident in non chemical areas and escalation leading to MAE needs to be assessed.
No 8 (6) Security Measures and Security Fencing Changes: Statement in regards to the chemical of security concern removed.	No	No	Yes	Rejected - Amend condition to include, "QNS must meet or exceed the security measures contained in the Safety Case outline."	Chemicals of Security Concern covered by 6.e.iii (4.d.iii).

Proposed Condition No. (QNS No.)	Acceptable Non Chemical Areas	Acceptable Chemical Areas	Increase in MAE Risk	Accept/Reject/Amendment	Comment
No 9 (7) Asbestos Register Changes: Revalidation requirement removed.	No	No	No	Rejected - Amend condition to include, "High risk locations are to be reviewed on an annual basis by qualified person and report provided to the Regulator."	



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Queensland Government
Yabulu Nickel Refinery and Heavy
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Risk Assessment Report



Queensland Government

Appendix 2 Reference Materials



Office of
Industrial Relations

Our Ref: 3644353

17 FEB 2017

Queensland Treasury

General Manager
Queensland Nickel Sales Pty Ltd
1 Greenvale Street
YABULU QLD 4818

Dear

I refer to my letter to you advising that no determination was validly made on 19 August 2016 and that my letter to you dated 25 August 2016 is of no effect and the conditions contained in that letter do not apply.

As a result, I propose to make a fresh determination under section 542 of the *Work Health and Safety Regulation 2011* (the WHS Regulation).

The information provided to my office by Queensland Nickel Sales Pty Ltd (QNS) on 19 July 2016 confirmed that the Yabulu refinery is a facility at which schedule 15 chemicals are present in a quantity that exceeds the threshold quantity. I understand minor quantities of schedule 15 chemicals have subsequently been removed from the facility. However, the quantity of chemicals remaining onsite still exceed threshold quantities.

I propose to make a fresh determination decision and impose conditions as part of this determination. The proposed conditions on the fresh determination are enclosed for your review. The conditions are similar to those contained in my letter dated 25 August 2016. However, I note in respect to the proposed conditions as follows:

- Condition 1 now requires QNS to provide an improvement plan;
- Condition 2(a)(i) no longer includes Area 330;
- Condition 2(b) now requires an assessment to be completed by a competent person unless the Regulator approves another person as assessor;
- Condition 3, as contained in my letter dated 25 August 2016, has been removed; and
- Condition 4 no longer requires QNS to validate and provide proof (photographs and marked up P&IDs) of the isolations.

Level 11, 1 William Street Brisbane
Queensland 4000 Australia
GPO Box 69 Brisbane
Queensland 4001 Australia
Telephone 13 QGOV (13 74 68)
WorkSafe +61 7 3247 4711
Wageline +61 7 3225 2299
Website www.worksafe.qld.gov.au
www.business.qld.gov.au

QNS should of course satisfy itself regarding the changes to the conditions and that the proposed conditions are suitable.

I will consider QNS's submissions, if any, when making my decision under section 542 and when making my decision as to the appropriateness of any conditions to be imposed under section 544. I request that any formal submission on the proposed conditions be submitted to me by 3 March 2017. The notice of determination, including final conditions, must be given within 14 days of the making of the determination decision: see section 545 of the WHS Regulation.

As the operator of the facility, QNS is eligible to apply for an external review of the decision to determine and/or impose a condition. The application for review must be made to the Queensland Civil and Administrative Tribunal. Decisions made under chapter 9 of the WHS Regulation are not eligible for internal review, and are not automatically stayed: see section 677 of the WHS Regulation.

From the date of effect of the determination, QNS is required to comply with part 9.3 of the WHS Regulation and prepare to apply for a major hazard facility licence within 24 months after the determination: see section 549 of the WHS Regulation.

Should you have any queries in relation to this matter, please contact
Executive Director, Safety, Policy and Workers' Compensation Services, Office of Industrial Relations, on (07)

Yours sincerely

**Deputy Director-General
Office of Industrial Relations**

Encl.

Proposed Conditions for QNS:

The following conditions shall apply to the determination of the major hazard facility, within the area depicted in Map 1, and to the heavy fuel oil pipeline operated by QNS.

1. QNS must provide an improvement plan to ensure fire-fighting protection systems are and will continue to be effective on demand and be proportionate to the major incident risks. The improvement plan must address all identified non-conformances with relevant Australian Standards in any installed Special Fire Services¹ and firefighting protection systems for the facility, including but not limited to:
 - a. Firefighting water hydrants and plant deluge systems;
 - b. Firefighting water supply pumps;
 - c. Firefighting water ring mains; and
 - d. Ancillary firefighting equipment such as extinguishers, hoses and reels.

This plan must be developed to the reasonable satisfaction of the Regulator and be submitted to the Regulator by COB 12 April 2017 for his approval. QNS must comply with the approved improvement plan. Variations to the improvement plan must be approved by the Regulator.

2. QNS must engage competent persons² to conduct assessments and reports for all plant, vessels, tanks, pipework and buildings located at the refinery and the heavy fuel oil pipeline to the port to demonstrate these items are structurally stable, suitable for storage or manufacturing loads, duty and service, and will not collapse during service, storage or high wind load events. These assessments shall include, but are not limited to:
 - a. Integrity surveys and assessments of all concrete structures and supports within the refinery, including but not limited to:
 - i. Area 320 and 514 concrete stacks (see Map 1); and
 - ii. Building and plant area footings, bunds, plinths and supports.

Unless the Regulator has given prior written approval of a person to be an assessor, these assessments must be completed by a competent person who is an independent third party. The assessments and report must be completed by COB 1 May 2017. QNS must address any recommendations in a timely manner but not later than COB 1 October 2017.

- b. Corrosion surveys and assessments of all fixed infrastructure, including but not limited to:

¹ As detailed in the Sustainable Planning Regulation 2009, Schedule 8

² All references to competent persons refer to WHS Regulation, Schedule 19, definition of 'competent person' paragraph (g) or otherwise specified under applicable law. Note the Professional Engineers Act 2002 requires any professional engineering service to be provided by or under the supervision of a Registered Professional Engineer of Queensland. See: section 115. A professional engineering service includes the identification of relevant standards and assessment criteria where not prescribed by law. In some instances, the inspections or repairs must be carried out by licenced persons.

- i. building structures and supports;
- ii. process tanks and vessel;
- iii. pumps and pipework; and
- iv. pipelines.

Unless the Regulator has given prior written approval of a person to be an assessor, this assessment must be completed by a competent person who is an independent third party. This assessment and report must be completed by COB 1 May 2017. QNS must address any recommendations in a timely manner but not later than COB 1 October 2017.

- c. An interim assessment and report of priority infrastructure³ (vessels and tanks containing hazardous chemicals) must be completed by 1 May 2017 and provided to the Regulator. The final assessment and report must be completed by 1 July 2017 or prior to restart of the refinery, whichever is the earliest. The competency of the assessors must be agreed by the Regulator⁴.
- d. Inspection of all electrical equipment in service on site. Electrical equipment not in service must be isolated.

An interim assessment and report by competent persons agreed to by the Regulator based on high risk zones (hazard x use) and public safety must be completed by 1 October 2017. A full assessment and report must be completed by 1 May 2018 or prior to restart of the refinery, whichever is the earliest. The competency of the assessors must be agreed to by the Regulator.

- e. Inspection of the heavy fuel oil pipeline against the requirements of AS2885. An interim visual assessment and report must be completed by COB 1 October 2017. A full assessment and report, including the use of an "Intelligent PIG", must be completed by 1 November 2017 or prior to the restart of the refinery, whichever is the earliest. Alternatively, if the above is not complied with, an acceptable outcome is the removal of hazardous chemical inventories from this pipeline.

A copy of the reports detailed in condition 2 items a-e, must be provided to the Regulator within 5 days of being completed by QNS. All additional reports pertaining to this condition which are not directly covered in condition 2 items a-e must be provided to the Regulator by 1 January 2018 or prior to restart of the refinery, whichever is the earliest.

Any installations determined not to be able to withstand loads associated with storage or manufacturing, duty and service, or considered at risk of collapse shall be isolated from workers such that any failure of the structure and subsequent impact to adjacent structures is taken into consideration. Any infrastructure requiring exclusion zones shall be reported to the Regulator immediately.

³ The matters to fall within the meaning of 'priority infrastructure' are to be agreed with the Regulator.

⁴ The competency of the assessor must be agreed by the Regulator, despite the definition of 'competent person' in Schedule 19 of the WHS Regulation.

Following assessments conducted under condition 2 (including items a-e), any items which require replacement, repair or reconstruction are to be subject to an Improvement Plan to be approved by the Regulator. A copy of the Improvement Plan must be provided to the Regulator within 4 weeks of QNS's receipt of the report which identifies the remedial action required. The approved Improvement Plan must be complied with and any variations to the Improvement Plan shall be reported to the Regulator immediately.

3. By 1 July 2017, QNS must provide a report to the Regulator demonstrating that QNS has and can continue to manage the risks associated with the storage of hazardous chemicals. Demonstration must include the implementation of appropriate control and mitigation measures to manage risks to health and safety so far as is reasonably practicable. Additional controls which must be included are:
 - a. Provide automatic activation of the deluge system via gas detection, with alarms reported to an occupied central location and QFES, for the ammonium hydrosulphide sphere; and
 - b. Provide, for hazardous chemicals with off-site risk potential, a monitoring and response system with alarms reported to an occupied central location and QFES.

Evidence of actions taken to reduce risk must be provided in a summary within four weeks of that assessment and a final report provided to the Regulator within six months of the assessment. If the above is not complied with, an alternative acceptable outcome is the removal of hazardous chemical inventories with offsite risk.

4. QNS must ensure all tanks and vessels containing hazardous chemicals remain isolated by double block and bleed, lock closed drain point and lock closed as close as possible to the source whilst the facility is not manufacturing.
5. QNS must supply evidence on request to the Regulator that the facility is monitored and maintained to ensure that:
 - a. building structures and supports;
 - b. plant area footings, bunds, plinths and supports;
 - c. process tanks and vessels; and
 - d. pumps and pipework,

remain in a state that does not create a risk to the health and safety of any person.

This evidence may include, but is not limited to, a plan which provides a scope of work to be done, with a proposed timeline, to maintain the above items a-d. The plan shall document the required resources (financial and workers) to conduct the activities. Evidence of work being conducted shall be provided in written reports or documentation which support the work activities and/or photographs of work completed. This evidence must be provided by 1 October 2017.

6. QNS must immediately notify the Regulator of the following events or conditions, in addition to the notification requirements specified in the *Work Health and Safety Act 2011*:

- a. Any near miss dangerous event⁵, whether or not a person was exposed to imminent risk;
- b. Any loss of a chemical of security concern⁶;
- c. Any process excursion outside the designated operating envelope as determined by the equipment design;
- d. Any activity which requires operation materially outside the standards espoused in the safety management system⁷;
- e. Any change in operations status on site, including but not limited to:
 - i. The decision to commission/re-commission or use of equipment for any manufacturing operations at the refinery;
 - ii. the receipt of any bulk hazardous chemicals or dangerous goods to the site boundary (including, but not limited to, nitrogen and ore/ore concentrates); and
 - iii. the dispatch of any bulk hazardous chemicals or dangerous goods from the site boundary (including, but not limited to, anhydrous ammonia, sulphur, ammonium hydrosulphide, hydrogen peroxide, asbestos containing products, and metal ores, powders and concentrates).

For the purposes of this condition, bulk hazardous chemicals or dangerous goods refers to quantities equalling to or exceeding 1 tonne.

7. QNS must provide evidence to the Regulator that the facility is safe to operate prior to the commencement of any manufacturing activities in any operational areas depicted in 'Map 1', and/or transfer activities through the heavy fuel oil pipeline to the site. The Regulator must be reasonably satisfied with this evidence before QNS can recommence any manufacturing activities.

Evidence to support this requirement may include, but is not limited to:

- a. training records of workers;
- b. operating procedures and work instructions;
- c. structural, equipment and/or asset integrity reports;
- d. applicable risk and safety assessments;
- e. performance standards;
- f. developed operating envelope parameters;
- g. plant/equipment datasheets;
- h. employee rosters;
- i. minimum manning studies;

⁵ 'Near miss dangerous event' means any sudden event that, apart from mitigating effects, actions or systems, could have escalated to a major incident.

⁶ As covered by the National Code of Practice for Chemicals of Security Concern published by the Attorney-General's Department, Canberra and available on www.nationalsecurity.gov.au

⁷ As required by s 558 of the *Work Health and Safety Regulation 2011*

- j. plant/equipment maintenance records and schedules, and
 - k. any other evidence which supports that a safety management system is in place and will remain effective in ensuring the continual safety of workers, plant, and community.
8. QNS must provide confirmation to the Regulator on request that security measures and security fencing surrounding the site is sound and is fit for purpose. A number of the hazardous chemicals on site are identified in the National Code of Practice for Chemicals of Security Concern and the list of ninety six chemicals assessed as potential security concern.
- QNS must provide evidence on request to the Regulator that Chemicals of Security Concern⁸ are securely stored to reduce the likelihood of them being stolen or diverted (see condition 3). This includes regular inventory checks, maintenance of the security fencing or other suitable barriers for securing Chemicals of Security Concern.
9. By 1 October 2017, QNS must provide the Regulator with evidence that the asbestos register for the facility has been revalidated. QNS must also by this time provide confirmation to the Regulator that the asbestos located on site (including any ore remaining or to be brought into the site) does not pose a health risk to any persons, including employees and the community.



Figure 4-1: Facility and Main Processing / Storage Areas

Map 1: Operational areas - heavy fuel oil pipeline not shown

⁸ See "National Code of Practice for Chemicals of Security Concern" and "Ninety six chemicals assessed as a potential security concern" published by the Attorney-General's Department, Canberra and available on www.nationalsecurity.gov.au

Proposed Revised Conditions – QNS v.1

1. QNS must provide an Improvement Plan to ensure fire-fighting protection systems are and will continue to be effective on demand and be proportionate to the major incident risks. The Improvement Plan must address all identified non-conformances with relevant Australian Standards in any installed Special Fire Services¹ and firefighting protection systems for the facility, including but not limited to:
 - a) Firefighting water hydrants and plant deluge systems;
 - b) Firefighting water supply pumps;
 - c) Firefighting water ring mains; and
 - d) Ancillary firefighting equipment such as extinguishers, hoses and reels.

This Plan must be developed to the reasonable satisfaction of the Regulator and be submitted to the Regulator by COB 1 December 2017 for approval. QNS must comply with the approved improvement plan. Variations to the Improvement Plan must be approved by the Regulator.

2. QNS must ensure all tanks and vessels containing hazardous chemicals remain isolated where possible by double block and bleed, alternatively by lock-closed (drain point) or lock-closed (as close as possible to the source) whilst the facility is not manufacturing.
3. QNS must provide evidence on request to the Regulator that hazardous chemical storage areas are monitored to ensure
 - a) building structures and supports;
 - b) plant area footings, bunds, plinths and supports;
 - c) process tanks and vessels; and
 - d) pumps and pipework

remain in a structurally stable state unable to impact on the hazardous chemical storage locations. Any items which require replacement, repair or reconstruction are to be subject to an Improvement Plan to be approved by the Regulator. A copy of the Improvement Plan must be provided to the Regulator within 4 weeks of QNS's receipt of the report which identifies the remedial action required. The approved Improvement Plan must be complied with and any variations to the Improvement Plan shall be reported to the Regulator immediately.

4. QNS must immediately notify the Regulator of the following events or conditions, in addition to the notification requirements specified in the *Work Health and Safety Act 2011*:
 - a) Any near miss dangerous event², whether or not a person was exposed to imminent risk;
 - b) Any process excursion outside the designated operating envelope as determined by the equipment design;
 - c) Any activity which requires operation materially outside the standards espoused in the safety management system³;
 - d) Any change in operations status on site, including but not limited to:

¹ As detailed in the Sustainable Planning Regulation 2009, Schedule 8.

² 'Near miss dangerous event' means any sudden event that, apart from mitigating effects, actions or systems, could have escalated to a major incident.

³ As required by s 558 of the *Work Health and Safety Regulation 2011*.

- i. the decision to commission/re-commission or use of equipment for any manufacturing operations at the refinery;
- ii. the receipt of any bulk hazardous chemicals or dangerous goods to the site boundary (including, but not limited to, nitrogen and ore/ore concentrates); and
- iii. the dispatch of any bulk hazardous chemicals or dangerous goods from the site boundary (including, but not limited to, anhydrous ammonia, sulphur, ammonium hydrosulphide, hydrogen peroxide, asbestos containing products, and metal ores, powders and concentrates).

For the purposes of this Condition, bulk hazardous chemicals or dangerous goods refers to quantities equaling to or exceeding 1 tonne.

5. QNS must provide evidence to the Regulator the facility is safe to operate prior to the commencement of any manufacturing activities in any operational areas depicted in 'Map 1', and/or transfer activities through the heavy fuel oil pipeline to the site. The Regulator must be reasonably satisfied with this evidence before QNS can recommence any manufacturing activities.

Evidence to support this requirement can include, but is not limited to:

- a) Training records of workers;
- b) Operating procedures and work instructions;
- c) Structural, equipment and/or asset integrity reports
- d) Applicable risk and safety assessments;
- e) Performance standards
- f) Developed operating envelopes
- g) Plant/equipment datasheets;
- h) Employee rosters;
- i) Minimum manning studies;
- j) Plant/equipment maintenance records and schedules; and
- k) Any other evidence which supports that a safety management system is in place and will remain effective in ensuring the continual safety of workers, plant and community.

6. QNS must provide confirmation to the Regulator on request that security measures and security fencing surrounding the site is sound and is fit for purpose.
7. QNS must provide the Regulator with evidence the asbestos register for the facility has been revalidated prior to a restart of the refinery.
8. The areas at the refinery to which these Conditions applies are restricted to:

- 420 Gas Plant
- Fire water reservoir and pumping system
- Primary and secondary tailings pumps and overflow containment pits.

These are depicted on Map 1.



Map 1: Areas depicted (green) are those to which these Conditions apply.



Advisian
WorleyParsons Group

Queensland Government
Yabulu Nickel Refinery and Heavy
Fuel Oil Pipeline
Risk Assessment Report



Queensland Government

Appendix 3 Attendance



Meeting Attendance Record

Date 25/09/2017
Meeting topic Yabulu Nickel Refinery and Heavy Fuel Oil Pipeline Risk Assessment
Facilitated by
Venue Level 31, 12 Creek St, Diversity Room

NAME	SIGNATURE	POSITION	COMPANY / EMAIL
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