Appendix F

Response to DPIE – Hazards' Queries for the McPhillamys Mine Proposal

REGIS RESOURCES LTD

ATOMICDG
Dangerous Goods Consultants

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13th August 2020

Attn: Drew Noble
Group Metallurgist
Regis Resources Ltd
Level 2, 615 Hay St
Subiaco WA 6008

Dear Drew,

Re: Responses to DPIE queries for the McPhillamys mine proposal

Attached to this letter are responses to queries raised by the NSW Department of Planning, Industry & Environment (DPIE) in relation to dangerous goods storage at the proposed McPhillamys gold mine.

Attachments:

1. DPIE queries – background information and responses.
2. Copy of email from DPIE containing the queries addressed in this letter.
3. McPhillamys drawings:
    a. Site plan.
    b. Process area layout.
4. Explosive blast overpressure calculations

If you have any queries on the attached, please don't hesitate to contact me.

Warm regards,

Tim Norris
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Atomic DG Consultants

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Attachment 1 – DPIE Queries, Background Information & Responses

Background

A preliminary hazard analysis was prepared by Risk Mentor on behalf of Regis Resources (document version 3, dated 29/06/2019) and submitted to DPIE as part of the mining approvals process.

After reviewing the preliminary hazard analysis, DPIE requested additional information from Regis Resources, to demonstrate it was prepared in accordance with the Hazardous Industry Planning Advisory Paper No. 4 “Risk Criteria for Land Use Safety Planning (HIPAP 4)”.

The request for additional information was contained in an email from DPIE dated 21/010/2019, a copy of which is shown in Attachment 2 of this letter.

This email listed five specific queries, which are shown below in italics. Responses are provided under each query, with additional supporting information attached to this letter where applicable.

Query 1

Provide a site layout diagram of the "magazine and ammonium nitrate emulsion storage" areas as shown in the EIS Figure 2.8, clearly showing:

a. *the location of each magazine and tank;*
b. *the quantity of dangerous goods (DG) within each magazine and tank;*
c. *separation distances between magazines, tanks and protected works as defined under AS 2187 and AIESG codes of practice; and*
d. *how item 1c above can comply with all relevant Australia Standards and codes of practices for explosives and explosives precursors.*

Response to a & c: the site layout and process area drawings have been updated to show the location of site features noted above, and are in Attachment 3 of this letter.

Response to b & d: The quantities of explosives and ammonium nitrate, and the corresponding separation distances to protected works as given in Australian Standards and Codes of Practice, are provided in the tables below.

Explosives & Detonators

Quantity: 36t explosives, 15,000 detonators
Code of practice: AS2187.1

Separation from DG to:	Distance	Comment	Separation Complies?
Protected Works Class A (open air & outdoor areas, including the mine pit)	489m	Laydown areas near the mine process plant are >1.2km from explosives The mine pit is >700m from explosives	Y
Protected Works Class B (human occupied structures and buildings)	733m	The mine process plant and associated buildings & structures are >1.2km from explosives	Y
Vulnerable Facilities (aged care, schools)	1466m	No vulnerable facilities within a 2km radius of explosives	Y
Nearby ammonium nitrate facility, to prevent a "no-warning knock-on explosion"	59m	Regis to ensure a 59m separation between AN and explosives	Can be achieved during detailed design
Detonators to explosives	13m	Regis to ensure explosives and detonator magazines are separated per AS2187.1	Can be achieved during detailed design

Ammonium Nitrate

Quantity: 400t ammonium nitrate solid, 160t ammonium nitrate emulsion
Code of practice: AEISG Code of Practice for Storage and Handling of UN3375

Separation from DG to:	Distance	Comment	Separation Complies?
Protected Works Class A (open air & outdoor areas, including the mine pit)	1017m	Laydown areas near the mine process plant are >1.2km from explosives The mine pit is >700m from explosives	Y
Protected Works Class B (human occupied structures and buildings)	1525m	The mine process plant and associated buildings & structures are >1.2km from explosives	Y
Vulnerable Facilities (aged care, schools)	3050m	No vulnerable facilities within a 2km radius of explosives	Y

Note that to be conservative, the separation distances noted above are based on the combined quantities of explosives and ammonium nitrate.

Query 2

In view of item 1 (Query 1) above, provide:

a. *the TNT-equivalency for precursors (ie ammonium nitrate emulsion, ANE), boosters and detonators;*
b. *the quantity and type of explosive (TNT?) for estimating the worst case explosive impacts in PHA Section 4.3.2.1; and*
c. *verification that suitable ANE quantities are included in item 2b above. Please note that ANE presents explosive risks, although classified as DG Class 5.1, conforming to UN 3375. From prior assessments of ANE plants, the Department understands that the TNT-equivalency for ANE could be as high as 68%.*

Response to a & b: the type of explosives used to estimate the worst case explosive impacts in PHA Section 4.3.2.1 appears to have been "blasting explosives", which have a dangerous goods classification of "Division 1.1D" and a UN number of 0082. These types of explosives are commonly used for mining drill and blast activities.

It is noted that the PHA Section 3.3 lists explosives and ammonium nitrate as:

1. 20t of boosters and 10t of detonators:
    a. "Boosters" is a generic name for blasting explosives used by industry.
    b. The aggregate of 30t was used to estimate worst case impacts in PHA Section 4.3.2.1.
2. 1000t of ammonium nitrate precursors.

Since the PHA was issued to DPIE, Regis has revised the proposed quantities of explosives and precursors for McPhillamys. The TNT equivalency for these explosives and ammonium nitrate precursors is shown in the "Adjusted NEQ" column of the table below.

Item	**Mass Strength Value**	**Raw Quantity (kg)**	**Adjusted NEQ (kg)**
Explosives	100%	36,000	36,000
Ammonium nitrate prill (solid)	32%	400,000	128,000
Ammonium nitrate	100%	160,000	160,000

Notes to table:

1) The mass strength value is the percent of the item's mass that is equivalent to TNT.
    a) For blasting explosives, 100% is used.
    b) For ammonium nitrate prill, the value published in the SAFEX Good Practice Guide GPG 02: Storage of Solid Technical Grade Ammonium Nitrate) is 32%.
    c) For ammonium nitrate emulsion, the value, which can be less than 100%, is given by the emulsion supplier. In the absence of this value, 100% is used.
2) The raw quantity is the gross mass of the item that is proposed to be stored at McPhillamys.

3) The adjusted NEQ is the net explosive quantity of the item in equivalent kilograms of TNT. This is calculated by multiplying the raw quantity with the mass strength value.

The proposed location of explosives and ammonium nitrate precursors is shown in drawing 17016-00-G-001 (McPhillamys Process Plant Overall Site Plan), which is copied to Attachment 3 of this letter:

1. The area set aside for explosives and precursors is denoted as a rectangular area labelled “MAGAZINE”, which is North-Northeast of the mine pit (PIT 1).
2. It is highlighted that the explosives and precursors will need to be segregated by the distance given in AS2187.1 Table 3.2.3.2, in order to prevent an initiation of explosives from propagating to the precursors.
   a. For the 36t of explosives that will be stored at McPhillamys, the segregation distance to ammonium nitrate precursors is 59m, which can be reduced to 10m if the explosives magazine is mounded.
   b. This segregation distance will be confirmed during detailed design.

Response to c: worst case explosive impacts have been estimated for the revised quantity of explosives and ammonium nitrate precursors (prill and emulsion), using the Adjusted NEQ and the principles given in AS2187.1 and the Australian Explosives Industry Safety Group *Code of Practice for Storage and Handling of UN3375*, Edition 5.

These method and results of these calculations are detailed below in the response to Query 3.

Query 3

In view of items 1 and 2 (Query 1 & 2) above, verify if the appropriate quantity and type of explosives have been considered in the PHA for assessing the explosives impacts. Particularly, verify if the explosive impacts would not significantly impact the tailings storage facility (ie structural damage causing loss of containment) and processing plant area (ie would not escalate beyond the worst case described in PHA Sections 4.2.3.2 (hydrogen cyanide) and 4.3.2.3 (flammable materials)). In addition, assessment with the HIPAP 4 Section 2.4.4 (environmental risk) must be included in the PHA with regards to risks to the tailings storage facility.

Response to Query 3: Atomic DG has provided preliminary calculations of explosion blast overpressures (BOP) for a number of exposure scenarios, the results of which are summarised in the table on the following page. A copy of the overpressure preliminary calculations is included in Attachment 4 of this letter.

It is noted that blast overpressure for an explosion involving the combined quantity of explosives and ammonium nitrate cannot be meaningfully estimated until the precise location and arrangement of these stores is determined.

Factors such as explosives to precursor segregation and inter-stack separation within the precursor store will determine whether or not an explosion of precursors will propagate to explosives, whether or not all precursors will initiate, and so on.

The location and arrangement of explosives and precursors will be finalised during detailed design.

Exposure Scenario	**Estimated BOP (kPa)**
36t explosives to nearest section of TSF embankment	14.33
36t explosives to mine process plant	2.01
36t explosives to sodium cyanide & LPG tanks (approximately same distances)	1.87
288t AN & ANE to nearest section of TSF embankment	39.14
288t AN & ANE to mine process plant	5.5
288t AN & ANE to sodium cyanide & LPG tanks (approximately same distances)	5.12

Notes to table:

1. “BOP” is the blast over pressure, estimated by equation J7.2, of AS2187.2-2006 Appendix J7.
2. “TSF embankment” refers to the tailings storage facility dam wall.
3. The quantity of ammonium nitrate prill (AN) and ammonium nitrate emulsion (ANE) was aggregated and then adjusted to a TNT equivalent quantity, as required by equation J7.2.
4. The distances used in the calculations were based on the shortest distance between the area marked “MAGAZINE” and the exposure scenario site feature.

Explosion overpressure values (the pressure rise from blast wave) and the corresponding effects are shown in HIPAP 4 Table 7, which is copied on the following page for reference.

It is noted that HIPAP 4 recommends that explosion overpressure are limited to:

1. 7kPa for residential and sensitive use areas (HIPAP 4 Section 2.4.2.2)
2. 14kPa for hazardous installations e.g. mine process plants (HIPAP 4 Section 2.4.2.3)

At this stage, preliminary blast overpressure calculations indicate that the 14kPa limit is not predicted to be exceeded at the mine process plant and the high risk dangerous goods within it (cyanide and LPG).

HIPAP 4: Risk Criteria for Land Use Safety Planning | January 2011

Table 7: Effects of Explosion Overpressure

Explosion Overpressure	Effect
3.5 kPa (0.5 psi)	• 90% glass breakage • No fatality and very low probability of injury
7 kPa (1 psi)	• Damage to internal partitions and joinery but can be repaired • Probability of injury is 10%. No fatality
14 kPa (2 psi)	• House uninhabitable and badly cracked
21 kPa (3 psi)	• Reinforced structures distort • Storage tanks fail • 20% chance of fatality to a person in a building
35 kPa (5 psi)	• House uninhabitable • Wagons and plants items overturned • Threshold of eardrum damage • 50% chance of fatality for a person in a building and 1 5% chance of fatality for a person in the open
70 kPa (10 psi)	• Threshold of lung damage • 100% chance of fatality for a person in a building or in the open • Complete demolition of houses

Based on the above, Atomic DG recommends further investigation is undertaken during the detailed design phase of the McPhillamys project, to:

1. Provide formal calculations for these blast overpressure exposure scenarios, taking into account any adjustments to the quantity and location of explosives and precursors.
2. Ensure that the design specifications for structures and site features include the requirement to withstand these blast overpressures i.e.
    a. The structural and containment integrity of the tailings dam embankment will not be compromised.
    b. Similarly, there will be no loss of containment at gold process plant, and in particular the high risk dangerous goods stores i.e. cyanide and LPG.

Query 4

Provide a site layout diagram of the processing plant areas as shown in the EIS Figure 2.8, clearly showing:

a. *the location of all DG and hazardous chemicals (which may be non-DG, such as diesel) stores and tanks;*
b. *the quantity of DG and hazardous chemicals within each store and tank;*
c. *separation distances between stores, tanks and protected works as defined under the relevant Australian Standards and consistent with relevant codes of practice; and*
d. *how item 4c above can comply with all relevant Australia Standards and relevant codes of practice.*

Response to a, b, c: the site layout and process area drawings have been updated to show the location of site features noted above, and are in Attachment 3 of this letter. A preliminary manifest of dangerous goods (DG) to be stored at McPhillamys is provided below:

Name	DG Class	UN No.	PG	Qty	Comment
Explosives	1.1D	0082	N/A	36t	
Ammonium nitrate	5.1	1942	III	400t	Solid ammonium nitrate prill
Ammonium nitrate emulsion	5.1	3375	II	160t	
Sodium cyanide	6.1	3414	I	290kL	30% solution, contained in two tanks
Hydrochloric acid	8	1789	II	30kL	30% solution
Sodium hydroxide	8	1824	II	60kL	50% solution
LP Gas	2.1	1075	N/A	18kL	Contained in 6 x 3kL tanks
Diesel	N/A	N/A	N/A	660kL	C1 Combustible Liquid as defined in AS1940; contained in 6 x 110kL self bunded tanks

Response to d: The separation distances given in relevant Australian Standards for the dangerous goods to be stored at McPhillamys (as shown in the above preliminary DG manifest), are provided in the following tables. Explosives and ammonium nitrate separation distances are provided earlier in this letter, under the response to Query 1.

Sodium cyanide 30%, Div 6.1, PGI

Quantity: 290kL
Code of practice: AS4452

Separation from DG to:	**Distance**	**Comment**	**Separation Complies?**
Protected place OFF site	50m	Measure from bund not tanks	Appears yes
Protected place ON site	25m	Risk assessment required to reduce separation to 25m, otherwise make 50m. Measure distance from bund not tanks	Yes
Property boundary or public place	25m		Yes
Tank to tank	1m	Distance between adjacent cyanide tanks. Make cyanide to caustic 1m also.	Can be achieved during detailed design
Tank to bund	1m	Crest locus rule also applies	Can be achieved during detailed design
Acid	5m	Acid and cyanide react dangerously, therefore segregate by 5m and have totally separate bunds & bund drainage systems	Yes
Other dangerous goods stores on site	N/A	AS4452 does not define these as Protected Places	N/A

Hydrochloric acid 30%, Class 8, PGII

Quantity: 30kL
Code of practice: AS3780

Separation from DG to:	Distance (m)	Comment	Separation Complies?
Protected place OFF site	5m	Measure from tank	Yes
Protected place ON site	5m	Measure from tank, but also minimum 3m from bund to protected places	Yes
Property boundary or public place	5m		Yes
Tank to tank	0.6m	N/A, as acid tank is single tank only	N/A
Tank to bund	1m	Crest locus rule also applies	Yes
Cyanide	5m	Acid and cyanide react dangerously, therefore segregate by 5m and have totally separate bunds & bund drainage systems	Yes
Other dangerous goods stores on site	5m	AS3780 considers onsite DGs as Protected Places	Yes

Sodium hydroxide 50%, Class 8, PGII

Quantity: 60kL
Code of practice: AS3780

Separation from DG to:	Distance (m)	Comment	Separation Complies?
Protected place OFF site	8m	Measure from tank	Yes
Protected place ON site	8m	Measure from tank, but also minimum 3m from bund to protected places	Yes
Property boundary or public place	8m		Yes
Tank to tank	0.6m	N/A, as acid tank is single tank only	N/A
Tank to bund	1m	Crest locus rule also applies	Yes
Acid	5m	Acid and caustic react dangerously, therefore segregate by 5m and have totally separate bunds & bund drainage systems	Yes
Other dangerous goods stores on site	5m	AS3780 considers onsite DGs as Protected Places Exclude adjacent cyanide tanks from this requirement because cyanide and caustic are compatible	Yes

LP Gas, Tanks

Quantity: 6 x 3kL tanks
Code of practice: AS1596

Separation from DG to:	**Distance (m)**	**Comment**	**Separation Complies?**
Tank to tank	Diameter	For multiple tanks, separate by diameter of largest tank	Yes
Public place or railway line	4.3m	Distance based on a 3kL tank	Yes
Property boundary	4.3m	Distance based on a 3kL tank, for a public place on the edge of the property boundary	Yes
Protected place OFF site	6.7m	Distance based on a 3kL tank	Yes
Protected place ON site	6.7m	Distance based on a 3kL tank - nearest PP is Reagents Store, >20m West of LPG	Yes
Source of ignition	4.3m	From AS60079.10.1 Table ZA.6.5.2.1, for a 3kL tank. Nearest source of ignition will be Reagents Store	Yes
Tank for combustible liquids	6m	Diesel tanks >20m to SE of LPG	Yes
Bund for flammable or combustible liquid tanks, package stores, package filling	6m	To diesel tanks	Yes
Oxidisers e.g. oxygen, other Division 5.1	6m	N/A, none on site	N/A
Combustible material e.g. vegetation or waste matter	6m	>10m to nearest uncleared area. Will require ongoing maintenance to prevent vegetation regrowth	Yes
Tank fill point to tank body	N/A	3kL tanks to be direct filled	N/A
Tank fill point to a pit drain	6m	Based on limited loss dry break coupling on filling hose	Can be achieved during detailed design
Tank fill point to a source of ignition	6m	Based on limited loss dry break coupling on filling hose. Nearest source of ignition will be Reagents Store, >20m from LPG	Yes

Diesel, 6 x 110kL self bunded tanks

Quantity: 660kL
Code of practice: AS1940

Separation from DG to:	Distance (m)	Comment	Separation Complies?
Flammable or combustible liquid package stores, package filling areas	3m	>3m to nearby Lube Store	Yes
Protected place ON site	7.25m	>20m to Stores Laydown, North of diesel	Yes
Other dangerous goods stores on site	7.25m	>100m to DGs at reagents area. AS1940 considers onsite DGs as Protected Places	Yes
Protected place OFF site	7.25m	>100m to property boundary	Yes
Property boundary or public place	3m	>100m to property boundary	Yes
Tank to tank	0.6m	1m better than 0.6m, but 0.6m is minimum	Can be achieved during detailed design
Tank to bund	1m	N/A, as diesel tanks are self bunded	N/A
Source of ignition	N/A	N/A as diesel is non-flammable	N/A

Query 5

Considering separation distances between 14 tonnes of LPG and 240 tonnes of diesel (only quantities and not locations are indicated in PHA Table 2, and Sections 4.3.1 and 4.3.2.3), provide verification that the fire impacts as shown in PHA Figure 6 would not escalate beyond the worst case described in PHA Sections 4.3.2.2 (hydrogen cyanide) and 4.3.2.3 (flammable materials).

Response to Query 5

Measures to control the fire impacts from diesel, which will be verified during detailed design, are summarised as follows:

1. The primary method of mitigating the impact of a diesel fire is compliance with the requirements given in Australian Standards 1940 and 1596 for:
    a. Fire protection equipment, for both diesel tanks and LPG vessels.
    b. “Separation to protected works” requirements, which prevent an incident in one area escalating to the other.
2. Diesel will be stored at McPhillamys in self bunded tanks, which offers a degree of insulation from radiant heat from nearby fires.
3. It is highlighted that diesel is a combustible liquid, and therefore the diesel tanks are highly unlikely to be the source of a fire:

   a. When undertaking a fire safety study, it is convention to omit combustible liquid tanks as they are not credible "tanks on fire".
   b. The possibility is acknowledged that diesel tanks could contribute to a fire.

The primary measure to prevent fire impacts from sodium cyanide solution is the use of robust process controls to maintain a high solution pH, which eliminates all credible causes of hydrogen cyanide release that present a flammability hazard.

1. Section 4.3.2.2 discusses the potential for hydrogen cyanide gas to be released after an accidental mixing with acid.
   a. It is understood that Regis will base the design of the McPhillamys gold process plant on their Moolart Well and Garden Well mines in Western Australian, both of which have been assessed by Atomic DG for compliance with the WA Dangerous Goods Regulations.
   b. Consequently, Atomic DG agrees with the opinion expressed in Section 4.3.2.2 that an acid "mixing with cyanide" scenario is barely plausible.
2. Figure 5 of the PHA shows the estimated extent of a plume of hydrogen cyanide gas, released under the circumstances described in Section 4.3.2.2. As outlined below, this plume presents a toxicity hazard but no fire hazard:
   a. The plume model in Figure 5 shows concentrations of toxicity, using the acute exposure guideline levels 1 to 3, for 60 minutes.
   b. The zone in the plume is AEGL-3 at 60 minutes (shown in red), which for hydrogen cyanide is 15ppm; AEGL refers to the acute exposure guideline level for exposing a person to airborne chemicals.
   c. To be conservative when estimating the fire hazard, Atomic DG has considered the AEGL-3 value for 10 minutes, which is 27ppm.
   d. The lower flammability limit for HCN is 5.6%, which equates to 56,000ppm. This is orders of magnitude above the 10 minute AEGL-3.
   e. The conclusion is that even in the most hazardous part of the plume given in Figure 5, the fire hazard presented by hydrogen cyanide is negligible.

The primary measure to control fire impacts from LPG will be compliance with site location, operational and fire protection requirements from AS1596.

It is noted that Section 4.3.2.3 of the PHA has discussed the effect of an LPG fire resulting from a tank rupture. Whilst spontaneous "non-fire" tank ruptures are theoretically possible (almost unheard of), the main credible causes are mechanical damage (e.g. vehicle impact), and a fire that impinges on the tank causing a boiling liquid, expanding vapour explosion (BLEVE). For these scenarios, the following controls will be in place if the tanks comply with AS1596:

1. AS1596 requires tanks to be protected from traffic impact, and have pipes arranged with relief valves directed away from tanks. These requirements significantly reduce the risk of an LPG jet fire impinging on a tank due to small rupture (traffic impact) or relief valve discharge.

2. AS1596 requires LPG tanks to be separated from accumulations of combustible matter and vegetation; the risk of a fire from these materials impinging on tanks is considerably reduced.
3. For a BLEVE to occur an LPG tank, it must be preceded by a fire large enough to engulf and then weaken the tank structure. Such a fire is unlikely to go unnoticed at McPhillamys, and it is reasonable to expect that personnel will have sufficient warning to evacuate outside the 4.7kw/m2 heat flux area (required by HIPAP 4 Section 2.4.2.2).
4. A “no warning” BLEVE is unlikely i.e. large fire impinging on an LPG tank is not noticed.
    a. Credible causes include a vehicle impacting an LPG tank at enough speed to puncture a tank or pipe, resulting in an LPG jet fire that impinges on an adjacent tank.
    b. Traffic impact protection, design of the roadway near the LPG tanks, and traffic management are controls to minimise this risk.
5. Jet fires from leaking pipe joints or unseated relief valves are possible, but these have a lower heat flux.

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Attachment 2 – Copy of email containing DPIE queries

Elle Clementine

Subject: McPhillamys Gold Mine Project (SSD 9505) - Notice of Exhibition

From: Nicholas Hon <Nicholas.Hon@planning.nsw.gov.au>
Sent: Monday, 21 October 2019 11:46 AM
To: Elle Clementine <Elle.Clementine@planning.nsw.gov.au>
Cc: Doris Yau <doris.yau@planning.nsw.gov.au>
Subject: RE: McPhillamys Gold Mine Project (SSD 9505) - Notice of Exhibition

Hi Elle,

Thanks for forwarding this SSD for our review.

Having reviewed the EIS, it is noted that dangerous goods (DG) storage quantities and transportation rates exceed the relevant thresholds in the Department's *Applying SEPP 33*. As such, the SSD is considered potentially hazardous under SEPP 33, and a preliminary hazard analysis (PHA) is submitted (EIS Appendix R) as required under SEPP 33.

Although not clearly stated in the SEARs of 10 December 2018, we expect the PHA to be prepared in accordance with the Department's *Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis'* (HIPAP 6) and *Multi-level Risk Assessment* (MLRA), showing that the SSD can comply with the Department's *Hazardous Industry Planning Advisory Paper No. 4, 'Risk Criteria for Land Use Safety Planning'* (HIPAP 4). This approach is in-line with assessments for other potentially hazardous developments.

Having reviewed the PHA, it is understood that the PHA adopted an approach consistent with a Level 2 semi-quantitative risk analysis as per MLRA. This approach is considered appropriate, given that the SSD is situated relatively remotely from significantly populated areas. However, further information as set out below should be requested from the Applicant to:

- clarify the information provided in the PHA (i.e. EIS Appendix R);
- ensure that the PHA is prepared in accordance with HIPAP 6; and
- verify that the SSD can comply with HIPAP 4.

1. Provide a site layout diagram of the "magazine and ammonium nitrate emulsion storage" area as shown in EIS Figure 2.8, clearly showing:
    a. the location of each magazine and tank;
    b. the quantity of dangerous goods (DG) within each magazine and tank;
    c. separation distances between magazines, tanks and protected works as defined under AS 2187 and AIESG codes of practice; and
    d. how item 1c above can comply with all relevant Australian Standards and codes of practices for explosives and explosives precursors.

2. In view of item 1 above, provide:
    a. the TNT-equivalency for precursors (i.e. ammonium nitrate emulsion, ANE), boosters and detonators;
    b. the quantity and type of explosive (TNT?) for estimating the worst case explosive impacts in PHA Section 4.3.2.1; and
    c. verification that suitable ANE quantities are included in item 2b above. Please note that ANE presents explosives risks, although classified as DG Class 5.1, conforming to UN 3375. From prior assessments of an ANE plants, the Department understands that the TNT-equivalency for ANE could be as high as 68%.

3. In view of items 1 and 2 above, verify if the appropriate quantity and type of explosives have been considered in the PHA for assessing the explosives impacts. Particularly, verify if the explosive impacts would not significantly impact the tailing storage facility (i.e. structural damage causing loss of containment) and processing plant area

(i.e. would not escalate beyond the worst cases described in PHA Sections 4.2.3.2 [hydrogen cyanide] and 4.3.2.3 [flammable materials]). In addition, assessment with HIPAP 4 Section 2.4.4 (environmental risk) must be included in the PHA with regards to risks to the tailings storage facility.

4. Provide a site layout diagram of the processing plant area as shown in EIS Figure 2.8, clearly showing:
    a. the location of all DG and hazardous chemicals (which may be non-DG, such as diesel) stores and tanks. "Reagents store", "reagent area" and "emergency stockpile area" are noted;
    b. the quantity of DG and hazardous chemicals within each store and tank;
    c. the separation distances between stores, tanks and protected works as defined under the relevant Australian Standards and consistent with relevant codes of practice; and
    d. how item 4c above can comply with all relevant Australian Standards and relevant codes of practice.

5. In view of item 4 above, and considering separation distances between 14 tonnes of LPG and 240 tonnes of diesel (only quantities and not locations are indicated in PHA Table 2, and Sections 4.3.1 and 4.3.2.3), provide verification that the fire impacts as shown in PHA Figure 6 would not escalate beyond the worst cases described in PHA Sections 4.2.3.2 (hydrogen cyanide) and 4.3.2.3 (flammable materials).

Please refer to me any queries from the Applicant on the above.

Thanks.

Regards,

Nicholas Hon
Technical Specialist (Hazards)
Industry Assessments
320 Pitt Street | Sydney NSW 2000
T 02 9274 6344

NSW GOVERNMENT | Planning, Industry & Environment

Attachment 3 – McPhillamys reference drawings

Drawing Number	Revision	Title
17016-00-G-001	2	McPhillamys Process Plant Overall Site Plan
17016-00-G-002	2	McPhillamys Process Plant Process Plant Area General Arrangement

NO	DATE	DRN	CHD	ENG	PM	REVISION
2	13.05.20	JLM	PH	HK	THN	PLANT LOCATION AND ORIENTATION CHANGED. CONTRACTORS AREA ADDED.
1	01.03.19	JLM	AG	HK	NAR	SITE LAYOUT REVISED. SCALE REDUCED TO SHOW SOUTHERN BOUNDARY
0	23.01.19	JLM	AG	HK	NAR	ISSUED FOR DFS

REFERENCE DRAWING TITLE	DRAWING NUMBER
PROCESS PLANT AREA - GENERAL ARRANGEMENT - PLAN	17016-00-G-002

REGIS RESOURCES LTD
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Job No. 17016
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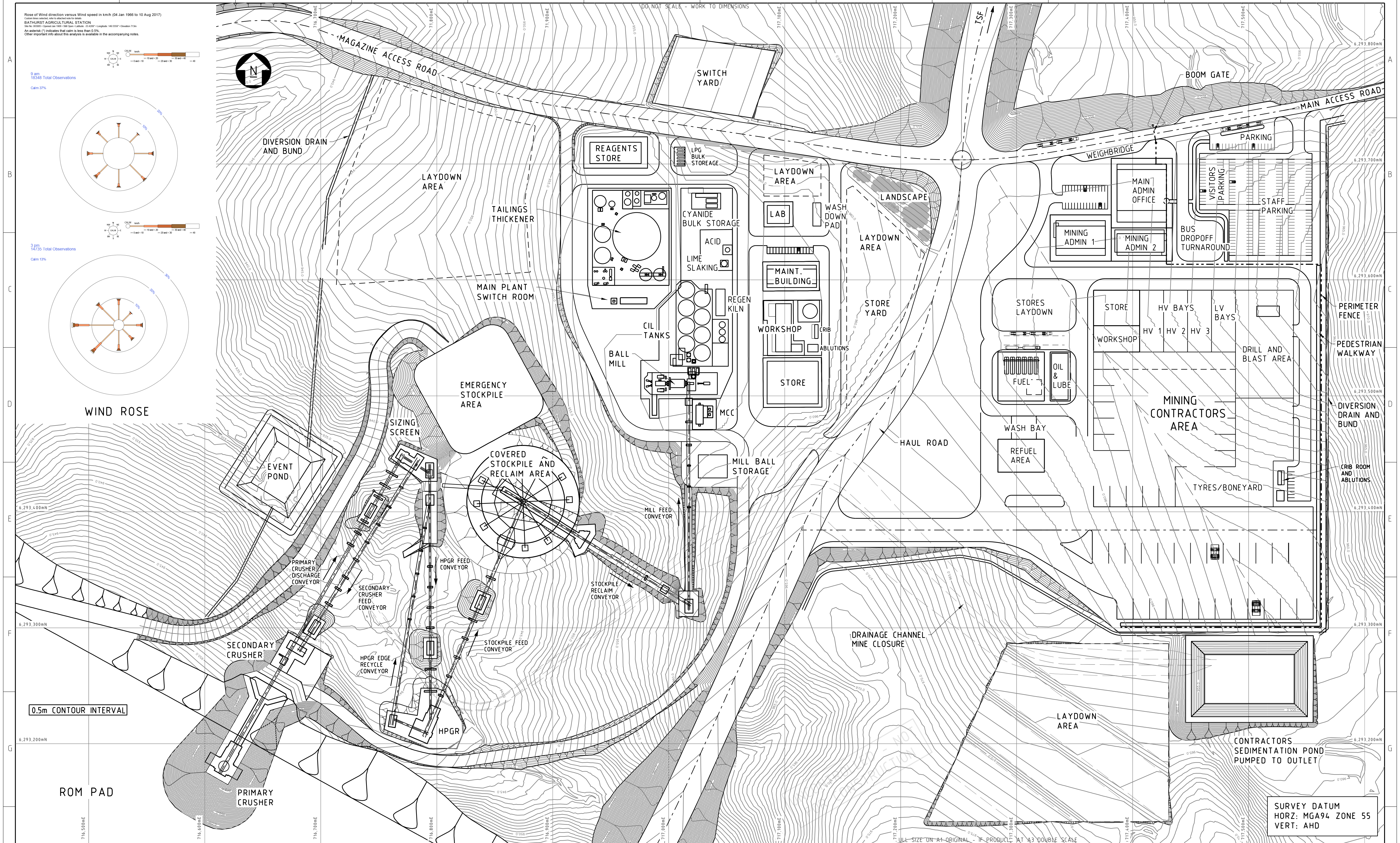
PROJECT
McPHILLAMYS GOLD PROJECT DFS

DRAWN	CHECKED	APPROVED	DATE
JLM	AG	NAR	23.01.19
DESIGN ENG. HK	DESIGN CHK. HDN		

TITLE
McPHILLAMYS PROCESS PLANT OVERALL SITE PLAN

SCALE	DRAWING No	REV
1:12,500	17016-00-G-001	2

A1



NO	DATE	DRN	CHD	ENG	PM	REVISION
2	12.05.20	JLM	PH	HK	THN	PLANT LOCATION AND ORIENTATION CHANGED. CONTRACTORS AREA ADDED.
1	14.02.19	JLM	AG	HK	NAR	STOCKPILE AND ASSOCIATED LAYOUT REVISED
0	23.01.19	JLM	AG	HK	NAR	ISSUED FOR DFS

REFERENCE DRAWING TITLE	DRAWING NUMBER
LEACHING, ADSORPTION & REAGENTS - GENERAL ARRANGEMENT - ISOMETRIC	17016-30-M-001
MILLING & CLASSIFICATION AREA - GENERAL ARRANGEMENT - ISOMETRIC	17016-20-M-003
STOCKPILE & RECLAIM AREA - GENERAL ARRANGEMENT - ISOMETRIC	17016-20-M-001
DRY SCREENING AREA - GENERAL ARRANGEMENT - ISOMETRIC	17016-10-M-007
TERTIARY CRUSHING - GENERAL ARRANGEMENT - ISOMETRIC	17016-10-M-005
SECONDARY CRUSHING - GENERAL ARRANGEMENT - ISOMETRIC	17016-10-M-003
PRIMARY CRUSHING - GENERAL ARRANGEMENT - ISOMETRIC	17016-10-M-001

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PROJECT
McPHILLAMYS GOLD PROJECT DFS

DRAWN	CHECKED	APPROVED	DATE
JLM	AG	NAR	23.01.19
DESIGN ENG. HK	DESIGN CHK. HDN		

TITLE
McPHILLAMYS PROCESS PLANT
PROCESS PLANT AREA
GENERAL ARRANGEMENT

SCALE 1:1500 | DRAWING No 17016-00-G-002 | REV 2

A1

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Attachment 4 – Explosion overpressure preliminary calculations

$$P = K_a \left(\frac{R}{Q^{1/3}} \right)^a$$

Refer AS2187.2 Appendix J7.2 for equation

Blast over pressure for: 36t explosives to nearest section of TSF embankment

Symbol	Value	Unit	Description
P	14.33	kPa	Blast over pressure
Q	36000	kg	Mass of explosives charge
R	391	m	Separation distance from explosion, scaled from drawing 17016-00-G-001 Rev 2
K_a	516		Site constant, unconfined surface charge
a	-1.45		Site exponent, unconfined surface charge

Blast over pressure for: 36t explosives to mine process plant

Symbol	Value	Unit	Description
P	2.01	kPa	Blast over pressure
Q	36000	kg	Mass of explosives charge
R	1513	m	Separation distance from explosion, scaled from drawing 17016-00-G-001 Rev 2
K_a	516		Site constant, unconfined surface charge
a	-1.45		Site exponent, unconfined surface charge

Blast over pressure for: 36t explosives to sodium cyanide & LPG tanks (approximately same distances)

Symbol	Value	Unit	Description
P	1.87	kPa	Blast over pressure
Q	36000	kg	Mass of explosives charge
R	1590	m	Separation distance from explosion, scaled from drawing 17016-00-G-001 Rev 2
K_a	516		Site constant, unconfined surface charge
a	-1.45		Site exponent, unconfined surface charge

Blast over pressure for: 288t AN & ANE to nearest section of TSF embankment

Symbol	Value	Unit	Description
P	39.14	kPa	Blast over pressure
Q	288000	kg	Mass of explosives charge
R	391	m	Separation distance from explosion, scaled from drawing 17016-00-G-001 Rev 2
K_a	516		Site constant, unconfined surface charge
a	-1.45		Site exponent, unconfined surface charge

Blast over pressure for: 288t AN & ANE to mine process plant

Symbol	Value	Unit	Description
P	5.50	kPa	Blast over pressure
Q	288000	kg	Mass of explosives charge
R	1513	m	Separation distance from explosion, scaled from drawing 17016-00-G-001 Rev 2
K_a	516		Site constant, unconfined surface charge
a	-1.45		Site exponent, unconfined surface charge

Blast over pressure for: 288t AN & ANE to sodium cyanide & LPG tanks (approximately same distances)

Symbol	Value	Unit	Description
P	5.12	kPa	Blast over pressure
Q	288000	kg	Mass of explosives charge
R	1590	m	Separation distance from explosion, scaled from drawing 17016-00-G-001 Rev 2
K_a	516		Site constant, unconfined surface charge
a	-1.45		Site exponent, unconfined surface charge