Cowal Gold Operations
Cyanide Management Plan

July 2018
COWAL GOLD OPERATIONS

CYANIDE MANAGEMENT PLAN

JULY 2018
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</tbody>
</table>
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<td>1.1</td>
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<td>7</td>
</tr>
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<td>8</td>
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<td>14</td>
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<td>4</td>
<td>15</td>
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<td>4.1</td>
<td>15</td>
</tr>
<tr>
<td>4.2</td>
<td>16</td>
</tr>
<tr>
<td>4.2.1</td>
<td>16</td>
</tr>
<tr>
<td>4.2.2</td>
<td>16</td>
</tr>
<tr>
<td>4.2.3</td>
<td>17</td>
</tr>
<tr>
<td>4.2.3.1</td>
<td>17</td>
</tr>
<tr>
<td>4.2.3.2</td>
<td>17</td>
</tr>
<tr>
<td>4.2.3.3</td>
<td>17</td>
</tr>
<tr>
<td>4.2.3.4</td>
<td>18</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>5.1</td>
<td>19</td>
</tr>
<tr>
<td>6</td>
<td>20</td>
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<tr>
<td>6.1</td>
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<td>6.2.2</td>
<td>21</td>
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<tr>
<td>6.2.3</td>
<td>21</td>
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<tr>
<td>6.2.3.1</td>
<td>21</td>
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<tr>
<td>6.2.3.2</td>
<td>22</td>
</tr>
<tr>
<td>6.2.4</td>
<td>22</td>
</tr>
<tr>
<td>6.2.5</td>
<td>22</td>
</tr>
<tr>
<td>6.3</td>
<td>22</td>
</tr>
<tr>
<td>6.4</td>
<td>23</td>
</tr>
<tr>
<td>6.5</td>
<td>25</td>
</tr>
</tbody>
</table>
7 CONTINGENCY MEASURES FOR CYANIDE REDUCTION 26
7.1 CONTINGENCY MEASURES FOR REDUCING HYDROGEN CYANIDE LEVELS AT LOCATIONS WHERE EMPLOYEES ARE OPERATING 26
7.1.1 Procedure 26
7.1.2 Contingency Measures 26
7.2 CONTINGENCY MEASURES FOR REDUCING CN\textsubscript{WAD} LEVELS DUE TO LEVELS EXCEEDING 20 MG/L (90 PERCENTILE OVER SIX MONTHS) OR 30 MG/L (AT ANY TIME) AT THE PROCESS PLANT 27
7.2.1 Contingency Measures 27
7.3 CONTINGENCY MEASURES FOR REDUCING CYANIDE LEVELS IN THE TAILINGS DAMS FOLLOWING FAUNA DEATHS 27
7.4 REVIEW OF CYANIDE LEVELS FOLLOWING FAUNA DEATHS 28

8 STAKEHOLDER CONSULTATION 29
8.1 COMMUNITY ENVIRONMENTAL MONITORING AND CONSULTATIVE COMMITTEE 29
8.2 COMPLAINTS REGISTER AND RECORDS 30
8.2.1 Complaints Register 30
8.2.2 Complaints Records for EPL 11912 30

9 REPORTING 31
9.1 ANNUAL REVIEW 31
9.2 INCIDENT REPORTING 31
9.3 CN\textsubscript{WAD} REPORTING 31

10 AUDITING AND REVIEW 32
10.1 HAZARD AUDIT 32
10.2 EXTERNAL AUDITS 32
10.2.1 Independent Environmental Audit 32
10.2.2 Independent Monitoring Panel 33
10.3 REVIEW OF THIS CMP 33

11 REFERENCES 34

LIST OF TABLES
Table 1 Summary of Key CGO Activities
Table 2 Development Consent Conditions Relevant to this CMP
Table 3 Overview of Other EMPs Relevant to Cyanide Management
Table 4 Overview of Pre-Construction and Pre-Commissioning Studies Relevant to Cyanide Management

LIST OF FIGURES
Figure 1 CGO Locality
Figure 2 General Arrangement of Approved CGO
Figure 3 Indicative Primary Ore Process Flowsheet
Figure 4 Location of Groundwater Bores Used to Monitor CN\textsubscript{WAD}
### LIST OF APPENDICES

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendix A</td>
<td>Legislative Regime</td>
</tr>
<tr>
<td>Appendix B</td>
<td>Codes of Practice, Australian Standards and Other Guidelines</td>
</tr>
<tr>
<td>Appendix C</td>
<td>Safety Data Sheets for Solid Sodium Cyanide, Sodium Cyanide Solution and Hydrogen Cyanide Gas</td>
</tr>
<tr>
<td>Appendix D</td>
<td>Correspondence with Regulatory Authorities</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

The Cowal Gold Operations (the CGO) is located approximately 38 kilometres (km) north-east of West Wyalong in New South Wales (NSW) (Figure 1). Evolution Mining (Cowal) Pty Limited (Evolution) is the owner and operator of the CGO. Evolution acquired the CGO from Barrick (Cowal) Pty Ltd in July 2015.

Development Consent (DA 14/98) for the CGO (including the Bland Creek Palaeochannel Borefield water supply pipeline) was granted by the NSW Minister for Urban Affairs and Planning under Part 4 of the NSW Environmental Planning and Assessment Act, 1979 (EP&A Act) on 26 February 1999. Development Consent (DA 2011/64) for the operation of the Eastern Saline Borefield was granted by the Forbes Shire Council on 20 December 2010.

The NSW Minister for Planning granted approval to modify Development Consent (DA 14/98) for the Cowal Gold Mine Extension Modification under Section 75W of the EP&A Act on 22 July 2014. The Cowal Gold Mine Extension Modification involves the continuation and extension of open pit mining and processing operations for an additional operational life of approximately 5 years (i.e. to 2024). The general arrangement of the approved CGO is provided in Figure 2.

Development Consent (DA 14/98) was further modified by the NSW Minister for Planning on 13 May 2016 under Section 75W of the EP&A Act to require cyanide monitoring results to be reported in the CGO Annual Review, and to modify the conditions of the Development Consent to reflect the relocation of the cyanide monitoring automated sampler to the process plant (which was originally approved by the then Department of Planning in October 2010).

On 7 February 2017, Development Consent (DA 14/98) was again modified by the NSW Minister for Planning under Section 75W of the EP&A Act to allow continued operations at the existing CGO for an additional 8 years to allow an additional 1.7 million ounces of gold production.

A copy of the Development Consent (DA 14/98) for the CGO (as modified on 7 February 2017) is available on Evolution's website (www.evolutionmining.com.au).

The CGO’s Cyanide Management Plan (CMP) was originally approved in January 2006, with subsequent Addenda dated August 2007, June 2008, October 2009 and July 2010 prepared to the satisfaction of the then Department of Planning. This revised CMP has been prepared to reflect the Development Consent as modified on 7 February 2017 and supersedes all former revisions of the CMP and supporting Addenda.

1.1 OBJECTIVES AND SCOPE

Objectives

The objectives of this CMP are to fulfil the requirements of Development Consent Condition 5.3(b) (Section 2.1) by providing:

- measures to contain cyanide contaminated waters entirely within the mine site;
- measures to maintain CNWAD (weak acid dissociable cyanide) levels at the process plant to the levels stated in Development Consent Condition 5.3(a);
- contingency measures for cyanide reduction; and
- a cyanide monitoring programme.
This CMP also addresses the requirements of Development Consent Conditions 5.3 (a), (c) and (d) (Section 2.1), the Conditions of Authority for Mining Lease (ML) 1535 (Section 2.2) and the conditions of the CGO’s Environment Protection Licence (EPL) Number 11912.

**Scope**

This CMP has been prepared to reflect the modified Development Consent approved by the NSW Minister for Planning on 7 February 2017 under Section 75W of the EP&A Act.

In accordance with the requirements of Development Consent Condition 5.3(b), the Division of Resources and Energy (DRE) (within the NSW Department of Industry, Skills and Regional Development), NSW Environment Protection Authority (EPA) and NSW Department of Primary Industries – Water (DPI-Water) have been consulted during preparation of this CMP. No issues or objections were raised during the consultation process. Copies of correspondence with regulatory authorities is provided in Appendix D.

The remainder of this CMP is structured as follows:

- **Section 2**: Identifies the Development Consent, Mining Lease and Environmental Protection Licence conditions applicable to this CMP.
- **Section 3**: Outlines the CGO’s Environmental Management System, environmental management plans (EMPs) and studies relevant to cyanide management.
- **Section 4**: Describes cyanide containment and management measures.
- **Section 5**: Describes wildlife management in relation to cyanide.
- **Section 6**: Describes the cyanide monitoring programme.
- **Section 7**: Outlines contingency measures for cyanide reduction and the process for EPA review of cyanide levels in the event of wildlife deaths occurring due to cyanide.
- **Section 8**: Summarises stakeholder consultation and complaints receipt.
- **Section 9**: Details reporting requirements for issues related to cyanide management and monitoring.
- **Section 10**: Outlines auditing and review requirements.
- **Section 11**: Lists the references cited in this CMP.

### 1.2 CGO OVERVIEW

Key features of the CGO are shown on Figures 1 and 2 and include:

- an open pit;
- a processing plant to extract the gold from the mined ore;
- waste rock emplacements which contain mined rock which has no commercial quantities of gold;
- two tailings storages which contain the slurry residue from the processing plant;
- a lake isolation system between the mine and the lake to separate the mine from Lake Cowal over the long-term;
- a public access road and a travelling stock reserve adjoining the western boundary and part of the northern and southern boundaries of ML 1535;
- water supply pipelines and borefields located approximately 20 km to the north-east of the CGO and within ML 1535; and
• an Up-Catchment Diversion System (UCDS) to divert up-catchment runoff around the CGO and the Internal Catchment Drainage System (ICDS) to separate surface water external to the CGO from contained waters generated within the CGO disturbance area.

The CGO also includes a 132 kilovolt (kV) electricity transmission line from Temora to the mine site (Figure 1).

A description of key activities associated with the CGO is provided in Table 1. Further details of activities associated with the mine site are provided in *Cowal Gold Mine Mine Life Modification Environmental Assessment* (Evolution, 2016) and in the CGO’s various EMPs.

### Table 1
**Summary of Key CGO Activities**

<table>
<thead>
<tr>
<th>CGO Component</th>
<th>Description</th>
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<tbody>
<tr>
<td>Mining and Waste Rock Management</td>
<td>The CGO will be developed by conventional open pit methods, mining both oxide (weathered) ore which comprises the upper portion of the orebody and primary (unweathered) ore which constitutes the majority of the orebody. The waste rock (rock containing no commercial gold) and ore (rock containing commercially viable quantities of gold) is broken through a routine sequence of in-pit drilling and blasting. Broken rock is hauled from the pit to be placed within dedicated waste rock emplacements or, in the case of ore, direct to the primary crusher or run-of-mine (ROM) stockpiles.</td>
</tr>
<tr>
<td>Processing Plant and Tailings Management</td>
<td>Broken ore from the mine will either be stockpiled or hauled to a primary crusher located near the processing plant. The crushed ore will then be conveyed to the grinding circuit which will reduce the ore to a finely ground slurry. After being ground, primary ore will pass through a flotation circuit where the gold-bearing portion of the slurry will be floated off as a froth or concentrate. The concentrate will then pass to a leaching circuit where cyanide is added to leach gold from the concentrate. The flotation circuit reduces the amount of ore required to be cyanide leached and therefore greatly reduces cyanide usage. The ground oxide ore will be cyanide leached without having to pass through the flotation circuit. A conceptual primary ore processing flowsheet is provided in Figure 3. The gold extracted from the cyanide leaching circuit will be recovered and poured as gold bars (or doré). These gold bars represent the final product of the mine and will be sold to a refinery for purification. The finely ground ore residue left after the flotation and leaching processes (tailings) will be treated to destroy cyanide to prescribed limits and then pumped to one of two tailings storages. The tailings storages are located about 3.5 km west of the Lake Cowal shoreline (Figure 2). The tailings storages will be stage constructed throughout the mine life by raising the height of the embankments in advance of storage requirements. To increase the area available for tailing deposition, the area in between the tailings storage facilities will be used as an additional storage area. The bulk of the water from the tailings storages will drain from the surface of the tailings and collect in the centre of each storage from where it will be reclaimed and recycled within the processing plant.</td>
</tr>
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</table>
| Lake Isolation System                | The lake isolation system comprises a temporary isolation bund and a permanent lake protection bund (Figure 2):  
  - The temporary isolation bund was designed and constructed to control water inflow to the pit development area during construction of the permanent lake protection bund. The bund is a short-term feature and is proposed to be reshaped and rehabilitated during mine closure.  
  - The lake protection bund has been designed and constructed to meet specific engineering criteria for compaction so that it forms a permanent barrier between the lake and the open pit. The lake protection bund has been revegetated and will continue to be maintained in accordance with the CGO’s Rehabilitation Management Plan (RMP). |
Table 1 (Continued)
Summary of Key CGO Activities

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<thead>
<tr>
<th>CGO Component</th>
<th>Description</th>
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<td>Water Supply</td>
<td>Raw water requirements for the mine will be met through a combination of open pit dewatering, recycling within the processing plant and the tailings water decant and return system and (where the demand exceeds the available supply from these sources) make-up water pumped from external water supply sources. Extraction of saline groundwater is licensed via the saline groundwater supply borefield within ML 1535 (Figure 2) and from the Eastern Saline borefield (Figure 1). In addition, a licensed borefield is located within the Bland Creek Palaeochannel which is linked to the mine site via a buried pipeline (Figure 1). Licensed water is also accessed from the Lachlan River which is supplied via a pipeline from the Jemalong Irrigation Channel.</td>
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<tr>
<td>Access Roads</td>
<td>Road access to the CGO is via an approved route from West Wyalong. Within ML 1535, haul roads and internal roads have been constructed as necessary to provide transport links between the processing plant, tailings storages, waste rock emplacements and open pit. The former public road which ran in a north/south direction through ML 1535 has been closed and replaced by a new public road which has been constructed in a new travelling stock reserve adjoining the western boundary and part of the northern and southern boundaries of ML 1535. The location of the new travelling stock reserve is shown in Figure 2.</td>
</tr>
<tr>
<td>Electricity Transmission Line</td>
<td>Electrical power supply to meet the demands of the CGO is supplied by a a 132 kV line constructed from Temora (Figure 1). A substation is has been constructed to distribute power within ML 1535.</td>
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<td>Rehabilitation</td>
<td>The rehabilitation philosophy for the CGO is to create stable rehabilitated landforms which increase areas of endemic vegetation in ML 1535 and the status of lake-land habitats. The CGO's rehabilitation strategy and management is described in detail in the CGO's RMP.</td>
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1.3 OVERVIEW OF EXISTING ENVIRONMENT

The region supports mainly dryland agriculture with irrigation farming practised in the Jemalong/Wylde Plains to the north-east of Lake Cowal. The general landscape of the area is flat to very gently undulating land with occasional hills such as Wamboyne Mountain. Lake Cowal is part of the wider Lachlan River valley. When full, Lake Cowal overflows into Nerang Cowal to the north which in turn overflows to Manna Creek, Bogandillon Creek and ultimately into the Lachlan River. The Lake Cowal wetland forms part of the Wilbertroy-Cowal wetlands which includes Lake Cowal, Nerang Cowal and Bogandillon Swamp. The Wilbertroy-Cowal wetland system has been described as one of the most significant waterbird concentration areas in NSW by the former Australian Heritage Commission (1992). In 1992 the Lake was listed by the then Australian Heritage Commission on the former Register of the National Estate and is currently listed on the Directory of Important Wetlands in Australia. Lake Cowal provides, albeit episodically and for relatively short periods of time, habitat for wetland bird life that is of national significance.
2 STATUTORY REQUIREMENTS

The Development Consent, EPL and ML 1535 conditions relevant to this CMP are outlined below. A summary of the legislative regime relevant to this CMP is included as Appendix A. A summary of the codes of practice, Australian Standards and other guidelines relevant to this CMP is included as Appendix B.

2.1 DEVELOPMENT CONSENT CONDITIONS

This CMP has been prepared in accordance with the requirements of Development Consent Condition 5.3(b) and includes a description of the CGO cyanide monitoring programme as required by Development Consent Condition 5.3(d). The requirements of Development Consent Conditions 5.3(b) and (d) and other conditions relevant to this CMP are outlined in Table 2 below.

<table>
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<th>Development Consent Condition</th>
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<td>5.3 Cyanide Management</td>
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<td>(a) Cyanide Levels</td>
<td>4.2.2</td>
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<td>The Applicant shall ensure that cyanide levels of the aqueous component of the tailings slurry stream do not exceed: 20 mg CNWAD/L (90 percentile over six months), and 30 mg CNWAD/L (maximum permissible limit at any time), at the process plant.</td>
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<tr>
<td>(b) Cyanide Management</td>
<td>This CMP</td>
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<td>The Applicant shall prepare and implement a cyanide management plan for the development to the satisfaction of the Secretary. The plan is to be prepared in consultation with DRE, EPA and DPI (Water), and include monitoring and reporting of cyanide use on the site. The plan shall make provision for, but is not limited to:</td>
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<td>(i) containing cyanide contaminated waters entirely within the mine site;</td>
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<td>(ii) maintaining weak acid dissociable (WAD) cyanide levels at the process plant to the levels stated in condition 5.3(a);</td>
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<td>(iii) contingency measures for cyanide reduction.</td>
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<td>(c) Wildlife Deaths</td>
<td>7.4</td>
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<td>In the event of wildlife deaths occurring due to cyanide, review of cyanide levels shall occur by the EPA in consultation with the Applicant and DRE. Any decision to require cyanide reduction shall include, but not be limited to, consideration of the number of fauna deaths, the species involved, antecedent condition of species, methods employed at the time to prevent use of tailings dams by fauna, and antecedent climatic and surface water conditions of the Lake and surrounding area. The Applicant shall notify the CEMCC of any reductions in cyanide levels as soon as practicable.</td>
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<tr>
<td>(d) Cyanide Monitoring</td>
<td>6.2 and 7.2</td>
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<td>The Applicant shall prepare and implement a cyanide monitoring programme for the development to the satisfaction of the Secretary. The plan must be prepared in consultation with the EPA and DRE, and shall include, but not be limited to, provision for:</td>
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<td>(i) monitoring of CNWAD levels of the aqueous component of the tailings slurry stream at the process plant twice daily or as otherwise directed by the Secretary, with any increases above 20mg CNWAD/L to be assessed daily to ensure compliance and reported in the Annual Review, unless otherwise agreed by the Secretary. If the CNWAD levels of 30mg/L are exceeded in the liquid at any time, discharge to the tailings dams shall cease until CNWAD levels can be achieved below the levels stated in condition 5.3(a) and such exceedance shall be reported to the EPA within 24 hours;</td>
<td>6.2</td>
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<tr>
<td>(ii) monitoring CNWAD levels in the decant water of the tailings dams twice daily or as otherwise directed by the Secretary;</td>
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### Table 2 (Continued)
**Development Consent Conditions Relevant to this CMP**

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<td>(iii) an on site laboratory for quickly establishing $CN_{WAD}$ levels in the liquid at the</td>
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<td>process plant and in the decant ponds for monitoring purposes;</td>
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<td>(iv) on-line monitoring of $CN($FREE$)$ at locations where employees are operating;</td>
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<td>(v) establishing a monitoring regime for detection of cyanide movement beneath and adjacent</td>
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<td>to the tailings impoundments.</td>
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<td>A summary of the cyanide monitoring results shall be provided on the Applicant’s website for</td>
<td>6.1 and 9</td>
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<td>the development on a regular basis, or as directed by the Secretary.</td>
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Further to Development Consent Condition 5.3 above, additional Development Consent conditions of relevance to the CMP include:

- Development Consent Condition 2.1 which requires the preparation of a Mining Operations Plan (MOP). This is referred to in Section 3.2.
- Development Consent Condition 3.2 which includes wildlife management measures in respect of cyanide and the requirement to provide contingency measures for reducing cyanide levels in the tailings storages in the event it is established that fauna deaths are occurring from cyanide. This condition is addressed in Sections 5 and 7.3.
- Development Consent Condition 4.4 which requires the preparation of a Water Management Plan (WMP) and Condition 4.5 which requires preparation of a water monitoring program. These conditions are referred to in Section 3.2.
- Development Consent Condition 5.2 which requires the tailings storages to be constructed in accordance with the requirements of relevant regulatory authorities. This condition is addressed in Section 4.2.3.
- Development Consent Condition 5.7 which requires preparation of a Hazardous Waste and Chemical Management Plan (HWCMP). The HWCMP is discussed in Sections 3.2 and 4.
- Development Consent Condition 4.5(c) which requires the preparation of a Monitoring Programme for Detection of Movement of Lake Protection Bund, Water Storage and Tailings Structures and Pit/Void Walls. This condition is discussed in Sections 3.2 and 4.2.3.4.
- Development Consent Condition 9.1(a) which requires the preparation of an Environmental Management Strategy (EMS). This condition is addressed in Section 9.1.
- Development Consent Condition 9.1(b) which requires the preparation of an Annual Review. This condition is addressed in Section 9.1.
- Development Consent Condition 9.1(c) which outlines the review requirements for the CGO’s EMPs, strategies and programs, including the CMP. This condition is addressed in Section 10.3.
- Development Consent Condition 9.1(d) which requires the establishment of a Community Environmental Monitoring and Consultative Committee (CEMCC). This condition is addressed in Section 8.1.
• Development Consent Condition 9.2(a) which requires Independent Environmental Audits to be conducted, and Development Consent Condition 9.2(b) which requires the establishment of an Independent Monitoring Panel. These conditions are addressed in Section 10.

• Development Consent Condition 9.3 which outlines incident reporting requirements and requirements for reporting under the CGO’s EMPs, strategies and programs. This condition is addressed in Section 9.2.

• Development Consent Condition 9.4(a)(v) which requires the maintenance of a complaints register. This condition is addressed in Section 8.2.1.

2.2 ML 1535 CONDITIONS OF AUTHORITY

The DRE’s Conditions of Authority for ML 1535 also includes a requirement relevant to the use of cyanide, viz.:

• Condition of Authority 28 which requires the leaseholder not to use cyanide or any solution containing cyanide without the prior written approval of the Minister for Industry, Resources and Energy and subject to any conditions stipulated by the Minister.

Written approval from the Minister was obtained in correspondence from the (then) DPI, dated 17 January 2006.

2.3 EPL 11912 CONDITIONS

The EPA has additional requirements that relate to cyanide management and monitoring as detailed in EPL 11912. These include:

• Limit Condition L2 which requires that cyanide levels in the tailings slurry stream measured at the process plant (i.e. EPL Monitoring Point 48) do not exceed 20 milligrams $CN_{WAD}$ per litre (mg $CN_{WAD}$/L) (90 percentile over six months), and 30 mg $CN_{WAD}$/L (maximum permissible limit at any time). This condition is addressed in Section 4.2.2.

• Operating Condition O4.2 which requires the tailings storages and contained water storage facilities to have a basal barrier or impermeable liner with an equivalent permeability of $1 \times 10^{-9}$ metres per second (m/s) over a thickness of 1 metre (m). This condition is addressed in Section 4.2.3.3.

• Monitoring and Recording Condition M1 which outlines requirements for monitoring records for samples collected for the purpose of the EPL. This condition is addressed in Section 6.2.4.

• Monitoring and Recording Condition M2 which requires the monitoring of $CN_{WAD}$ at a number of points within the CGO. This condition is addressed in Section 6.4.

• Monitoring and Recording Conditions M5 and M6 which require the licensee to keep a record of all complaints made in relation to pollution arising from a licensed activity and to provide a telephone complaints line. These conditions are addressed in Section 8.2.2.

• Reporting Condition R2 which requires the licensee to notify the EPA of incidents causing or threatening material harm to the environment. This condition is addressed in Section 9.2.
3 ENVIRONMENTAL MANAGEMENT SYSTEM, STRATEGY, PLANS AND STUDIES

Environmental management of the CGO encompasses a range of environmental management strategies, plans, studies and monitoring programmes developed in accordance with the CGO’s statutory approvals. Evolution’s environmental management system software includes an Environmental Obligations Register (EOR) which tracks the CGO’s environmental obligations prescribed by the CGO’s approvals, environmental management strategies, plans, studies and monitoring programmes.

The CGO’s environmental management system has been independently audited and certified as compliant with the ISO 14001 Environmental Management System guidelines in June 2013 and October 2014.

This remainder of this Section provides an overview of the CGO’s EMS, EMPs and pre-construction and pre-commissioning studies relevant to the management of cyanide at the CGO. Details of the CGO’s certification the International Cyanide Management Institute’s (ICMI) (2002) Code for Cyanide Management is also described in Section 3.4.

3.1 ENVIRONMENTAL MANAGEMENT STRATEGY

In accordance with the requirements of Development Consent Condition 9.1(a), Evolution has prepared an EMS which provides a strategic framework for environmental management at the CGO.

Evolution’s EMS details:

- the requirements of the CGO’s statutory environmental approvals;
- the EMPs, strategies, and monitoring programs prepared for the CGO;
- the CGO’s site management structure;
- Evolution’s corporate environmental policy;
- the internal and external review process for environmental improvement at the CGO;
- the complaints and dispute resolution process implemented at the CGO;
- the process for reporting any non-compliances with the CGO’s statutory approvals; and
- the CGO’s emergency or incident response procedures.
3.2 ENVIRONMENTAL MANAGEMENT PLANS

In addition to this CMP, a number of EMPs are also relevant to the management of cyanide at the CGO including those summarised in Table 3.

<table>
<thead>
<tr>
<th>Environmental Management Plan</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining Operations Plan</td>
<td>MOPs have been regularly prepared since commencement of operations at the CGO. CGO MOPs provide a detailed description of the proposed mining operations and rehabilitation activities at ML 1535 for set operational terms.</td>
</tr>
<tr>
<td>Hazardous Waste and Chemical Management Plan</td>
<td>In accordance with Development Consent Condition 5.7, a HWCMP has been prepared for the CGO. The HWCMP includes details of the management of chemicals (including cyanide) and wastes, emergency spill response procedures and details of the Hazardous Substance and Dangerous Goods Register (HSDGR).</td>
</tr>
<tr>
<td>Emergency Response Plan/Pollution Incident Response Management Plan</td>
<td>In accordance with Development Consent Condition 5.4(b)(ii) and in accordance with the requirements of Part 5.7A of the NSW Protection of the Environment Operations Act, 1997; an Emergency Response Plan/Pollution Incident Response Management Plan has been prepared for the CGO. The plan details emergency response procedures to pollution incidents including procedures for spillage, clean-up, control and protection, and for the rescue of wildlife during the emergency.</td>
</tr>
<tr>
<td>Water Management Plan</td>
<td>A WMP has been prepared for the CGO in accordance with Development Consent Condition 4.4(a). The WMP details the measures for management and mitigation of potential water quality and quantity (surface and groundwater) impacts of the CGO and describes the CGO site water management system which is designed to contain all potentially contaminated water generated within the CGO area while directing all other water around the perimeter of the site.</td>
</tr>
<tr>
<td>Surface Water, Groundwater, Meteorological and Biological Monitoring Programme</td>
<td>A Surface Water, Groundwater, Meteorological and Biological Monitoring Programme (SWGMBMP) has been developed for the CGO in accordance with the requirements of Development Consent Condition 4.5(b). The SWGMBMP includes details of cyanide monitoring undertaken at relevant CGO surface water and groundwater monitoring sites.</td>
</tr>
<tr>
<td>Monitoring Programme for Detection of Movement of Lake Protection Bund, Water Storage and Tailings Structures and Pit/Void Walls</td>
<td>The Monitoring Programme for Detection of Movement of Lake Protection Bund, Water Storage and Tailings Structures and Pit/Void Walls has been prepared for the CGO in accordance with Development Consent Condition 4.5(c). This plan includes a description of the typical seismicity of Lake Cowal and West Wyalong, an outline of the visual assessment and survey assessment monitoring programmes and procedures to be undertaken in the event of detection of any movement of the tailings structures.</td>
</tr>
<tr>
<td>Flora and Fauna Management Plan</td>
<td>The Flora and Fauna Management Plan (FFMP) includes measures to keep fauna and avifauna away from tailings storage, wildlife rescue procedures, methods for monitoring daily and seasonal fauna usage of the tailings dams and contingency measures for reducing cyanide levels in the tailings dams in the event it is established that fauna deaths are occurring from cyanide in tailings dam water.</td>
</tr>
<tr>
<td>Implementation Plan to Protect Fauna from Interactions with the Tailings Storage Facilities</td>
<td>An Implementation Plan to Protect Fauna from Interactions with the Tailings Storage Facilities has also been prepared for the CGO. The plan includes actions to deter fauna visitation to the tailings storage facilities, actions to apply best available technology and practices for monitoring fauna visitation and actions to apply best available technology and practices for monitoring fauna deaths caused by cyanosis.</td>
</tr>
</tbody>
</table>

3.3 PRE-CONSTRUCTION AND PRE-COMMISSIONING STUDIES

Prior to the construction, commissioning and operations at the CGO, a number of pre-construction and pre-commissioning studies were prepared as required by Development Consent Condition 5.4. The studies that are relevant to cyanide management are described in Table 4.
As described in the Fire Safety Study, the fire hazards are known and there are control measures in place to minimise the risk of fire related incidents involving sodium cyanide. The risks associated with sodium cyanide were reviewed by the HAZOP Study and no further actions to those detailed in the HAZOP were recommended by the Fire Safety Study.

### Transportation of Hazardous Materials Study

Development Consent Condition 5.4(b)(i) requires a Transport of Hazardous Materials Study to be undertaken prior to commissioning of the CGO. The study details the arrangements for the transport of hazardous materials (including cyanide) and details the routes to be used for the movement of vehicles carrying hazardous materials to and from the CGO. The study also addresses issues associated with spills, clean-up procedures, training of clean-up teams, communication, and liaison with organisations such as the fire brigades, District Emergency Management Coordinator (and Committee), Local Emergency Management Committee(s), and state emergency services. In addition, the study addresses issues associated with inspection and monitoring procedures for chemicals such as explosives, xanthates and cyanides prior to commencement of a trip, to verify the integrity of the packaging.

### Safety Management System

Development Consent Condition 5.4(b)(iii) requires the preparation of a safety management system prior to commissioning of the CGO, covering all operations on-site and associated transport activities involving hazardous materials. The document system is to specify all safety related procedures, responsibilities and policies, along with details of mechanisms for ensuring adherence to procedures.

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**Table 4**

**Overview of Pre-Construction and Pre-Commissioning Studies Relevant to Cyanide Management**

<table>
<thead>
<tr>
<th>Study</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazard and Operability Study</td>
<td>A HAZOP Study has been undertaken for the CGO in accordance with Development Consent Condition 5.4(a)(ii). The HAZOP Study was chaired by an independent qualified person approved by the Director-General of the former Department of Infrastructure, Planning and Natural Resources (DIPNR) prior to the commencement of the study. The study included areas of the process which store and/or handle dangerous goods or hazardous materials and/or have the potential for off-site impact in consultation with DIPNR. The HAZOP Study addresses the monitoring, control, alarm and shutdown systems associated with the cyanide process.</td>
</tr>
<tr>
<td>Final Hazard Analysis (Pinnacle Risk Management Pty Ltd, 2004b)</td>
<td>A FHA has been undertaken for the CGO in accordance with Development Consent Condition 5.4(a)(iii). The results of the FHA indicated that the risk associated with the proposed development complies with the Hazardous Industry Planning Advisory Papers No. 4 and No. 6 Guidelines for tolerable fatality, injury, irritation and societal risk. Also, the FHA concluded that the risks to the biophysical environment, the risk of propagation and the impact on cumulative risk in the area from releases are generally negligible. Overall, the FHA concluded the proposed facility does not pose any unacceptable levels of risk. Transport risk is separately analysed in the Transport of Hazardous Materials Study.</td>
</tr>
<tr>
<td>Fire Safety Study (Pinnacle Risk Management Pty Ltd, 2005b)</td>
<td>A Fire Safety Study has been prepared for the CGO in accordance with Development Consent Condition 5.4(a)(i). The objective of the Fire Safety Study was to ensure the proposed fire prevention, detection, protection and fighting measures are appropriate for specific fire hazards and are adequate to meet the extent of potential fires at the processing facility. The Fire Safety Study provides: Hydrogen cyanide (HCN) is a product of decomposition from sodium cyanide. HCN is a flammable gas. However, as the acute toxicity effects of HCN present significant hazards then the likelihood of HCN formation to levels where combustion can occur is low. This is due to the nature of the process (i.e. the slurry has relatively low sodium cyanide levels) and HCN analysers will be positioned throughout the plant to alert the operators of potential toxic impact at levels well below the concentrations for flammable concerns. Sodium cyanide is non-flammable although, under certain conditions, it is possible to generate flammable gases from this material (e.g. when decommissioning the cyanide sparge mixing tank, the sludge may dry out and ignite due to the presence of carbides). As described in the Fire Safety Study, the fire hazards are known and there are control measures in place to minimise the risk of fire related incidents involving sodium cyanide. The risks associated with sodium cyanide were reviewed by the HAZOP Study and no further actions to those detailed in the HAZOP were recommended by the Fire Safety Study.</td>
</tr>
<tr>
<td>Transport of Hazardous Materials Study</td>
<td>Development Consent Condition 5.4(b)(i) requires a Transport of Hazardous Materials Study to be undertaken prior to commissioning of the CGO. The study details the arrangements for the transport of hazardous materials (including cyanide) and details the routes to be used for the movement of vehicles carrying hazardous materials to and from the CGO. The study also addresses issues associated with spills, clean-up procedures, training of clean-up teams, communication, and liaison with organisations such as the fire brigades, District Emergency Management Coordinator (and Committee), Local Emergency Management Committee(s), and state emergency services. In addition, the study addresses issues associated with inspection and monitoring procedures for chemicals such as explosives, xanthates and cyanides prior to commencement of a trip, to verify the integrity of the packaging.</td>
</tr>
<tr>
<td>Safety Management System</td>
<td>Development Consent Condition 5.4(b)(iii) requires the preparation of a safety management system prior to commissioning of the CGO, covering all operations on-site and associated transport activities involving hazardous materials. The document system is to specify all safety related procedures, responsibilities and policies, along with details of mechanisms for ensuring adherence to procedures.</td>
</tr>
</tbody>
</table>
3.4 ICMI CODE FOR CYANIDE MANAGEMENT

On 17 April 2006, the CGO was the first non-operational gold mine using cyanide in the world to be certified to the ICMI Code for Cyanide Management. Then on 2 August 2007, the CGO was then also the first operational gold mine using cyanide in the world to be pre-operationally and operationally certified to the ICMI Code. The CGO maintained full compliance to the ICMI Code during 2008, 2009 and 2010 and achieved re-certification to the ICMI Code by an independent third-party audit in February 2010, May 2012, November 2013, May 2014 and February 2015.
4 CYANIDE CONTAINMENT AND MANAGEMENT

Many gold-containing ores comprise finely disseminated gold particles locked up with other constituents of the ore. Gold is separated from the other minerals by chemically extracting it after physical processing (e.g. crushing and grinding) of the ore. After more than 100 years of operational use and research into alternative technologies, cyanide remains the preferred reagent for extracting gold where leaching is required. Cyanide is a potentially hazardous chemical which requires careful management and control.

The focus of this CMP is on the management of cyanide within the mining lease. The Transport of Hazardous Materials Study details the management of cyanide transport.

4.1 HANDLING AND STORAGE OF CYANIDE

In accordance with the CGO Chemical Management Strategy which is detailed in the HWCMP, all raw materials/consumables brought on site for use at the CGO will be recorded in an Inventory Register which is updated (as materials arrive on-site) and available for inspection by the appropriate authorities. Safety Data Sheets (SDSs) for solid sodium cyanide, sodium cyanide solution and HCN gas are included in the Inventory Register. The SDSs for these substances are provided in Appendix C.

In accordance with the Chemical Management Strategy, chemicals such as cyanide, recorded on the Inventory Register that are designated as hazardous substances and/or dangerous goods will also be included in the HSDGR. The purpose of the HSDGR is to facilitate efficient audit functions as well as conform to best practice environmental and safety management.

Delivery and storage of cyanide on-site will take place in a controlled area. Cyanide delivery and storage will be within a concrete-bunded area located away from general work areas and incompatible reagents.

Cyanide will be handled and stored in accordance with the requirements of the Minerals Industry Safety Handbook (Department of Mineral Resources [DMR], 2002), AS/NZS 4452:1997 The Storage and Handling of Toxic Substances and the relevant SDSs.

Section 5 of the abovementioned Standard sets out the requirements for storage and handling of toxic substances in bulk, including:

- design and construction requirements for containers;
- requirements for portable and fixed tanks;
- bunds and compounds;
- locations of bulk containers; and
- filling of bulk containers.

A summary of legislation of relevance to the handling and storage of cyanide is included in Appendix A. For example, the Work Health and Safety (Mines and Petroleum) Act 2013 and the Work Health and Safety (Mines and Petroleum) Regulation 2014 require occupiers to notify WorkCover of dangerous goods stored and handled. The requirements for notification of an incident is set out in Schedule 8 to the Work Health and Safety (Mines and Petroleum) Regulation 2014.
The drainage provision for the storage area will slope away from the tanks to a sump. A pump will be fitted at the sump and will transfer any rainfall, hose down or spilt liquid collected to the leach tanks, or alternatively back into the cyanide solution tanks. In the event that spillage does occur within the bunded area, the affected area will be ameliorated in accordance with the procedures contained in the HWCMP.

Storage areas, tanks, pipelines, pumps and valves will have high visibility labelling and will be inspected regularly for signs of leakage, presence of solution outside of the tanks in the bunded areas and integrity of the containment. Any aspects requiring maintenance or repair will be noted and records documenting the inspection and corrective measures will be kept.

Each solids isotainer that arrives at the CGO will contain up to 22 tonnes of solid cyanide. During cyanide transfer, a pump will circulate water from a mixing tank through the solids isotainer, thereby dissolving the solid cyanide in the isotainer. The solution will be recirculated through the isotainer and mixing tank, resulting in a progressive increase in the concentration of cyanide in the liquor until all the cyanide is dissolved. A pump will be used to remove the remaining solution from the bottom of the isotainer and transfer it to the mixing tank. This process is known as sparging. The liquor in the mixing tank will be transferred to the storage tank, from which it will be distributed to the leach tanks via the cyanide ringmain. Prior to departing the delivery bay, the driver will complete a cyanide driver checklist.

4.2 USE OF CYANIDE IN OPERATIONS

4.2.1 Overview of Cyanide Use

Cyanide will be used at the CGO in the leaching of gold from ore and the elution of gold from carbon. The cyanide solution will be pumped from the storage tank to the dual leaching circuit, where it will be added to the ore slurry. Gold leached from the ore will then be adsorbed onto carbon in the leach tanks. The adsorbed gold will be passed to an enclosed system where the gold will be eluted using a heated cyanide and caustic soda solution. The heated cyanide used in this process will be passed to the electrowinning circuit where it will be recycled.

Following processing, the tailings slurry will pass through a cyanide destruction process before being discharged to one of two tailings storages. Cyanide destruction has been incorporated into the process to ensure CNWAD levels at the process plant are maintained at the required levels (as described in Section 4.2.2). The tailings slurry will be deposited peripherally via a spigotted ring main allowing for the progressive development or ‘build-up’ of tailings around the surface of the tailings storages.

4.2.2 Maintaining CNWAD Levels at the Process Plant to the Required Levels

In accordance with Development Consent Condition 5.3(b)(ii), CNWAD levels of the aqueous component of the tailings slurry stream will be maintained so that they do not exceed 20 mg/L CNWAD (90 percentile over six months) and 30 mg/L CNWAD (maximum permissible limit at any time) at the process plant. Cyanide destruction has been incorporated into the process to ensure CNWAD levels at the process plant will be maintained to the levels stated above. Caro’s Acid and the INCO process will be used to destroy cyanide. Caro’s Acid is a mixture of sulphuric acid (H2SO4) and hydrogen peroxide (H2O2). The INCO process involves the introduction of sulphur dioxide (SO2) as sodium metabisulphite (SMBS). The reaction is catalysed by the presence of copper, which may have to be added (as copper sulphate).
4.2.3  Containment of Cyanide-contaminated Waters Entirely within the Mine Site

4.2.3.1  Process Plant Water Management

Tanks holding process solutions (e.g. leach tanks) will be located on bunded concrete containments. The processing plant has been designed such that process water containing cyanide is recycled and therefore kept within the area encompassed by the processing plant run-off collection drain and storage. In the event of spillages, all solutions will be contained within the process plant bunding, and the appropriate spill response procedure will be initiated (as described in the HWCMP). Portable pumps will be provided within the processing area for the pumping of spills within the bunded areas back to the storage tanks or emergency holding tanks.

4.2.3.2  Tailings Delivery and Return Water Management

The tailings delivery and return water lines will be contained within a bunded pipeline corridor that will run parallel to the service corridor between the processing plant and tailings storage facilities. The tailings slurry will be pumped to the tailings storages at ground level. The bunded corridor will drain back to the processing plant and will contain any spills in the event of pipeline rupture/failure. The service corridor will be located alongside the pipeline to facilitate inspections of the pipelines. Daily inspections of the tailings delivery and water return pipelines will be undertaken for physical integrity and to identify any minor leaks. The drain back to the processing plant will also be visually inspected for integrity and function daily. Opportunistic inspections will also be made by personnel working in the area. In addition, an automatic, pressure activated shut-down mechanism will be provided on the tailings discharge pipeline to enable the early detection and stoppage of significant leaks or failures. The tailings pipeline will be fitted with a low flow alarm linked to the central control room with automatic shutdown capability. In the event that spillage does occur within the bunded area, the affected area will be ameliorated in accordance with the HWCMP.

4.2.3.3  Tailings Water Management

The tailings storages have been designed with sufficient freeboard to store water from a 1 in 1,000 average recurrence interval rainfall event (North Limited, 1998). The required free-board will be maintained during the mine life as the storage fills with tailings via a series of embankment lifts.

Detailed analyses and modelling undertaken as part of the Cowal Gold Project: Environmental Impact Statement (EIS) (North Limited, 1998) indicated that limited seepage from the tailings storages would occur through the storage floor. Modelling indicated that under the most conservative conditions, the cyanide plume would not move 200 m beyond the tailings storages. Under the most probable conditions, the plume would not move significantly beyond the base of the tailings storages.

Any seepage flow entering the underlying highly saline aquifers (during mining operations and for a limited time, post-closure) would be permanently diverted to flow towards the final void. Modelling indicated that this seepage would move very slowly and would not reach the open pit during the operating life of the CGO. Any residual contaminants which enter the groundwater system below the tailings storages are expected to either be immobilised or substantially reduced in concentration near the base of the storage. The groundwater modelling indicated residual cyanide concentrations would be reduced by a factor of one thousand (to negligible levels) near the base of the tailings storages.
In summary, any limited seepage from the tailings storages is likely to have a negligible impact on existing groundwater levels or quality and would migrate slowly towards the final void. Within some 30 to 40 years following mine closure, the tailings storages would be essentially de-saturated and measurable seepage through the floor would cease.

A number of seepage control measures have been incorporated into the tailings storages, including:

- the pre-stripping of surficial soils beneath the embankment footprint;
- construction of a moisture-conditioned and compacted-low-permeability storage floor where necessary, to achieve permeability criteria; and
- installation of an underdrainage and decant network.

As required by Development Consent Conditions 4.4(c)(i) and 5.2(a) the tailings storages will continue to be constructed to the requirements of DPI-Water, EPA, DRE and the Dams Safety NSW. Further, the floor of the tailings storages have been constructed and compacted to a permeability acceptable to the DRE and EPA in consultation with DPI-Water, in accordance with Development Consent Condition 5.2(b).

In accordance with EPL 11912, the tailings storages and contained water storage facilities have been constructed with a basal barrier or impermeable liner with an equivalent permeability of $1 \times 10^{-9}$ m/s over a thickness of 1 m.

Following tailings deposition, supernatant water will drain to the central pond and decant towers. The decant tower will be accessible via a causeway. An underdrainage pipe network has been installed to facilitate drainage of the tailings mass. The bulk of the water from each tailings storage will, however, drain from the surface of the tailings and collect in the centre of each storage. This water as well as underdrainage water will be reclaimed and used within the processing plant. The decant system (including access causeway) will be progressively raised during the development of the tailings storages.

4.2.3.4 Tailings Storage Movement

Monitoring will be conducted for any movement of the tailings storages as described in the Monitoring Programme for Detection of any Movement of Lake Protection Bund, Water Storage and Tailings Structures and Pit/Void Walls, as follows:

- Visual assessments of the tailings structures will be undertaken routinely (i.e. weekly), following review of surface and groundwater monitoring data and following seismic events to identify the initial signs of movement.
- Survey assessment of the tailings structures will be routinely undertaken at six monthly intervals or following visual assessments that indicate movement of a structure and/or following seismic events to determine and quantify any movement of these structures.
5 WILDLIFE MANAGEMENT

The FFMP and Implementation Plan to Protect Fauna from Interactions with the Tailings Storage Facilities outline a number of measures relevant to cyanide and wildlife management including:

- Mechanisms to keep fauna and avifauna away from the tailings storages including:
  - minimising the area of open water in the tailings dams;
  - fencing to prevent both medium and large fauna, terrestrial and amphibians, from entering the area;
  - making the area non-conducive to the establishment of wildlife habitats, as far as possible; and
  - use of current best practice methods for avifauna deterrence.
- Methods for monitoring the daily and seasonal fauna usage of the tailings storages.
- Plans for the rescue and rehabilitation of wildlife.
- Protocol for deaths or other incidents involving native fauna recorded on the mining lease (including monitoring of deaths or other incidents involving fauna, reporting of deaths or other incidents involving fauna and provision of fauna autopsy facilities).
- Investigation of fauna deaths recorded off the mining lease.
- Provision of fauna autopsy facilities.
- Investigation of whether fauna death(s) recorded on the mining lease occurred as a result of cyanide in the tailings dams.
- Contingency measures for reducing cyanide levels in the tailings dams in the event it is established that fauna deaths are occurring from cyanide in tailings dam water, in accordance with Development Consent Condition 3.2(b)(iv) (refer also Development Consent Condition 5.3(c)).
- Training of environment department staff.

5.1 INVESTIGATION OF WHETHER NATIVE FAUNA DEATHS OCCURRED AS A RESULT OF CYANIDE IN THE TAILINGS DAMS

The following procedure will be implemented to investigate whether recorded fauna death(s) occurred as a result of cyanide in the tailings dams:

**Step 1** – Report native fauna death(s) (except those attributable to physical trauma such as vehicle strike) to the NSW Office of Environment and Heritage (OEH), DRE and CEMCC, and in the case of fish, NSW Department of Primary Industries – Fisheries (DPI-Fisheries) within 24 hours (or the next working day).

**Step 2** – Conduct autopsy of dead fauna (refer Section 6.3 of the FFMP) and report findings to the OEH, DRE, and CEMCC, and in the case of fish, DPI-Fisheries, when they become available.
6  CYANIDE MONITORING PROGRAMME

In accordance with Development Consent Condition 5.3(d), the cyanide monitoring programme includes:

- monitoring of CNWAD levels of the aqueous component of the tailings slurry stream at the process plant (Section 6.2);
- monitoring CNWAD levels in the decant water of the tailings dams (Section 6.2);
- an on-site laboratory for quickly establishing CNWAD levels in the liquid at the process plant and in the decant ponds for monitoring purposes (Section 6.2);
- on-line monitoring of HCN (i.e. a form of CNFREE\(^1\), as discussed in Appendix G of the EIS) at locations where employees are operating (Section 6.3); and
- a monitoring regime for the detection of cyanide movement beneath and adjacent to the tailings storages (Section 6.4).

6.1  REPORTING OF MONITORING

In accordance with Development Consent Condition 5.3(d) a summary of the cyanide monitoring results will be provided on Evolution’s website on a regular basis, or as directed by the Secretary. All monitoring results will also be included in the Annual Review (refer to Section 9 for reporting obligations).

6.2  CNWAD LEVELS AT THE PROCESS PLANT AND IN THE DECANT WATER OF THE TAILINGS STORAGES

Sections 6.2.1 to 6.2.4 describe the monitoring locations and frequency, sample collection, laboratory analysis, and data management for monitoring CNWAD levels at the process plant and for monitoring CNWAD levels in the decant water of the tailings storages. Section 6.2.5 outlines the review of this monitoring programme.

6.2.1  Monitoring Locations and Frequency

CNWAD levels of the aqueous component of the tailings slurry stream will be monitored at the process plant twice daily (or as otherwise directed by the Secretary of the Department of Planning and Environment [DP&E]), in accordance with Development Consent Condition 5.3(d)(i). In accordance with Development Consent Condition 5.3(d)(ii), CNWAD levels in the decant water of the tailings storages will be monitored twice daily (or as otherwise directed by the Secretary of the DP&E).

CNWAD levels are also monitored at several groundwater monitoring bores surrounding the tailings storage facilities as required by EPL Condition M2, as described in Section 6.4.

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\(^1\) CNFREE: Free cyanide, generally includes the cyanide ion (CN\(^-\)) and HCN.
6.2.2 Sample Collection

$CN_{WAD}$ samples will be collected at the process plant and in the decant water of the tailings storages using the following procedures and methodologies.

1. $CN_{WAD}$ samples will be collected twice daily at the process plant and in the decant water of the tailings storages in accordance with the AS/NZS 5667:1:1998 Water Quality – Sampling and preserved in accordance with American Public Health Association (APHA) (2012) Standard Methods for the Examination of Water and Wastewater (APHA Standard Methods) (Method 4500-CN-B Preliminary Treatment of Samples) for analysis at an off-site laboratory located in West Wyalong.

2. $CN_{WAD}$ samples will also be collected twice daily at the process plant and in the decant water of the tailings storages (at the same time as the abovementioned samples) in accordance with the AS/NZS 5667:1:1998 Water Quality – Sampling and preserved in accordance with APHA Standard Method 4500-CN-B Preliminary Treatment of Samples for analysis at the on-site laboratory.

3. Additional $CN_{WAD}$ samples will be collected at the process plant weekly (at the same time as the abovementioned samples) in accordance with AS/NZS 5667:1:1998 Water Quality – Sampling and preserved in accordance with APHA Standard Method 4500-CN-B Preliminary Treatment of Samples for analysis at a National Association of Testing Authorities (NATA) accredited laboratory.

The sampling programme will be consistent with the quality assurance/quality control measures required by AS/NZS 5667:1:1998 Water Quality – Sampling guidelines and APHA Standard Methods. A sample register will be maintained on-site for each sample collected.

Sample collection will be undertaken by appropriately qualified staff and appropriate safety precautions (such as gloves and protective clothing) will be employed.

6.2.3 Laboratory Analysis

6.2.3.1 On-site Laboratory Analysis

In accordance with Development Consent Condition 5.3(d)(iii) an on-site laboratory has been established to quickly establish $CN_{WAD}$ levels in the liquid at the process plant and in the decant ponds for monitoring purposes. $CN_{WAD}$ samples collected twice daily at the process plant and in the decant water of the tailings storages will be analysed at the on-site laboratory. The samples will be analysed for $CN_{WAD}$ in the on-site laboratory using Picric Acid Colorimetric determination (or any other method considered appropriate in consultation with the DRE, the EPA and the DP&E). The $CN_{WAD}$ samples will then also be analysed at the on-site laboratory using APHA Standard Method 4500-CN-I Weak Acid Dissociable Cyanide (except instead of manual distillation, an automated VELP distillation unit will be used and instead of sulphuric acid as the pH modifier, magnesium chloride will be used) and then using the APHA Standard Method 4500-CN-E Colorimetric Method. The results of the on-site analysis will be verified by the off-site laboratory analysis set out in Section 6.2.3.2.

An automated $CN_{WAD}$ sampler (i.e. a Cyanoprobe analyser) would also be used on-site to assist with quickly establishing $CN_{WAD}$ levels in the liquid at the process plant and in the decant ponds.
6.2.3.2 Off-site Laboratory Analysis

CNWAD samples will be collected twice daily at the process plant and in the decant water of the tailings storages in accordance with AS/NZS 5667:1:1998 Water Quality – Sampling and will be analysed at an off-site laboratory located in West Wyalong. The samples will be analysed for CNWAD at the off-site laboratory in accordance with APHA Standard Method 4500-CN-I Weak Acid Dissociable Cyanide (except instead of manual distillation an automated VELP distillation unit will be used and instead of sulphuric acid as the pH modifier, magnesium chloride will be used) and then using the APHA Standard Method 4500-CN-E Colorimetric Method.

The additional weekly CNWAD samples collected at the process plant will be sent as soon as practicable\(^2\) for analysis at an off-site NATA-accredited laboratory for analysis in accordance with APHA Standard Method 4500-CN-O Total Cyanide and Weak Acid Dissociable Cyanide by Flow Injection Analysis. The CNWAD results from the NATA-accredited laboratory will be used to verify the CNWAD results from the on-site laboratory and off-site laboratory in West Wyalong.

For samples sent to off-site laboratories, a sample chain-of-custody (CoC) form will be completed for each sample collected. A copy of the CoC will be provided to the laboratory with the samples. A copy of the CoC will be held on site for the life of the CGO.

6.2.4 Data Management

Data obtained by the monitoring of CNWAD levels at the process plant and in the decant water of the tailings storages will be maintained on-site by the Metallurgy Manager (or delegate) in accordance with the requirements of EPL Condition M1.

6.2.5 Monitoring Programme Review

The monitoring programme for CNWAD levels at the process plant and in the decant water of the tailings storages was reviewed subsequent to the first two months of operations in consultation with the EPA, the then DMR and the then Director General for Planning.

The monitoring programme outlined in Section 6.2 will be reviewed and revised/updated if necessary, as a result of the review process prescribed by Development Consent Condition 9.1(c) described in Section 10.3.

6.3 On-line Monitoring of CN\textsubscript{FREE} at Locations Where Employees Are Operating

Development Consent Condition 5.3(d)(iv) requires the on-line monitoring of \(\text{CN}_{\text{FREE}}\) levels at locations where employees are operating. As cyanide is transported to the CGO in solids isotainers which are then sparged directly as a liquid into an on-site sparge mixing tank, employee contact with solid cyanide (i.e. fine cyanide dust) will not occur during sparging or storage. As a result, on-line monitoring will only be conducted for the HCN gas component of \(\text{CN}_{\text{FREE}}\). In the event that an emergency brings employees into contact with solid cyanide (e.g. ruptured solids isotainers), the appropriate emergency response will be initiated.

This section outlines the on-line (i.e. ambient) monitoring of HCN gas that will be undertaken with regard to employee safety.

\(^2\) Samples will be sent within a period of time which does not compromise sample integrity.
The on-line monitoring of HCN gas will be carried out at the cyanide sparging and storage area and in the processing plant, as follows:

- at the cyanide sparging and storage area;
- above the leach tanks;
- at cyanide destruct tanks;
- at the leach tail safety screen;
- at the top and bottom of the elution column; and
- at the electrowinning section.

The ambient monitoring units will take continuous readings and display the results in the process control centre. In addition to the ambient monitors, employees may be required to carry personal monitoring units in designated areas.

Both personal and ambient HCN gas monitoring units will trigger alarms at the National Occupational Exposure Limits detailed in the relevant SDS (Appendix C). Ambient monitoring units will be equipped with a flashing light and siren. Personal monitoring units will vibrate and sound a high pitched alarm.

Section 7.1.1 describes the procedure that will be followed in the event the ambient or personal monitoring units trigger an alarm, while Section 7.1.2 outlines the contingency measures available to reduce levels of HCN gas for employee safety.

6.4 DETECTION OF CYANIDE MOVEMENT BENEATH AND ADJACENT TO THE TAILINGS STORAGES

Development Consent Condition 5.3(d)(v) requires a monitoring programme to be established for the detection of cyanide movement beneath and adjacent to the tailings storages.

As discussed in Section 4.2.3.3, the tailings storage facilities were assessed in the EIS (North Limited, 1998) for their potential seepage impacts on groundwater (quality, flows and levels).

In accordance with EPL 11912, monitoring of CNWAD levels will be undertaken at a network of groundwater monitoring bores to monitor cyanide movement beneath and adjacent to the tailings storages, namely:

- up-gradient bores P555 A-R, P558A-R; and
- tailings storage monitoring bores MON01A & MON01B and MON-02A & MON02B.

The locations of the groundwater monitoring bores are shown on Figure 4. The groundwater monitoring bores will be sampled for CNWAD quarterly. Sampling of the groundwater monitoring bores will be undertaken using the AS/NZS 5667:1998 Water Quality – Sampling series. In accordance with EPL 11912, analysis of the groundwater monitoring bores will be conducted using the APHA Standard Methods. Water quality samples will be labelled and placed in a refrigerator within one hour (or chilled on ice and kept in the dark). Samples will be sent by the following working day for analysis at an off-site NATA-accredited laboratory.
LEGEND
- Mining Lease Boundary (ML 1535)
- Road
- Contour AHD (2 m interval)
- Approximate Extent of Approved Surface Development
- Drainage Path

Note: Pit Downdraining Bore not shown

FIGURE 4
Location of Groundwater Bore used to Monitor CH4 Gas
A laboratory CoC form will be completed for each batch of samples. A copy of the CoC will be provided to the laboratory along with the water samples. A copy of the CoC will be retained on-site.

The CNWAD results that are obtained for the groundwater bores will be recorded and retained as required by EPL 11912.

6.5 CNFREE AND CNWAD LEVELS IN THE PROCESSING PLANT

CNFREE and CNWAD levels will be monitored in the processing plant to provide information relevant to process control and/or cyanide destruction, as described below. As described in Section 6.3, on-line monitoring of the HCN gas component of CNFREE will be undertaken at locations where employees are operating.

CNFREE levels in solution will be monitored at a number of locations in the processing plant for process control and cyanide destruction (i.e. to regulate the dosage of Caro’s Acid or other approved process reagents and to ensure cyanide in the tailings is destroyed down to the required levels). On-line monitoring of CNFREE levels in solution will be conducted using a Cyanoprobe automated unit (or other instrumentation considered appropriate in consultation with DRE, EPA and the DP&E). Elevated levels of CNFREE will be displayed in the process control centre where corrective actions will be implemented.

On-line monitoring of CNFREE levels in solution will be conducted in the first and/or second leach tanks to control the rate and efficiency of dissolution of the gold in the leach circuit. The rate of cyanide addition will be determined by laboratory test work conducted on the type of ore being treated. Routine geochemical assays of the ore feed will be conducted so that the anticipated cyanide levels can be derived from known concentrations of copper and zinc.

On-line monitoring of CNFREE levels in solution will also be conducted in the final leach tank; the rate of cyanide addition will be fine tuned in the plant to control the level of cyanide in the final leach tank. The aim is for the CNFREE level to be as low as possible. The CNFREE level will determine the quantity of Caro’s Acid or other approved process reagents required to be used in the cyanide destruction process.

On-line monitoring of CNFREE levels and pH in solution will also be conducted in the tailings discharge water. In the event this on-line monitoring indicates that CNFREE levels in the tailings discharge water would result in CNWAD levels that would exceed 30 mg/L in the aqueous component of the tailings slurry stream at the process plant at any time, system alarms will be triggered and automated shutdown of the discharge to the tailings storages will occur.

CNWAD levels will also be sampled at a number of locations and analysed at the on-site laboratory. Samples will be taken of the final Carbon-In-Leach tank discharge and the cyanide destruction system discharge, the latter by an automated CNWAD sampler. CNWAD levels will also be sampled in the aqueous component of the tailings slurry stream at the process plant and in the decant water of the tailings storages, as described in Section 6.2. Samples collected at these points will be analysed at off-site and on-site laboratories. In the event CNWAD levels at the process plant exceed 20 mg/L (90 percentile over six months) or 30 mg/L (at any time), one or more of the contingency measures outlined in Section 7.2.1 will be implemented to reduce CNWAD levels to below these levels.
7 CONTINGENCY MEASURES FOR CYANIDE REDUCTION

Development Consent Condition 5.3(b)(iii) requires the CMP to provide contingency measures for reducing cyanide levels. Section 7.1 provides contingency measures for the reduction of HCN levels in areas where employees are operating. Section 7.2 provides contingency measures for reducing CN_WAD levels in the event CN_WAD levels exceed 20 mg/L (90 percentile over six months) or 30 mg/L (at any time) at the process plant. Section 7.3 outlines contingency measures for reducing cyanide levels in the tailings dams in the event it is established that fauna deaths are occurring from cyanide in tailings dam water. Section 7.4 describes the process for EPA review of cyanide levels in the event of wildlife deaths occurring due to cyanide.

7.1 CONTINGENCY MEASURES FOR REDUCING HYDROGEN CYANIDE LEVELS AT LOCATIONS WHERE EMPLOYEES ARE OPERATING

7.1.1 Procedure

The following procedure indicates when contingency measures will be used to reduce HCN levels for employee safety:

Step 1 – Personal or ambient monitoring alarms sound indicating HCN levels are at or above 10 parts per million (ppm).

In the case of an ambient monitor, a siren and flashing lights will be activated and HCN levels will be displayed in the process control centre.

In the case of a personal monitor, the monitor will vibrate and emit a high pitched alarm.

Step 2 – Personnel will be evacuated from the alarm-activated area and the appropriate standard operating procedure will be initiated. Personnel will not be permitted to enter the area in question without the correct personal protective equipment.

Step 3 – Process control centre personnel will investigate the possible causes of the alarm and implement appropriate contingency measures where necessary.

7.1.2 Contingency Measures

In the event HCN levels reach 10 ppm in the cyanide sparging and storage area, personnel will be evacuated, and the appropriate standard operating procedure will be initiated. Personnel will not be permitted to return to the cyanide sparging and storage area without the correct personal protective equipment or until safe HCN levels are achieved.

The contingency measures implemented by the process control centre to reduce HCN levels in the processing plant will vary depending on the circumstances (e.g. the particular HCN levels, the cause of the increased levels and the plant location). The following measures are available to reduce HCN levels in the processing plant:

- reduce the amount or rate of cyanide addition;
- increase the pH of the cyanide solution/process stream;
- reduce the rate of ore feed;
• change the blend of the ore; or
• shut down the process plant.

Each of the above measures will take some time to reduce the level of HCN. Employees will not be permitted to access the area in question without the correct personal protective equipment or until safe HCN levels are achieved.

7.2 CONTINGENCY MEASURES FOR REDUCING CN_{WAD} LEVELS DUE TO LEVELS EXCEEDING 20 MG/L (90 PERCENTILE OVER SIX MONTHS) OR 30 MG/L (AT ANY TIME) AT THE PROCESS PLANT

This section provides contingency measures for the reduction of CN_{WAD} levels at the process plant in accordance with Development Consent Condition 5.3(b)(iii). The CGO’s processing plant has been designed so that CN_{WAD} levels at the process plant do not exceed 20 mg/L (90 percentile over six months) and 30 mg/L (at any time) (North Limited, 1998). As a result, it is not anticipated that the contingency measures provided below would ever need to be activated.

7.2.1 Contingency Measures

In the event CN_{WAD} levels at the process plant exceed 20 mg/L (90 percentile over six months) or 30 mg/L (at any time), one or more of the following contingency measures will be implemented to reduce CN_{WAD} levels to below these levels:

• in accordance with Development Consent Condition 5.3(d)(i), in the event CN_{WAD} levels exceed 30 mg/L in the aqueous component of the tailings slurry stream at the process plant at any time, discharge to the tailings storages will cease until CN_{WAD} levels can be achieved below the levels stated in Development Consent Condition 5.3(a);
• increase the amount or dosage rate of cyanide destruction chemicals being used in the cyanide destruction circuit to achieve lower cyanide levels at the process plant;
• reduce the amount or rate of cyanide addition;
• reduce the rate of ore feed;
• change the blend of the ore;
• modify the cyanide destruction circuit being used (e.g. change to the back-up cyanide destruction unit);
• add cyanide destruction chemicals directly to the tailings storages; or
• add dilution water, if available.

Monitoring of the effectiveness of the contingency measures will be undertaken.

7.3 CONTINGENCY MEASURES FOR REDUCING CYANIDE LEVELS IN THE TAILINGS DAMS FOLLOWING FAUNA DEATHS

Development Consent Condition 3.2(b)(iv) requires contingency measures for reducing cyanide levels in the tailings dams in the event it is established that fauna deaths are occurring from cyanide in tailings dam water.

The process for determining whether fauna deaths are occurring from cyanide in the tailings dam water is contained in Section 5.1 of this CMP.
The following are contingency measures that may be implemented to reduce cyanide levels in the tailings dams in the event it is established that fauna deaths are occurring from cyanide in the tailings dam water:

- increase the amount or dosage rate of cyanide destruction chemicals being used in the cyanide destruction circuit to achieve lower cyanide levels within the tailings dams;
- reduce the amount or rate of cyanide addition;
- reduce the rate of ore feed;
- change the blend of the ore;
- modify the cyanide destruction circuit being used (e.g. change to the back-up cyanide destruction unit);
- add cyanide destruction chemicals directly to the tailings dams to lower existing cyanide levels; or
- add dilution water, if available.

In the event that one or more contingency measures are implemented, regular monitoring of the effectiveness of the contingency measures will be undertaken.

7.4 REVIEW OF CYANIDE LEVELS FOLLOWING FAUNA DEATHS

As set out in Development Consent Condition 5.3(c), in the event of wildlife deaths occurring due to cyanide, the EPA shall conduct a review of cyanide levels in consultation with Evolution and DRE. Any decision to require cyanide reduction will include, but not be limited to, the consideration of:

(a) the number of fauna deaths;
(b) the species of fauna involved in deaths;
(c) the antecedent condition of the species;
(d) methods employed at the time to prevent use of tailings by fauna; and
(e) antecedent climatic and surface water conditions of the lake and surrounding areas.

Evolution will notify the CEMCC of any reductions in cyanide levels as soon as practicable.
8 STAKEHOLDER CONSULTATION

8.1 COMMUNITY ENVIRONMENTAL MONITORING AND CONSULTATIVE COMMITTEE

A CEMCC has been set up for the CGO in accordance with Development Consent Condition 9.1(d). The condition is reproduced below:

9.1 Environmental Management

(d) Community Environmental Monitoring and Consultative Committee

(i) The Applicant shall establish and operate a Community Environmental Monitoring and Consultative Committee (CEMCC) for the development to the satisfaction of the Secretary. This CEMCC must:

- be comprised of an independent chair and at least 2 representatives of the Applicant, 1 representative of BSC, 1 representative of the Lake Cowal Environmental Trust (but not a Trust representative of the Applicant), 4 community representatives (including one member of the Lake Cowal Landholders Association);
- be operated in general accordance with the Guidelines for Establishing and Operating Community Consultative Committees for Mining Projects (Department of Planning, 2007, or its latest version).
- monitor compliance with conditions of this consent and other matters relevant to the operation of the mine during the term of the consent.

Note: The CEMCC is an advisory committee. The Department and other relevant agencies are responsible for ensuring that the Applicant complies with this consent.

(ii) The Applicant shall establish a trust fund to be managed by the Chair of the CEMCC to facilitate the functioning of the CEMCC, and pay $2000 per annum to the fund for the duration of gold processing operations. The annual payment shall be indexed according to the Consumer Price Index (CPI) at the time of payment. The first payment shall be made by the date of the first Committee meeting. The Applicant shall also contribute to the Trust Fund reasonable funds for payment of the independent Chairperson, to the satisfaction of the Secretary.

As required by Development Consent Condition 9.1(d)(i), the CEMCC comprises an independent chair and representatives of the Bland Shire Council, Lake Cowal Environmental Trust, two Evolution representatives and four community representatives including one from the Lake Cowal Landholders Association.

The CEMCC provides an opportunity for members of the community to attend CEMCC meetings to discuss specific issues relevant to them, including any concerns relating to cyanide. A landholder can make a request to the CEMCC regarding a particular issue, or the landowner can register a complaint in the complaints register. Landowners who register complaints may be invited to join in discussion of the issue at the next CEMCC meeting.
8.2 COMPLAINTS REGISTER AND RECORDS

8.2.1 Complaints Register

A process for the handling of complaints is provided below in accordance with the requirements of the CGO’s EPL and Development Consent conditions and to facilitate prompt and comprehensive responses to any community concerns.

As required by EPL Condition M6.1, a dedicated Community Complaints Line has been established (via phone [02] 6975 3454 or email community.cowal@evolutionmining.com.au) that is available 24 hours, seven days a week for community members who have enquiries or who wish to lodge complaints in relation to Evolution’s activities at the CGO.

A complaints register will be maintained by the CGO Environment and Social Responsibility Manager in accordance with EPL Condition M5 and will be made available on Evolution’s website in accordance with Development Consent Condition 9.4(a)(v).

Information recorded in the complaints register with respect to each complaint will include:

- date of complaint;
- the method by which the complaint was made;
- nature of complaint; and
- response action taken to date (if no action was taken, the reasons why no action was taken).

An initial response will be provided to the complainant within 24 hours. Preliminary investigations into the complaint will commence within 48 hours of complaint receipt.

8.2.2 Complaints Records for EPL 11912

Condition M5 of EPL 11912 includes specific requirements for recording of all complaints made in relation to pollution arising from any activity to which EPL 11912 applies. The record will include details of the following:

- the date and time of the complaint;
- the method by which the complaint was made;
- any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
- the nature of the complaint;
- the action taken by Evolution in relation to the complaint, including any follow-up contact with the complainant; and
- if no action was taken by Evolution, the reasons why no action was taken.

The record of a complaint will be kept for at least four years after the complaint was made. The record will be available for inspection by the EPA.
9 REPORTING

9.1 ANNUAL REVIEW

In accordance with Condition 9.1(b) of the Development Consent, Evolution will prepare an Annual Review to report on the environmental performance of the CGO by the end of July each year, or other timing as may be agreed by the Secretary of the DP&E. The Annual Review will be made publicly available on Evolution's website (www.evolutionmining.com.au) in accordance with Development Consent Condition 9.4(a)(vii). The Annual Review will also address the Annual Environmental Management Report requirements of ML 1535 Condition of Authority 26.

The Annual Review will report on cyanide management and use and the cyanide monitoring programme. Cyanide monitoring results collected in accordance with Development Consent Condition 5.3(d)(i) will be reported in the Annual Review (Section 9.3).

9.2 INCIDENT REPORTING

An incident is defined in the CGO Development Consent as a set of circumstances that causes or threatens to cause material harm to the environment, and/or breaches or exceeds the limits or performance measures/criteria of the Development Consent.

In accordance with Development Consent Condition 9.3(a) Evolution will immediately notify the Secretary of the DP&E and any other relevant agencies of any incident related to the CGO. Within seven days of the date of the incident, Evolution will provide the Secretary of the DP&E and any other relevant agencies with a detailed report on the incident, and any further reports that may be requested. In addition, in accordance with EPL 11912 Condition R2, Evolution will notify the EPA (and all other relevant authorities) of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident. Evolution will provide written details of the notification to the EPA within seven days of the date on which the incident occurred.

Evolution will maintain a record of and report on any cyanide-related incidents. The form will be completed when recording incidents at the site.

9.3 CNWAD REPORTING

In accordance with Development Consent Condition 5.3(d)(i), any CNWAD measurements of the aqueous component of the tailings slurry stream at the process plant verified by the off-site laboratory in West Wyalong as exceeding 20 mg/L CNWAD will be assessed daily (to ensure that CNWAD levels do not exceed 20 mg/L [90 percentile over six months]) and reported in the Annual Review, unless otherwise agreed by the Secretary of the DP&E.

As required by Development Consent Condition 5.3(b)(i), in the event CNWAD levels are verified by the off-site laboratory in West Wyalong as exceeding 30 mg/L in the aqueous component of the tailings slurry stream at the process plant at any time, discharge to the tailings dams shall cease until CNWAD levels can be reduced to below the levels stated in Development Consent Condition 5.3(a), and the exceedance will be reported to the EPA within 24 hours.

In accordance with Development Consent Condition 5.3(d) a summary of the cyanide monitoring results will be provided on Evolution’s website on a regular basis, or as directed by the Secretary of the DP&E.
10 AUDITING AND REVIEW

10.1 HAZARD AUDIT

In accordance with Development Consent Condition 5.4(c), a comprehensive hazard audit of the proposed development was conducted (by a duly qualified independent person or team approved by the then Department of Planning [DoP]) 12 months after the commencement of operations and an audit report submitted to the then Director-General for Planning.

As required by Development Consent Condition 5.4(c) Evolution will continue to conduct audits every three years or as determined by the Secretary and a report of each audit will be submitted to the Secretary within a month of the audit. Hazard audits will be carried out in accordance with the DP&E’s Hazardous Industry Planning Advisory Paper No. 5, Hazard Audit Guidelines.

10.2 EXTERNAL AUDITS

10.2.1 Independent Environmental Audit

An Independent Environmental Audit will be conducted in accordance with Development Consent Condition 9.2(a) and may include cyanide-related issues. The condition is reproduced below:

9.2 Independent Auditing and Review

(a) Independent Environmental Audit

(i) By the end of July 2016, and every 3 years thereafter, unless the Secretary directs otherwise, the Applicant shall commission and pay the full cost of an Independent Environmental Audit of the development. This audit must:

• Be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary;
• Include consultation with relevant regulatory agencies, BSC and CEMCC;
• Assess the environmental performance of the development and assess whether it is complying with the requirements in this consent and any other relevant approvals (such as environment protection licences and/or mining lease (including any assessment, plan or program required under this consent));
• Review the adequacy of any approved strategy, plan or program required under this consent or the abovementioned approvals; and
• Recommend measures or actions to improve the environmental performance of the development, and/or strategy, plan or program required under this consent.

Note: This audit team must be led by a suitably qualified auditor, and include ecology and rehabilitation experts, and any other fields specified by the Secretary.

(ii) Within 3 months of commissioning this audit, or as otherwise agreed by the Secretary, the Applicant shall submit a copy of the audit report to the Secretary, together with its response to any recommendations contained in the audit report, and a timetable for the implementation of these recommendations as required. The applicant must implement these recommendations, to the satisfaction of the Secretary.

This process provides a mechanism by which management and monitoring of cyanide at the CGO can be assessed against relevant Development Consent, mining lease and licence conditions, legislation and Australian Standards.
10.2.2 Independent Monitoring Panel

The Independent Monitoring Panel will, amongst other things, review the Independent Audit required by Development Consent Condition 9.2(b). In accordance with Development Consent Condition 9.2(b):

(i) The Applicant shall at its own cost establish an Independent Monitoring Panel prior to commencement of construction. The Applicant shall contribute $30,000 per annum for the functioning of the Panel, unless otherwise agreed by the Secretary. The annual payment shall be indexed according to the Consumer Price Index at the time of payment. The first payment shall be paid by the date of commencement of construction and annually thereafter. Selection of the Panel representatives shall be agreed by the Secretary in consultation with relevant government agencies and the CEMCC. The Panel shall at least comprise two duly qualified independent environmental scientists and a representative of the Secretary.

(ii) The panel shall:
   • provide an overview of the annual reviews and independent audits required by conditions 9.1(b) and 9.2(a) above;
   • regularly review all environmental monitoring procedures undertaken by the Applicant, and monitoring results; and
   • provide an Annual State of the Environment Report for Lake Cowal with particular reference to the on-going interaction between the mine and the Lake and any requirements of the Secretary. The first report shall be prepared one year after commencement of construction. The report shall be prepared annually thereafter unless otherwise directed by the Secretary and made publicly available on the Applicant’s website for the development within two weeks of the report’s completion.

10.3 REVIEW OF THIS CMP

In accordance with Condition 9.1(c) of the Development Consent, this CMP will be reviewed within three months of:

• the submission of an Annual Review under Condition 9.1(b);
• the submission of an incident report under Condition 9.3(a);
• the submission of an audit under Condition 9.2(a);
• the submission of an Annual State of the Environment Report under Condition 9.2(b);
• the approval of any modification to the conditions of the Development Consent; or
• any direction of the Secretary under Condition 1.1(c).

Where this review leads to revisions of the CMP, then within four weeks of the review, the revised CMP will be submitted for the approval of the Secretary of the DP&E (unless otherwise agreed with the Secretary). The revision status of this CMP is indicated after the title page of this CMP.

This CMP will be made publicly available on Evolution’s website (www.evolutionmining.com.au) in accordance with Condition 9.4(a)(iii) of the Development Consent. A hard copy of the CMP will also be kept at the CGO.
11 REFERENCES


APPENDIX A

LEGISLATIVE REGIME
The following sections identify major requirements in the areas of dangerous goods, pollution and mining which may be of relevance to cyanide management at the CGO.

**Dangerous Goods Laws**

*Work Health and Safety Act 2011 (NSW), Work Health and Safety Regulation 2011 (NSW)*

The *Work Health and Safety Act 2011* and the supporting *Work Health and Safety Regulation 2011* regulates the storage, handling and processing of dangerous goods (apart from explosives) in NSW.

*Dangerous Goods (Road and Rail Transport) Act 2008, Dangerous Goods (Road and Rail Transport) Regulation 2008,*

The *Dangerous Goods (Road and Rail Transport) Act 2008 (NSW)* regulates the transport of dangerous goods (other than explosives) by road and rail in NSW. It enables the making of regulations in relation to all aspects of the transportation of dangerous goods, including importing, loading, consigning, marking and placarding of goods and driving of vehicles. It creates a number of offences, including the offence of failing to ensure, as far as practicable, that dangerous goods are transported in a safe manner.

**Pollution Laws**

*Protection of the Environment Operations Act 1997 (NSW)*

This Act creates a number of offences relevant to the management of cyanide, including:

- non-compliance with EPL licence conditions;
- the wilful or negligent disposal of waste in a manner that harms or is likely to harm the environment;
- the wilful or negligent causing of a substance to leak, spill or otherwise escape in a manner that harms or is likely to harm the environment;
- the unlawful transporting of waste;
- the pollution of waters; and
- the proposed new offence of land pollution.

**Mining Laws**


The *Work Health and Safety (Mines and Petroleum Sites) Act 2013* and the supporting *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* regulates the safety of persons and workers at mine and petroleum sites, and ensures effective provisions for emergencies are in place.
APPENDIX B

CODES OF PRACTICE, AUSTRALIAN STANDARDS AND OTHER GUIDELINES
CODES OF PRACTICE

A number of industry codes of practice have been developed to provide practical guidance for employers required to meet occupational health, safety and welfare provisions of relevant legislation. Codes of practices relevant to the management of cyanide at the CGO are summarised below.

Model Work Health and Safety Regulations (9 January 2014)

The National Model Regulations apply to all workplaces in which hazardous substances are used or produced, and to all persons with potential exposure to hazardous substances in those workplaces. The two principal components of the regulations are:

- information provisions - which address the delivery of specific information, for example, labels and SDSs, that the supplier of a workplace hazardous substance has to provide through the employer to employees. These provisions ensure that employee representatives, relevant public authorities and emergency services are also provided with access to relevant information; and
- assessment and control provisions - which require employers to identify hazardous substances in the workplace, make an assessment of those hazards, which arise out of the work activity and then take appropriate control action.

The National Model Regulations require employers to obtain SDSs for all substances from suppliers and ensure these are readily accessible to employees. Employers must also ensure all substances are labelled properly and must keep and maintain a register for all hazardous substances used or produced in the workplace. The register must contain a list of all hazardous substances used or produced at the workplace and the SDSs for all hazardous substances for which SDSs are required by these national model regulations. The model regulations also require employers to provide induction and on-going training to all employees with the potential for exposure to hazardous substances in the workplace. It also provides for health surveillance, record keeping and employees duties to comply with the model regulations.

Model Code of Practice – Managing Risks of Hazardous Chemicals in the Workplace

The Model Code of Practice – Managing Risks of Hazardous Chemicals in the Workplace provides a practical guide on how to manage health and safety risks associated with hazardous chemicals.

Model Code of Practice – Labelling of Workplace Hazardous Chemicals

The Model Code of Practice – Labelling of Workplace Hazardous Chemicals is a national standard for determining whether a chemical is a hazardous chemical, and provide guidance for labelling hazardous chemical labels in the workplace.

Model Code of Practice – Preparation of Safety Data Sheets for Hazardous Chemicals

This code provides practical guidance on meeting the requirements for SDSs under the Work Health and Safety Act, 2011.

Hazardous Substance Information System

The Hazardous Substance Information System contains information on hazardous chemicals that have been classified in the Model Work Health and Safety Regulations.

The database provides hazardous substance (including cyanide) information and exposure standards.
AUSTRALIAN STANDARDS

Where applicable, Evolution or its contractors will comply with the requirements of the following Australian Standards. The Australian Standards will be available to Evolution employees and contractors on site.

**AS/NZS 4452:1997 The Storage and Handling of Toxic Substances**

AS/NZS 4452:1997 The Storage and Handling of Toxic Substances sets out requirements and recommendations for the safe storage and handling of toxic substances that are classified as Class 6.1 in the Australian Code for the Transport of Dangerous Goods by Road and Rail 1998 and also applies to other dangerous goods that are assigned a Class 6.1 subsidiary risk by the Australian Code for the Transport of Dangerous Goods by Road and Rail 1998, except where they are of Class 2, or where more stringent requirements apply under another relevant Standard or applicable regulation.

**AS/NZS 5667 Water Quality – Sampling Series**

The AS/NZS 5667 Water Quality – Sampling series provides principles to be applied in the design of water and waste water sampling programmes, guidance on sampling techniques and guidance on the procedures to be followed to preserve and transport samples. The series includes guidelines for the selection of containers, quality control measures and tables that provide details of preservation techniques.

OTHER GUIDELINES

A number of guidelines outlining best practice principles, procedures and assessments for the hazardous materials and mining industries have been developed. A summary of these guidelines is provided below.

**Best Practice Environmental Management in Mining – Cyanide Management (Environment Australia, 2003)**

Produced by Environment Australia this booklet outlines principles and procedures of cyanide management so that it is used effectively, safely, economically and with no adverse effects on the environment. The aim of best practice cyanide management is "to ensure that the risk of adverse health and environmental impacts is negligible and maintained at levels acceptable to the community and, therefore, to regulators”.


The Minerals Industry Safety Handbook has been developed by the NSW Government (DMR, 2002) with the contribution and commitment of industry stakeholders and other government mining authorities throughout Australia. The handbook has been produced specifically to assist miners in the metalliferous and extractive industries to attain and maintain a safe and healthy workplace.

Section 4.14.4 (Cyanide) of the safety handbook is of particular relevance to the management of cyanide and includes recommendations for control strategies, storage, procedures following exposure, protective clothing, workplace assessment and monitoring.
**Environmental Guidelines: Assessment, Classification, and Management of Liquid and Non-Liquid Wastes (EPA, 1999)**

These guidelines define the assessment and classification procedure for liquid and non-liquid wastes. The guidelines outline the legal obligations of the waste generator and identifies those activities which require an environment protection licence. Guidance is provided as to the waste assessment process and the general rules of waste classification. Management options for the collection, storage, treatment and disposal of classified waste and the requirements for the handling and disposal of special wastes are discussed.


The *International Cyanide Management Code for the Manufacture, Transport and Use of Cyanide in the Production of Gold* (the Code) has been developed as a voluntary industry code to encourage improvement on an industry-wide basis. The principles of the Code are as follows:

- **Production** - Encourage responsible cyanide manufacturing by purchasing from manufacturers who operate in a safe and environmentally protective manner.

- **Transportation** - Protect communities and the environment during cyanide transport.

- **Handling And Storage** - Protect workers and the environment during cyanide handling and storage.

- **Operations** - Manage cyanide process solutions and waste streams to protect human health and the environment.

- **Decommissioning** - Protect communities and the environment from cyanide through development and implementation of decommissioning plans for cyanide facilities.

- **Worker Safety** - Protect workers' health and safety from exposure to cyanide.

- **Emergency Response** - Protect communities and the environment through the development of emergency response strategies and capabilities.

- **Training** - Train workers and emergency response personnel to manage cyanide in a safe and environmentally protective manner.

- **Dialogue** - Engage in public consultation and disclosure.
APPENDIX C

SAFETY DATA SHEETS FOR SOLID SODIUM CYANIDE, SODIUM CYANIDE SOLUTION AND HYDROGEN CYANIDE GAS
This material is hazardous according to criteria of NOHSC. Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for Transport by Road and Rail.

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name: SODIUM CYANIDE
Supplier: Orica Australia Pty Ltd
ABN: 004 117 828
Street Address: 1 Nicholson Street, Melbourne 3000 Australia
Telephone Number: +61 3 9665 7111
Facsimile: +61 3 9665 7937
Emergency Telephone: 1 800 033 111 (ALL HOURS)

2. COMPOSITION/INFORMATION ON INGREDIENTS

Product Description: Uses: Extraction of gold and silver from ores; electroplating; heat treatment of metals; chemical intermediate.

<table>
<thead>
<tr>
<th>Components / CAS Number</th>
<th>Proportion</th>
<th>Risk Phrases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium cyanide 143-33-9</td>
<td>&gt;60%</td>
<td>R26/27/28, R32</td>
</tr>
</tbody>
</table>

3. HAZARDS IDENTIFICATION

Risk Phrases: Very toxic by inhalation, in contact with skin and if swallowed. Contact with acids liberates very toxic gas.

Poisons Schedule: S7 Dangerous Poison.

4. FIRST AID MEASURES

For advice, contact a Poisons Information Centre (Phone eg. Australia 131 126; New Zealand 0 800 764766) or a doctor at once. Urgent hospital treatment is likely to be needed.

Inhalation: Take precautions to ensure rescuer is not overcome. Remove victim from area of exposure - avoid becoming a casualty. Remove contaminated clothing and loosen remaining clothing. Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered. If patient finds breathing difficult and develops a bluish discolouration of the skin (which suggests a lack of oxygen in the blood - cyanosis), ensure airways are clear of any obstruction and have a qualified person give oxygen through a face mask. Apply artificial respiration if patient is not breathing. Seek
immediate medical advice.

**Skin Contact:** If skin contact occurs, remove contaminated clothing and wash skin with running water. If irritation occurs seek medical advice.

**Eye Contact:** If in eyes, wash out immediately with water. In all cases of eye contamination it is a sensible precaution to seek medical advice.

**Ingestion:** Immediately rinse mouth with water. If swallowed, remove from contaminated area. Apply artificial respiration if not breathing. Do not give direct mouth-to-mouth resuscitation. To protect rescuer, use air-viva, oxy-viva or one-way mask. Resuscitate in a well-ventilated area. Never give anything by the mouth to an unconscious patient. Get to a doctor or hospital quickly.

**Notes to physician:** May be fatal if inhaled, swallowed or absorbed through skin. At all places where there is a risk of cyanide poisoning, the following items should be kept in an accessible and convenient location: An oxygen resuscitator and a source of oxygen; a clearly marked CYANIDE ANTIDOTE box containing an approved airway, elasticised tourniquet, disposable in dwelling intravenous cannulae, 20ml sterile disposable syringes and needles, fluoride heparinised blood sample tubes, skin prep swabs, dressings and adhesive tape, and ampoules of kelocyanor (dicobalt edetate), including the prescribing information outlining side effects and precautions (a copy of the appropriate Material Safety Data Sheet and a copy of the Worksafe Australia Guide, 'Cyanide Poisoning'). antidote for cyanide poisoning is the intravenous administration of dicobalt edetate. Due to adverse reactions which may occur in the absence of poisoning, this should be administered when absorption of cyanide is beyond doubt. Cyanide poisoning occurs apidly after exposure. If the patient is conscious after the usual time taken to reach hospital then exposure to cyanide either from inhalation, ingestion or skin contamination is unlikely to have resulted in a significant amount of cyanide being absorbed. In these circumstances the patient should be observed carefully with particular attention being given to the state of consciousness. Over zealous administration of the antidote is contraindicated and may result in serious adverse reactions of an anaphylactic (allergic) nature. Adverse reactions reported include gross oedema of the face and neck, urticaria, palpitations, hypotension, convulsions, vomiting, chest pains, difficulty in breathing, and collapse. If after clinical assessment the patient is considered to require the antidote, that is, the patient is known to have been exposed to cyanide and is unconscious or lapsing into unconsciousness, administer one ampoule containing 300 mg Dicobalt edetate in 20 mL glucose solution (Kelocyanor) intravenously by slow injection. The initial effect is a fall in blood pressure, rise in pulse rate, and sometimes retching. Immediately after this phase, lasting about one minute, the patient should recover. The injection should be discontinued if allergic adverse effects are noted. A second dose may be given if the response is inadequate and allergic adverse effects are absent.

### 5. FIRE FIGHTING MEASURES

**Specific Hazards:** Non-combustible material.

**Fire-fighting advice:** Decomposes on heating emitting toxic fumes, including those of hydrogen cyanide, and ammonia. If safe to do so, remove containers from path of fire. Fire fighters to wear self-contained breathing apparatus and suitable protective clothing if risk of exposure to products of decomposition.

**Suitable Extinguishing Media:** Not combustible, however, if material is involved in a fire use: Water fog (or if unavailable fine water spray), foam, dry chemical powder.

**Unsuitable Extinguishing Media:** DO NOT USE the following as extinguishing media: Carbon dioxide.

### 6. ACCIDENTAL RELEASE MEASURES
Clear area of all unprotected personnel. Avoid breathing in dust. Work up wind or increase ventilation. Wear protective equipment to prevent skin and eye contact and breathing in vapours/dust. DO NOT allow material to get wet. Contain - prevent run off into drains and waterways. Spillage area and contaminated solids can be detoxified by treatment with an excess of dilute sodium hypochlorite, calcium hypochlorite, or ferrous sulfate after the addition of soda ash or lime to raise the pH to greater than 10.5. Allow 1 hour for complete decomposition before washing spillage area down with large quantities of water to ensure maximum dilution. Collect and seal in properly labelled containers or drums for disposal. If contamination of sewers or waterways has occurred advise local emergency services.

### 7. HANDLING AND STORAGE

**Handling advice:** Avoid skin and eye contact and breathing in dust. Avoid handling which leads to dust formation.

**Storage advice:** Store in a cool, dry, well ventilated place and out of direct sunlight. Keep dry - reacts with water. Protect from moisture. Store away from foodstuffs. Store away from incompatible materials described in Section 10. Keep containers closed when not in use - check regularly for spills.

This material is a Scheduled Poison S7 and must be stored, maintained and used in accordance with the relevant regulations.

### 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

**Occupational Exposure Limits:**
No value assigned for this specific material by the National Occupational Health and Safety Commission. However, Exposure Standard(s) for constituent(s):

Cyanides (as CN): 8hr TWA = 5 mg/m3, Sk
Decomposition product(s): Hydrogen cyanide: Peak Limitation = 11 mg/m3 (10 ppm), Sk

As published by the National Occupational Health and Safety Commission.

TWA - The time-weighted average airborne concentration over an eight-hour working day, for a five-day working week over an entire working life.

'Sk' Notice – absorption through the skin may be a significant source of exposure. The exposure standard is invalidated if such contact should occur.

Peak Limitation - a ceiling concentration which should not be exceeded over a measurement period which should be as short as possible but not exceeding 15 minutes.

These Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

**Engineering Control Measures:**
Ensure ventilation is adequate and that air concentrations of components are controlled below quoted Exposure
9. PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Physical state:</th>
<th>Solid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour:</td>
<td>White</td>
</tr>
<tr>
<td>Odour:</td>
<td>Faint ‘Bitter almonds’</td>
</tr>
<tr>
<td>Molecular Formula:</td>
<td>NaCN</td>
</tr>
<tr>
<td>Solubility:</td>
<td>Soluble in water.</td>
</tr>
<tr>
<td>Specific Gravity:</td>
<td>1.6-1.62 @20°C</td>
</tr>
<tr>
<td>Relative Vapour Density (air=1):</td>
<td>Not available</td>
</tr>
<tr>
<td>Vapour Pressure (20 °C):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flash Point (°C):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flammability Limits (%):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Autoignition Temperature (°C):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Melting Point/Range (°C):</td>
<td>ca. 560</td>
</tr>
<tr>
<td>pH:</td>
<td>Not available</td>
</tr>
</tbody>
</table>

10. STABILITY AND REACTIVITY


11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label. Symptoms or effects that may arise if the product is mishandled and overexposure occurs are:

Ingestion: Swallowing can result in nausea, vomiting, diarrhoea, abdominal pain, convulsions and loss of consciousness. Collapse and possible death may occur.

Eye contact: May be an eye irritant. Exposure to the dust may cause discomfort due to particulate nature. May cause physical irritation to the eyes.

Skin contact: Contact with skin may result in irritation. Can be absorbed through the skin. Effects can include those described for ‘INGESTION’.

Inhalation: Breathing in high concentrations may result in the same symptoms described for ‘INGESTION’. High inhaled concentrations may lead to a feeling of suffocation and cause difficulty in breathing, headaches, dizziness and loss of consciousness. Can cause suffocation.

Long Term Effects:
Repeated or prolonged skin contact may lead to irritant contact dermatitis - 'cyanide rash' - characterised by itching and skin eruptions. (1)

Toxicological Data:

Oral LD50 (rat): 6440 ug/kg. (2)
Dermal LD50 (rabbit): 10400 ug/kg. (2)

### 12. ECOTOXICOLOGICAL INFORMATION

Avoid contaminating waterways.

### 13. DISPOSAL CONSIDERATIONS

Refer to Waste Management Authority. Dispose of material through a licensed waste contractor. Empty containers must be decontaminated and destroyed.

### 14. TRANSPORT INFORMATION

**Road and Rail Transport**

Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for Transport by Road and Rail.

- **UN No:** 1689
- **Class-primary:** 6.1 Toxic
- **Packing Group:** I
- **Proper Shipping Name:** SODIUM CYANIDE

- **Hazchem Code:** 2X

**Marine Transport**

Classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea.

This material is classified as a Marine Pollutant (P) according to the International Maritime Dangerous Goods Code.

- **UN No:** 1689
- **Class-primary:** 6.1 Toxic
- **Packing Group:** I
- **Proper Shipping Name:** SODIUM CYANIDE, SOLID

**Air Transport**

Classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air.

- **Product Name:** SODIUM CYANIDE
- **Substance No:** 000031019701
- **Issued:** 24/03/2005
- **Version:** 2

Page 5 of 7
UN No: 1689  
Class-primary: 6.1 Toxic  
Packing Group: I  
Proper Shipping Name: SODIUM CYANIDE, SOLID

15. REGULATORY INFORMATION

Classification: This material is hazardous according to criteria of NOHSC.  
T+: Very Toxic

Risk Phrase(s):  
R26/27/28: Very toxic by inhalation, in contact with skin and if swallowed.  
R32: Contact with acids liberates very toxic gas.

Safety Phrase(s):  
S7: Keep container tightly closed.  
S22: Do not breathe dust.  
S29: Do not empty into drains.  
S45: In case of accident or if you feel unwell, seek medical advice immediately (show the label whenever possible).

Poisons Schedule: S7 Dangerous Poison.

This material is listed on the Australian Inventory of Chemical Substances (AICS).

16. OTHER INFORMATION


This material safety data sheet has been prepared by SH&E Shared Services, Orica.

Reason(s) for Issue:
5 Yearly Revised Primary MSDS

This MSDS summarises to our best knowledge at the date of issue, the chemical health and safety hazards of the material and general guidance on how to safely handle the material in the workplace. Since Orica Limited cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact their Orica representative or Orica Limited at the contact details on page 1.
Orica Limited's responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.
1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

Product name: Sodium Cyanide Solution - (30% w/w)
Synonyms: Cyanide of Sodium Solution - (30% w/w)

CAS-No.: 
Molecular Formula:
Supplier: Orica Australia Pty Ltd
ACN: 004 117 828
Street Address: 1 Nicholson Street
Melbourne 3000
Australia
Telephone: + 61 3 9665 7111
Facsimile: + 61 3 9665 7937

Emergency telephone number: 1 800 033 111 (ALL HOURS)

2. COMPOSITION/INFORMATION ON INGREDIENTS

Recommended use: Extraction of gold and silver from ores; electroplating; heat treatment of metals; chemical intermediate.

Appearance: Colourless to straw-coloured liquid with a faint, 'bitter almonds' odour.

<table>
<thead>
<tr>
<th>CHEMICAL ENTITY</th>
<th>CAS NO.</th>
<th>PROPORTION (% weight per weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>7732-18-5</td>
<td>70</td>
</tr>
<tr>
<td>Sodium cyanide</td>
<td>143-33-9</td>
<td>30</td>
</tr>
</tbody>
</table>

All the constituents of this material are listed on the Australian Inventory of Chemical Substances (AICS).

3. HAZARDS IDENTIFICATION

Hazardous according to criteria of Worksafe Australia.

Hazard Category
T+ Very toxic

R-phrase(s)
R26/27/28 Very toxic by inhalation, in contact with skin and if swallowed.
Material Safety Data Sheet

R32  Contact with acids liberates very toxic gas.

Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by road or rail.

Class: 6.1  Toxic

Poisons Schedule (Aust)/Toxic Substance (NZ): S7

This material is a Scheduled Poison S7 and must be stored, maintained and used in accordance with the relevant regulations.

4. FIRST AID MEASURES

* Poison Information Centres in each State Capital City can provide additional assistance for scheduled poisons.
* CONCURRENTLY WITH THE FOLLOWING FIRST AID PROCEDURES, TRANSFER PATIENT IMMEDIATELY TO HOSPITAL OR MEDICAL CENTRE, ACCOMPANIED BY AN ATTENDANT WITH THE CYANIDE EMERGENCY KIT.

For all routes of exposure, remove patient from contaminated area and ensure rescuers avoid contamination. Give oxygen and if necessary, artificial respiration. If giving mouth-to-mouth resuscitation wash out patient’s mouth and lips - do not inhale patient’s expired air. Remove contaminated clothing and wash contaminated skin thoroughly. Get to ahospital or doctor quickly.

Ingestion: *
- If the patient is conscious:
  - Do not give anything by mouth.
  - Rest and reassure the patient who may become agitated.
  - If available, oxygen should be administered by a qualified person.
- If the patient is unconscious and breathing:
  - Do not give anything by mouth.
  - Lie the patient on their side, ensuring the airway is clear. If available, oxygen should be administered by a qualified person.
- If the patient is not breathing:
  - Ensure airway is clear.
  - Commence expired air resuscitation using a pocket mask with a one-way valve. If available, oxygen should be administered by a qualified person. Take care to prevent contamination of the rescuer by removing all contaminated clothing and if giving mouth-to-mask resuscitation wash out patient’s mouth and lips - do not inhale patient’s air.
  - If cardiac arrest occurs (no pulse present), commence cardiopulmonary resuscitation (CPR).

Eye contact: *
- Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Remove clothing if contaminated and wash skin. Treat as for ‘INGESTION’.

Skin contact: *
- If skin contact occurs, remove contaminated clothing and wash skin thoroughly. Can be absorbed through the skin with resultant toxic effects. Treat as for ‘INGESTION’.

Inhalation: *
- Remove victim from exposure - avoid becoming a casualty. Treat as for ‘INGESTION’.

EMERGENCY KIT FOR CYANIDE POISONING:

At all places where there is a risk of cyanide poisoning, the following items should be kept in an accessible and convenient location:
- an oxygen resuscitator and a source of oxygen;
- a clearly marked CYANIDE ANTIDOTE box containing:
  - an approved airway,
  - elasticised tournequet,
Material Safety Data Sheet

- disposable in dwelling intravenous cannulae,
- 20 ml sterile disposable syringes and needles,
- fluoride heparinised blood sample tubes,
- skin prep swabs, dressings and adhesive tape, and
- ampoules of kelocyanor (dicobalt edetate), including the prescribing information outlining side effects and precautions;

- a copy of the appropriate Material Safety Data Sheet and

Notes to physician: The antidote for cyanide poisoning is the intravenous administration of dicobalt edetate (trade name - Kelocyanor). Due to adverse reactions which can occur in the absence of poisoning, this should only be administered when absorption of cyanide is beyond doubt. The antidote should only be administered by a suitably qualified professional health attendant (3).

Cyanide poisoning occurs rapidly after exposure. If the patient is conscious after the usual time taken to reach hospital then exposure to cyanide either from inhalation, ingestion or skin contamination is unlikely to have resulted in a significant amount of cyanide being absorbed. In these circumstances the patient should be observed carefully with particular attention being given to the state of consciousness.

Over zealous administration of the antidote is contraindicated and may result in serious adverse reactions of an anaphylactic (allergic) nature. Adverse reactions reported include gross oedema of the face and neck, urticaria, palpitations, hypotension, convulsions, vomiting, chest pains, difficulty in breathing, and collapse (3).

If, after clinical assessment the patient is considered to require the antidote, ie. the patient is known to have been exposed to cyanide and is unconscious or lapsing into unconsciousness, administer one ampoule containing 300 mg Dicobalt edetate in 20 ml glucose solution (Kelocyanor) intravenously by slow injection. The initial effect is a fall in blood pressure, rise in pulse rate, and sometimes retching. Immediately after this phase, lasting about one minute, the patient should recover. The injection should be discontinued if allergic adverse effects are noted. A second dose may be given if the response is inadequate and allergic adverse effects are absent.

5. FIRE-FIGHTING MEASURES

Specific hazards: Non-combustible material.

Fire fighting further advice: Not combustible. Can decompose on heating or on contact with acidic media emitting highly toxic fumes including those of hydrogen cyanide, ammonia, oxides of carbon, and oxides of nitrogen. If safe to do so, remove containers from path of fire. Fire fighters to wear self-contained breathing apparatus if risk of exposure to products of decomposition.

Suitable extinguishing media: Not combustible, however, if material is involved in a fire use water fog (or if unavailable fine water spray), foam, dry agent (carbon dioxide, dry chemical powder).
6. ACCIDENTAL RELEASE MEASURES

Immediate action required. Avoid inhalation of mists. Work up wind or increase ventilation. Clear area of all unprotected personnel to a minimum of 20 metres. Vacate completely if spill occurs in a confined area. Wear protective equipment to prevent skin and eye contamination and inhalation of highly toxic hydrogen cyanide gas. Contain - prevent run off into drains and waterways.

FOR SMALL SPILLS TO SOIL Remove a conservative amount of soil, collect all contaminated soil and seal in clean, dry, properly labelled drums.

FOR LARGE SPILLS TO SOIL
Remove top layers of contaminated soil for treatment or treat in situ. Contact supplier for expert advice required for this treatment.

DO NOT wash to drain. If contamination of sewers or waterways has occurred advise local emergency services.

Spillage area and contaminated soils can be detoxified by treatment with an excess of dilute sodium hypochlorite or calcium hypochlorite. Expert advice is required for this treatment. Take care to avoid contact with detoxification solutions which are corrosive.

SPILLS TO WATERWAYS Seek advice from emergency services and local authorities prior to treating spills to waterways.

Spills to waterways can be detoxified with ferrous sulphate or sodium hypochlorite, however expert advice is required for this treatment.

Note: The detoxification procedure converts the cyanide ion to the cyanate ion which on continued reaction breaks down to carbon dioxide and nitrogen.

7. HANDLING AND STORAGE

Storage: Not to be available except to authorised or licensed persons. Sodium cyanide solution is only available in bulk and should be stored in mild steel or stainless steel tanks; the solution is corrosive to zinc and aluminium. Tanks should be vented to a safe atmosphere as they may develop a build-up of highly toxic hydrogen cyanide gas. The storage area must be fully bunded and facilities available to detoxify any spillage. Check tanks regularly for leaks. A safety shower and eye wash facility must be available at the discharge point. Store away from acids, oxidising agents and foodstuffs.

This material is a Scheduled Poison S7 and must be stored, maintained and used in accordance with the relevant regulations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

National occupational exposure limits
No value assigned for this specific material by the National Occupational Health and Safety Commission (Worksafe Australia).

However, Exposure Standards for constituent and decomposition product:

<table>
<thead>
<tr>
<th></th>
<th>TWA</th>
<th>STEL</th>
<th>NOTICES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ppm</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>Cyanides (as CN)</td>
<td>-</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Hydrogen cyanide **</td>
<td>10</td>
<td>11</td>
<td>(Peak limitation)</td>
</tr>
<tr>
<td>** (decomposition product).</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As published by the National Occupational Health and Safety Commission.
Peak Limitation - a ceiling concentration which should not be exceeded over a measurement period which should be as short as possible but not exceeding 15 minutes.

‘Sk’ notice - absorption through the skin may be a significant source of exposure. The exposure standard is invalidated if such contact should occur.

TWA - the Time-Weighted Average airborne concentrations over an eight-hour working day, for a five-day working week over an entire working life.

STEL (Short Term Exposure Limit) - the average airborne concentration over a 15 minute period which should not be exceeded at any time during a normal eight-hour work day. According to current knowledge these concentrations should neither impair the health of, nor cause undue discomfort to, nearly all workers.

These Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. Exposure Standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

**Engineering measures:** Ensure ventilation is adequate and that air concentrations of components and decomposition products are controlled below quoted Exposure Standards. Use with local exhaust ventilation or while wearing respirator (see PERSONAL PROTECTION section below) or air supplied mask.

**Personal protection equipment:** Orica Personal Protection Guide No.1, 1998: J - OVERALLS, RUBBER BOOTS, FACE SHIELD OR AIR MASK, GLOVES (L), APRON.

Avoid all contact. Wear overalls, full face shield, elbow-length impervious gloves, splash apron and rubber boots. Use with adequate ventilation. If inhalation risk exists wear full-face respirator (Type B2 or B3 gas filter combined with Class P3 particulate filter) or air supplied mask meeting the requirements of AS/NZS 1715 and AS/NZS 1716. Always wash hands before smoking, eating, drinking or using the toilet. Wash clothing and other protective equipment before storage or re-use.

**9. PHYSICAL AND CHEMICAL PROPERTIES**

**Form / Colour / Odour:** Colourless to straw-coloured liquid with a faint, 'bitter almonds' odour.

**Solubility:** Miscible with water. Insoluble in organic solvents.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity (20 C)</td>
<td>1.170</td>
</tr>
<tr>
<td>Rel Vapour Density (air=1):</td>
<td>N Av</td>
</tr>
<tr>
<td>Vapour Pressure (20 C)</td>
<td>1.73 kPa</td>
</tr>
<tr>
<td>Flash Point (C)</td>
<td>N App</td>
</tr>
<tr>
<td>Flammability Limits (%)</td>
<td>N App</td>
</tr>
<tr>
<td>Autoignition Temp (C)</td>
<td>N App</td>
</tr>
<tr>
<td>% Volatile by volume</td>
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<tr>
<td>Solubility in water (15 C)</td>
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<tr>
<td>(Typical values only - consult specification sheet)</td>
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</tr>
<tr>
<td></td>
<td>(n-Butyl acetate=1)</td>
</tr>
<tr>
<td>Freezing Point (C)</td>
<td>ca. 1</td>
</tr>
<tr>
<td>Boiling Point (C)</td>
<td>ca. 111</td>
</tr>
<tr>
<td>Decomp. Point (C)</td>
<td>N Av</td>
</tr>
<tr>
<td>Sublimation Point :</td>
<td>N App</td>
</tr>
<tr>
<td>pH</td>
<td>&gt;12</td>
</tr>
<tr>
<td>Viscosity</td>
<td>N Av</td>
</tr>
<tr>
<td>Evaporation Rate :</td>
<td>N Av</td>
</tr>
<tr>
<td>% Solubility in water (15 C):</td>
<td>Miscible</td>
</tr>
<tr>
<td>(N Av = Not available)</td>
<td>N App = Not applicable</td>
</tr>
<tr>
<td>(Typical values only - consult specification sheet)</td>
<td></td>
</tr>
</tbody>
</table>
10. STABILITY AND REACTIVITY

Stability: Will liberate highly toxic hydrogen cyanide gas upon contact with acids or acidic media. Incompatible with oxidising agents. Will decompose when heated generating toxic ammonia gas and hydrogen cyanide gas. For hydrogen cyanide gas (decomposition product): Rel Vapour Density (air=1): 0.94; Explosive Limits (%): 5.6-40; Flash Point (C): -17.

11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label. Symptoms that may arise if the product is mishandled are:

Short term exposure by all routes is considered to be highly toxic. May be fatal if inhaled, swallowed or absorbed through skin.

Possible exposure routes are (1,2):
- Breathing hydrogen cyanide gas from decomposing solid or solutions, or by breathing cyanide dust.
- Swallowing solid or solutions.
- By absorption through skin or eyes as a result of contact with solutions, dust or solid material.

Early symptoms of exposure (1,2,3):
- Irritation of mucous membranes in eyes, nose and throat. Burning sensation of the the tongue.
- Salivation.
- Irritation of skin or eyes with discomfort or burning sensation.
- Headaches.
- Unusual behaviour.
- Nausea.
- General weakness, and heaviness in arms and legs.
- Rapid pulse.
- Increased difficulty in breathing.

Signs of severe poisoning (1,2,3):
- Cherry-red complexion.
- Feeling of suffocation, gasping for breath.
- Vomiting.
- Convulsions and collapse.
- Decreasing consciousness.
- Cessation of breathing.

Acute Effects

Ingestion: See Main symptoms above.

Eye contact: See Main symptoms above.

Skin contact: See Main symptoms above.

Inhalation: See Main symptoms above.

Long Term Effects:
Repeated or prolonged skin contact may lead to irritant contact dermatitis - 'cyanide rash' - characterised by itching and skin eruptions (3).

Acute toxicity / Chronic toxicity
No LD50 data available for the product.
For Sodium Cyanide (solid):
Oral LD50 (rat): 6.4 mg/kg; Oral Lowest Lethal Dose (human): 2.9 mg/kg (4)
Ocular LD50 (rabbit): 5.0 mg/kg (4)
For Hydrogen Cyanide (gas -)
Oral LD50 (mouse): 3.7 mg/kg (4)
Inhalation LC50 (rat): 160 ppm/30 min (4)
Inhalation Lowest Lethal Concentration (human): 120 mg/m3/1 hr (4)
Inhalation Lowest Lethal Concentration (human): 200 mg/m3/10 min (4)
Inhalation Lowest Lethal Concentration (human): 400 mg/m3/2 min (4)
Ocular LD50 (rabbit): 1.0 mg/kg (4)

No signs of cyanide toxicity were observed in a 2 year feeding study
in rats given food containing 100 and 300 ppm of hydrogen cyanide. (5)
The high toxicity of cyanide compounds results from their ability to
interfere with the body's utilisation of oxygen at the cellular level
by inhibiting the cytochrome oxidase enzyme system (1,3)
In a study of the effect of chronic cyanide exposure at up to twice the
current recommended exposure standard (ie 6.4 to 10.4 ppm) (6)
  No signs of hypo- or hyperthyroidism.
  56% of the workers had thyroid enlargement to a mild or moderate
degree.
  Workers were exposed to other chemicals.
  There was no association between the period of exposure and the
incidence of enlargement or size of the thyroid.

12. ECOLOGICAL INFORMATION

Avoid contaminating waterways. Very toxic to aquatic organisms.
For Hydrogen Cyanide - (7)
96 hr LC50 (rainbow trout): 57 ug/L
TLM 24 (sunfish): 0.18 mg/L
TLM 24 (pinperch): 0.05 mg/L in sea water
TLM 24: Median Tolerance Limit - the concentration of toxicant or
substance at which 50% of the test organisms survive over a 24 hour test
period.

13. DISPOSAL CONSIDERATIONS

Refer to State/Territory Land Waste Management Authority. Waste treatment is essential. Empty containers
must be decontaminated and destroyed. Dispose of material through a licensed waste contractor.

14. TRANSPORT INFORMATION

Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for
transport by road or rail.

UN-No:  1935
Class:  6.1  Toxic
Material Safety Data Sheet

Hazchem code: 2X
EPG: 6.0.009
Packing group: Packing Group 1

Proper shipping name: CYANIDE SOLUTIONS

Segregation Dangerous Goods: Not to be loaded with explosives (Class 1), nitromethane, acids of Class 8, food and food packaging in any quantity, however exemptions may apply.

15. REGULATORY INFORMATION

Hazardous according to criteria of Worksafe Australia.

Hazard Category
T+ Very toxic

R-phrase(s)
R26/27/28 Very toxic by inhalation, in contact with skin and if swallowed.
R32 Contact with acids liberates very toxic gas.

S-phrase(s)
S 7 Keep container tightly closed.
S23 Do not breathe spray.
S24 Avoid contact with the skin.
S28 After contact with skin, wash immediately with plenty of water.
S29 Do not empty into drains.
S45 In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).

Poisons Schedule (Aust)/Toxic Substance (NZ): S7

16. OTHER INFORMATION

Literary reference

(2), Toxicology Profile for Cyanide; Agency for Toxic Substances and Disease Registry; US Department of Health and Human Services; 08/95
(4), On ‘CC Info Disc No. C2 ’ (Canadian Centre for Occupational Health and Safety; Ontario 1996)
(7), In ‘Handbook of Environmental Data on Organic Chemicals Second
Material Safety Data Sheet

This Material Safety Data Sheet has been prepared by SHE Pacific Pty Ltd on behalf of Orica Ltd and its subsidiary companies.
Contact Point: SHE Pacific Pty Ltd, MSDS Services
Within Australia: Telephone 1 800 624 132
Facsimile (03) 9665 7929
Outside Australia: Telephone +61 3 9665 7500
Facsimile +61 3 9665 7929

Reason(s) For Issue: Change to Dangerous Goods requirements.

Safety Data Sheets are updated frequently. Please ensure that you have a current copy.

This MSDS summarises at the date of issue our best knowledge of the health and safety hazard information of the product, and in particular how to safely handle and use the product in the workplace. Since Orica Limited and its subsidiaries cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, review this MSDS in the context of how the user intends to handle and use the product in the workplace.

If clarification or further information is needed to ensure that an appropriate assessment can be made, the user should contact this company.

Our responsibility for product as sold is subject to our standard terms and conditions, a copy of which is sent to our customers and is also available upon request.
Material Safety Data Sheet

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

Product name: HYDROGEN CYANIDE GAS

Synonyms: HYDROGEN CYANIDE GAS (DECOMPOSITION PRODUCT OF SODIUM CYANIDE), Hydrocyanic acid gas

CAS-No.: 74-90-8

Molecular Formula: H-C-N

Supplier: Orica Australia Pty Ltd
ACN: 004 117 828
Street Address: 1 Nicholson Street
Melbourne 3000
Australia
Telephone: + 61 3 9665 7111
Facsimile: + 61 3 9665 7937

Emergency telephone number: 1 800 033 111 (ALL HOURS)

2. COMPOSITION/INFORMATION ON INGREDIENTS

Recommended use: Decomposition product of sodium cyanide. Hydrogen cyanide will be encountered as a gas associated with the spillage of sodium cyanide liquid or solid.

Appearance: Colourless gas with a distinctive 'bitter almonds' odour.

3. HAZARDS IDENTIFICATION

Hazardous according to criteria of Worksafe Australia.

Hazard Category
T+ Very toxic

R-phrase(s)
R26 Very toxic by inhalation.

Classified as Dangerous Goods for the purpose of transport by road or rail. Refer to relevant regulations for storage and transport requirements.

Class: 6.1 Toxic
Subsidiary Risk 1: 2.1 Flammable Gas

Poisons Schedule (Aust)/Toxic Substance (NZ): S7
Material Safety Data Sheet

This material is a Scheduled Poison S7 and must be stored, maintained and used in accordance with the relevant regulations.

4. FIRST AID MEASURES

Poison Information Centres in each State capital city can provide additional assistance for scheduled poisons.

CONCURRENTLY WITH THE FOLLOWING FIRST AID PROCEDURES, TRANSFER PATIENT IMMEDIATELY TO HOSPITAL OR MEDICAL CENTRE, ACCOMPANIED BY AN ATTENDANT WITH THE CYANIDE EMERGENCY KIT.

For all routes of exposure, remove patient from source and ensure rescuers avoid contamination.

Ingestion: Not applicable.

Eye contact: Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Remove clothing if contaminated and wash skin. Treat as for 'INHALED'.

Skin contact: If skin contact occurs, remove contaminated clothing and wash skin thoroughly. Can be absorbed through the skin with resultant toxic effects. Treat as for 'INHALED'.

Inhalation: Remove victim from exposure - avoid becoming a casualty.

IF THE PATIENT IS CONSCIOUS:
- Do not give anything by mouth.
- Rest and reassure the patient who may become agitated.
- If available, oxygen should be administered by a qualified person.

IF THE PATIENT IS UNCONSCIOUS AND BREATHING:
- Do not give anything by mouth.
- Lie the patient on their side, ensuring the airway is clear. If available, oxygen should be administered by a qualified person.

IF THE PATIENT IS NOT BREATHING:
- Ensure airway is clear.
- Commence expired air resuscitation using a pocket mask with one-way valve.
  If available, oxygen should be administered by a qualified person
- If cardiac arrest occurs (no pulse present), commence cardiopulmonary resuscitation (CPR).
- Take are to prevent contamination of the rescuer by removing all contaminated clothing and if giving mouth-to-mask resuscitation wash out patient's mouth and lips - do not inhale patient's air.

EMERGENCY KIT FOR CYANIDE POISONING:
At all places where there is a risk of cyanide poisoning, the following items should be kept in an accessible and convenient location:

- an oxygen resuscitator and a source of oxygen;

- a clearly marked CYANIDE ANTIDOTE box containing:
  - an approved airway,
  - elasticised tourniquet,
Material Safety Data Sheet

- disposable in dwelling intravenous cannulae,
- 20 ml sterile disposable syringes and needles,
- fluoride heparinised blood sample tubes,
- skin prep swabs, dressings and adhesive tape,
- ampoules of kelocyanor (dicobalt edetate), including the prescribing information outlining side effects and precautions;
- a copy of the appropriate Material Safety Data Sheet.

Notes to physician:  The antidote for cyanide poisoning is the intravenous administration of dicobalt edetate (trade name - Kelocyanor). Due to adverse reactions which can occur in the absence of poisoning, this should only be administered when absorption of cyanide is beyond doubt. The antidote should only be administered by a suitably qualified professional health attendant.
Cyanide poisoning occurs rapidly after exposure. If the patient is conscious after the usual time taken to reach hospital then exposure to cyanide either from inhalation, ingestion or skin contamination is unlikely to have resulted in a significant amount of cyanide being absorbed. In these circumstances the patient should be observed carefully with particular attention being given to the state of consciousness.
Over zealous administration of the antidote is contraindicated and may result in serious adverse reactions of an anaphylactic (allergic) nature. Adverse reactions reported include gross oedema of the face and neck, urticaria, palpitations, hypotension, convulsions, vomiting, chest pains, difficulty in breathing, and collapse.
If, after clinical assessment the patient is considered to require the antidote, ie. the patient is known to have been exposed to cyanide and is unconscious or lapsing into unconsciousness, administer one ampoule containing 300 mg Dicobalt edetate in 20 ml glucose solution (Kelocyanor) intravenously by slow injection. The initial effect is a fall in blood pressure, rise in pulse rate, and sometimes retching. Immediately after this phase, lasting about one minute, the patient should recover. The injection should be discontinued if allergic adverse effects are noted. A second dose may be given if the response is inadequate and allergic adverse effects are absent.

5. FIRE-FIGHTING MEASURES

Specific hazards: Highly flammable gas. Avoid all ignition sources. Flameproof equipment necessary in area where this chemical is present. Nearby equipment must be earthed.

Fire fighting further advice: Highly flammable gas. Do not spray sodium cyanide containers with water. Fire fighters to wear self-contained breathing apparatus

Suitable extinguishing media: Dry chemical powder. (DO NOT use carbon dioxide.)

6. ACCIDENTAL RELEASE MEASURES

Product name: HYDROGEN CYANIDE GAS
Substance Key: 000032505901
Issued: 24.02.2000
Version: 1.0
Page: 3 of 8
NOTE: HCN is a decomposition product which may be released in a solid or liquid sodium cyanide spill. For solid or liquid sodium cyanide spill see MSDS’s for solid or liquid sodium cyanide (3,4). Immediate action required. Clear area of all unprotected personnel and move upwind. Increase ventilation. Wear protective equipment (see PERSONAL PROTECTION above) to prevent skin and eye contamination and inhalation of highly toxic hydrogen cyanide gas (liberated upon contact with water).

7. HANDLING AND STORAGE

Storage: Not applicable as hydrogen cyanide is a decomposition product of sodium cyanide.

This material is a Scheduled Poison S7 and must be stored, maintained and used in accordance with the relevant regulations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

National occupational exposure limits

<table>
<thead>
<tr>
<th>Peak Limitation/ Ceiling Limit</th>
<th>STEL</th>
<th>Carcinogen Category</th>
<th>Notices</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 ppm</td>
<td>11 mg/m3</td>
<td></td>
<td>Sk</td>
</tr>
</tbody>
</table>


Exposure Standard (TWA) is the time-weighted average airborne concentration over an eight-hour working day, for a five-day working week over an entire working life. According to current knowledge this concentration should neither impair the health or, not cause undue discomfort to, nearly all workers.

Peak limitation - a ceiling concentration which should not be exceeded over a measurement period which should be as short as possible but not exceeding 15 minutes.

‘Sk’ Notice - absorption through the skin may be a significant source of exposure. The exposure standard is invalidated if such contact should occur.

These Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These Exposure Standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

Engineering measures: Ensure ventilation is adequate to maintain air concentrations below Exposure Standards. Hydrogen cyanide gas is lighter than air DO NOT enter confined spaces where gas may have collected. Refer to AS 2865 for requirements for entry to confined spaces.

Personal protection equipment: Orica Personal Protection Guide No.1, 1998: J - OVERALLS, RUBBER BOOTS, FACE SHIELD OR AIR MASK, GLOVES (L), APRON.

Avoid all contact. Use with adequate ventilation. Wear polypropylene disposable overalls, elbow-length impervious gloves, enclosed rubber boots. Wear full-face respirator (Type B2 or B3 gas filter combined with Class P3 particulate filter) or air supplied mask meeting the requirements of AS 1715 and AS 1716. Always wash
Material Safety Data Sheet

hands before smoking, eating, drinking or using the toilet. Wash clothing and other protective equipment before storing or re-using. Where exposure to sodium cyanide solid or liquid is likely refer to the appropriate MSDS for personal protection requirements (3,4)

9. PHYSICAL AND CHEMICAL PROPERTIES

Form / Colour / Odour: Colourless gas with a distinctive ‘bitter almonds’ odour.

Solubility: Soluble in water and organic solvents.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity (4 C)</td>
<td>N App</td>
</tr>
<tr>
<td>Rel Vapour Density (air=1)</td>
<td>0.93 (26 C)</td>
</tr>
<tr>
<td>Vapour Pressure (20 C)</td>
<td>62 kPa</td>
</tr>
<tr>
<td>Flash Point (C) (CC)</td>
<td>-17.8</td>
</tr>
<tr>
<td>Flammability Limits (%)</td>
<td>6-41</td>
</tr>
<tr>
<td>Autoignition Temp (C)</td>
<td>538</td>
</tr>
<tr>
<td>% Volatile by volume</td>
<td>100</td>
</tr>
<tr>
<td>Solubility in water</td>
<td>N App</td>
</tr>
<tr>
<td>Solubility in water (n-Butyl acetate=1)</td>
<td>(Typical values only - consult specification sheet)</td>
</tr>
<tr>
<td>Melting Point (C)</td>
<td>N App</td>
</tr>
<tr>
<td>Boiling Point (C)</td>
<td>N App</td>
</tr>
<tr>
<td>Decomp. Point (C)</td>
<td>N Av</td>
</tr>
<tr>
<td>Sublimation Point</td>
<td>N Av</td>
</tr>
<tr>
<td>pH</td>
<td>N App</td>
</tr>
<tr>
<td>Viscosity</td>
<td>N App</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>N Av</td>
</tr>
</tbody>
</table>

10. STABILITY AND REACTIVITY

Stability: If not stabilised, can polymerise violently. Reacts with oxidising agents.

11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label. Symptoms that may arise if the product is mishandled and overexposure occurs are:

Acute Effects
Short term exposure at concentrations greater than the TLV by all routes is considered to be highly toxic. Can kill by any exposure route. The adverse effects depend on concentration and duration of exposure.

Possible exposure routes are:
- Breathing hydrogen cyanide gas.
- By absorption through skin or eyes as a result of contact with gas in a confined area at high concentrations.

Early symptoms of exposure:
- Irritation of mucous membranes in eyes, nose and throat.
- Burning sensation of the tongue.
- Salivation
- Irritation of skin or eyes with discomfort or burning sensation.
- Headaches.
- Unusual behaviour.
Material Safety Data Sheet

- Nausea
- Cessation of breathing.
- General weakness, and heaviness in arms and legs.
- Rapid pulse
- Increased difficulty in breathing.

Signs of severe poisoning:
- Cherry-red complexion.
- Feeling of suffocation, gasping for breath.
- Vomiting.
- Convulsions and collapse.
- Decreasing consciousness.

Long Term Effects:
Repeated or prolonged skin contact may lead to irritant contact dermatitis - ‘cyanide rash’ - characterised by itching and skin eruptions.

Acute toxicity / Chronic toxicity
Inhalation (gaseous) LC50 (rat): 160 ppm/30 min (1)
Inhalation Lowest Lethal Concentration (human): 113 ppm/1 hr  (1)
Inhalation Lowest Lethal Concentration (human): 188 ppm/10 min (1)
Inhalation Lowest Lethal Concentration (human): 376 ppm/2 min  (1)
Ocular LD50 (rabbit): 1.0 mg/kg (1)
The high toxicity of cyanide compounds results from their ability to interfere with the body’s utilisation of oxygen at the cellular level by inhibiting the cytochrome oxidase enzyme system.
In a study of the effect of chronic cyanide exposure at up to twice the current recommended exposure standard:
. No signs of hypo- or hyperthyroidism.
. 56% of the workers had thyroid enlargement to a mild or moderate degree. (2)

12. ECOLOGICAL INFORMATION

Highly toxic to aquatic life. Avoid contaminating waterways.
For Hydrogen Cyanide - (5)
96 hr LC50 (rainbow trout): 57 ug/L
TLm 24 (sunfish): 0.18 mg/L
TLm 24 (pinperch): 0.05 mg/L in sea water
TLm 24: Median Tolerance Limit - the concentration of toxicant or substance at which 50% of the test organisms survive over a 24 hour test period.

13. DISPOSAL CONSIDERATIONS

Refer to State Land Waste Management Authority. Waste treatment essential. Empty containers MUST BE decontaminated and destroyed.
14. TRANSPORT INFORMATION

Road and Rail Transport

Classified as Dangerous Goods for the purpose of transport by road or rail. Refer to relevant regulations for storage and transport requirements.

UN-No: 1051
Class: 6.1 Toxic
Hazchem code: 2WE Hazchem Code
EPG: 6C3
Packing group: Packing Group 1
Subsidiary Risk 1: 2.1 Flammable Gas

Proper Shipping Name: HYDROGEN CYANIDE

Segregation Dangerous Goods:
Dangerous goods segregation: Not applicable. HYDROGEN CYANIDE (HCN) GAS IS A DECOMPOSITION PRODUCT OF SODIUM CYANIDE. THE ABOVE DANGEROUS GOODS CLASSIFICATION INDICATES THAT HCN IS A COMPRESSED GAS AND COULD BE PRESENT AS A LIQUID. HCN LIQUID OR COMPRESSED GAS ARE NOT SOLD OR USED BY ICI AUSTRALIA.

15. REGULATORY INFORMATION

Hazardous according to criteria of Worksafe Australia.

Hazard Category
T+ Very toxic

R-phrase(s)
R26 Very toxic by inhalation.

S-phrase(s)
S16 Keep away from sources of ignition - No smoking.
S38 In case of insufficient ventilation, wear suitable respiratory equipment.
S45 In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).

Poisons Schedule (Aust)/Toxic Substance (NZ): S7

16. OTHER INFORMATION

Literary reference

(1), In ‘Worksafe Disc One’ (94/1) - National Material Safety Data Sheet Repository (1994); RTECS (1994) National Institute for Occupational
Material Safety Data Sheet

Safety and Health of the Dept. of Health and Human Services, USA;
Australian Atmospheric Exposure Standards, Commonwealth of Australia
(3) Safety Data Sheet - Solid Sodium Cyanide; CDS# 10197
ICI Australia Operations Pty Ltd; 07/94
(4) Safety Data Sheet - Liquid Sodium Cyanide; CDS# 36402
ICI Australia Operations Pty Ltd; 12/94
(5), In ’Handbook of Environmental Data on Organic Chemicals Second
Edition’ (Ed Verschveren, Karel), (Van Nostrand Reinhold Company: New
York 1983).
This chemical is listed on the Australian Inventory of Chemical
Substances (AICS).
This Material Safety Data Sheet has been prepared by SHE Pacific Pty Ltd
on behalf of Orica Ltd and its subsidiary companies.
Contact Point: SHE Pacific Pty Ltd, MSDS Services
Within Australia: Telephone 1 800 624 132
Facsimile (03) 9665 7929
Outside Australia: Telephone +61 3 9665 7500
Facsimile +61 3 9665 7929
Issue Date: 18/SEP/96/JF Supersedes Issue Date: 01/95
Reason(s) For Issue: Change in Dangerous Goods Requirements. Change in
Physical Properties.
Safety Data Sheets are updated frequently. Please ensure that you have
a current copy.

This MSDS summarises at the date of issue our best knowledge of the health and safety hazard information of
the product, and in particular how to safely handle and use the product in the workplace. Since Orica Limited and
its subsidiaries cannot anticipate or control the conditions under which the product may be used, each user
must, prior to usage, review this MSDS in the context of how the user intends to handle and use the product in
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If clarification or further information is needed to ensure that an appropriate assessment can be made, the user
should contact this company.

Our responsibility for product as sold is subject to our standard terms and conditions, a copy of which is sent to
our customers and is also available upon request.
APPENDIX D

CORRESPONDENCE WITH REGULATORY AUTHORITIES
Dear Tim,

RE: Cowal Gold Operations – Revised Cyanide Management Plan

As you are aware, the Cowal Gold Operations’ (CGOs’) Development Consent (DA 14/98) was modified by the New South Wales Minister for Planning on 7 February 2017 for the CGOs Mine Life Modification (Modification 13).

The modified Development Consent includes revised conditions relevant to cyanide management and modified requirements for the CGOs’ Cyanide Management Plan (CMP) (among other things). Accordingly, the CGOs’ CMP has been revised to reflect the modified Development Consent (DA 14/98) requirements.

Further, Evolution has also revised the CGO’s CMP to reflect the agreed cyanide sampling and analysis methodology, as reflected in the revised Environment Protection Licence (EPL) 11912.

The key revisions to the CMP are summarised in Table 1.

<table>
<thead>
<tr>
<th>Section/Figure Reference</th>
<th>Proposed Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>All, including Figures 1 to 4</td>
<td>Revised to reflect the contemporary requirements of the modified Development Consent (DA 14/98) and to reflect the approved CGO, including updates to Table 1 to include reference to the approved dual leach circuit.</td>
</tr>
<tr>
<td>Sections 2.1, 5 and 6</td>
<td>Incorporates and addresses the conditions relevant to cyanide management as required by Development Consent (DA 14/98) Condition 5.3.</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Incorporation of the indicative primary ore process flowsheet, including the dual leach circuit.</td>
</tr>
<tr>
<td>Section 2.3</td>
<td>Revised to incorporate the updated conditions of EPL 11912, including Limit Condition L2 which requires that cyanide levels in the tailings slurry stream measured at the process plant (i.e. EPL Monitoring Point 48) do not exceed 20 milligrams CN$<em>{aav}$. per litre (mg CN$</em>{aav}$/L) (90 percentile over six months), and 30 mg CN$_{aav}$/L (maximum permissible limit at any time).</td>
</tr>
<tr>
<td>Section 3</td>
<td>Updates to reflect the currently approved CGO environmental management system, including the reference to the Environmental Obligations Register and the incorporation of additional management plans of relevance to cyanide management in Table 3.</td>
</tr>
<tr>
<td>Section 3.4</td>
<td>New section to describe the CGO’s International Cyanide Management Institute (ICMI) code for cyanide management compliance.</td>
</tr>
<tr>
<td>Section 4.2.2</td>
<td>Updates to include more detailed description of the INCO process.</td>
</tr>
</tbody>
</table>
Table 1 (Continued)
Key Revisions to the CMP

<table>
<thead>
<tr>
<th>Section/Figure Reference</th>
<th>Proposed Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 6.2.1</td>
<td>Updates to include reference to EPL 11912 Condition M2 in relation to groundwater monitoring bores surrounding the tailings storage facilities.</td>
</tr>
<tr>
<td>Sections 6.2.2 ad 6.2.3</td>
<td>Amendments to the sample collection methodologies, including reference to contemporary standards. In addition, updates to the laboratory analysis procedures have also been incorporated including (but not limited to):</td>
</tr>
<tr>
<td></td>
<td>• The CN$_{\text{NAD}}$ samples will also be analysed at the on-site laboratory using APHA Standard Method 4500-CN-I Weak Acid Dissociable Cyanide (except instead of manual distillation, an automated VELP distillation unit will be used and instead of sulphuric acid as the pH modifier, magnesium chloride will be used) and then using the APHA Standard Method 4500-CN-E Colorimetric Method.</td>
</tr>
<tr>
<td></td>
<td>• An automated CN$<em>{\text{NAD}}$ sampler (i.e. a Cyanoprobe analyser) would also be used on-site to assist with quickly establishing CN$</em>{\text{NAD}}$ levels in the liquid at the process plant and in the decant ponds.</td>
</tr>
<tr>
<td></td>
<td>• The samples will be analysed for CN$_{\text{NAD}}$ at the off-site laboratory in accordance with APHA Standard Method 4500-CN-I Weak Acid Dissociable Cyanide (except instead of manual distillation an automated VELP distillation unit will be used and instead of sulphuric acid as the pH modifier, magnesium chloride will be used) and then using the APHA Standard Method 4500-CN-E Colorimetric Method.</td>
</tr>
<tr>
<td>Section 8</td>
<td>Revised to include contemporary complaints register requirements, including the dedicated Community Complaints Line required by EPL 11912 Condition M6.1.</td>
</tr>
<tr>
<td>Sections 9.1 and 9.2</td>
<td>Revised to reflect the modified annual review and reporting requirements of the modified Development Consent (DA 14/98) and to reflect the approved CGO.</td>
</tr>
<tr>
<td>Appendix A</td>
<td>Updates to reflect contemporary legislative requirements.</td>
</tr>
<tr>
<td>Appendix B</td>
<td>Updates to reflect contemporary codes of practice, Australian Standards and guidelines.</td>
</tr>
</tbody>
</table>

The revised CMP is enclosed.

In accordance with Condition 5.3(b) of the Development Consent, the Department of Primary Industries – Water (DPI-Water) is required to be consulted during the preparation/revision of the CMP.

Accordingly, would you kindly advise us as to whether the revised CMP meets the DPI-Water’s requirements by Thursday 13 April 2017.

We look forward to your input and invite you to contact us with any queries.

Please do not hesitate to contact me on 0408 745 397 should you have any queries or wish to discuss.

Yours faithfully,
Evolution Mining (Cwal) Pty Limited

BRONWYN FLYNN
Approvals Manager
Cowa Gold Operations
COW.400.02.3918BF

31 March 2017

NSW Department of Industry, Skills and Regional Development
Division of Resources and Energy
161 Kite Street
Locked Bag 21
ORANGE NSW 2800

Attention: Mike Young

Dear Mike,

RE: Cowal Gold Operations – Revised Cyanide Management Plan

As you are aware, the Cowal Gold Operations’ (CGOs’) Development Consent (DA 14/98) was modified by the New South Wales Minister for Planning on 7 February 2017 for the CGOs Mine Life Modification (Modification 13).

The modified Development Consent includes revised conditions relevant to cyanide management and modified requirements for the CGOs’ Cyanide Management Plan (CMP) (among other things). Accordingly, the CGOs’ CMP has been revised to reflect the modified Development Consent (DA 14/98) requirements.

Further, Evolution has also revised the CGO’s CMP to reflect the agreed cyanide sampling and analysis methodology, as reflected in the revised Environment Protection Licence (EPL) 11912.

The key revisions to the CMP are summarised in Table 1.

Table 1

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| Sections 6.2.2 ad 6.2.3   | Amendments to the sample collection methodologies, including reference to contemporary standards.  
In addition, updates to the laboratory analysis procedures have also been incorporated including (but not limited to):  
- The $C_N^{NAD}$ samples will also be analysed at the on-site laboratory using APHA Standard Method 4500-CN-I Weak Acid Dissociable Cyanide (except instead of manual distillation, an automated VELP distillation unit will be used and instead of sulphuric acid as the pH modifier, magnesium chloride will be used) and then using the APHA Standard Method 4500-CN-E Colorimetric Method.  
- An automated $C_N^{NAD}$ sampler (i.e. a Cyanoprobe analyser) would also be used on-site to assist with quickly establishing $C_N^{NAD}$ levels in the liquid at the process plant and in the decant ponds.  
- The samples will be analysed for $C_N^{NAD}$ at the off-site laboratory in accordance with APHA Standard Method 4500-CN-I Weak Acid Dissociable Cyanide (except instead of manual distillation an automated VELP distillation unit will be used and instead of sulphuric acid as the pH modifier, magnesium chloride will be used) and then using the APHA Standard Method 4500-CN-E Colorimetric Method. |
| Section 8                 | Revised to include contemporary complaints register requirements, including the dedicated Community Complaints Line required by EPL 11912 Condition M6.1. |
| Sections 9.1 and 9.2      | Revised to reflect the modified annual review and reporting requirements of the modified Development Consent (DA 14/88) and to reflect the approved CGO. |
| Appendix A                | Updates to reflect contemporary legislative requirements. |
| Appendix B                | Updates to reflect contemporary codes of practice, Australian Standards and guidelines. |

The revised CMP is enclosed.

In accordance with Condition 5.3(b) of the Development Consent, the Division of Resources and Energy (DRE) is required to be consulted during the preparation/revision of the CMP.

Accordingly, would you kindly advise us as to whether the revised CMP meets the DRE’s requirements by Thursday 13 April 2017.

We look forward to your input and invite you to contact us with any queries.

Please do not hesitate to contact me on 0408 745 397 should you have any queries or wish to discuss.

Yours faithfully,
Evolution Mining (Cowal) Pty Limited

[Signature]

BRONWYN FLYNN
Approvals Manager  
Cowal Gold Operations
COW.400.04.3919BF

31 March 2017

NSW Environment Protection Authority
PO Box 397
GRIFFITH NSW 2680

Attention: Jason Price

Dear Jason,

RE: Cowal Gold Operations – Revised Cyanide Management Plan

As you are aware, the Cowal Gold Operations’ (CGOs’) Development Consent (DA 14/98) was modified by the New South Wales Minister for Planning on 7 February 2017 for the CGOs Mine Life Modification (Modification 13).

The modified Development Consent includes revised conditions relevant to cyanide management and modified requirements for the CGOs’ Cyanide Management Plan (CMP) (among other things). Accordingly, the CGOs’ CMP has been revised to reflect the modified Development Consent (DA 14/98) requirements.

Further, Evolution has also revised the CGO’s CMP to reflect the agreed cyanide sampling and analysis methodology, as reflected in the revised Environment Protection Licence (EPL) 11912.

The key revisions to the CMP are summarised in Table 1.

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In accordance with Condition 5.3(b) of the Development Consent, the Environment Protection Authority (EPA) is required to be consulted during the preparation/revision of the CMP.

Accordingly, would you kindly advise us as to whether the revised CMP meets the EPA's requirements by Thursday 13 April 2017.

We look forward to your input and invite you to contact us with any queries.

Please do not hesitate to contact me on 0408 745 397 should you have any queries or wish to discuss.

Yours faithfully,
Evolution Mining (Cowal) Pty Limited

BRONWYN FLYNN
Approvals Manager
Cowal Gold Operations
Dear Ms Flynn

Re: Cowal Gold Operations – Revised Cyanide Management Plan

I refer to your letter dated 31 March 2017 requesting comment from DPI Water regarding the Revised Cyanide Management Plan (CMP) for Cowal Gold Operations’ Mine Life Modification (Modification 13). It is noted that revisions have resulted from the modification of Development Consent (DA14/98) and the revised Environmental protection Licence (EPL) 11912.

The requirement for DPI Water to be consulted in relation to preparation/revision of the CMP is stated in Development Consent Condition 5.3(b) for Cowal Gold Operations (Modification 13).

DPI Water is satisfied that consultation requirements have been met in respect of revision of the CMP, and are satisfied that revisions are consistent with the Department’s requirements.

Should further information or clarification be required please do not hesitate to contact me on (02) 6841 7403.

Yours sincerely

Tim Baker
A/ Regional Manager
Water Regulatory Operations
NSW Department of Primary Industries - Water
8th May 2017

Dear Mr Bronwyn,

Cowal Gold Operations – Revised Cyanide Management Plan

Thank you for forwarding to the Division of Resources and Geoscience (DRG) an updated Cyanide Management Plan (CMP) for the Cowal Gold Operations. We also acknowledge that you have provided an opportunity for DRG to provide comments on the updated CMP.

However, it is not proposed to provide any comments on the plan, other than to state that we have no objections to its implementation and that the use of cyanide has previously been approved by the Minister in accordance with Condition 28 of ML1535 on January 17th 2006 (Ref: L03/324).

Yours sincerely,

Michael Young
Manager & Principal Inspector
Environmental Sustainability Unit
Dear Ms Flynn

Re: Cowal Gold Operations – Revised Cyanide Management Plan

I refer to your electronic mail dated 4 April 2017 to the Environment Protection Authority (EPA) requesting our comments on the revised Cyanide Management Plan (CMP) for the Evolution Mining (Cowal) Pty Limited gold mine at Lake Cowal.

We understand the revision is based on the modified development consent conditions (DA 14/98) approved by the Department of Planning and Environment on 7 February 2017 and to reflect the cyanide sampling methodology variations made to Environment Protection Licence No 11912 held by Evolution Mining for activities at the gold mine.

We have reviewed the revised CMP and note it is consistent with the modified development consent and varied licence and the EPA has no objections to the proposed revisions.

If you have any further enquiries about this matter please contact Jason Price by telephoning 02 6969 0700.

Yours sincerely

CRAIG BRETHERTON
Manager Regional Operations South West
Environment Protection Authority

11.4.2017