

CONTENTS

17.0	RISK MANAGEMENT	17-1
17.1	Introduction	17-1
17.2	Risk Assessment.....	17-3
17.3	Risk Register.....	17-7
17.4	Risk Control Action Plan.....	17-7
17.5	Risk Management Plan	17-8

TABLES

Table 17.1-1:	Risk Likelihood Matrix	17-2
Table 17.1-2:	Risk Impact Matrix.....	17-2
Table 17.2-1:	HAZID Workshop Attendees	17-3
Table 17.2-2:	Business Risk Analysis Attendees	17-4
Table 17.4-1:	Project Risk Control and Action Plan	17-8

FIGURES

Figure 17.1-1:	Risk Allocation Matrix.....	17-3
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17.0 RISK MANAGEMENT

17.1 Introduction

GCM has adopted a risk-based approach for the project, so that all material business decisions are based on judgments by competent people, following a structured and documented review of potential opportunities and threats. Steps can then be taken to manage the risk exposure or mitigate it within GCM's normal management and governance processes.

During the feasibility study the risk management activities started with the process of identifying risk factors (risk assessment), further analyzing and quantifying those factors (risk analysis), mitigating the impact of the factors on project performance and developing a risk management plan (risk mitigation), and implementing the risk management plan (risk control).

Risk management was applied to the following categories of risk:

- Technology
- Plant operations
- Finance
- Compliance
- Project strategy and execution.

Risk identification was carried out by inspecting the adverse impacts that could affect the project in the following areas:

- Natural environment
- Socio-economical and political
- Economic (external) and financial (internal)
- Markets
- Labour
- Health and safety
- Legal and commercial
- Technical – project design, geology, resources, mine design, metallurgy, process
- Management
- Project execution.

An assessment system was used for risks evaluation based on the possibility of occurrences (risk likelihood) shown in Table 17.1-1, and the risk impact shown in Table 17.1-2.

Table 17.1-1: Risk Likelihood Matrix

Value	Frequency (Risk Likelihood)	Occurrence
1	Very low	Not expected to occur in the project life
2	Low	May happen once every 20 years, and maybe 5% chance in one year, could happen once in the project.
3	Moderate	50% chance it will occur in one year, will probably happen during the project life.
4	High	Expected to occur more than once per year, will occur more than once in the project life.

Table 17.1-2: Risk Impact Matrix

Value	Impact	Definition
1	Very minor	Minor injury, minimal public health affect, small environmental impact, small production loss, small capital asset loss, minimal reputation damage.
2	Minor	Minor injury but with medical care required, minor health effect, relatively expensive clean-up but minor legal impact, significant financial loss but not affecting viability of operation, some reputation damage but will go away with time.
3	Moderate	Lost time accidents, disabilities, major fine and expensive clean-up, significant financial loss with negative financial period, loss of significant capital asset, significant reputation loss with long term impacts.
4	Significant	Fatality, serious long term health effects, significant fine and clean-up costs, significant financial loss with negative financial period, significant equipment loss, very significant reputation damage in the community.
5	Very significant	Multiple fatalities, multiple and severe health effects, environmental disaster with long term effects, long term financial damage to project, loss of major capital assets, damage to national and international reputation.

Combining the impacts of likelihood and impact produced a risk rating value which is shown in Figure 17.1-1 and can be used to establish the type of action required for risks control. The actions required based on the risk allocation are:

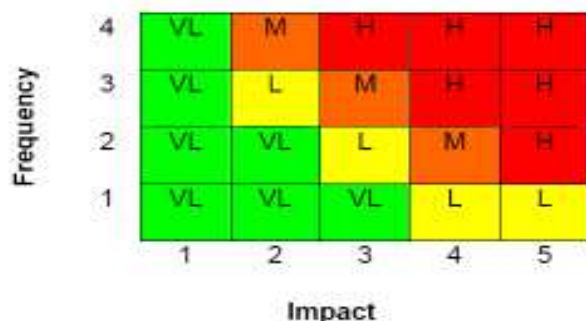
VL: No mitigation required

L: Establish control and safeguards

M: Risk reduction is necessary in the period in which the risk is most likely to occur.

H: Risk reduction required for project life before project can move forward.

Figure 17.1-1: Risk Allocation Matrix



17.2 Risk Assessment

During the study, a HAZID workshop for the identification of the technical and business risks was carried out. For the identification and assessment of the project risks AMEC procedures and worksheets were used. GCM participated in the activities of identification, analysis, and qualification of the risks.

HAZID Workshop

This workshop was carried out in December 2009 and was attended by the people listed in Table 17.2-1.

Table 17.2-1: HAZID Workshop Attendees

Name	Position	Name	Position
Rafael Ocariz	GCM Process Specialist	Carlos Reyes	AMEC Process Lead
Marzio Giuliano	AMEC HSEC Manager	Gonzalo Figueroa	AMEC Mechanical-Piping Lead
Gonzalo A. Figueroa	AMEC Civil, Structural, & Architecture Lead	Ina Castro	GCM Environmental & Permitting Lead
Gonzalo Tufino	GCM Consultant	Ivan Caceres	GCM Project Manager
Stabro Kasaneva	GCM COO	Rodrigo Ramirez	GCM Mine Manager
Alejandro Coppo	CEYGE General Manager	Luis Grunewald	AJG Engineering Manager
Antonio Jara	AJG General Manager	Pamela Villa	AMEC Environmental Specialist
Carlos Vargas	Vector Project Manager	Jennifer Thompson	Vector Engineer
Rene Burgos	AMEC Project Manager	Micaela Barrientos	AMEC Workshop Facilitator

This HAZID workshop focused on the analysis of risks for the following facilities:

- Crushing plant
- Heap leach pad N° 3
- Agitated leach plant
- ADR plant.

GCM requested that mining, tailings disposal, and infrastructure not be covered at this stage. The consolidated Hazid risk matrix is included in Appendix D.

In May 2010 GCM delivered a Hazid risk analysis matrix for the underground and open pit mines. This is included in Appendix D.

Business Risk Analysis

In March 2010 a business risk analysis workshop was carried out with the participation of the individuals shown in Table 17.2-2.

Table 17.2-2: Business Risk Analysis Attendees

Name	Position	Name	Position
Rafael Ocariz	GCM Process Specialist	Ina Castro	GCM Environmental & Permitting Lead
Stabro Kasaneva	GCM COO	Sebastián Engelsztajn	GCM CFO
Christian Yañez	AMEC Senior Estimator	Rene Burgos	AMEC Project Manager

In this workshop the following which could impact the business were analyzed:

- Natural environment
- Socio-economical and political
- Economic (external) and financial (internal)
- Markets
- Labour
- Health and Safety
- Legal and commercial
- Technical – project design, geology, resources, mine design, metallurgy, process
- Management
- Project execution.

The consolidated business risk matrix is included in Appendix D.

Risk Identification

During the workshops and further review of the risk matrices, four major risks were identified for the project:

a) Increase of the project CAPEX

A bad estimate of the work, lack of quality personnel and qualified HSEC staff, insolvent suppliers and contractors, non-fulfillment of commitments with stakeholders and incorrect application of the standards were issues that could affect the CAPEX and increase the investment required, due to:

- Accidents during construction
- Major damage to critical equipment as a result of inappropriate construction or erection.
- Loss of critical equipment due to logistic issues or Force Majeure
- Lack of contractors' guarantees to assure the fulfillment of the HSEC procedures, times of execution, and quality.
- Quality control and HSEC
- Lack of scheduling and definition of the commitments and responsibilities acquired with the stakeholders.
- Collapse of the project structures and facilities.

Mitigation measures recommended that must be adopted by the project are:

- Ongoing control of the work, qualified personnel will be assigned to this objective.
- Incorporation of qualified personnel in HSEC and Quality
- Performance bonds will be requested from contractors.
- Commitments and responsibilities with stakeholders will be established and specific, and qualified personnel will be assigned to these duties
- Seismic standards will be applied correctly and testing and geotechnical studies will be carried out by experts

b) Delay in the Implementation of the project:

A delay in the implementation of the project could occur due to:

- No guaranteed financing to complete the project
- Damage to cultural heritage sites identified in the environmental assessment.

- No appropriate management of the impacts on the flora and fauna in wetlands
- Archaeological findings
- Delays due to limitations in the working day caused by extremely windy conditions

Mitigation measures recommended that must be adopted by the project are:

- Assign a specific team that will provide guarantees on time and will complete formalities with potential investors and ensure that project reports are reliable and correct and meet industry standards.
- During project execution a preservation plan for cultural heritage sites will be established (include in HSEC Plan),
- A monitoring plan will be prepared for critical flora and fauna, keeping a record of the variables and assigning resources for the monitoring plan (include in HSEC Plan)
- An archaeological survey will be carried out and a contingency plan will be prepared for archaeological findings
- Allowances will be included in the construction schedule to absorb extreme windy periods when work would be stopped

c) Damage to People's Health and Safety during Construction, Start-up and Operation

The principal risks are fire and explosion, structural collapse, facilities and equipment, work in confined spaces, lifting of equipment/material, and traffic accidents between Antofagasta and Guanaco, as a result of:

- Deficiency in HSEC control and planning and demarcation of areas,
- Lack of HSEC procedures

Mitigation measures recommended that must be adopted by the project will be to incorporate qualified HSEC personnel, assign resources, and prepare the HSEC manual which will include all the procedures required for the work execution, applying the Chilean standards and GCM regulations.

d) Impact during Operation

The main risks associated with the operation are the following:

- Bad selection of the doré metal refiner
- Refiner penalizing doré payments for impurities

- Insufficient input of materials and critical resources for the operation e.g. water, energy, fuel, reagents
- Change of mineralogy of the resource.

Mitigation measures recommended that must be adopted by the project are:

- Prepare a plan for the selection of the refiner that will include at least the pro-forma contract to be presented to potential refiners, perform benchmarking of the potential refiners, obtaining legal and technical advice during refiner selection.
- Prepare a production plan that will consider variables such as the limits of impurities. To achieve this, the types of impurity and impurity limits in the contracts must be established, as well as a quality control plan in the plant.
- Prepare a supply plan; identify critical resources, suppliers of these resources will be contractually committed, fulfillment of contracts will be monitored and an alternative plan for the obtaining resources will be established.

17.3 Risk Register

A total of four main risks and 18 events were evaluated after conducting the risk assessment for the project. Causes and impacts were identified for the risks; and an owner was assigned to each risk to control and be responsible for further action, due dates were established and will be followed up until completion.

The risk record will be periodically updated and information on risk management will be regularly presented to GCM management.

17.4 Risk Control Action Plan

The risk control and action plan shown in Table 17.4-1 is part of the risk register. All controls and further actions have an owner who will follow up the status. The risk management plan establishes a continuous updating of the risk register and the review of the status of tasks and existing controls.

Table 17.4-1: Project Risk Control and Action Plan

Task	Due Date	Action by	Status (at May 2010)
Assignment of qualified planning and Project Control personnel	June 2010	Ivan Cáceres	Not Started
Assignment of qualified HSEC and QA/QC personnel	June 2010	Ivan Cáceres	Not Started
Request guarantee bonds from contractors	June 2010	Ivan Cáceres	Not Started
Assignment of personnel for the management of stakeholders	June 2010	Stabro Kasaneva	Not Started
Assignment of a geotechnical expert	June 2010	Iván Cáceres	Not Started
Assignment of the team for the management of potential investors	June 2010	Sebastian Engelsztajn	Not Started
HSEC Plan for the project	June 2010	Iván Cáceres	Not Started
Contingency plan for archaeological findings	June 2010	Iván Cáceres	Not Started
Construction schedule for the project	June 2010	Iván Cáceres	Not Started
Plan for refiner selection	June 2010	Sebastian Engelsztajn	Not Started
Production Plan	June 2010	Iván Cáceres	Not Started
Plan for supplies	June 2010	Iván Cáceres	Not Started

17.5 Risk Management Plan

The GCM project team will develop a Risk Management Plan during the next project phase based on the activities to be performed. The HAZID and business risk registers will be reviewed and updated to reflect current project risks status.