BHP CHALLENGE - CORPORATE

# BHP-45-2021 “Agglomeration/leaching gas measurement and mitigation”

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## Aim and scope

In the context of a metallurgical test program being developed at Escondida Mine's Pilot Plant, technological solutions are being sought that allow to:

1. Measure the amount of gases generated (HCl and $NO_x$) during the agglomeration and leaching of copper ores.
2. Mitigate or avoid the generation and release of these gases (HCl and $NO_x$) to the environment.

The requirements for the solutions are:

- For the measurement of gases, they should be oriented to implement a system that allows to accurately quantify the generation of gases, both in agglomeration and in column (regular and large) leaching.
- It is desirable that the solutions referred to mitigation during leaching be scalable to industrial heap leaching operations. Therefore, solutions that avoid the generation and release of gases into the environment (e.g. chemical reagents, bacteria or others) are expected.
- Do not generate interferences or adverse effects on the leaching, solvent extraction (SX) and electrowinning (EW) processes.
- The solutions, both for measurement and mitigation of gases, must be applicable, in the first instance to the tests in columns (0.16 m diameter and 6 m high) and then in large columns of 40 ton capacity.
- Have a degree of technological maturity TRL greater than or equal to 5, i.e. at least at the level of a prototype validated in a complex environment.
- Comply with Escondida Mine's quality and safety standards.

### Excluded solutions

- Advisory services, consulting or engineering studies.

## Operation and processes involved

Innovation in Leaching

## Current problem

### Challenge

The BHP team is developing pilot plant tests at Escondida Mine for the leaching of copper ores under different conditions, which involve the generation of HCl and nitrous gases (NO, $NO_2$).
During the agglomeration process, sulfuric acid, salt (NaCl) and water are in contact with the copper minerals in order to initiate copper sulfation and generate the glomers that favor the percolation of the leaching irrigation solutions. Both processes generate gases, mainly hydrochloric acid (HCl) and nitrous ($NO_x$), which are pollutants and hazardous to human health.
Inside the pilot plant, leaching columns of 6 m in height and 0.16 m in diameter and 40 ton capacity larger columns are operated, which require control of the gases generated.
Due to the above, the Innovation in Leaching team of Escondida Mine, in charge of these metallurgical tests, needs to quantify the generation of polluting gases and also their mitigation in the pilot plant facilities (See Annex 1).

### Consequences

Exposure of pilot plant and industrial plant operators to toxic gases (HCl and $NO_x$) generated in agglomeration and leaching processes.

### When does the problem occur?

Permanently during pilot plant leaching tests. The effects increase each time new tests are started with agglomeration and column loading stages.

### How is it currently resolved?

During the agglomeration and column loading stages, the pilot plant building must be evacuated and ventilated until $NO_2$ levels drop to 5 ppm, the maximum allowed by Chilean regulations. For this purpose, the pilot plant has a monitoring system that detects the presence of nitrous gases in the air. In addition, each leaching column is sealed and connected to bottles with acid solution, where the captured gases are retained and washed (see Annex 2).

### Tested technologies

Similar technologies have not been tested.

# Supply innovation BHP

Supply Innovation aims to promote the development of projects between the Company and the Suppliers with an associative approach, where the design and construction of the solution for the "Challenge" detected by an area of the Operation is addressed jointly. In this way, the generated projects develop solutions that add value to the Company and the suppliers build capacities and competencies that translate in more and better business opportunities.

# Expande Program

The Open Innovation in Mining Program, Expande, is a public-private initiative designed and carried out by Fundación Chile. The purpose is to drive innovation and make possible a better future for global mining, promoting the mining ecosystem in Chile along with building a collaborative model that enables the best solutions for the high complexity challenges of mining today and tomorrow.

# Confidentiality

The delivery of personal information to register in the database, such as details related to technological solutions to apply for Expande's open innovation processes is strictly confidential; as is the information contained in the contact forms with information of these processes subsequent stages.

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**Link**
**https://fch.brightidea.com/BHP452021Medicionymitigaciongasesaglolix**

# Required documents

- **Indicate relevant skills of the team members who will solve the challenge.**
- **Previous experience in similar solutions or in the technological field of the challenge.**
- **Description of the technological solution and degree of maturity (under development, tested, implemented or in operation).**
- **Success stories.**
- **Ability to provide consulting services.**
- **International companies/suppliers for this challenge are not required to operate in Chile or through technical sales representatives.**

# Milestones

YOU ARE HERE

**01 SCOUTING**
25-08 / 08-09-2021
4 PM (UTC-4)
Receipt of pre-qualification background on challenge page.

**02 SAVE THE DATE**
*To be confirmed*
Pre-qualification notice and access to bidding documents.

**03 LAUNCH**
*To be confirmed*
Workshop where the operation explains the problem and vendors solve their inquiries.

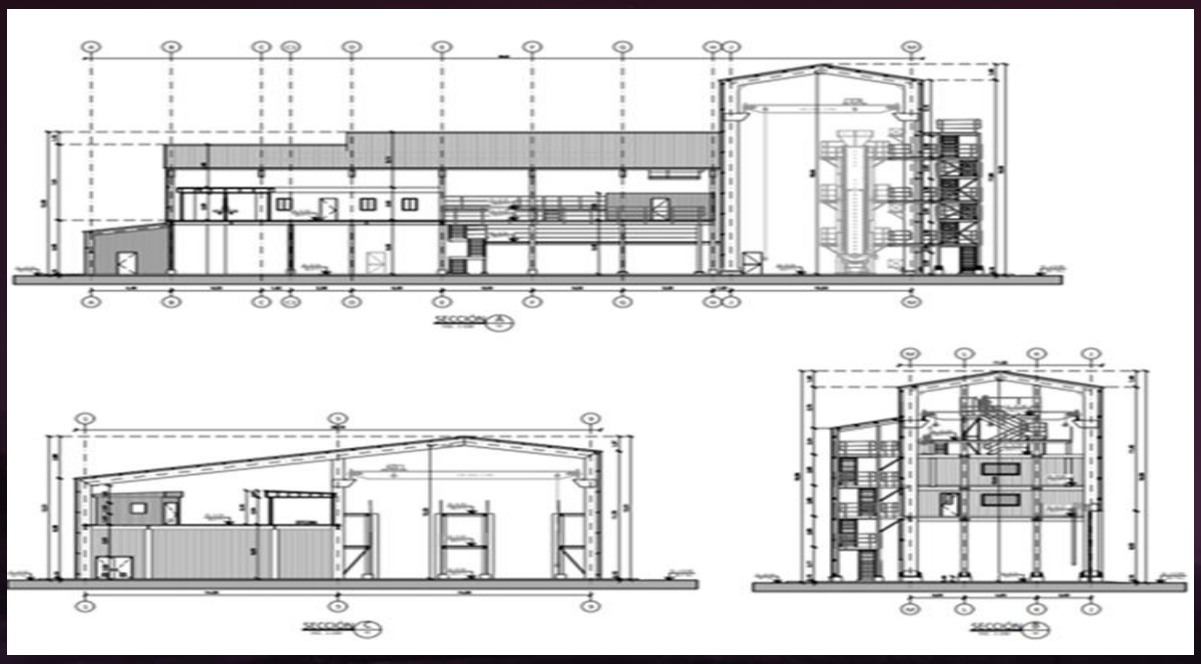
**04 TECHNICAL-ECONOMIC OFFER**
Receipt of technical-economic offer, according to established formats

**05 EVALUATION**
Proposals evaluation period.

**06 AWARD**
Notification if the process is awarded or deserted.

# Annexes

## Annex 1 - Pilot Plant Facilities



Pilot Plant dimensions: 13 m and 18 m high, 45 m long and 30 m wide. Inside, 6 m high leaching columns are operated to simulate the operating conditions of an industrial leaching platform.

# Annexes

## Annex 2 - Monitoring and control of gases in Pilot Plant