

Environmental and Social Aspects of Polymetal's POX-2 project in Amursk.

1 Introduction

Polymetal International plc ('Company', 'Polymetal' or 'the Group') is a top-20 global gold producer and top-5 global silver producer with assets in Russia and Kazakhstan. Polymetal currently has 9 operating mines across Russia & Kazakhstan, 1 downstream processing facility (Amursk POX plant) and 3 major development projects.

The existing Amursk POX plant is located in the Russian Far East and is involved in processing refractory concentrates via pressure oxidation (POX) technology to recover gold. The plant was commissioned in 2012 and achieved its design throughput and recovery levels in 2013. The Amursk POX plant currently runs at its design capacity with concentrates sourced from Albazino, Mayskoye, Kyzyl and various third-party producers.

Polymetal has a substantial refractory reserve base that makes up more than 50% of its total reserves.

Project Description

POX-2 is designed for processing double refractory concentrates, which contain micron gold particles encapsulated in sulfides (pyrites and arsenic pyrites) together with high concentrations of organic carbon. High carbon content drives high sorption activity (preg-robbing) and dictates the use of high-temperature (240°C) pressure oxidation compared with medium-temperature (200°C) oxidation utilized at the existing Amursk POX facility.

The expansion of the existing Amursk POX plant by a second POX line (POX-2) will result in a substantial capacity increase and will meaningfully increase the value of Polymetal's refractory reserve base. Furthermore, POX-2 will ensure strategic security of downstream processing against the backdrop of tightening environmental regulations in China, currently the main market for Polymetal's refractory gold concentrates.

Based on the project's feasibility study, a total of 4.3 Mt of concentrate containing 9.3 Moz of gold will be processed from Kyzyl, Nezhda, Mayskoye, and Voro over a period of 23 years. Additionally, the project will allow Polymetal to create capacity for treatment of third-party refractory concentrates, a market which has grown considerably in Russia and globally in recent years.

POX-2 will be adjacent to the current Amursk POX facility and will share some of its infrastructure. The project will include a new hydrometallurgical area (POX proper), CIL and intensive cyanidation areas, an oxygen plant, an upgrade to the existing dry tailings facility, reverse osmosis water treatment facility, and several smaller infrastructural facilities (warehouses, maintenance areas, etc.) including a new dedicated powerline from the 110kW regional grid.

Starting in 2024, the expansion will result in improved effective gold recovery from concentrate (incremental production of ~30–35 Koz of GE p.a. from the same amount of feedstock, recovery improvement from 90% to 96%), as well as bring down processing and transportation costs resulting in USD100-110m p.a. incremental EBITDA and lower TCC by USD100–150/oz for each of the above-mentioned operations.

POX-2 will also further Polymetal's sustainable development strategy. The environmental footprint of the Company's value chain will shrink drastically on the back of substantial reductions in air pollution, water usage, and solid toxic waste.

2 Sustainability at the Company Level

The Group applies highest standards of corporate governance and disclosure and best business practices. Polymetal has been guided by the principles of the UN Global Compact since 2009, Cyanide Code since 2016, the Company commits to UNDHR, ILO and EBRD Environmental and Social Policy and uses GRI G4 guidelines for sustainability reporting. Management is outspoken to reinforce the safety culture across the organization. The Group tightened safety procedures and intensified training programmes across all its mining operations, through which the Company strives for 0 fatalities going forward (1 fatality was recorded in 2018 vs 2 fatalities in 2017).

Polymetal has a strict Environmental Policy in place which focuses on continuous improvement, risk reduction, best practice and compliance. The Group's efforts have been recognized by Sustainalytics, which ranked the company as Outperformer (1st among 47 mining companies included in 2018 Sustainalytics report).

3 Anticipated Environmental Impacts of POX-2

3.1 Introduction

The existing Amursk POX plant is located near the city of Amursk with the closest residential areas being 5km away. The environmental impact of POX-2 has been preliminarily assessed as part of the engineering study including atmosphere air, surface and underground water bodies.

The on-site ambient monitoring program, forms the basis for periodic/continuous studies of atmospheric air, emissions from processing equipment, surface and groundwaters, as well as the assessment of the effectiveness of air purification plants and wastewater treatment plants.

In general, POX can be considered to have a reduced environmental impact compared to the common alternative refractory processes BIOX (bio oxidation) and roasting due to lower effluent levels, particularly arsenic content, lower cyanide usage and lower SO₂ (sulfur dioxide) and AS₂O₃ (arsenic trioxide) emissions.

Amursk POX plant was recertified for compliance with the requirements of ISO 14001 in 2019 and for ISO 45001 in 2018. Audit for compliance with ISO 45001 is planned for December 2019. The ESIA

(Environmental and Social Impact Assessment) for POX-2 is expected to be finalized in 3Q 2019. All environmental permits for Amursk POX are in place, with new permits for POX-2 expected in 2020.

In April 2019, the Amursk POX plant became the second gold production operation in Russia and FSU which has been certified as being in full compliance with the International Cyanide Management Code (Cyanide Code) as both a gold mining company and separately as a cyanide transporter by the International Cyanide Management Institute (ICMI).

3.2 Air Quality

All predicted values for ambient air quality after the completion of POX-2 are within the maximum permissible concentration levels set by Russian law. This applies to both on-site values and the background concentration in the closest residential areas. For further details, see Table 1.

Table 1: Air concentration levels that shall not be exceeded

Substance	Maximum permissible concentration at site	Maximum permissible background concentration for residential areas
Sulphur dioxide (SO ₂)	0,5 mg/m ³	0,015 mg/m ³
Nitrogen dioxide (NO ₂)	0,2 mg/m ³	0,079 mg/m ³
Nitrogen oxide (NO)	0,4 mg/m ³	0,044 mg/m ³
Dust	0,95 mg/m ³	0,229 mg/m ³
Hydrogen cyanide	0,01 mg/m ³	
Sulphuric acid	0,3 mg/m ³	
Chlorides, NH ₃ , PCDD/F		

In terms of air pollution controls, the Amursk POX plant uses a venture scrubber to remove dust and particles from exhaust streams of hydrometallurgical processes and a (KФE-48A) bag filter for the melting process. Waste filters and gas absorption residues are handed over to a contracted licensed organization for disposal. In order to reduce dust emission during further production processes, such as crushing, sieving, mixing, transportation of raw material as well as during incineration, calcining, drying and refining, different types of dust and gas treatment equipment are used including bag filters, scrubber filters and hydro filters.

The air purification facilities are equipped with the following security measures to prevent accidental releases of hazardous gases: Two condensation tanks and extra backups for all pumps operating as part of the purification system. All tanks are equipped with level sensors. The treatment facility is controlled by an APCS (Automated Process Control System). All equipment undergoes planned maintenance as per schedule.

3.3 Water Quality

The consumption of fresh water in 2018 amounted to 212,590m³. Fresh water is withdrawn from the city of Amursk's municipal water facility.

At Amursk POX plant a water cycle system is installed to reuse the water from the cooling system for the refractory process (to create the slurry). Purging of the cooling system is at 7.3 – 9.1 m³/h. Waters which are discharged now, later will be used in the technological process at the POX, the rest will be treated at the facilities of Amursk city. Discharge of domestic waters and excess industrial

wastewater is carried out through an underground sewage collector to the Amursk municipal treatment facilities. Discharge volumes are recorded via a flow meter. In 2018, discharge of industrial and domestic water was 48,560m³. The surface wastewater from the site is purified at the treatment facilities and then discharged into the surface watercourse (at Medvezhy spring). In 2018, the discharge volume of surface waters was at 15,193m³. Prior to discharge, waste water is analyzed for compliance with the permitted limits (see Table 2 below).

All process waters from both POX lines will be fully utilized in the closed water cycle system. The process water is cleaned using reverse osmosis technology and is then recycled. Storm drains at the cake storage are cleaned by hypochlorination technology, followed by filtration through geotubes using peat sorbent, and then discharged into the Medvezhy spring.

The following safety measures have been implemented to prevent accidental discharge of polluted waste water into environment: There is an emergency pipe for discharge of process water into sediment tanks with further cycling to the plant via the treatment area.

Table 2: Effluent parameters for (i) discharge of domestic and process waters and (ii) storm waters that shall not be exceeded

Content	(i) domestic and process waters	(ii) storm waters
Unit	Limit mg/dm ³	Limit mg/dm ³
CN+SCN	0.05	0.014
pH	6 – 9	n/a
Arsenic	0.05	0.0075
Suspended matters	300	16.7
Iron	5.0	0.253
Chlorides	1000	256
SO ₄	1000	362
Copper	1.0	0.71
Zinc	1.0	0.066
Manganese	n/a	0.01
Oil	n/a	0.05

Table 3: Polymetals is in line with all of the below mentioned maximum permissible concentration of chemicals in the water of water bodies of drinking and household water use.

Content	Max. Permissible concentrations, mg/L
Arsenic	0.01
Lead	0.01
Mercury	0.0005
Zinc	1
Cadmium	0.001
Copper	1
Nickel	0.02
Chromium	0.05
Iron	0.3
Selenium	0.01
Silver	0,05

Cyanide	0,07
(COD) Chemical Oxygen Consumption	-
Chlorides	350
Nitrogen	1,5
Sulphides	0,05
Suspended substances	-

3.4 Hazardous Substances

During the extraction process acids and solvents are used to separate the gold particles from the refractory ore. At Amursk POX plant the following amounts of acids and solvents usage is estimated after the completion of POX-2:

- Sodium cyanide - 270 t/year
- Sodium hydrate - 114 t/year
- Sulfamic acid - 114 t/year
- Calcium hypochlorite - 166,5 t/year

These hazardous substances are stored in sealed package at closed storages in 20 ft containers. These containers are placed on a wood block filler to prevent water ingress. In addition, different hazardous substances are stored separately to avoid dangerous reactions with one another.

The Amursk POX plant became the second gold production operation in Russia and FSU which has been certified as being in full compliance with the International Cyanide Management Code (Cyanide Code) as both a gold mining company and separately as a cyanide transporter by the International Cyanide Management Institute (ICMI).

In addition, Polymetal has developed a corporate Cyanide Management System which will be implemented in 2019 and has fully integrated the Cyanide Code principles and standards of practice into its Health, Safety and Environmental Management Systems.

3.5 Solid Waste

The biggest amount of solid waste are semi-dry tailings. Under Russian law, this waste is not hazardous. It is classified under 5th category of hazardous waste. The tailings are transferred to storage areas and permanently stored as dry cake (as the remaining water is being filtered and reused for the refractory process). Filled areas of storage are recultivated. A monitoring system checks parameters in the ground water at wells located along the perimeter of the storage area. So far, the total amount of dry cakes per year after the construction of POX-2 has not yet been determined, but along with POX-2 a second, larger cake storage will be created.

Safety measures include the following: the foundation of the cake storage is equipped with a water-proof screen, sediment ponds for collecting storm waters (equipped with a water-proof screen on the bottom), a pumping station for cycled water coming from the ponds, treatment facilities for waste water discharged into the surface watercourse.

Apart for the dry cakes, all further waste is transferred to licensed companies. The licenses of these companies are officially published at the state agencies websites and tracked by Polymetal. Selective audits of waste treatment plants where the waste is deposited have also been conducted by the environmental team head.

3.6 Resource Extraction

At POX-2 a total of 4.3 Mt of concentrate containing 9.3 Moz of gold are expected to be processed over a period of 23 years. The concentrate will be sourced from the mines Kyzyl, Nezhda, Mayskoye, and Voro.

4 Anticipated Social Impacts of POX-2

4.1 Ambient Noise

The construction of POX-2 is not expected to cause a notable increase in noise levels (> 3 dBA) at the production plant. The general noise levels (37 dBA during daytime, 39 dBA during nighttime) are well below permissible noise levels according to IFC's general EHS guidelines (70 dBA for commercial sites and 45 dBA for residential sites). At some locations (in the compressor shop), noise levels do exceed 85 dBA and personal hearing protection equipment is being used.

4.2 Occupational Health and Safety

In accordance with Polymetal's robust safety procedures and intense training programmes across all its mining operations, at the Amursk POX plant there was only one minor accident per year both in 2017 and 2018. Employees of the Amursk POX plant live in the city of Amursk or neighboring towns. Some corporate apartments are also available in the city. Polymetal hires contractors for the project, but does not provide accommodation to them. However, sites for temporary buildings and structures, as well as key utilities are provided by Polymetal and the contracting organizations provide their personnel with accommodation as per the applicable Russian standards, which are largely in line with IFC and EBRD standards. The selection of contractors is carried out under the Company's corporate policy. Part of the contract is the obligation to comply with Polymetal's Occupational Health and Safety System. A potential contractor has to present all necessary permissions and the existence of a Health & Safety system. If these requirements are below Polymetal's standards, contractors are obliged to follow Polymetal's standards. Introduction safety trainings are mandatory for all employees of Polymetal and the contractors before entering the plant. An emergency response plan has been made public and was approved by the Russian Far Eastern Emergency Center. All personnel of the plant was familiarized with this plan.

In order to minimize impacts and possible risks (due to increased traffic, explosions and/or dust) for adjacent communities, Polymetal designs the process equipment based on HAZOP (Hazard and Operability Analysis) procedures that allow identification of potential risks at an early stage and ensure the implementation of preventive measures. A detailed risk assessment is scheduled for 2020.

4.3 Employment

The installation of POX-2 is expected to create approximately 400 new jobs by 2023. More than 50% of these jobs are going to be engineering and technical employment opportunities. Polymetal is focused on providing employment opportunities to the local population and has been operating a training centre in Amursk since 2016 which offers 52 licensed qualification programmes.

5 Conclusion

Therefore, the environmental and social impacts of the production expansion and the Amursk POX facility are deemed to be acceptable and well within the permissible limits. The estimates of the engineering study suggest that no exceedance of limits will occur, also taking into account baseline levels in the sanitary protection zone around the Amursk POX plant and adjacent residential areas.