

Appendix 6.1-B

*Greenhouse Gas Emission Inventory Summary
for KGHM Ajax Mine*

AJAX PROJECT

**Environmental Assessment Certificate Application / Environmental Impact Statement
for a Comprehensive Study**



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January 22, 2015
File: 123510762

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Reference: Greenhouse Gas Emission Inventory Summary for KGHM Ajax Mine

KGHM Ajax Mining Inc. (KGHM) has contracted Stantec Consulting Ltd. (Stantec) to quantify GHG emissions from a subset of the Ajax Mine activities considered in the Environmental Assessment Certificate Application. Stantec has prepared a summary of Greenhouse Gas (GHG) emissions originating from sources that are also included in the air quality emission inventory. The same assumptions and processes are considered in the GHG emission inventory as are included in the air quality assessment.

This letter report summarizes the GHG emissions quantified by Stantec and the methods used in these quantifications. It should be noted that the values contained in the emission inventory tables are preliminary totals for the current mine plan. The mine plan has changed, and Stantec will be issuing revised totals in about a month. The approach and methods used in this assessment should remain the same, however.

PROJECT PHASES

Construction Phase

There are four years in the development stage (year -4, -3, -2, -1). Construction starts in year -4 with small works such as road construction and pre-stripping. By the development year -1, the Ajax Mine will reach its peak pre-production activity. Ore production will be occurring in some areas of the mine, however, some pre-stripping will still be occurring in the pit, new haul roads will still be under development and overburden and reclamation stockpile loading activities will continue active. Much of the actual construction activities do occur in the other 3 development years, however, based on the amount of material being moved and the number of vehicles in operation during year -1 that year is assumed to have the greatest construction activity. For this reason year -1 is considered to have the greatest emissions out of the four development years and was chosen for assessment.

Operation Phase

Out of all the operational years, year 8 has the highest amount of material moved and the highest number of equipment in operations. Also during this year, most of the main large mining features



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are active, except the overburden and reclaim areas which will be active in the construction phase. Therefore this year is considered to be the worst case production year.

METHODS

The Ajax Mine activities producing GHG emissions are from ammonium-nitrate fuel oil (ANFO) blasting agents and fuel burning for mobile equipment. For each activity the following quantification methodologies were used.

ANFO Blasting

The Mining Association of Canada published a document entitled "Energy and GHG Emissions Management Guidance" (2009) which established an emission factor for carbon dioxide (CO₂) emissions originating from the use of ANFO in blasting operations. The emission factor is 0.189 kg of CO₂ per kg of ANFO used. The below formula was used to calculate the CO₂ emitted to the atmosphere as a function of ANFO usage on a daily basis estimated by KGHM.

$$CO_2 \text{ emissions } \left(\frac{\text{tonnes}}{\text{year}} \right) = ANFO \text{ usage } \left(\frac{\text{tonnes}}{\text{day}} \right) \times \left(\frac{365 \text{ day}}{\text{year}} \right) \times \text{Emission Factor } \left(\frac{0.189 \text{ tonnes } CO_2}{\text{tonnes ANFO}} \right)$$

Mobile Equipment

Mobile equipment was disaggregated based on the intended activity that the equipment will be involved with. Similar to the air quality assessment, Tier 3 fuel consumption rates were incorporated into the emission estimation methodology as well as the annual utilization hours provided by KGHM. Activity data were then converted to emission assertions with the use of emission factors from the 2012 National Inventory Report (Environment Canada 2014). The National Inventory Report provides emissions factors for light duty trucks, heavy duty vehicles and off-road vehicles fuelled by diesel. These emission factors were matched up against the fleet inventory and emissions were quantified based on the following equation:

$$\text{Annual Emissions } \left(\frac{\text{tonnes}}{\text{year}} \right) = \text{Fuel Consumption Rate } \left(\frac{\text{L}}{\text{hour}} \right) \times \text{Emission Factor } \left(\frac{\text{g}}{\text{L}} \right) \times \text{Annual Utilization } \left(\frac{\text{hours}}{\text{year}} \right) \times \left(\frac{\text{tonnes}}{10^6 \text{ g}} \right)$$

EMISSION SUMMARY

The total GHG emissions calculated from activities also included in the air quality assessment are presented below.

Construction Phase

In construction year -1, the GHG emissions calculated from ANFO blasting and mobile equipment are presented in Table 1.

Design with community in mind



Reference: Greenhouse Gas Emission Inventory Summary for KGHM Ajax Mine

Table 1: Summary of GHG Emissions for Construction Year -1

Activity	CO ₂ (tonnes/year)	CH ₄ (tonnes/year)	N ₂ O (tonnes/year)	CO ₂ e (tonnes/year)
ANFO Blasting	139.4	NA	NA	139.4
Main Mining Equipment	23,186	1	10	26,073
Support Equipment	39,742	2	13	43,601
Explosives transport	2,096	0.1	0.06	2,116
Access Road Vehicles	2,648	0.1	0.1	2,693
Total	67,811	4	23	74,623

Note: NA= Not Available. The Energy and GHG Emissions Management Guidance (Mining Association of Canada, 2009) does not identify an emission factor for this substance and therefore assumed to be negligible.

Operation Phase

In one year of operation, the GHG emissions calculated from ANFO blasting and mobile equipment are presented in Table 2. Values presented in Table 2 are for Year 8 of operation which was considered the worst case, maximum emission year.

Table 2: Summary of GHG Emissions for One Year of Operation

Activity	CO ₂ (tonnes/year)	CH ₄ (tonnes/year)	N ₂ O (tonnes/year)	CO ₂ e (tonnes/year)
ANFO Blasting	623.7	NA	NA	623.70
Main Mining Equipment	30,624	2	13	34,437
Support Equipment	51,277	3	16	56,203
Explosives transport	2,096	1E-01	6E-02	2,116
Access Road Vehicles	3,536	1E-01	2E-01	3,590
Total	88,156	5	29	96,970

Note: NA= Not Available. The Energy and GHG Emissions Management Guidance (Mining Association of Canada, 2009) does not identify an emission factor for this substance and therefore assumed to be negligible.



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REFERENCES

Mining Association of Canada. 2009. Energy and GHG Emissions Management Guidance. Final Version. Available at <http://mining.ca/sites/default/files/documents/EnergyandGHGEmissionsManagementGuidanceDocumentJuly2009.pdf>

Environment Canada. 2014. National Inventory Report 1990 to 2012: Greenhouse Gas Sources and Sinks in Canada. Available at: http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php

CLOSURE

This report has been prepared on behalf of and for the exclusive use of KGHM Ajax Mining Inc. and its representatives for this project. The assessment represents only the conclusions at the time of the assessment. The conclusions presented herein represent the best judgment of the assessor based on current environmental standards. Stantec Consulting Ltd. attests that to the best of our knowledge, the information presented in this report is accurate.

Regards,

STANTEC CONSULTING LTD.

STANTEC CONSULTING LTD.

A handwritten signature in black ink that reads "Sana Talebi".

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