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## ASSESSMENT OF EMISSIONS OF TRACE ELEMENTS AND SULFUR GASES FROM SULFIDE TAILINGS

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## Abstract

This article presents the results of field and laboratory experiments performed to determine the compositions of gases in the air above the Komsomolsk sulfide tailings. Concentrations of SO<sub>2</sub> were measured using a GANK-4 portable gas analyzer. The possibility of the gaseous transport of trace elements was estimated by pumping air through a bubbler with an absorber. Qualitative analyses of sulfur gases (CS<sub>2</sub>, C<sub>2</sub>H<sub>6</sub>S<sub>2</sub>, C<sub>2</sub>H<sub>6</sub>S<sub>3</sub>, S<sub>8</sub>, S<sub>7</sub>, and S<sub>6</sub>) were performed using a field chromatography-mass spectrometer. The SO<sub>2</sub> concentrations in the air above the surface of the Komsomolsk tailings can reach up to > 50 MPC and vary significantly during the day, depending on the difference between the temperature of the tailings surface and that of the ambient air. A wide range of chemical elements (i.e., rock-forming elements, metals, and anionic elements) can migrate with the gaseous phase from both sulfide tailings and background sites. Correlation analysis indicates that the main source of trace elements in gas streams from tailings material is unstable crystalline hydrates, which are represented by sulfates and sulfarsenates of Al, Fe, Mg, Zn, and Cu. The emissions of alkaline and alkaline earth elements are mainly caused by the compositions of pore solutions. Volatile sulfur compounds, including sulfur dioxide, carbon disulfide, dimethyl disulfide, and dimethyl trisulfide, as well as elemental sulfur, are the products of microbiological activity. The results obtained here indicate that the gas phase above the surface of the sulfide tailings has a complex composition and that many chemical elements may be transferred by gases under low-temperature conditions.

## Highlights

- Sulfide tailings are a constant source of Cu, Zn, Cd, As, and Sb etc. in the air.
- Secondary minerals and pore solutions are sources of elements in the gas streams.
- SO<sub>2</sub>, CS<sub>2</sub>, C<sub>2</sub>H<sub>6</sub>S<sub>2</sub>, C<sub>2</sub>H<sub>6</sub>S<sub>3</sub>, S<sub>6-8</sub> are probably the products of microbiological activity.
- The elemental emission of sulfur from tailings has not previously been discussed.

Keywords: environmental; gaseous transport; trace elements; sulfide tailings; sulfur dioxide, sulfur gases.

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