Mines generate large volumes of waste, involving materials that must be removed to gain access to the mineral resource, such as topsoil, overburden and waste rock, as well as tailings remaining after minerals have been largely extracted from the ore. Some of this waste is inert and consequently unlikely to be a significant environmental hazard apart from smothering river beds and the risk of collapse if stored in large quantities. However other fractions, in particular those generated by the non-ferrous metal mining industry, may contain large quantities of dangerous substances, such as heavy metals.
Structures such as waste dumps, tailings impoundments and/or dams, and containment facilities should be planned, designed, and operated in such a way that geotechnical risks and environmental impacts are appropriately assessed and managed all the way through the mine cycle.
Water use and quality
Management of water use and quality in and around mine sites can be a significant issue. Potential contamination of water sources may occur early in the mine cycle during the exploration stage and many factors including indirect impacts (e.g. population migration) can result in negative impacts to water quality. Through the extraction and subsequent processing of minerals, metals and metal compounds tend to become chemically more available, which can result in acid or alkaline drainage. Reduction of surface and groundwater availability is also a concern at the local level and for communities in the vicinity of mining sites, particularly, in arid regions, or in regions of high agricultural potential.
Land use and biodiversity
Habitat alteration is one of the most significant potential threats to biodiversity associated with mining. It may occur at any stage in the mine cycle with the greatest potential for temporary or permanent alteration of terrestrial and aquatic habitats during construction and operation. Additionally, exploration often requires the construction of access routes, transportation corridors and temporary camps to house workers, all of which may result in land-clearing and population influx to a varying extent.
Air quality
Managing ambient air quality at mine sites is important at all stages of the mine cycle. Airborne emissions may occur during each stage of the mine cycle, but particularly during exploration, development, construction and operation. The main sources include dust escaping from blasting, exposed surfaces such as tailings facilities, stockpiles, waste dumps, haul roads and infrastructure, and to a lesser extent, gases from combustion of fuels in equipment and vehicles.

Hazardous materials

Hazardous materials may be used at various stages of mineral extraction, for example cyanide for gold leaching. Such materials should be handled, stored and transported in such a way as to avoid leaks, spills or other types of accidental release into soils, surface water and groundwater resources. Other environmental concerns include noise and vibration, energy use and visual impacts created by mining operations.

Transboundary pollution

Mining and minerals processing operations share a number of pathways in which the surrounding environment and communities can be exposed to the harmful effects of pollutants which can be of transboundary nature. Once pollution travels across boundaries, it adds the potential for political conflict between the affected countries. Relevant trans boundary pathways include:

airborne transport of pollutants such as dust, smelter emissions, gases, vapours;
mass movement of “solid” wastes (generally tailings containing heavy metals and toxic compounds);
mass movement of liquid, or semiliquid wastes (again, generally tailings containing heavy metals and toxic compounds);
waterborne transport of wastes as suspended solids and as dissolved materials.

It has shown that the dominant pathway of exposure – at all levels of interest – is via waterways (fluvial transport). A second exposure pathway, airborne toxic emissions from smelters transported in the atmosphere, has been a very significant issue in the past. However, as a number of smelter operations have ceased operations, or are closed until such time that acceptable levels of emission can be achieved through upgrading of plant, the regional and transboundary importance of airborne emissions appear to have generally reduced in importance. A third important pathway appears to be toxic particulate pollutant transport as dust – this is a largely local and sub-regional effect.