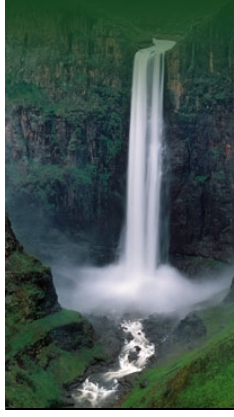






The River Basin

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Water Quality: Acidity, Heavy Metals and Radionuclides:  

Heavy Metals

The other major impact that the region experiences as a result of mining is heavy metal contamination, which include cadmium, copper, nickel, zinc, chromium, arsenic, mercury, lead and others.

Metal contamination occurs in various areas along the Orange-Senqu and can make water toxic to both aquatic organisms and humans. Toxicity depends on the type of metal, the chemical interactions of the metal with other metals and the presence of organic compounds which may increase the availability and spread of the toxic metal. The flow rate and volume of water, the physical make-up of sediments, water temperature, pH and salinity also impact how toxic a metal is in a given environment (Davies and Day 1998). Heavy metals include cadmium, copper, nickel, zinc, chromium, arsenic, mercury, lead, etc. These metals are persistent in the environment and can be bio-accumulated in aquatic organisms.

The main sources of metal pollution in the Orange-Senqu are industries and mines through direct discharges of effluent, and diffuse seepage and runoff from polluted areas and waste dumps. There are many industrial sources of metal pollution and waste disposal sites in the Vaal triangle area of the Upper Vaal. They produce a cocktail of metal pollution which contaminate runoff and impact both surface and groundwater sources. Metal contamination also originates from urban storm water runoff from roads, parking areas and other impervious surfaces, ending up either in waste water treatment plants, or directly in the river. Toxic metals are also associated with some pesticides (Heath and Claassen 1999). The table below provides a list of sources for heavy metals.

Table: Sources of metal pollution from industry.

Metal	Source
Cadmium	Laundrettes, electroplating workshops, plastic manufacturing, pigments, enamels, paints
Chromium	Alloys, preservatives, dyeing and tanning activities, metal coatings
Copper	Electronics, plating, electrical wires, paper, textiles, rubber, printing, plastic
Iron	Galvanising, electroplating, polishing
Lead	Fuel additive, batteries, pigments, roofing, fishing weights
Zinc	Domestic wastes, galvanizing, batteries, paints, fungicides, textiles, cosmetics, pulp, papermills, and pharmaceuticals
Nickel	Alloys, electroplating, nickel-cadmium batteries, laundrettes, paints
Mercury	Dental practices, clinical thermometers, glass mirrors

Source: Moletsisi et al 2004

"Heavy metals are basic elements and cannot be broken down. While organic pollutants slowly degrade into carbon dioxide and water, heavy metals tend to bio-accumulate, especially in lake, estuarine or marine sediments – they persist in the environment, moving from one place to another. Human symptoms and the level of toxicity depend on the specific metal in question, the dose absorbed, as well as whether or not the exposure was acute or chronic." (CSIR 2010)


A number of heavy metals are considered carcinogenic or toxic – affecting the central nervous system (mercury, lead, arsenic), the kidneys and liver (mercury, lead, cadmium, copper) or skin and bones (nickel, cadmium, chromium).

Particularly dangerous are the 600 tonnes of uranium that South Africa produces each year, much of it a by-product of gold production. This highly toxic and radioactive metal can cause leukaemia, nerve damage, and above all kidney failure. The World Health Organization recommends an upper limit of 15 micrograms of uranium per litre of drinking water; the water in the Robinson Lake, which in the Western Basin for a hundred years has served as a dumping ground for waste water from surrounding gold mines, contains 16 000 micrograms per litre of water. The South African National Nuclear Regulator has declared the lake a "radioactive hazard".

Next: Radio-Nuclides ▶

Interactive


Basin Map



Explore the sub-basins of the Orange-Senqu River

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Video Tour



Tour video scenes along the Orange-Senqu River related to the River Basin

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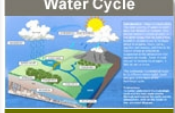
Geography Maps



Investigate land cover and terrestrial ecoregions in the basin

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Explore the interactions of living organisms in aquatic environments

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