Health and environmental impacts of platinum mining: Report from South Africa

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on behalf of PHM
March 2014

Timeline: Impacts of the mining life cycle

Invasion of land

Occupation of land, displacement of people, influx

Air and water pollution, solid waste dumps, dust, loss of land, social impacts

Air and water pollution, solid waste dumps, dust, loss of land, financial costs

Applicable laws: The Constitution, Mineral and Petroleum Resources Development Act, National Environmental Management Act, National Water Act, laws related to Just Administrative Action and to Access to Information, Air Quality Act and related regulations

Platinum mining in South Africa

- Platinum mining in SA is comparatively recent, supply increasing from 1.76 million ounces (50 tons) in 1975 to a peak of 4.86 million ounces (138 tons) in 2011. Value of 2012 output, about R56billion.
- SA currently produces about 75% of world production
- Uses: 38% for vehicle emission control devices (catalytic converters), 31% for jewelry, 25% industrial uses and 7% for investment
- Amplats, Impala Platinum and Lonmin, the three largest producers, produced a total of 158 tons in 2011, and employed a total of 160 000 employees
- The value of the cumulative SA production of 3900 tons for the years 1975 to 2012 (Johnson Matthey, 2013) is, at the December 2012 price, about US$200 billion, about R2 000 billion or R2 trillion.
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Platinum process, resource consumption and impacts

Above ground or below ground mining	Rock crushing and milling	Flotation and drying	Smelting and refining
Blasting operations	Crushing and milling operations	Production of concentrate	Recovering platinum from concentrate
Noise, dust, ground vibrations	Dust, energy consumption	Energy and water consumption, slurry of fine rock and chemicals deposited on slimes dams. Dust, water pollution	Air pollution (dust, sulphur dioxide). Energy consumption (electric arc furnace, electrowinning)

The main environmental impacts of platinum mining

- Solid waste – tailings dams and waste rock dumps
  - 580 000 tons ore/ton Pt produced;
  - Plus waste rock: 20% – 90% of ore (UGM)
- Water consumption: 273 to 544 m3/kg PGM (average about 400 m3/kg)
- Energy consumption (mine, concentrator and smelter): 168 to 256 GJ/ kg PGM
- CO_{2e} emissions: 40 to 50 t/kg PGM
- SO2 and dust emissions??
- Water pollution? (acidic seepage and runoff, AMD?)

Farming land taken over by mining operations and fenced off

Surface platinum mining operations

Dust storm off a platinum tailings dump

Platinum smelter operation

Resettlement camp, Wonderkop district

Health impacts of SO2 exposure

Health Effects of sulphur dioxide (SO_2)*:

- Decreased lung function,
- Respiratory illness,
- Alterations in pulmonary defences,
- Aggravation of existing cardiovascular disease.
- In children, the elderly and people with asthma are most susceptible to cardiovascular disease or chronic lung disease (such as bronchitis or emphysema).
- **Increased daily mortality**
- **No safe level**

***WHO, 2006: WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. Global update 2005.**

South African Ambient Air Quality Standard (SAAAQS) for SO_2

24 hours	125 µg/m³ (48 ppb)
1 year	50 µg/m³ (19 ppb)

WHO Guideline values for SO_2*:

Daily average value: 20 µg/m3

(This is also the WHO yearly average guideline value.)

*WHO, 2006

Control of SO_2 Smelter and converter emissions: Listed Activities under AQA

(16) *Subcategory 4.16: Smelting and Converting of Sulphide Ores*

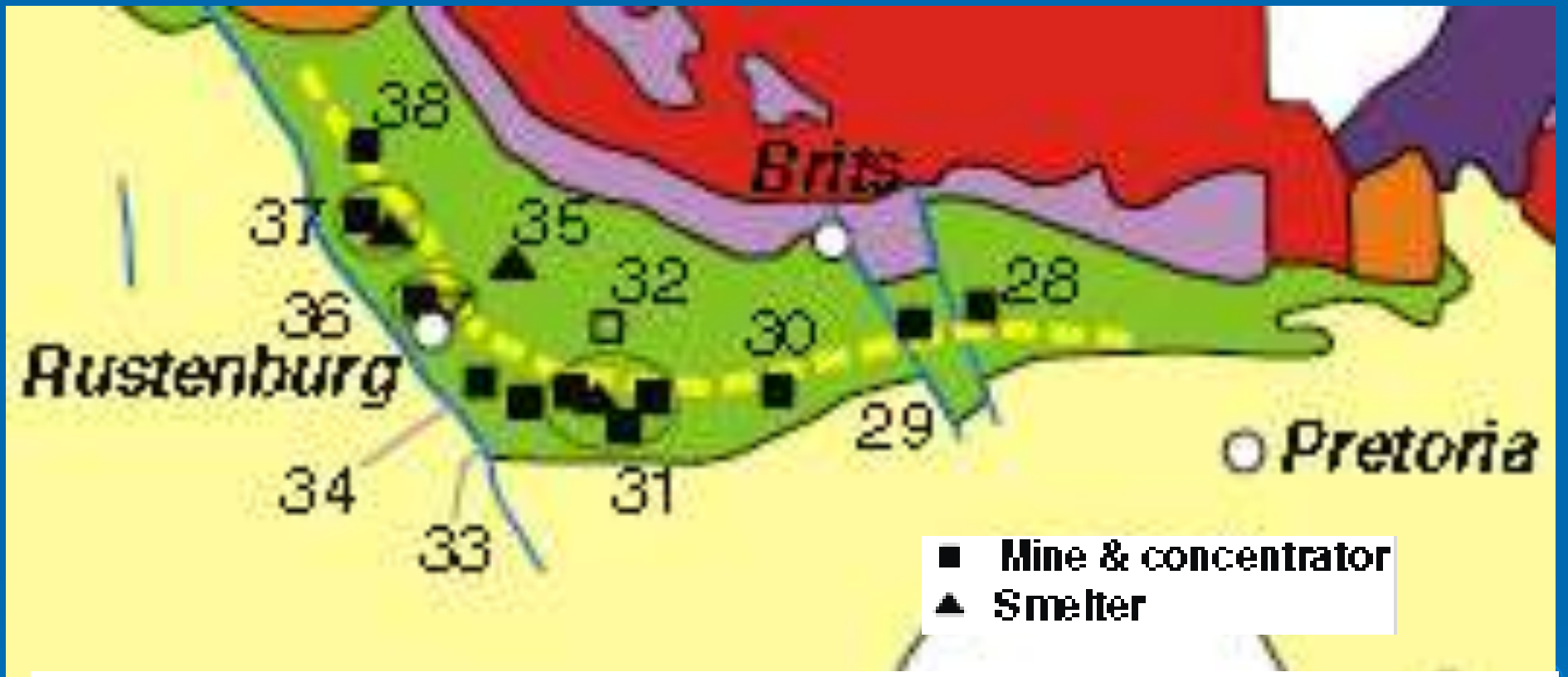
Description:	Processes in which sulphide ores are smelted, roasted calcined or converted (Excluding Inorganic Chemicals-related activities regulated under Category 7).
Application:	All installations.

Substance or mixture of substances		**Plant status**	**mg/Nm³ under normal conditions of 273 Kelvin and 101.3 kPa.**
Common name	**Chemical symbol**		
Particulate matter	N/A	New	50
		Existing	100
Oxides of nitrogen	NO_X expressed as NO_2	New	350
		Existing	2000
Sulphur dioxide (feed SO_2 <5% SO2)	SO_2	New	1200
		Existing	3500
Sulphur dioxide (feed SO_2 >5% SO_2)	SO_2	New	1200
		Existing	2500

(a) The following special arrangement shall apply –

All facilities must install apparatus for the treatment of the sulphur content of the off-gases.

Mines and smelters



28 Elandsfontein, 29 Crocodile River, 30 Pandora, 31 Lonmin (Marikana) Group, 32 Leeuwkop (Afplats), Rustenberg, 37 Impala Group, 38 Bafokeng-Rasimone, 33 Marikana Joint Venture, 34 Kroondal, 35 Waterval, 36

Excerpted from Glaister and Mudd, 2010.

Health impacts of dust (PM10/ PM2.5) exposure

- Two sizes, PM10 and PM2.5
- The smaller size, PM2.5, is the more health damaging, effects occur at lower concentrations
- Health impacts: effects on breathing and respiratory systems, damage to lung tissue, cancer, and premature death. The elderly, children, and people with chronic lung disease, influenza, or asthma, are especially sensitive to the effects of particulate matter.*
- **There is no safe level***

***WHO, 2006: WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. Global update 2005.**

The SA PM10 Standard:

3.3 National Ambient Air Quality Standards for Particulate Matter (PM_{10})

Averaging Period	Concentration	Frequency of Exceedence	Compliance Date
24 hours	120µg/m^3	4	Immediate – 31 December 2014
24 hours	75 µg/m^3	4	1 January 2015
1 year	50 µg/m^3	0	Immediate – 31 December 2014
1 year	40 µg/m^3	0	1 January 2015

The reference method for the determination of the particulate matter fraction of suspended

The WHO Guideline Value*:

PM_{10}: 20 µg/m^3 annual mean

50 µg/m^3 24-hour mean

*WHO, 2006

The PM2.5 Standard

3. NATIONAL AMBIENT AIR QUALITY STANDARD FOR PARTICULATE MATTER ($PM_{2.5}$)

Averaging Period	Concentration	Frequency of Exceedence	Compliance Date
24 hours	65 µg/m³	4	Immediate - 31 December 2015
24 hours	40 µg/m³	4	1 January 2016 - 31 December 2029
24 hours	25 µg/m³	4	1 January 2030
1 year	25 µg/m³	0	Immediate - 31 December 2015
1 year	20 µg/m³	0	1 January 2016 - 31 December 2029
1 year	15 µg/m³	0	1 January 2030

WHO Guideline*

$PM_{2.5}$: 10 µg/m³ annual mean
25 µg/m³ 24-hour mean

*WHO, 2006

Dust Control Regulations

Promulgated 01 November 2013

- “The purpose of the regulations is to prescribe general measures for the control of dust in all areas.”
- “"premises" means any land and structures thereon including stockpiles of materials, roadways and other means of conveyance, from which dust may be generated through anthropogenic or natural activities or processes;

  (Refer to Dust Control Regs)

But, the Dust Control regulation is problematic:

(2) The method to be used for measuring dustfall rate and the guideline for locating sampling points shall be ASTM D1739: 1970, or equivalent method approved by any internationally recognized body.

4. Dustfall monitoring programme

(1) The air quality officer may require any person, through a written notice, to undertake a dustfall monitoring programme as contemplated in subregulation (5) if:

(a) the air quality officer reasonably suspects that the person is contravening regulation 3; or

(b) the activity being conducted by the person requires a fugitive dust emission management plan as per the notice published in terms of section 21 of the Act.

Comment: The sampling bucket system described in ASTM D1739: 1970 is a very poor measuring instrument.

Using the CER Mining Environmental Rights Toolkit