The Environmental and Health Impacts of Carbon emission from active and abandoned coal mines, in South Africa: A review of secondary data

Closing Workshop of the IGCP/SIDA Projects 594 and 606

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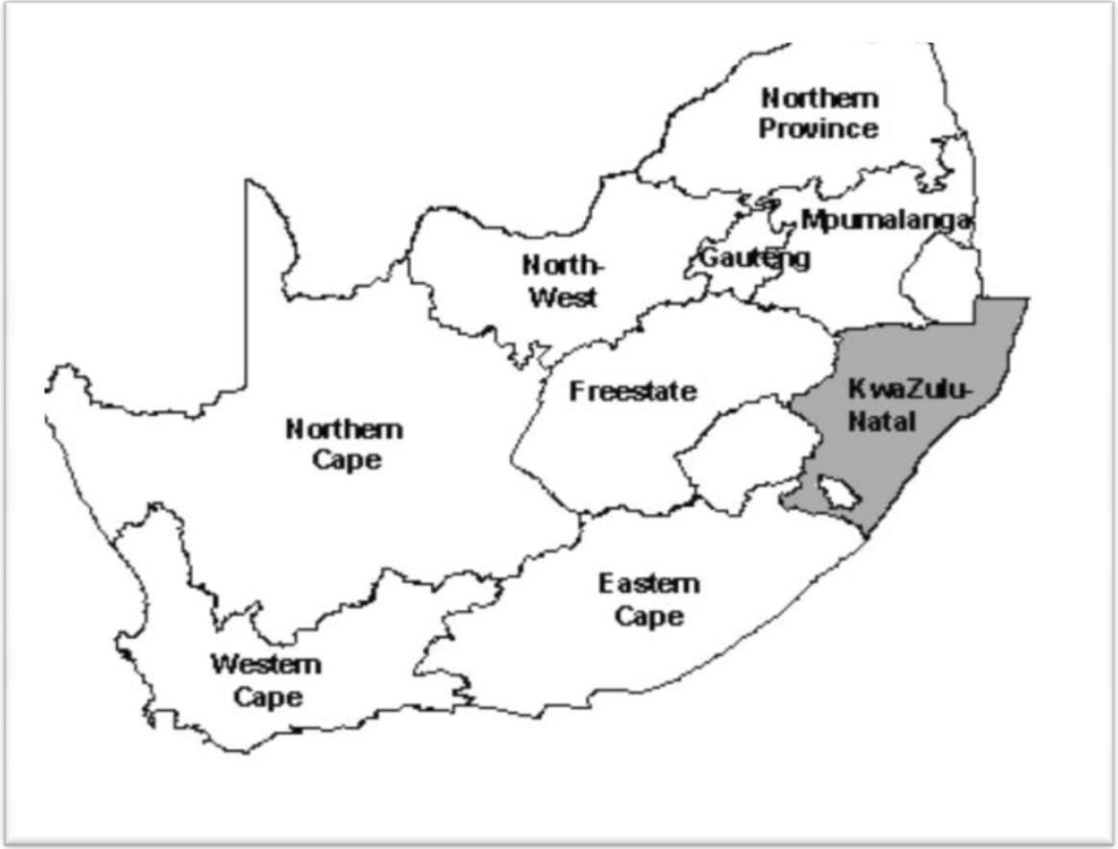
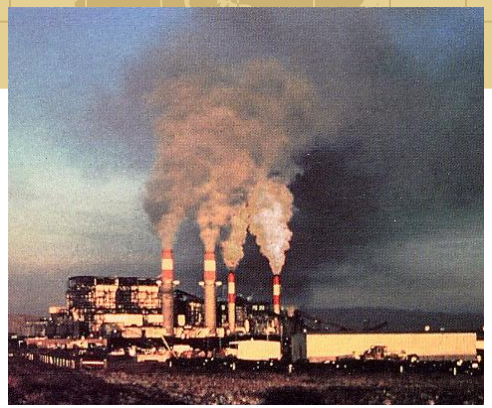
Topics of Discussion

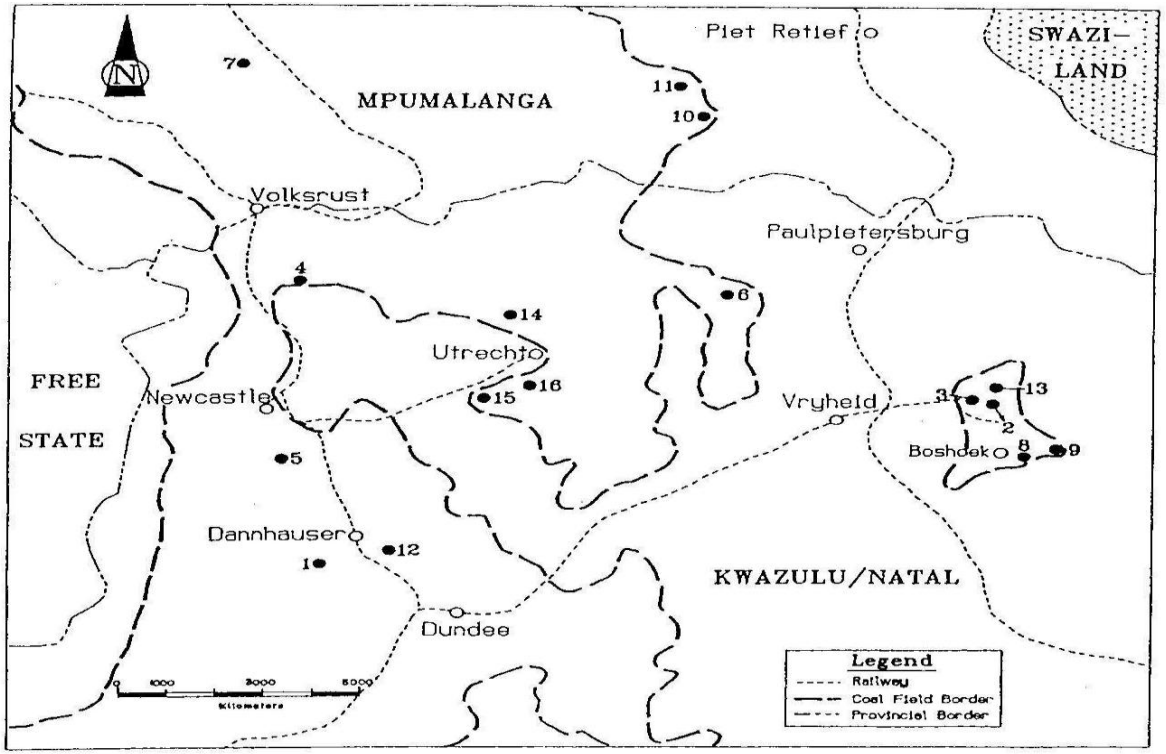
- Coal mining in South Africa
- Why is Coal Mined?
- How is Coal Mined in South Africa?
- The legislative control on mining in SA.
- The environmental health impacts of Carbon emissions in South Africa.
- The Current Status of Coal Mines Closure in South Africa.
- Conclusions

Map of South Africa





Coal Mines in South Africa

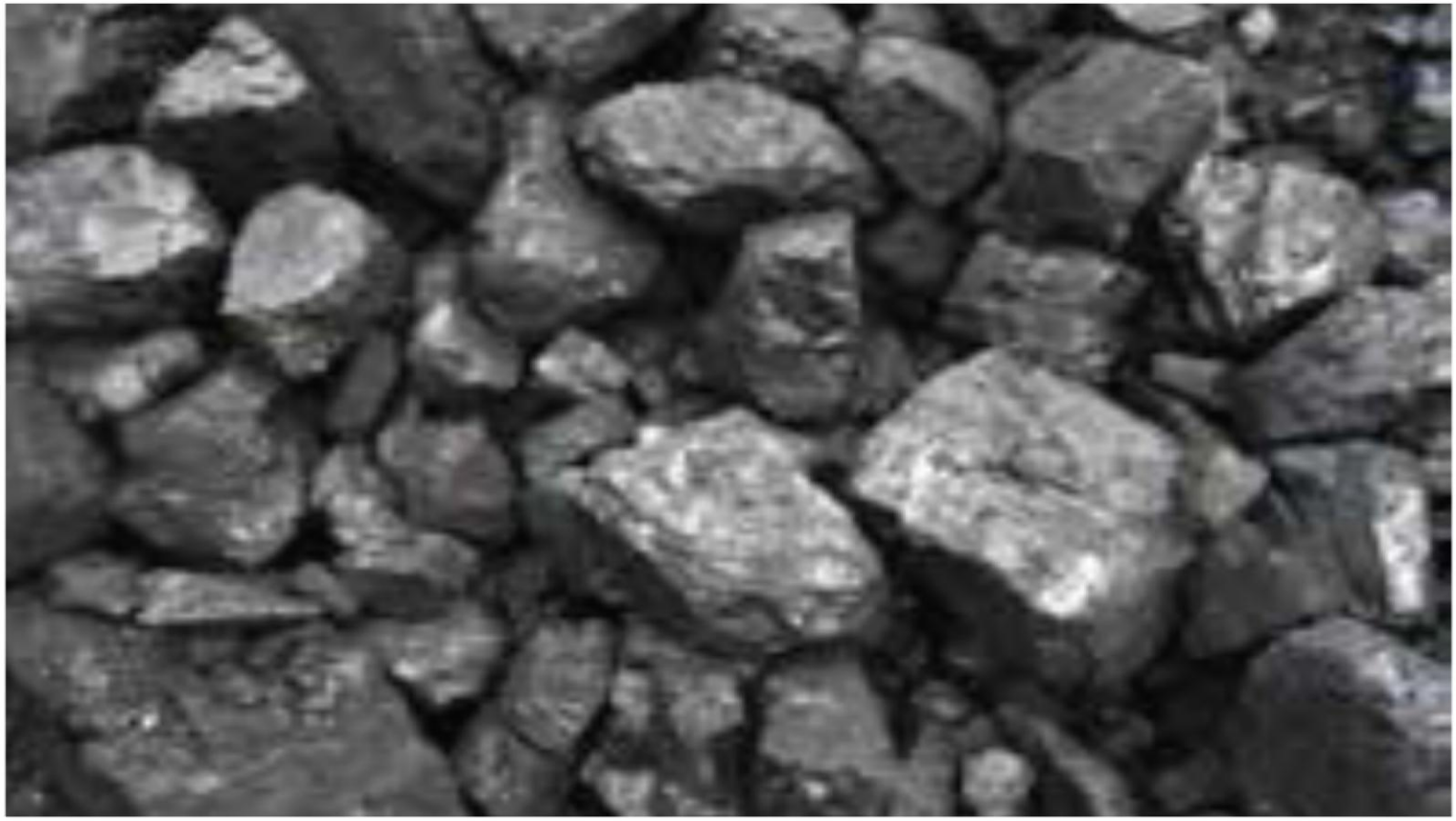


A coal mine Dump at Klipriver Coalfields: KZN, South Africa. Date 04/05/2014

What is Coal?

- Coal is a black rock that can be ignited and burned to produce energy in the form of heat.
- Coal formation began during the Carboniferous Period, known as the first coal age.
- It is a combustible dark brown rock consisting chiefly of carbonized plant matter, found mainly in underground seams used as fuel.
- The main challenge to the ongoing use of coal as an energy source is environmental concerns.

This is Coal



Coal mining in South Africa

- Coal is the most polluting energy source on the planet, and the main cause of the world's CO_2 emissions.
- South Africa is the world's fifth largest producer of coal, and is already the sixth largest consumer.
- As a result; the country is among the highest emitters of CO_2 in the world.
- It is amongst the twenty most carbon-intensive economies in the world.
- But does not yet face any binding international treaty obligations to reduce its greenhouse gas emissions.

Why is Coal Mined?

- Coal mining has partially contributed to the development of South Africa's economy, providing the impetus and fuel for industrialization of what previously a largely agrarian country
- South Africa is the world's third largest coal exporting country, exporting 25% of its production internationally.
- Just over two thirds (by mass) of domestic coal consumption are for electricity generation by Eskom, the national power utility.
- Coal-to-liquid-fuel (CTL) plants, operated by Sasol, account for another fifth of coal consumption.
- Small merchants, who supply mainly residential users and small business, account for about 2%, metallurgical industries about 3% and cement, chemical and other industries consume the remaining 5%.

How is Coal Mined in South Africa? pict. 04/05/2014

How is Coal Mined in South Africa?

- About 51% of South African coal mining in carried out underground, with the balance produced by open cast methods.
- The industry is highly concentrated, with a handful of companies producing about 80% of the saleable coal production.
- More than 58 000 workers are employed in this industry.
- Most of the country's coal is currently mined in the Highveld, Witbank and Ermelo coalfields located in Mpumalanga province.
- Geology has determined that the Witbank coalfield is by far the most important source of South Africa's mined coal at present.

Carbon Emission trend in South Africa

Mine dumps

Power plants

Ambient environment Sources

OnRoad Mobile Sources

Carbon Emission trend in South Africa

The environmental health impacts of Carbon emissions in South Africa.

- South Africa, a non-annex 1 developing country, is ranked among the top 20 countries measured by absolute carbon dioxide (CO_2) emissions.
- The vast majority of South Africa's CO_2emissions (about 80 per cent) are produced by the electricity sector, the metals industry and the transport sector.
- The resulting air pollutants due to carbon emission are:- Carbon Monoxide (CO) and Carbon Dioxide (CO_2).

The environmental health effects of Carbon Monoxide (CO)

- The impact of CO emission in the atmosphere are not as detrimental as CO_2 emission,
- The fact is most CO in the atmosphere occurs as a result of incomplete combustion of fossil fuels like coal.
- Coals heaps are prone to spontaneous combustion.
- Most often abandoned coal mines dump are left exposed to environmental variations resulting in combustion processes noticeable in the evening and this are major contributors of CO emissions.

The environmental effects of Carbon Dioxide (CO_2)

- South Africa has taken a profoundly ambivalent role in the climate change debate.
- On the one hand, South Africa is by far the largest emitter of carbon dioxide on the African continent with 10,165 Mt out of a total of 13,867 Mt for the whole of Africa (based on cumulative emissions from 1950 to 2000).
- It has the second most carbon intensive economy in the world, after oil-rich Venezuela.

The environmental effects of Carbon Dioxide (CO_2)

- The effects of CO_2 emission in South Africa are the high levels of Green House Gases responsible for the "Green House Effect" and hence climate change.
- Nevertheless, global warming and other environmental concerns are beginning to constrain further local coal-based investment decisions (Eberhard, 2011).

The environmental effects of Carbon Dioxide (CO_2)

- South Africa pledged at COP15 in Copenhagen to reduce its emissions, conditional on-Fair, ambitious and effective agreement in international climate change negotiations
- And provision of financial & technical support to the international community.
- South Africa needs alignment of trade and climate change policies in order to meet the challenges of both climate change and economic growth, creating jobs and reducing poverty ((The SA Coal Industry, 2011).

The Current Status of Coal Mines Closure in South Africa. Cont.

- Historically, mining activities have strongly dominated the South African economy, together with agricultural production.
- Disproportional to its geographical size, South Africa has an immense concentration of the world's mineral wealth,
- the most important being chrome (76% of the world's reserves), PGMs (56%), gold (52%), vanadium (44%), manganese (80%), alumino-silicates (37%), vermiculite (40%) and gem diamonds (SA Gov Comm. and Info. System, 2004).

The Current Status of Coal Mines Closure in South Africa. Cont.

- Similarly, coal, which is the primary fuel produced and consumed in South Africa, is also one of the country's largest sources of foreign exchange.
- The national coal reserve is currently estimated to be the world's seventh largest, amounting to approximately 5% of the world reserves (US Energy Inform. Admin, 2004).
- Over the years, the mining industry in South Africa has experienced uncertainty as to how to manage the associated impacts of mining closures in order to leave mine sites in successfully rehabilitated states.

The Current Status of Coal Mines Closure in South Africa. Cont.

- However, mine closure certification can now be secured from the South African national Department of Minerals and Energy (DME, 2004).
- By issuing a closure certificate, the government relieves a mine owner of obligations that might follow as a result of pollution and negative environmental impacts.
- However, the regulating body (DME) is reluctant to accept the burden of the past failures due to the inability and ignorance of mining houses to plan and manage the environmental risks associated with mining actions and make sufficient financial provision for the rehabilitation.

Mine rehabilitation process

- Due to these delays, closure certificates are not currently issued to mines. The responsibility of all impacts remains with the mining company, with large associated financial burdens.
- The South African legislation governing mine closure, particularly the Mineral and Petroleum Resources Development Act (28 of 2002), requires rigorous mitigation of both biophysical and socio-economic impacts.
- However, in most cases, enforcement and implementation of these legislations are still difficult because of the limited capacity of the relevant authorities.

Mine rehabilitation process Cont

- There are approximately 6000 abandoned mines in South Africa (not all coal mines), and the costs of rehabilitation (soil- and land-wise) has been estimated at 100 billion Rand (2008 amounts – US$ 14 billion at the time) by Ms Elize Swart, Director of Environmental Policy at the DME42.
- In addition, at the current rate of rehabilitation, it will take 800 years to rehabilitate the abandoned mines.

The Control of Carbon emission: Policy option

- The two main economic policy instruments available for putting a price on carbon and curbing GHG emissions are carbon taxation and emissions trading schemes.
- The carbon tax seeks to reduce emissions through the price mechanism directly, while emissions trading schemes establishes targets for 4 specific levels of emissions through the trade in allowances (Department of National Treasury, 2010).
- The Constitution of the South Africa, 1996 (Act No. 108 of 1996) provides the foundation for regulation and policy in South Africa, whiles the section 2(4)(p) of the National Environmental Management Act (Act No. 107 of 1998) says "the polluter must pay".
- Mines have terminated the operation and most companies may have been owned by foreign investors none of which can ever be traced back, as it can cost SA millions of rands.

Conclusion

- This paper introduces some major challenges concerning Carbon emissions from abandoned coal mine dumps in South Africa
- It also concluded that the lack of commitment from authorities and mining companies regarding rehabilitation as the closing phase in the mining process exacerbated the situation.
- South Africa needs to take drastic measures to introduce remedial actions to companies who abandon mines as set in the legal framework already exist. (Devarajan, S, *et al* 2009).

Conclusion Cont.

- Coal will remain the number one source of energy in this country for the next decades to come.
- Therefore it is important to prioritise the environmental health concerns.

Way Forward!

- An effective and reliable air quality data (on Carbon emission) is required for decision-making.
- Building database will require documentation, computerization, training, and continuous efforts
- Choices of control strategies will vary based on available resources, growth, feasibility, and acceptability
- Public participation and awareness of air quality issues related to mining activities (on Carbon emission) is key to political will and ultimate success.
- The role of Trade Unions for that Matter.

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I THANK YOU