Status of compliance with Minimum Emission Standards

Portfolio Committee on Environmental Affairs
6 February 2018

Prof. Eugene K. Cairncross
Air quality in the Priority Areas remains poor and unhealthy

All Eskom’s coal power stations operate in the three priority areas, and are major contributors to air pollutant emissions in these areas

Comparison of the DEA’s MES with other countries

Focusing on Eskom’s SO2 emissions; aggregate emissions, and emissions intensities of each plant

SO2 abatement - options, effectiveness and costs

Possible pathways to achieving compliance and reducing impacts
Air quality in the Priority Areas, and adjacent areas, remains poor and unhealthy.
Air quality in the Priority Areas remains poor and unhealthy.

**Vaal Triangle Priority Area**

**PM$_{2.5}$ - 10 YEAR TREND**

[Graph showing PM$_{2.5}$ concentration for different years and locations, with SA NAAQS and WHO guideline levels indicated.]
Air quality in the Priority Areas remains poor and unhealthy

Vaal Triangle Priority Area

**SO$_2$ - 10 YEAR TREND**

- **SA NAAQS**
- **WHO guideline**

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**environmental affairs**

**Republic of South Africa**
Air quality in the Priority Areas remains poor and unhealthy.
Air quality in the Priority Areas remains poor and unhealthy

![Graph showing SO₂ concentration trend in Highveld Priority Area](image)

- **SO₂ concentration (ppb)**
- **SA NAAQS**
- **WHO guideline**

**Legend:**
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016

*Department of Environmental Affairs, Republic of South Africa*
The SA daily SO2 standard is extremely lenient:

2016 to 2017 data
(May 2017 MSRG report)
Location of Eskom’s 15 coal power stations

Base load stations

1. Arnot 2,352 MW
2. Duva 3,600 MW
3. Hendrina 2,000 MW
4. Kendal 4,116 MW
5. Kriel 3,000 MW
6. Kusile 3,654 MW
7. Lethabo 3,708 MW
8. Majuba 4,110 MW
9. Masimba 3,990 MW
10. Mada 3,600 MW
11. Tutuka 3,654 MW
12. Camden 1,510 MW
13. Grootvlei 1,200 MW
14. Komati 940 MW
15. Medup 1,440 MW
16. Garies 3,600 MW
17. Drakensberg 1,000 MW
18. Palmiet 400 MW
19. Acacia 1,711 MW

Return-to-service stations

Coal
12. Camden 1,510 MW
13. Grootvlei 1,200 MW
14. Komati 940 MW

The return-to-service (RTS) stations were mothballed in 1999 and are in the process of being recommissioned due to the growing demand for electricity. The return-to-service project for Camden power station ended on 31 March 2007 with the entire station fully commercial.

Peak demand stations

Hydro-electric
15. Garies 3,600 MW
16. Vanderkloof 2,400 MW

Pumped storage scheme
17. Drakensberg 1,000 MW
18. Palmiet 400 MW

Gas turbine
19. Acacia 1,711 MW
# HPA: Pollution sources

Table 5: Total emission of PM$_{10}$, NO$_x$ and SO$_2$ from the different source types on the HPA (in tons per annum), and the percentage contribution for each source category

<table>
<thead>
<tr>
<th>Source category</th>
<th>PM$_{10}$ t/a</th>
<th>%</th>
<th>NO$_x$ t/a</th>
<th>%</th>
<th>SO$_2$ t/a</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eco-Hub Industrial (incl Kelvin)</td>
<td>8 909</td>
<td>3</td>
<td>15 636</td>
<td>2</td>
<td>25 772</td>
<td>2</td>
</tr>
<tr>
<td>Mpumalanga Industrial</td>
<td>684</td>
<td>0</td>
<td>590</td>
<td>0</td>
<td>5 941</td>
<td>0</td>
</tr>
<tr>
<td>Clay Brick Manufacturing</td>
<td>9 708</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>9 963</td>
<td>1</td>
</tr>
<tr>
<td>Power Generation</td>
<td>34 373</td>
<td>12</td>
<td>716 719</td>
<td>73</td>
<td>1 337 521</td>
<td>82</td>
</tr>
<tr>
<td>Primary Metallurgical</td>
<td>46 805</td>
<td>17</td>
<td>4 416</td>
<td>0</td>
<td>39 582</td>
<td>2</td>
</tr>
<tr>
<td>Secondary Metallurgical</td>
<td>3 060</td>
<td>1</td>
<td>229</td>
<td>0</td>
<td>3 223</td>
<td>0</td>
</tr>
<tr>
<td>Petrochemical</td>
<td>8 246</td>
<td>3</td>
<td>148 434</td>
<td>15</td>
<td>190 172</td>
<td>12</td>
</tr>
<tr>
<td>Mine Haul Roads</td>
<td>135 766</td>
<td>49</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Motor vehicles</td>
<td>5 402</td>
<td>2</td>
<td>83 607</td>
<td>9</td>
<td>10 059</td>
<td>1</td>
</tr>
<tr>
<td>Household Fuel Burning</td>
<td>17 239</td>
<td>6</td>
<td>5 600</td>
<td>1</td>
<td>11 422</td>
<td>1</td>
</tr>
<tr>
<td>Biomass Burning</td>
<td>9 438</td>
<td>3</td>
<td>3 550</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL HPA</strong></td>
<td><strong>279 630</strong></td>
<td><strong>100</strong></td>
<td><strong>978 781</strong></td>
<td><strong>100</strong></td>
<td><strong>1 633 655</strong></td>
<td><strong>101</strong></td>
</tr>
</tbody>
</table>

NB. SO$_2$ percentage contributions aggregate is greater than 100 due to rounding of numbers.

Data source: HPA AQMP
## VTPA: Pollution sources

<table>
<thead>
<tr>
<th>Sector</th>
<th>( \text{PM}_{10} ) (t/ha)</th>
<th>%</th>
<th>( \text{SO}_2 ) (t/ha)</th>
<th>%</th>
<th>( \text{NO}_x ) (t/ha)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>13,668.4</td>
<td>60.1%</td>
<td>247,224.4</td>
<td>99.5%</td>
<td>131,778.1</td>
<td>88.0%</td>
</tr>
<tr>
<td>Mines and Ash Dumps</td>
<td>4,675.9</td>
<td>20.6%</td>
<td>0.0</td>
<td>0.0%</td>
<td>0.0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Biomass Burning*</td>
<td>1,494.4</td>
<td>6.6%</td>
<td>84.5</td>
<td>0.0%</td>
<td>913.1</td>
<td>0.6%</td>
</tr>
<tr>
<td>Vehicles**</td>
<td>1,068.2</td>
<td>4.7%</td>
<td>448.1</td>
<td>0.2%</td>
<td>16,593.5</td>
<td>11.1%</td>
</tr>
<tr>
<td>Domestic Fuel</td>
<td>1,836.1</td>
<td>8.1%</td>
<td>826.0</td>
<td>0.3%</td>
<td>463.5</td>
<td>0.3%</td>
</tr>
<tr>
<td>TOTAL VTAPA</td>
<td>22,743.1</td>
<td>100%</td>
<td>248,583.0</td>
<td>100%</td>
<td>149,748.2</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Biomass burning herewith reported was estimated based on MODIS burn scar data for latest year available, 2007.

**Vehicle emissions remains unchanged from previous 2007 Baseline VTAPA EI

Data source: VTPA AQMP: Mid-term review
The MES: the key to achieving substantial improvements in air quality

- It should be common cause that pollutant emissions are the root cause of poor air quality, although factors such as meteorology and seasons affect short-term variations in concentration.
- Reminder: Ambient PM2.5 is the result not only of the direct emissions of PM2.5 from various sources, but also the result of secondary PM2.5 formation. That is, the conversion of the precursors SO2 and NOx to PM2.5 through chemical and physical processes in the atmosphere.
- 40 to 60% of ambient PM2.5 is the result of secondary PM2.5 formation
- It is not possible to reduce PM2.5 to the required levels without reducing the emission of SO2 and NOx (and PM) at the same time
- It should be obvious: without significantly reducing pollutant emissions, a significant reduction in ambient concentrations cannot be expected.
SA’s MES are extremely lax compared with international practice!

<table>
<thead>
<tr>
<th>‘Existing Plant’ ratios: SA/ country</th>
<th>SO2</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA/ China</td>
<td>17.5</td>
<td>3.3</td>
</tr>
<tr>
<td>SA/ Germany</td>
<td>17.5</td>
<td>5.0</td>
</tr>
<tr>
<td>SA/ India</td>
<td>5.8</td>
<td>1.0</td>
</tr>
<tr>
<td>SA/ Indonesia</td>
<td>4.7</td>
<td>0.7</td>
</tr>
<tr>
<td>SA/ Thailand</td>
<td>1.7</td>
<td>0.6</td>
</tr>
<tr>
<td>SA/ EU IED</td>
<td>17.5</td>
<td>5.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>‘New Plant’ ratios: SA/ country</th>
<th>SO2</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA/ China</td>
<td>14.3</td>
<td>5.0</td>
</tr>
<tr>
<td>SA/ Germany</td>
<td>3.3</td>
<td>5.0</td>
</tr>
<tr>
<td>SA/ India</td>
<td>5.0</td>
<td>1.7</td>
</tr>
<tr>
<td>SA/ Indonesia</td>
<td>0.7</td>
<td>0.5</td>
</tr>
<tr>
<td>SA/ Thailand</td>
<td>1.0</td>
<td>0.6</td>
</tr>
<tr>
<td>SA/ EU IED</td>
<td>3.3</td>
<td>5.0</td>
</tr>
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</table>

Total SO2 emissions: 1.76 million tons; power generated: 200 893 GWh (2016/17) (Eskom data)

Average SO2 emissions intensity is about 8.8 tons of SO2 per GWh generated; based on limited data, the range 6.0 to 11.4 tons of SO2 per GWh generated

SO2 emissions from all of Eskom’s coal plants are uncontrolled. There are no emission control systems in place

Emissions are essentially a function of coal sulphur content, coal quality, and energy efficiency

Based on limited data available, Matimba SO2 emissions are only marginally compliant or non-compliant with the existing plant standard of 3500 mg/Nm3

The most emissions-intensive plants are Matimba, Camden, Hendrina, Tutuka

To meet the new plant MES, SO2 emission reductions of 80% to 90% on all Eskom coal stations required
Options for controlling SO2 emissions

- Reducing sulphur levels in coal, and blending to reduce day-to-day variability in sulphur content
- Direct injection of a dry sorbent (limestone) into the furnace, such as suggested by the World Bank (capable of about a 50% SO2 reduction)
- Wet, semi-dry or dry Flue Gas Desulphurisation (capable of up to 98% SO2 reduction)
- How to obtain credible and objective costs estimates, given the history of large cost and time over-runs on the Medupi and Kusile projects? Rigorous competitive tender? An objective techno-economic study?
Possible pathways to achieve compliance and aggregate SO2 emission reductions

- Accelerate the shut-down and decommissioning of the oldest plants (Grootvlei, Komati and Hendrina) (Kriel and Camden are also candidates) that are already underutilised, and will become increasingly redundant as the most recent rounds and future rounds of the REIPPP come on-stream, within the next two to four years. This clearly requires a transparent and properly negotiated process to mitigate the social and labour impacts of the decommissioning of these plants.

- Evaluate and expedite the installation of DSI on both Medupi and Matimba; expedite the installation of FGD on both Medupi and Matimba.

- Develop a plan to bring the rest of Eskom’s coal plants into compliance with all 2020 MES by 2025, or to decommission them on an accelerated basis, based on maintaining security of power supply.
Thank you