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# Minimum Emission Standards

Parliamentary Committee on Environmental Affairs

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7 Nov 2017



# “Object” of the Air Quality Act

To protect the environment by:

- Protection and enhancement of the quality of air in the Republic
  - providing reasonable measures for preventing pollution and ecological degradation
  - securing ecologically sustainable development while promoting justifiable economic and social development
- Generally to give effect to section 24 (b) of the Constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of the people

# What does “quality of the air” mean?

Refers to ambient air; definition in the Act:  
'excludes air regulated by the Occupational Health and Safety Act'

This therefore means the air that the community is exposed to, as quantified by the National Ambient Air Quality Standards (NAAQS) which identify air pollutants and provide exposure limits

# Revised Final AQ Standards

(as published in Government Notice 1210, Government Gazette 32186,24 Dec 2009)

## 3. NATIONAL AMBIENT AIR QUALITY STANDARDS

### 3.1 National Ambient Air Quality Standards for Sulphur Dioxide (SO<sub>2</sub>)

| Averaging Period | Concentration                   | Frequency of Exceedence | Compliance Date |
|------------------|---------------------------------|-------------------------|-----------------|
| 10 minutes       | 500 µg/m <sup>3</sup> (191 ppb) | 526                     | Immediate       |
| 1 hour           | 350 µg/m <sup>3</sup> (134 ppb) | 88                      | Immediate       |
| 24 hours         | 125 µg/m <sup>3</sup> (48 ppb)  | 4                       | Immediate       |
| 1 year           | 50 µg/m <sup>3</sup> (19 ppb)   | 0                       | immediate       |

The reference method for the analysis of sulphur dioxide shall be ISO 6767

### 3.2 National Ambient Air Quality Standards for Nitrogen Dioxide (NO<sub>2</sub>)

| Averaging Period | Concentration                   | Frequency of Exceedence | Compliance Date |
|------------------|---------------------------------|-------------------------|-----------------|
| 1 hour           | 200 µg/m <sup>3</sup> (106 ppb) | 88                      | Immediate       |
| 1 year           | 40 µg/m <sup>3</sup> (21 ppb)   | 0                       | Immediate       |

The reference method for the analysis of nitrogen dioxide shall be ISO 7996





# Revised Final AQ Standards

(as published in Government Notice 1210, Government Gazette 32186,24 Dec 2009)

## 3.3 National Ambient Air Quality Standards for Particulate Matter (PM<sub>10</sub>)

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

The reference method for the determination of the particulate matter fraction of suspended particulate matter shall be EN 12341

## 3.4 National Ambient Air Quality Standards for Ozone (O<sub>3</sub>)

| Averaging Period  | Concentration                  | Frequency of Exceedence | Compliance Date |
|-------------------|--------------------------------|-------------------------|-----------------|
| 8 hours (running) | 120 µg/m <sup>3</sup> (61 ppb) | 11                      | Immediate       |

The reference method for the analysis of ozone shall be UV photometric method as described in SANS 13964



# Revised Final AQ Standards, PM<sub>2.5</sub>

(as published in Government Notice 486, Government Gazette 35463, 29 June 2012)

| Averaging Period | Concentration        | Frequency of Exceedence | Compliance Date                   |
|------------------|----------------------|-------------------------|-----------------------------------|
| 24 hours         | 65 µg/m <sup>3</sup> | 4                       | Immediate - 31 December 2015      |
| 24 hours         | 40 µg/m <sup>3</sup> | 4                       | 1 January 2016 - 31 December 2029 |
| 24 hours         | 25 µg/m <sup>3</sup> | 4                       | 1 January 2030                    |
| 1 year           | 25 µg/m <sup>3</sup> | 0                       | Immediate - 31 December 2015      |
| 1 year           | 20 µg/m <sup>3</sup> | 0                       | 1 January 2016 - 31 December 2029 |
| 1 year           | 15 µg/m <sup>3</sup> | 0                       | 1 January 2030                    |

The reference method for the determination of PM<sub>2.5</sub> fraction of suspended particulate matter shall be EN 14907



# Revised Final AQ Standards

(as published in Government Notice 1210, Government Gazette 32186,24 Dec 2009)

## 3.5 National Ambient Air Quality Standards for Benzene (C<sub>6</sub>H<sub>6</sub>)

| Averaging Period   | Concentration                  | Frequency of Exceedence | Compliance Date              |
|--|--------------------------------|-------------------------|------------------------------|
| 1 year   | 10 µg/m <sup>3</sup> (3.2 ppb) | 0                       | Immediate – 31 December 2014 |
| 1 year   | 5 µg/m <sup>3</sup> (1.6 ppb)  | 0                       | 1 January 2015               |
| The reference methods for the sampling and analysis of benzene shall either be EPA compendium method TO-14 A or method TO-17 |                                |                         |                              |

## 3.6 National Ambient Air Quality Standards for Lead (Pb)

| Averaging Period  | Concentration         | Frequency of Exceedence | Compliance Date |
|---|-----------------------|-------------------------|-----------------|
| 1 year  | 0.5 µg/m <sup>3</sup> | 0                       | Immediate       |
| The reference method for the analysis of lead shall be ISO 9855 |                       |                         |                 |

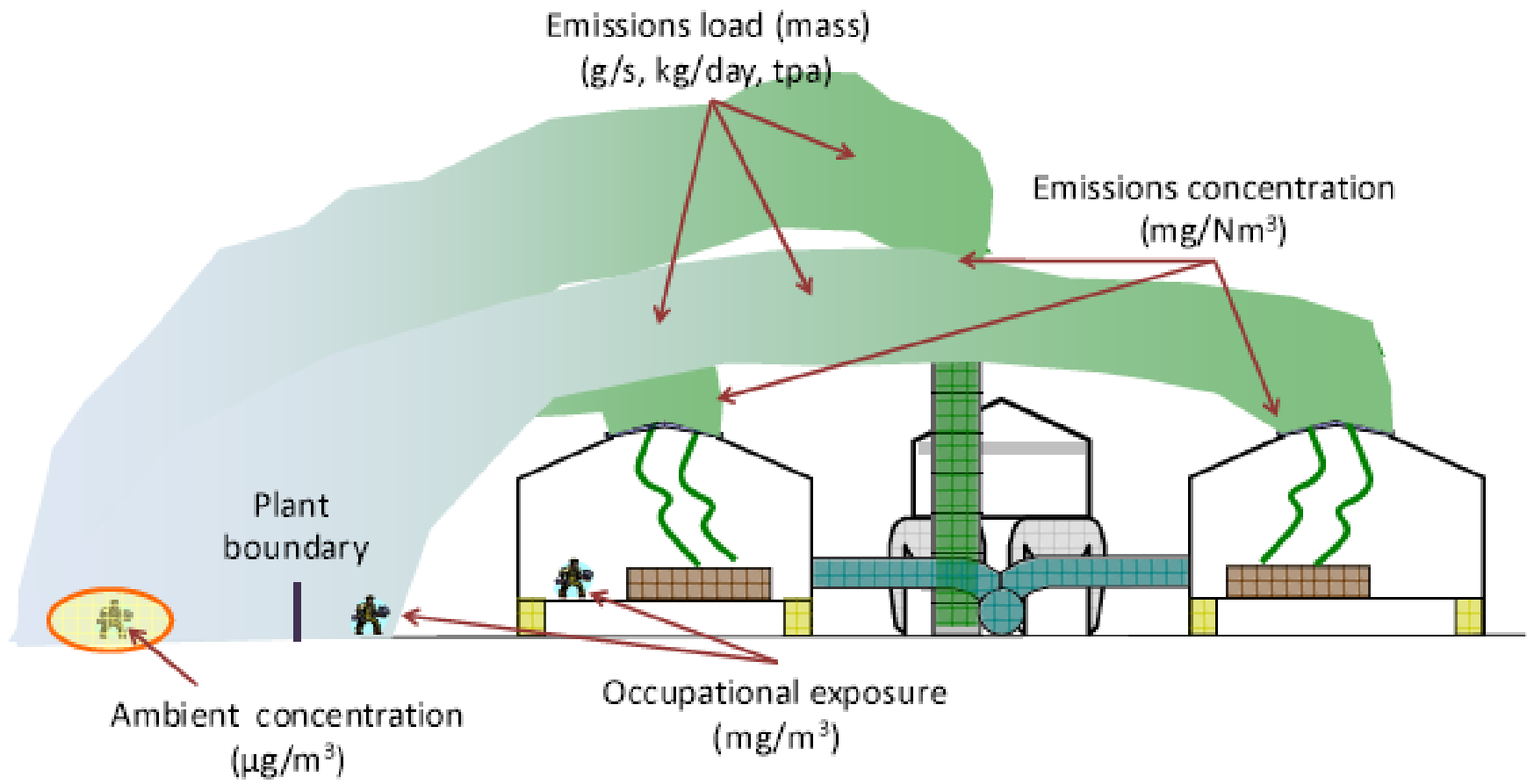
## 3.7 National Ambient Air Quality Standards for Carbon Monoxide (CO)

| Averaging Period   | Concentration                  | Frequency of Exceedence | Compliance Date |
|--|--------------------------------|-------------------------|-----------------|
| 1 hour   | 30 mg/m <sup>3</sup> (26 ppm)  | 88                      | Immediate       |
| 8 hour (calculated on 1 hourly averages)                               | 10 mg/m <sup>3</sup> (8.7 ppm) | 11                      | Immediate       |
| The reference method for analysis of Carbon Monoxide shall be ISO 4224 |                                |                         |                 |





# Link between ambient air quality and emissions



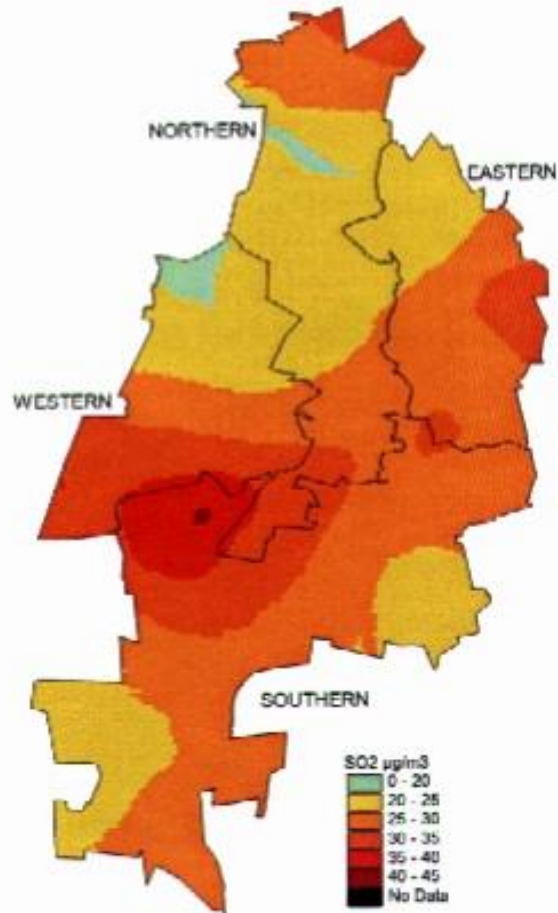


# Summary of air quality management process

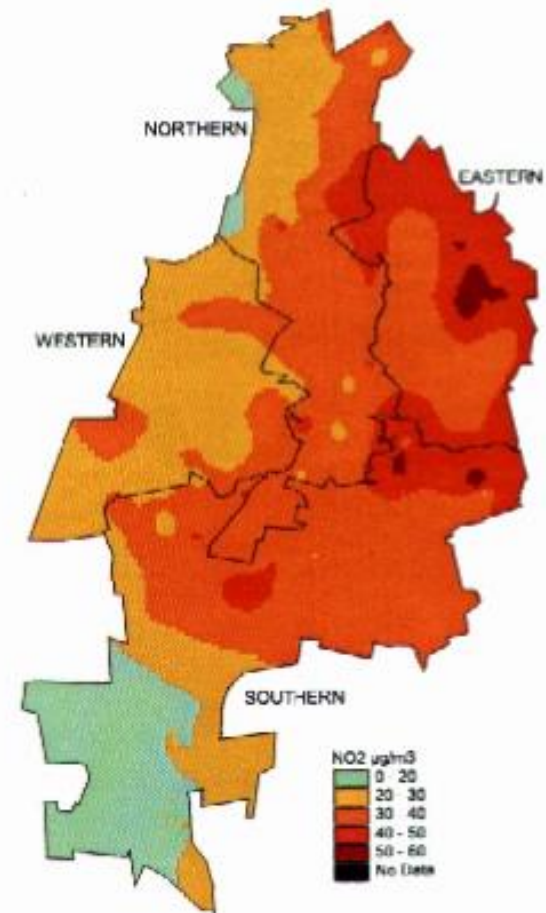
1. Baseline survey: What is the ambient air quality now?
2. Compare to NAAQS limit values
3. Which sources contribute to the exceedance of the NAAQS limits? (Emission inventory)
4. Prioritise source reduction measures
5. Implement reduction plan

# City of Johannesburg - Example of Passive Diffusive Monitoring Campaign Results (~300 sampling sites – July 1999)

## Sulphur dioxide

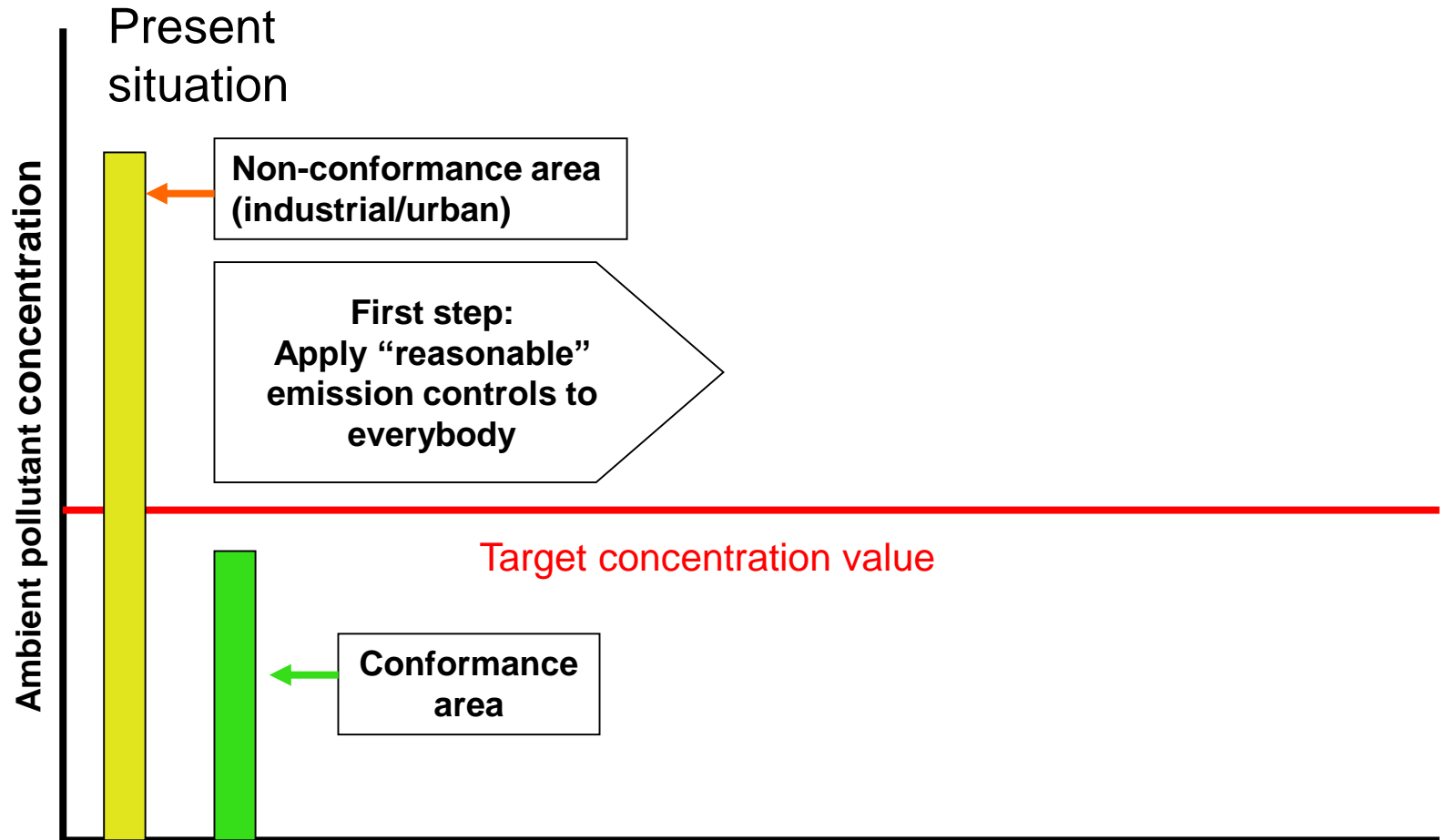


## Nitrogen dioxide

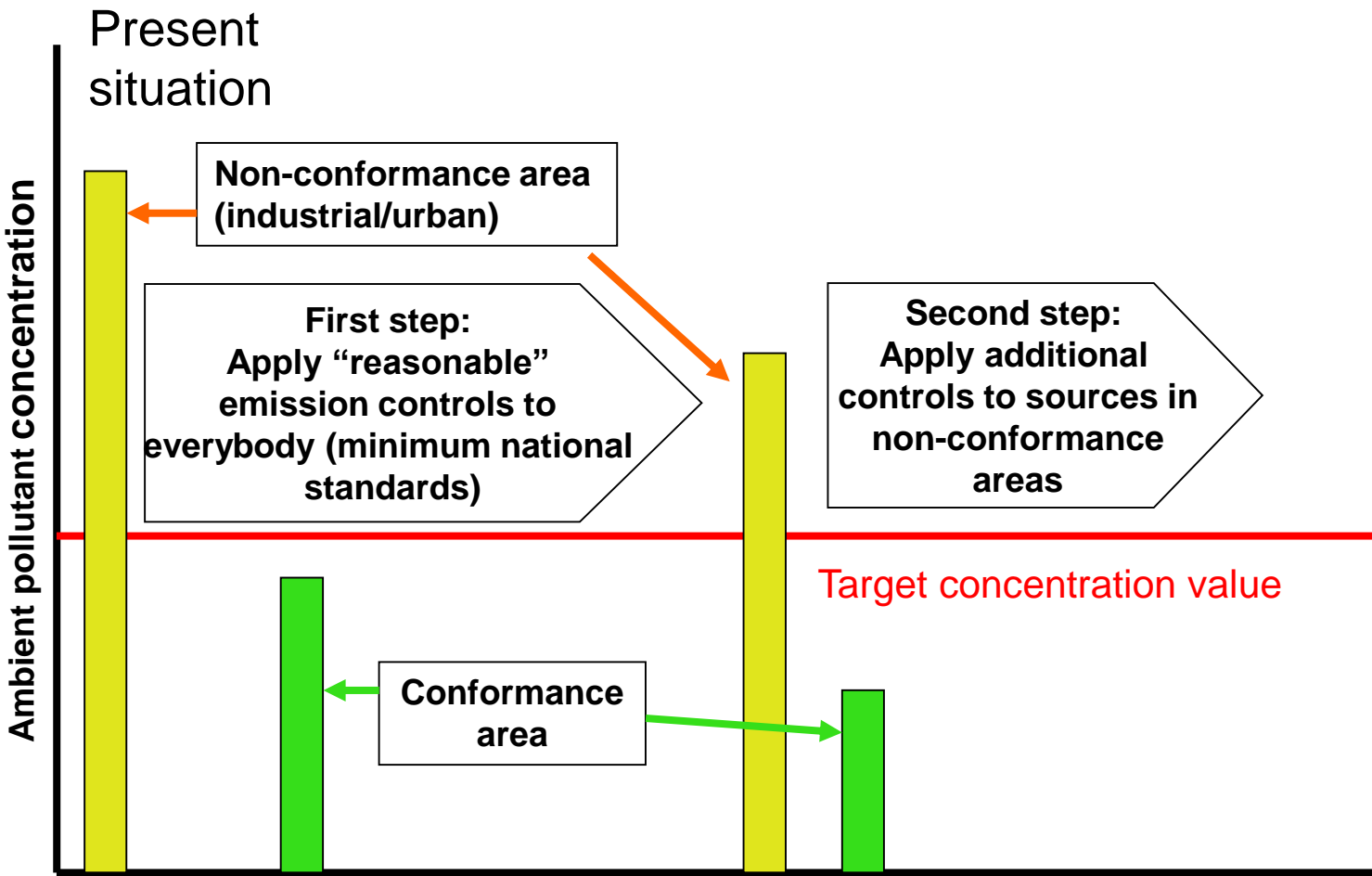


Pollution concentrations over the City of Joburg (Source: CSIR / IVL)

# Conceptual implementation framework (1)

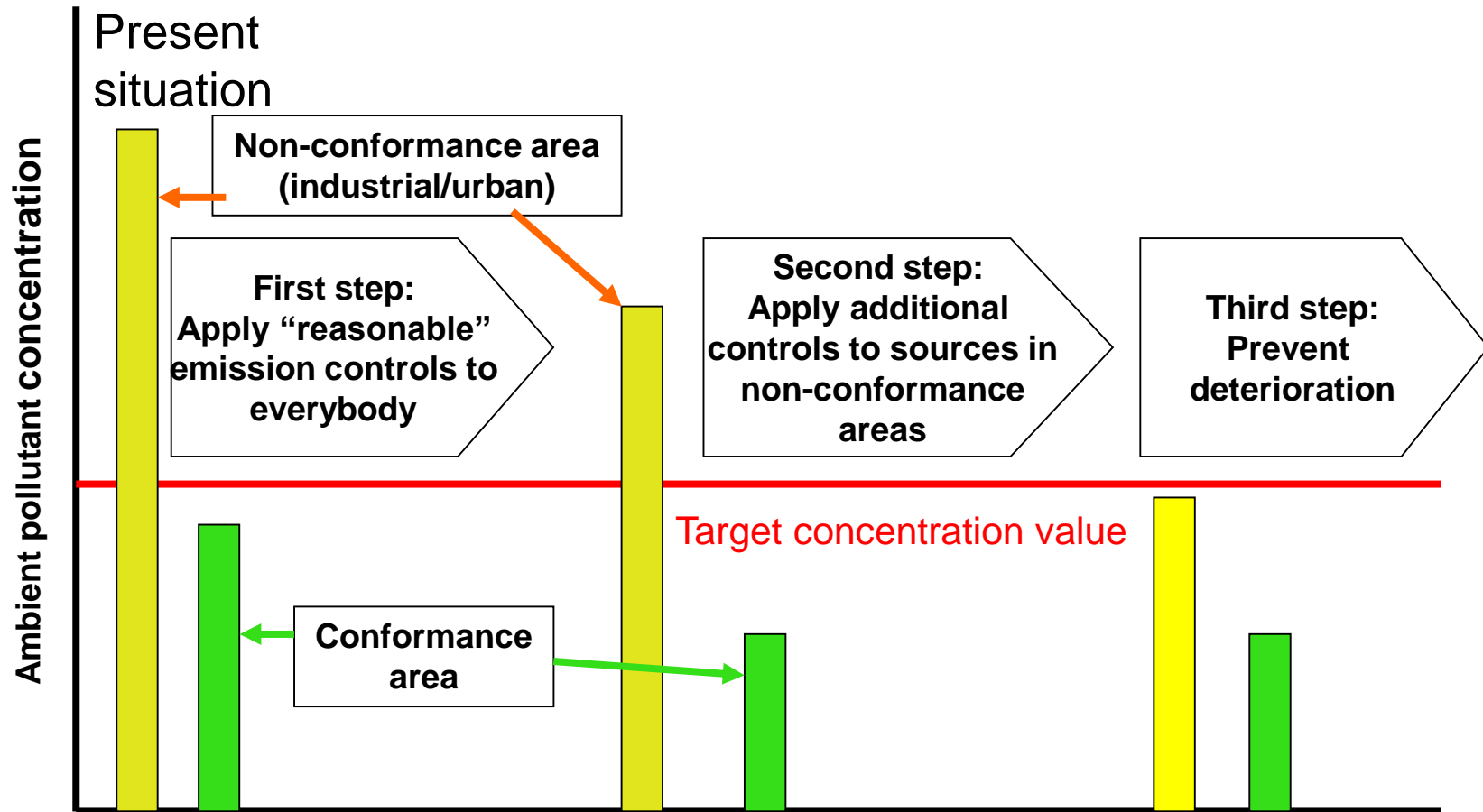


# Conceptual implementation framework (2)

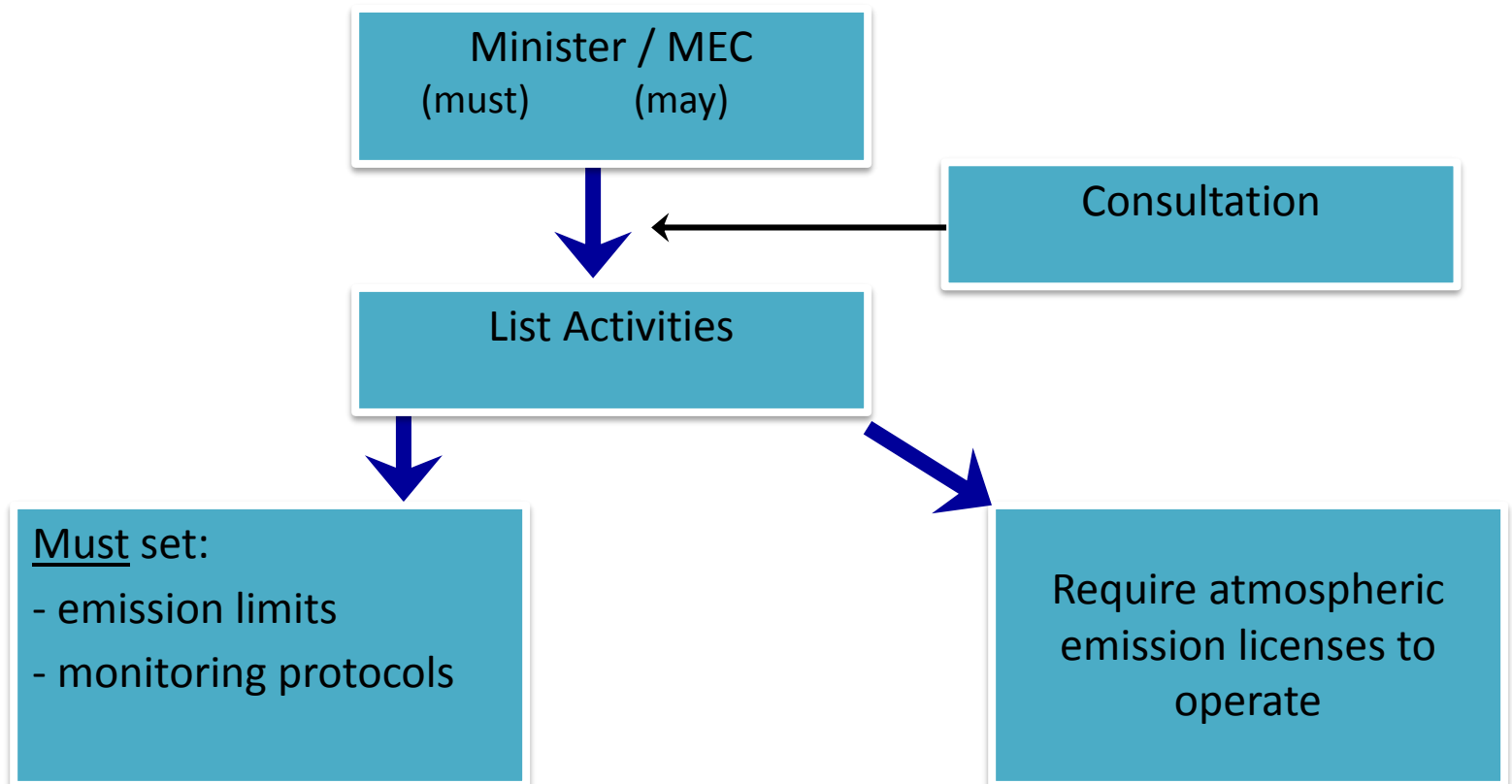




# Conceptual implementation framework (3)



# AQA s21 addresses one source category (mostly industrial sources)



# AQM Measures – Listed Activities

- licensing authority – metro or DM/province except (Amendment Act) for “national priorities” as per Cabinet decision
- license contents:
  - activity, premises, person, period
  - emission limits (normal, upset conditions)
  - point source emission measurement & reporting requirements
  - on site air quality measurement & reporting requirements
  - penalties

# Section 21 (Listed Activities) example

## 10. Category 1: Combustion Installations

### (1) Subcategory 1.1: Solid fuel combustion installations

|   |   |                     |  |
|---|---|---------------------|--|
| <b>Description:</b>                       | Solid fuels (excluding biomass) combustion installations used primarily for steam raising or electricity generation.                            |                     |  |
| <b>Application:</b>                       | All installations with design capacity equal to or greater than 50 MW heat input per unit, based on the lower calorific value of the fuel used. |                     |  |
| <b>Substance or mixture of substances</b> |   | <b>Plant status</b> | <b>mg/Nm<sup>3</sup> under normal conditions of 10% O<sub>2</sub>, 273 Kelvin and 101.3 kPa.</b> |
| <b>Common name</b>                        | <b>Chemical symbol</b>  |                     |  |
| Particulate matter                        | N/A   | New                 | 50   |
|   |   | Existing            | 100  |
| Sulphur dioxide                           | SO <sub>2</sub>   | New                 | 500  |
|   |   | Existing            | 3500   |
| Oxides of nitrogen                        | NO <sub>x</sub> expressed as NO <sub>2</sub>  | New                 | 750  |
|   |   | Existing            | 1100   |

- (a) The following special arrangement shall apply –
- (i) Continuous emission monitoring of PM, SO<sub>2</sub> and NO<sub>x</sub> is required.



# Section 21 (Listed Activities) example (2)

(1) Subcategory 3.1: Combustion Installations

|  |  |                     |  |
|--|--|---------------------|--|
| <b>Description:</b>  | Combustion installations not used primarily for steam raising or electricity generation. |                     |  |
| <b>Application:</b>  | All combustion installations (except test or experimental installations).                |                     |  |
| <b>Substance or mixture of substances</b>                        |  | <b>Plant status</b> | <b>mg/Nm<sup>3</sup> under normal conditions of 10% O<sub>2</sub>, 273 Kelvin and 101.3 kPa.</b> |
| <b>Common name</b>   | <b>Chemical symbol</b>   |                     |  |
| Particulate matter   | N/A  | New                 | 50   |
|  |  | Existing            | 100  |
| Oxides of nitrogen   | NO <sub>x</sub> expressed as NO <sub>2</sub>   | New                 | 700  |
|  |  | Existing            | 2000   |
| Total volatile organic compounds (from non-coke oven operations) | N/A  | New                 | 40   |
|  |  | Existing            | 90   |

- (a) The following special arrangements shall apply –
- (i) Sulphur-containing compounds to be recovered from gases to be used for combustion with a recovery efficiency of not less than 90% or remaining content of inorganic sulphur-containing compounds to be less than 1000 mg/Nm<sup>3</sup> measured as hydrogen sulphide, whichever is strictest.
  - (ii) Where co-feeding with waste materials with calorific value allowed in terms of the Waste Disposal Standards published in terms of the Waste Act, 2008 (Act No.59 of 2008) occurs, additional requirements under subcategory 1.6 shall apply.

# AQM Measures – Listed Activities

## Initial draft listing ToR included

- All processes scheduled under APPA should be included
- Categorisation should be by industry sector, rather than by process
- No ‘technology forcing’
- BPEO should be used to select emission limits
- Time constraints precluded detailed cost/benefits analysis for selecting emission limits

BPEO, as defined in [NEMA](#), “means the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long-term as well as in the short-term”

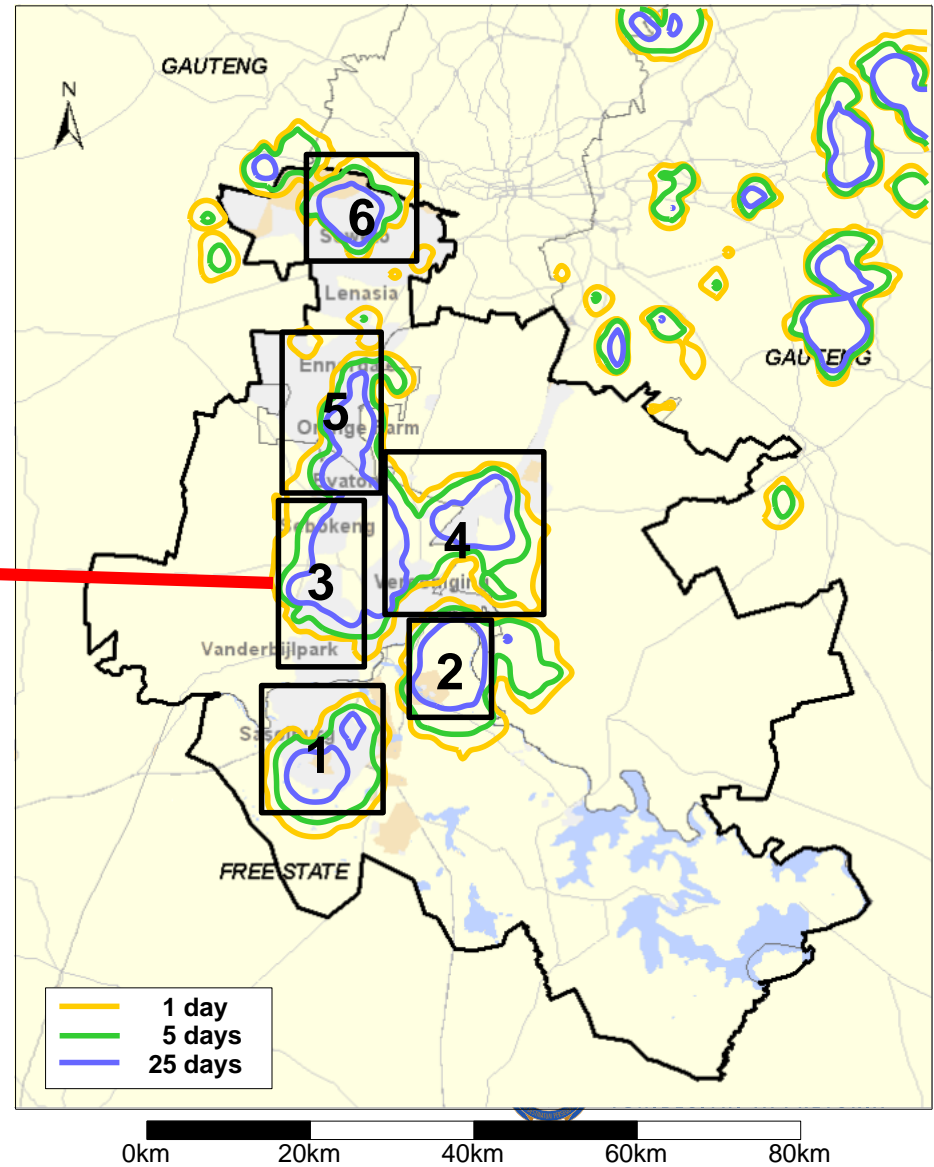
# AQM Measures – Listed Activities

- Initial draft list included ‘existing plant’ and ‘new plant’ distinction
- Emission limits mostly based on EU Integrated Pollution Prevention and Control directive (which is based on BPEO for Europe)
- Included proposal for 5 years to meet ‘existing plant’ limit values, and postponement option for this
- Did not include requirement for ‘existing plant’ to meet ‘new plant’ requirements 10 years from April 2010 (added by DEA?)

# Some examples: VTAPA 'hotspot' 3

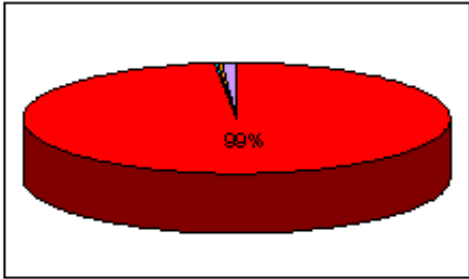
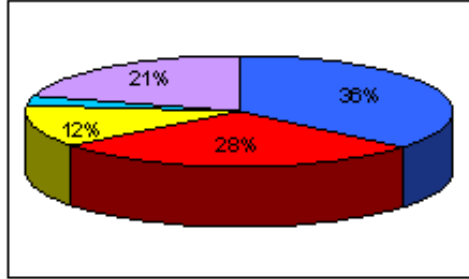
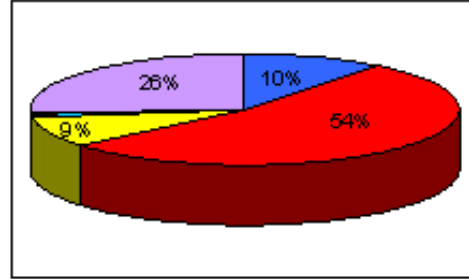
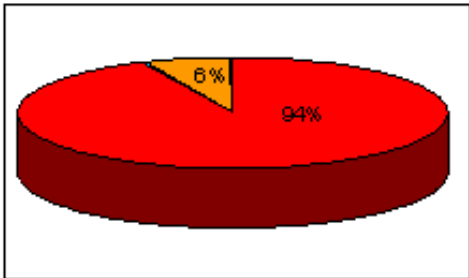
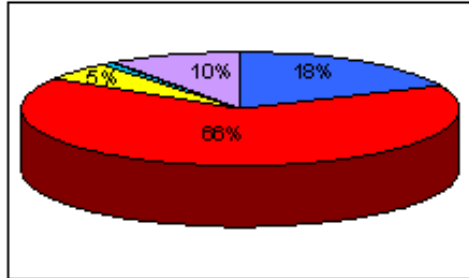
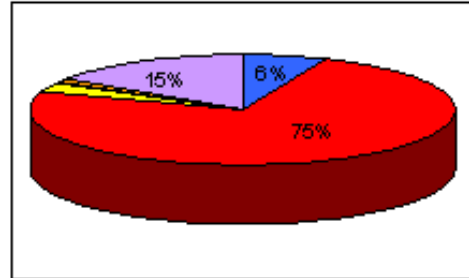
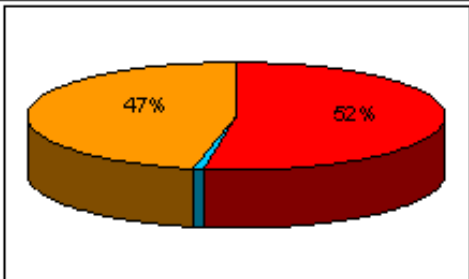
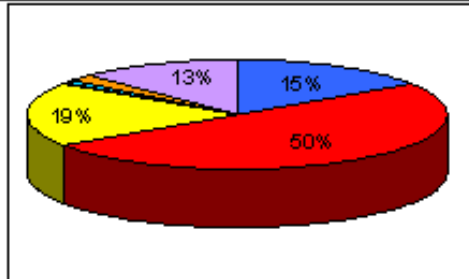
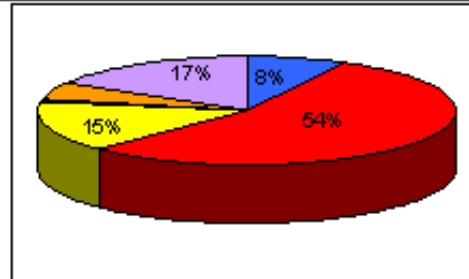
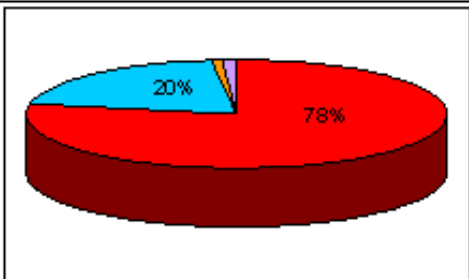
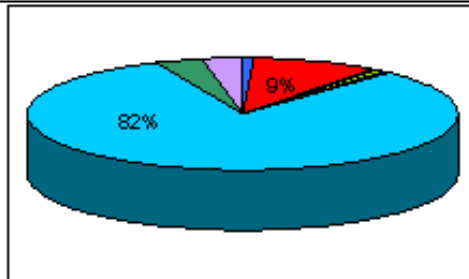
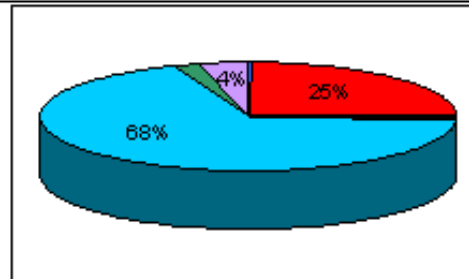


FREQUENCY OF EXCEEDANCE OF DAILY PM<sub>10</sub> LIMIT OF 75 µg/m<sup>3</sup>  
ALL CURRENT SOURCES



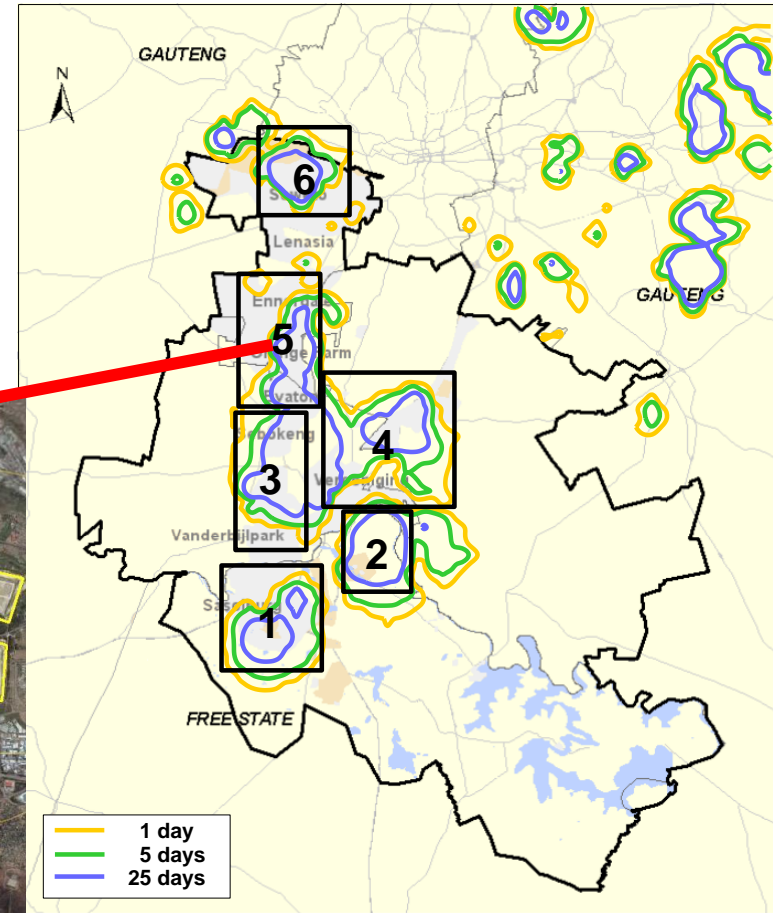


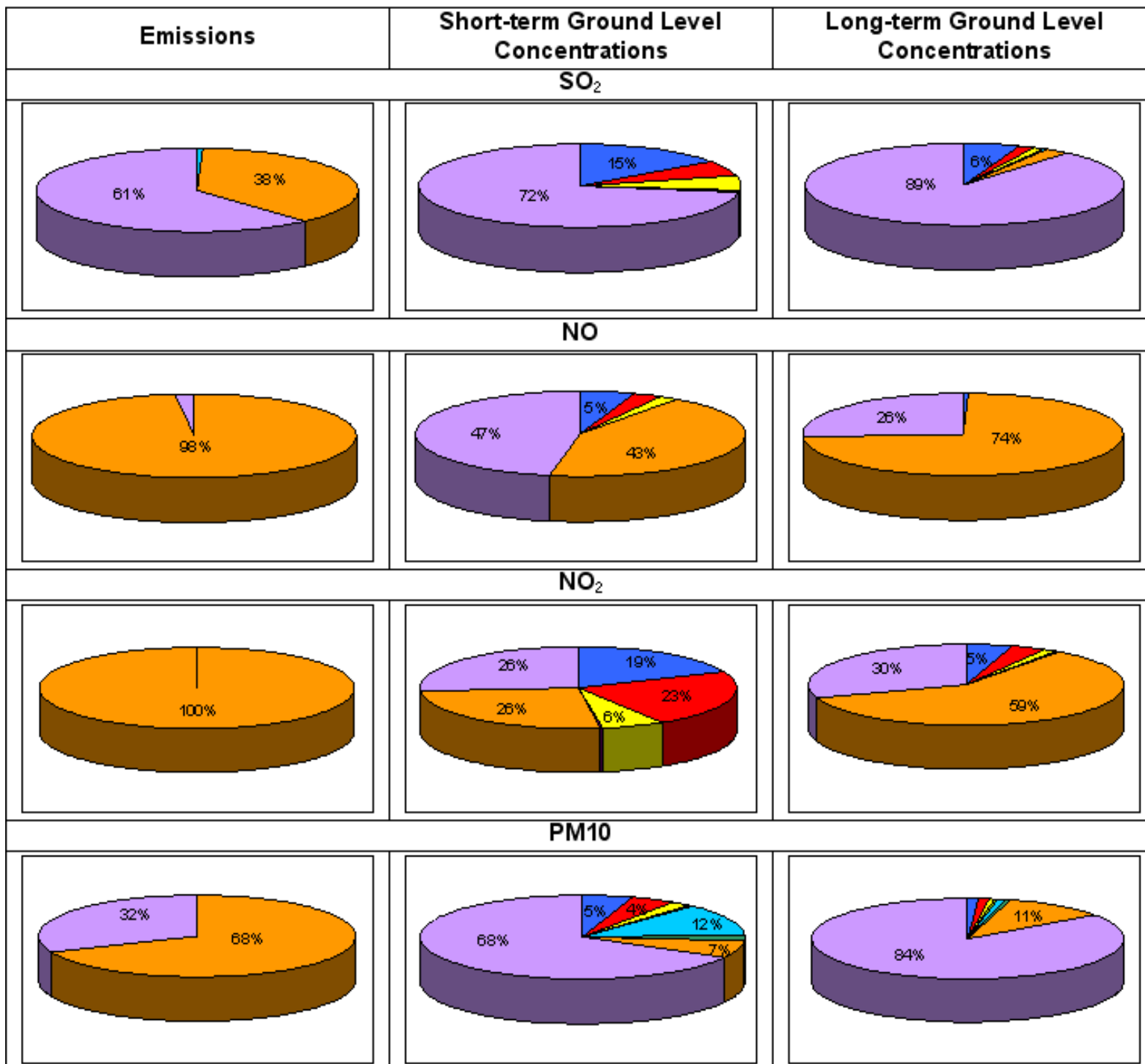
|                                |              |
|--------------------------------|--------------|
| Power Generation               | Blue         |
| Iron and Steel Process         | Red          |
| Petrochemical Processes        | Yellow       |
| Ferroalloy Processes           | Green        |
| Phosphate Fertilizer Processes | Purple       |
| Smaller Industries             | Cyan         |
| Vehicles                       | Orange       |
| Mines                          | Light Green  |
| Domestic Fuel Burning          | Light Purple |

| Emissions   | Short-term Ground Level Concentrations   | Long-term Ground Level Concentrations   |
|---|--|---|
| <b>SO<sub>2</sub></b>   |  |   |
|    |    |    |
| <b>NO</b>   |  |   |
|    |    |    |
| <b>NO<sub>2</sub></b>   |  |   |
|   |   |   |
| <b>PM10</b>   |  |   |
|  |  |  |

# VTAPA 'Hotspot' 6

FREQUENCY OF EXCEEDANCE OF DAILY PM10 LIMIT OF 75  $\mu\text{g}/\text{m}^3$   
ALL CURRENT SOURCES





|                                |  |
|--------------------------------|--|
| Power Generation               |  |
| Iron and Steel Process         |  |
| Petrochemical Processes        |  |
| Ferrous Processes              |  |
| Phosphate Fertilizer Processes |  |
| Smaller Industries             |  |
| Vehicles                       |  |
| Mines                          |  |
| Domestic Fuel Burning          |  |

# Cost-benefit analysis of postponement: a case study

- Sulfur dioxide emissions on the Mpumalanga Highveld: what are the benefits of flue gas desulfurisation?

Uses the concept of 'externalities': What are the (positive and negative) environmental consequences of an action that are not included in conventional economic analysis, and can we quantify the cost of such consequences?

# Classification of externalities

- Class 1 externalities: Sufficient information exists to quantify and assign a cost to the externality
  - Capital and operating costs
  - Water and lime supply
  - Health impacts
- Class 2 externalities: Insufficient data exists to quantify the externalities, but the externality can potentially be significant
  - Ecological impacts
- Class 3 externalities: Sufficient information exists to quantify the externality, but insufficient information exists to assign a cost
  - Selected vegetation impacts
- Class 4 externality: The externality is expected to have an insignificant impact on the outcome of the study or the cost is already internalized
  - Visibility impacts



# Calculation of benefits

- Quantification of exposure
  - Concentration changes between baseline and compliance scenario used to evaluate the change in impact
- Quantification of impacts
  - Health Impacts
    - Concentration response functions linking concentrations to physical impacts – functions from international studies used (Cohort studies and time-series studies) with sensitivity analysis using local studies where available
    - Baseline health data required and will determine health outcomes evaluated
    - Match model output to type of epidemiological study - correct use of averaging times
    - Appropriate health outcomes to evaluate - avoid double counting
- Valuation of impacts
  - Mortality impacts - benefit transfer adjusted for per capita income
  - Morbidity impacts – Cost of illness

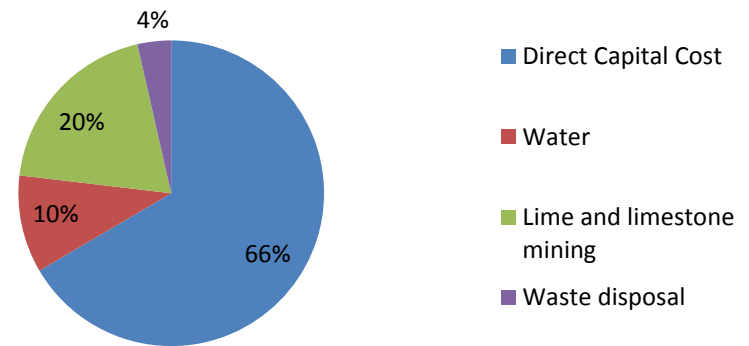




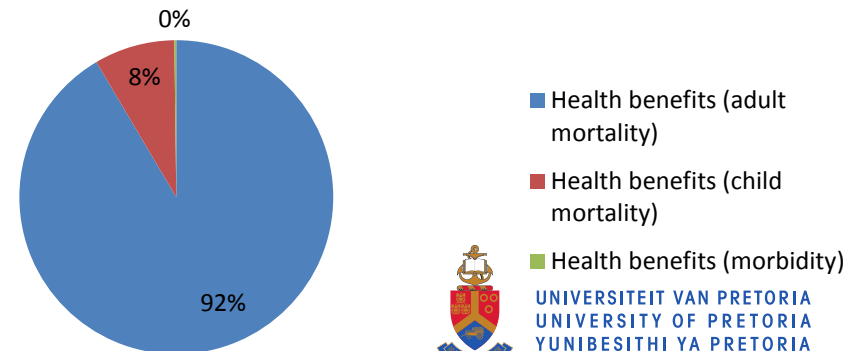
# Calculation of Net Present Value(NPV)

| Impact                                   | Valuation mean (Rbil) |
|--|-----------------------|
| <b>Costs</b>                             |                       |
| <i>Direct Capital Cost</i>               | <b>187</b>            |
| <i>Water</i>                             | <b>29</b>             |
| <i>Lime and limestone mining</i>         | <b>55</b>             |
| <i>Waste disposal</i>                    | <b>10</b>             |
| <b>Benefits</b>                          |                       |
| <i>Health benefits (adult mortality)</i> | <b>115</b>            |
| <i>Health benefits (child mortality)</i> | <b>10.44</b>          |
| <i>Health benefits (morbidity)</i>       | <b>0.25</b>           |
| <b>NPV</b>                               | <b>-166</b>           |

## Evaluation of Costs



## Evaluation of Benefits



# Conclusions

- Stopping all postponements under AQA section 21 will not ensure compliance with ambient air quality standards by itself
- The contribution of Listed activities (s21) to ambient exposure is location-dependent
- Enforcement of 'new plant' emission standards is not necessarily the most economic method to reduce ambient exposure

# Proposals

- Postponement option should not be abolished
- Applications should be considered based on the Air Quality Management Plan of the local district municipality or metro
- Will require close cooperation between NAQO (receives postponement application) and DM/metro (licensing authority) – provision is made for this in the regulations
- Where possible, CBA to be included in the Atmospheric Impact Report (AIR) that is required for postponement application



# Proposals

- Offsets may provide more economical method to produce the same reduction in impacts than enforcement of the MES
- Offset regulations could be made more specific
- DEA strategy to address air pollution in dense low income settlements should be prioritized
- Addition of certain categories to Listed Activities should be considered

# Proposals

- Systematic revision of existing Listed Activities using CBA
- Advisory committee?



Thank you