Authors' Response to Letter to the Editor "An economic assessment of SO_2 reduction from industrial sources on the highveld of South Africa" by Steyn and Kornelius

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Dear Editor

Thank you for the opportunity to respond to the Letter to the Editor sent by Prof Cairncross as a response to the Paper "An Economic assessment of SO_2 reduction from industrial sources on the highveld of South Africa" by Steyn and Kornelius, that was published in the Clean Air Journal Vol 28 No 1.

In the response letter Prof Cairncross raised seven points for clarification, which are highlighted in the response.

1. Sources included in the emissions inventory, 3. impacts of confined domain and 4. capital costs of flue gas desulphurisation

The study focused on the Highveld Priority Area (HPA) and as such included only the sources located in the HPA that were operational at the time of the study. As the Sasol Synfuels plants are located within this area, the emissions thereof were included in the model and the benefits associated with emission reduction from that facility were included in the calculations (point 1 and 4). Category 1.1 (in terms of the Air Quality Act section 21 regulations) sources that are not located in the Highveld Priority Area were not included in this study. The HPA was chosen as the area for analysis as it is a declared priority area with defined borders which hosts the majority of the sources that fall under category 1.1. The model domain was larger than the analysis area, but benefits were only calculated for populations residing in the priority area. We must emphasize that that analysis was done on concentration ***differences*** for the options, which would obviate or reduce to a minimum the effect of sources outside the modelling domain.

2. Are secondary sulphates included in health impact estimates?

The study considered both direct SO_2 impacts as well as the impacts associated with the resulting secondary sulfate formation. The results that are referred to in point 2 of the letter extracted only the SO_2 impacts for purposes of comparing the impacts when concentration response functions are used that are derived in different parts of the world to ascertain whether the concentration response functions derived in the United States were comparable with those derived in South Africa and Asia. Since the South African study that was used only considered the impacts associated with SO_2 and not sulfate, these impacts were discussed only in the context of that comparison. The analysis indicated that the concentration response functions derived in the United States compared well with a study conducted in South Africa. All other benefit calculations include the impact of sulfates.

6. The sorbent (lime or limestone) and water (point 5) consumption and cost estimates

Apportioning the 5 000 000 tons of limestone required per annum and deducting the usage by facilities not included in the study does result in an estimated limestone usage lower than the amount used in the study. It would be preferable to use the Eskom estimate, resulting in a 30% reduction in the calculated limestone cost. The limestone costs account for 20% of the net present value and therefore using the Eskom figure, the total cost will be adjusted by 6%. The limestone and water costs do reduce as the facilities are decommissioned. All costs and benefits were escalated using CPI to determine net present values, which would increase the NPV beyond merely multiplying by the number of years. The study assumed that wet FGD would be the preferred option, as discussed in the article.

7. Clarification of the emissions scenarios used in the modelling

It is indeed correct to state that it would not be preferable to retrofit facilities that are due to be decommissioned. The study considered the case of retrofitting ***only*** the station with the largest health impact. The results indicated that the costs still outweigh the benefits, albeit at a reduced ratio. The study only considered the retrofitting of the facilities and not benefits associated with accelerated decommissioning. The study indicates that retrofitting is associated with high operating costs

and alternative solutions such as accelerated decommissioning may well be preferable. While these alternatives fell outside the scope of our study, it would be quite informative to determine such benefits.

The study did not take into consideration the impact of an increase in electricity tariffs, which may have a significant broader economic impact. The costs associated with increased greenhouse gas emissions were similarly not included. The costs can therefore be seen to be conservative. On the benefit side, the largest benefit was the reduction in premature mortality. The increased risk associated with premature mortality used the Value of a Statistical Life (VSL) to monetise the benefit. The VSL used was based on values used by the United States Environmental Protection Agency as values for South Africa are not available. One of the areas for further research identified by the study is the need for the development of appropriate VSL values that are reflective of the economic consequences of premature mortality in South Africa. This value is the single most important factor in determining whether the costs of compliance outweigh the benefits.

Yours faithfully

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