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Osman Environmental Solutions, LLC

Sasol South Africa Limited
Secunda Operations

Independent Study of Load vs. Concentration Limits – SO_2 Emissions

Prepared by:

Osman Environmental Solutions, LLC

4708 Rock Ledge Drive

Harrisburg, PA 17110

USA

Fred P. Osman, BCEE, President

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Independent Study of Load vs. Concentration – Sulphur Dioxide (SO_2) Emissions

1. Background

I, Fred Osman, President of Osman Environmental Solutions, LLC, was asked by Sasol South Africa Limited: Secunda Operations ("Sasol") to conduct an independent technical review of their study that compares a mass-based SO_2 emission limit for several of their coal-fired boilers against the concentration-based SO_2 emission limits specified in Section 21 of the National Environmental Management Act, Section 21, Minimum Emission Standards, and additionally to review and critique the technical aspects of the appeal response report submitted by the non-profit shareholder organization Just Share.

Regarding qualifications to make this assessment, I am a Registered Professional Engineer in the Commonwealth of Pennsylvania, as well as the state of South Carolina, US, practicing in the environmental area, and am also a Board-Certified Environmental Engineer by the American Academy of Environmental Engineers in the field of Air Pollution Control. My work experience includes two years with the US Environmental Protection Agency as an Air Pollution Control Engineer, and eighteen years with the Pennsylvania Department of Environmental Protection, where I was, prior to leaving, Chief of the Air Quality Section. Since leaving government service in 1990, I have been in private practice and represent a diverse group of clients, including government agencies, major industrial operations, as well as smaller, local facilities. My client list includes Buzzi Unicem, Duke Energy, Cinergy, Caterpillar, Harley-Davidson, Nucor Steel, as well as many other lesser-known companies. In terms of specific experience relating to coal-fired boilers, I have consulted for Duke Energy, Horsehead Industries, and have been the primary air consultant for an industry group, called ARIPPA, which at its peak consisted of 18 waste-coal fired electrical generating plants in the US, as well as a consultant for several of the individual plants in this group. I have frequently been qualified as an expert witness in the field of air pollution control in various court proceedings in the United States.

In preparing this report, I have reviewed:

- Sasol's Background Information Document, April 2022
- Atmospheric Impact Report: Sasol's Secunda Operations, Mpumalanga Province, April 2022
- Final Motivation Report for Sasol South Africa Limited operating through its Secunda Operations, 29 June 2022
- Atmospheric Emission License for Sasol South Africa (Pty) Ltd, trading as Secunda Synfuels Operations, issued 23 April 2019, expiring 23 April 2024.
- The Appeal Response Report prepared by Just Share.

The results of my findings are included in the following paragraphs.

2. Rationale for Mass-Based Emission Limits.

As industrial development proceeded in the mid-20th century, and as the result of certain well-documented episodes of deadly air pollution, such as the 1930 Meuse River Valley smog incident, the 1948 Donora, Pennsylvania, smog incident, and the 1948 London killer fog incident, governments began efforts to study and curb air pollution. As the century progressed, the idea evolved that clean air was a resource and that there were limits to the extent this resource could be degraded by industrial emissions. The resource issue is critical to understanding the importance of mass-based emission limits. Concentrations of air pollution in a stack are far less important in evaluating environmental impacts than are the total masses of air pollutants emitted. A 3MW/hr boiler and a 75 MW/hr boiler both could have emission limits of 1,000 mg/Nm^3, but the larger boiler would consume 25 times more air resources than the smaller boiler. Consequently, in terms of environmental harm, the mass-based metric is much more important than the concentration at which pollutants are being emitted into the atmosphere.

In a recent regulation finalized by the US EPA in August 2023 on Standards of Performance for Steel Plants, US EPA addressed the issue of concentration versus mass in response to a comment relating to EPA changing a concentration-based standard to a mass-based standard. One of EPA's justifications for doing so was:

> The EPA is finalizing the proposed determination that the BSER (Best System for Emissions Reduction) for EAF (Electric Arc Furnaces) and AOD (Argon-Oxygen Decarbonization) is capture and control of PM with a fabric filter. The EPA is further finalizing the proposed determination that limit based on the BSER at 0.16 lb/ton total facility PM is achievable for any new, modified, or

> reconstructed facility because it is based on the EPA's data from approximately one third of the industry. **The format of the limit based on BSER (total facility lb PM/ton steel produced from all affected capture systems and fabric filters) provides complete information on the performance of the facility and their EAF rather than that of just the individual baghouse(s) and individual EAF via a concentration based standard and enables the public and regulators to know the total pollutant impact of the facility's EAF operation on the surrounding community.**[1] (my emphasis). [Note that the previous version of this rule established a concentration standard and the amended rule moved to a mass- based standard.]

While the above-referenced regulation has to do with steel plants and particulate matter, the position taken is directly applicable to SO_2 emissions at the Sasol boilers. Reports of concentrations in the stacks do not provide the public with complete information on the impact of the emissions on the surrounding community. As stated previously, the environmental impact is related to the mass of the emissions, not the concentration in the stack, and aligning the performance standard with the metric most demonstrative of that impact is another justification for approving the alternative emission load proposed by Sasol.

The difficulty the public has in determining the impact from a concentration-based limit is dramatically evidenced by the difficulty the Just Share authors had in their appeal response report (discussed later in this report) on understanding the relationship between stack concentration and mass loading. Transparency to the impacted community argues strongly in support of mass-based limits.

3. Effectiveness and Use of Mass-based Limits.

Mass-based emission limits are used quite frequently in the US, most commonly in limits of total tons of pollutants in a running 12-month period. In the US, large emitting facilities, called major sources (generally over 100 TPY of any regulated pollutant) are subject to regulation by the federal government, while smaller sources with emissions below that threshold, called minor sources, are regulated by the individual states. Many facilities take running 12-month limits below major source thresholds since these are subject to generally less restrictive permitting, public notice, and monitoring requirements. Additionally, shorter-term mass-based limits, in lbs./hr or tons per day are also included in permits to

[1]United States, Environmental Protection Agency. "New Source Performance Standards Review for Steel Plants: Electric Arc Furnaces and Argon-Oxygen Decarburization Vessel." 88 Fed. Reg. 58,442 (Aug. 25, 2023).

maintain emission levels to the limits that were used in atmospheric dispersion modeling to ensure that the permit, as issued, protects the ambient impacts that were evaluated in the application. Concentration limits are never used for this purpose because they don't provide the same level of assurance that the model is protected, since dispersion models are based on mass emissions. Concentration limits may be used to establish technology limits, but they are not as effective in guaranteeing the ambient impacts predicted by the dispersion model. Please see Attachment A to this report for several examples of mass-based emission limits from permits issued by states in the US.

Annual mass-based reporting is also an important component of any cap-and-trade program since these all involve showing that a regulated entity's annual emissions equal the number of allowances held in their account. Cap and trade programs operate independently of permit limits and require maintaining mass-based emissions below an account budget, either by source curtailment, over-control beyond permit limits, or by buying allowances from other sources that either over-control or curtail operations. The US acid rain program was the first US program established under cap and trade. It relies exclusively on mass emission calculations.

The United States Is not the only jurisdiction where mass-based limits are used. Japan limits SO_2 emissions on a daily mass basis.[2] States that charge fees or fines for the emission of pollutants also require mass-based annual emission calculations. The most widespread implementation of mass-based emission calculations is related to the institution of carbon taxes. These apply throughout the European Union, China, as well as several states in the US.

Regarding non-GHG pollutants like SO_2, the European Union, in 2001, issued Directive 2001/81/EC[3], which determined:

- At present it is not technically feasible to meet the long-term objectives of eliminating the adverse effects of acidification and reducing exposure to ground-level ozone…to guideline values established by the WHO. It is therefore necessary to provide for interim environmental objectives…
- Interim environmental objectives and the measures to meet them should take account of technical feasibility and the associated costs and benefits. Such measures should ensure that any action taken is cost-effective for the Community as a whole and should take account of the need to avoid excessive costs for any individual Member State.

[2] https://www.env.go.jp/en/air/aq/air.html
[3] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32001L0081

The Directive then established annual mass-based ceilings for each of the member states for SO_2, NO_X, VOC, and NH_3 to be achieved by 2010. The rationale for the mass-based limits and the method of implementation are the same as in the Sasol proposal.

A more recent example of this approach, which is analogous to the process allowed by MES Clause 12.A and Sasol's proposal under that option is the National Emission Reduction Plans adopted by the Energy Community, established by Treaty in 2006, under the auspices of the EU, and consisting of contracting parties: Albania, Bosnia and Herzegovina, Kosovo, North Macedonia, Georgia, Moldova, Montenegro, Serbia, and Ukraine. EU member countries are participants in the Community. Although these programs apply to entire countries, they would be equally applicable to being used at an individual plant, and very much mirror the Sasol proposal.

By way of background, the Ministerial Council of the Energy Community, on 24 October 2013, adopted rules limiting emissions from large combustion plants. The Ministerial Council also provided the possibility for the states to use a national emission reduction plan (NERP)[4] as an alternative to meeting the emission limit values, up until the end of 2027, as a transitional period. This proviso is quite similar to Clause 12A in the MES.

The relevant components of the NERP establish that for SO_2, the total annual emissions are capped at the average of 5 years of emission data from 2008 to 2012, calculated based on the emission limit, which for the 2018 emissions ceilings is 2,000 mg/Nm^3 for a 50-100 MW plant, the same as the existing South Africa MES.

The NERP further reduces the applicable emission limit for setting the emission cap in 2026 and 2027. In those years, the emission limit for a 50-100MW plant is 400 mg/Nm^3. Both caps are established by taking actual stack flows from the baseline period and calculating what the mass emission limit would have been had the source been operating at the applicable concentration limit, like the methodology used by Sasol in proposing their mass-based limits. Additionally, the ceiling concentrations decrease in a liner fashion from 2023 through 2026.

The similarities between the NERPs and Sasol's proposal include:

- A mass-based emissions cap that is based on the operating history of the boilers.
- An initial emission limit of 2,000 mg/Nm^3 to set the cap at the baseline stack flows.

[4] https://www.energy-community.org/dam/jcr:28533205-abe9-4f93-99db-c7802d0160fe/PG_03_2014_ECS_NERPs.pdf

- Operation of the source in the short term at levels representative of past operations, so that actual emissions do not increase from historical operation. (Sasol improves upon this with an immediate 4% reduction, which was not a requirement of the NERPs.)
- A plan to reduce total emissions in the future.

Differences between the NERP guidance and the Sasol proposal.

- The proposed Sasol cap is applied to a single plant rather than an entire country.
- The Sasol cap is based on near-maximum historical emissions, rather than a 5-year average.
- Ultimate pollution reduction is achieved by curtailment of existing sources rather than control of those sources at full operational capacity to a more stringent emissions limit.
- The time frame to achieve pollution reduction is longer.

Advantages of the Sasol proposal over the NERP's.

- The NERP's represent caps based on past emissions with no assurance that the existing emissions are not causing adverse health impacts. The Sasol proposal evaluated compliance with the NAAQS and provides additional assurance that compliance with this plan will not cause NAAQS violations.
- Final SO_2 emissions after 2030 are lower than would be seen with compliance with the MES at full capacity,

4. Special Considerations of Using Mass-based Limits

A critical component of any regulatory program is its practical enforceability and when it comes to longer-term mass-based standards, in the case of limits monitored by continuous emissions monitors ("CEMS"), one additional safeguard is that provisions must be included for data substitution in the event of CEMS malfunction. US EPA has developed data substitution procedures under their Acid Rain Program, 40 CFR Part 75. These procedures represent a commonsense method of accounting for missing data, in that short periods of missing data receive relatively benign treatment (e.g., a missing hour may be replaced by averaging the hour on either side), but as the number of missing data points increase, the procedures become more punitive in assigning higher values to the missing data. The process assures that there is no advantage in having missing data and encourages good operating practices on the CEMS. While the principle also applies to CEMS monitoring concentration-based limits, the importance of data substitution is more critical in monthly or longer-term mass-based limits because the facility is accumulating emissions to meet a longer-term limit and the absence of data impacts the entire period for which data is missing and must be accounted for in a reasonably fair manner. As an example, a missing day in a daily-limit impacts only that day, but in a running 30-day total it impacts the calculations for a full 30-days.

One potential disadvantage of a longer-term mass-based limit is that in the case where a pollutant is being controlled, a facility could run at lower capacity and back off controls to still stay just under the mass limit. For instance, if a cement plant had excess inventory and did not need to operate its kilns at maximum capacity for business reasons, the facility could potentially save money if it was using, for example, ammonia for NO_X control. While in that case, if there was a daily limit that had been established to protect a daily NAAQS, shorter term NAAQS might be threatened by that operating scenario. That situation is not applicable in the case of the Secunda boilers at issue, because the SO_2 emissions are simply a function of the sulfur in the coal and the amount of coal combusted. Since there are no add-on pollution controls that could be underutilized, that concern is not applicable in this case.

Another disadvantage setting a mass-based standard with a compliance period longer than the corresponding NAAQS is that there is no correspondence between the emission limit and the NAAQS. This is an issue with the MES, independent of Sasol's 12A application. The MES is based on daily averages, while there are both 10 minute and hourly NAAQS for SO_2. Mathematically, a source could operate for 10 minutes with emissions 100 times greater than the daily average concentration limit and still be in compliance with the MES. Thus, there is no guarantee that compliance with the MES is protective of human health.

In this regard, Sasol Secunda's proposal is an improvement on simply complying with the MES without an analysis of ambient impacts. Sasol has shown that at the current MES of 2,000 mg/Nm^3, the Secunda facility neither causes nor contributes to a NAQQS violation and their proposal for future operations meets this same criterion. That is a benefit from the Sasol proposal that is not necessarily guaranteed from sources simply meeting the MES without the ambient impact analysis conducted by Sasol.

5. Analysis of Sasol's Proposal for a Mass-based Permit Limit

Sasol's proposal to deliver equivalent and superior environmental benefits in a slightly longer time frame deserves serious attention. Arguing for the approach is the fact that starting on the regulatory compliance date of 1 April 2025, the Secunda facility will, because of a curtailment of operations, immediately reduce emissions of NO_X, particulate matter, and greenhouse gases 4% below any regulatory requirement to do so. This will have an immediate beneficial environmental effect. Secondly, as to the pollutant sulphur dioxide itself, starting in 2030, Sasol will reduce daily emissions by 84 tonnes below the equivalent concentration-based regulatory requirement, and this reduction will remain in place for as long as the coal boilers continue to operate. This is a voluntary reduction, twice what would be required to meet the same mass-based limit as the MES.

And while actual SO_2 emissions will also be reduced by 4% starting in 2025, the negative impacts of the Sasol proposal are that there will be the potential for SO_2 emissions of 54 tonnes per day more than if Sasol would be able to comply with the concentration limit. In the long run, the adverse impacts will be mitigated. Because the excess emissions sought in the short term are less than the reduced emissions offered in the long term, the total, accumulated emissions will be the same a little after 3 years after the 30% load reduction kicks in, and the benefits will continue to accrue forward from that time. (Also see Section 9, Alternative Analysis at the 99th percentile, an evaluation which dramatically impacts the over/under analysis.)

The decision of whether these actions (short-term reduction of pollutants besides SO_2; short-term reduction of SO_2 mass emissions, but less than would be required by the MES; dramatic mass-based reductions in the future for SO_2 and all other pollutants) are sufficient justification for allowing compliance with the proposed alternative mass-based standard is not a technical decision, but rather a decision that must be based on many holistic factors as to what is best for the environment and the country. The economic contributions of Sasol to South Africa are well documented in Annexure D to the appeal. While this document evaluates total economic contributions from the company, the contributions from the Secunda operation are an important component of that overall impact, which is further quantified in Annexure E. According to this report, Secunda produces 21% of the petroleum products produced in the country. A basic tenet of air pollution control is, health issues aside, technological standards must incorporate, on a case-by-case basis, energy, environmental, economic impacts, and other costs. Cleary, when considering the impact on energy and economics to South African in imposing a limit to Sasol Secunda that is unattainable and could force a partial curtailment of operations or even a shut-down, alternative compliance limits that are lawfully allowed, as in this case under Clause 12A of the MES, must be seriously considered. One important issue that does inform this decision, however, is whether the exceedance of the SO_2 MES concentration rate will cause harm over the interim period of the higher emissions. That issue is discussed below.

Air pollution emission standards are either technology based, or risk based. The approach that has been used in the US, at least regarding hazardous air pollutants, is to establish technology-based standards, based on what emission limits sources may be expected to meet as a first step, because it is the quickest way to achieve reductions. The second step is then to review each source that has implemented the technology requirements and see if there is a residual risk that requires further control. This is a time-consuming step that requires dispersion modeling on a large number of sources. The concentration limit of 1,000 mg/Nm^3 at 10% O_2 is a technology based standard and not a standard designed to directly protect public health. That function is provided by the establishment of ambient air quality standards. Air Quality Act 39 of 2004 establishes National Ambient Air Quality Standards ("NAAQS") for Sulphur Dioxide (among other pollutants) and establishes a "limit value", with the aim of reducing harmful effects on human health (or the environment). The NAAQS are designed to reduce harmful effects on the population, including the very young and the elderly. When the NAAQS are maintained, public health is protected. The NAAQS are the yardsticks that establish "safe" levels of air pollution.

Sasol, in its proposal, has provided the risk-based analysis that typically would come after the technology-based standards were implemented and has effectively speeded up the normal process. And just to demonstrate the lack of connection between the MES and the NAAQS, I used a screening model I had previously run on a stack at a cement kiln in the US. That particular stack would have exceeded the hourly NAAQS at a concentration of 1,000 mg/Nm^3 only emitting 10.6 t/d of SO_2. Of course, that was a much lower stack with elevated terrain higher than the stack, but the point is that a concentration standard does not necessarily protect public health and there is no guarantee that a source meeting the MES is not violating the NAAQS. Sasol has shown that their proposal does protect public health and assures compliance with the NAAQS.

If the Secunda operations were causing violations of the NAAQS, it would be an argument against allowing exceedances of the MES for SO_2 in the near-term, even without considering negative impacts on overall energy markets and economic cost. However, a review of the ambient impact analysis conducted for this proposal shows first that Sasol Secunda is not now *causing* any violations of the SO_2 NAAQS. Furthermore, a review of the ambient monitoring data within the areas impacted by the facility shows that all monitoring stations are measuring compliance with the SO_2 NAAQS, and therefore Sasol Secunda is not now *contributing* to any SO_2 NAAQS violations. And under Sasol's plan for a 4% load reduction starting no later than 1 April 2025, there will be further reductions of SO_2 emissions and further improvement in air quality.

Consequently, decision makers can focus on the larger issues regarding the merits of the Sasol proposal, having assurances that the public health is protected under the alternative compliance standard proposed.

6. Review of Sasol's Methodology

I have also reviewed the methodology that Sasol used in developing the emissions inventory and establishing the various scenarios used in their analysis. While I am not trained in dispersion modeling and have no expertise in that area, I frequently work with dispersion modelers on these very issues, that is, the inputs to the model. I am convinced that the model inputs were properly developed and are correctly presented in the modeling report. My calculations match Sasol calculations other than slight differences relating to rounding errors. A thorough review of the detailed calculations in the Sasol AIR report is presented below in conjunction with my review of the Just Share Appeal Response Report. And as further explained in Section 9 of this report, I believe the Sasol calculations using P95 factors are more conservative than necessary and a P99 calculation could have been used instead.

7. Implementation of a Mass-Based Limit.

As discussed previously, mass-based limits are very common in many countries in the field of air pollution control, and as also discussed above, have the advantage of more directly measuring total environmental impact than concentration standards and provide more transparency to the impacted community. These standards are practically enforceable by regulatory agencies. The compliance methodology is simply to use the same continuous emissions monitors (CEMS) that are currently measuring concentration and multiply them by the flow through the stack. Thus, if for example, you would have an SO_2 concentration of $1g/m^3$ and a flow of 1E06 m^3 per hour, the mass emissions would be 1 metric tonne per hour.

Stack flow may be measured by a stack flow monitor but may also be estimated based on knowledge of, or analysis of, the fuel being burned by a method called F-factor analysis.

And there are, of course, important factors to keep in mind regarding the consistency of units in making these calculations. If the concentration is measured by the CEMS on a dry basis, the stack flow must also be on a dry basis. This can be accomplished by some stack flow analyzers, which report on both a wet and dry basis, or by an independent moisture monitor as part of the CEMs system.

And, as noted previously, mass-based limits are only practically enforceable if there are procedures in place to substitute missing data during periods when the source is emitting but the CEMs units are not recording data.

8. Review of the Just Share Appeal Response Report Technical Arguments

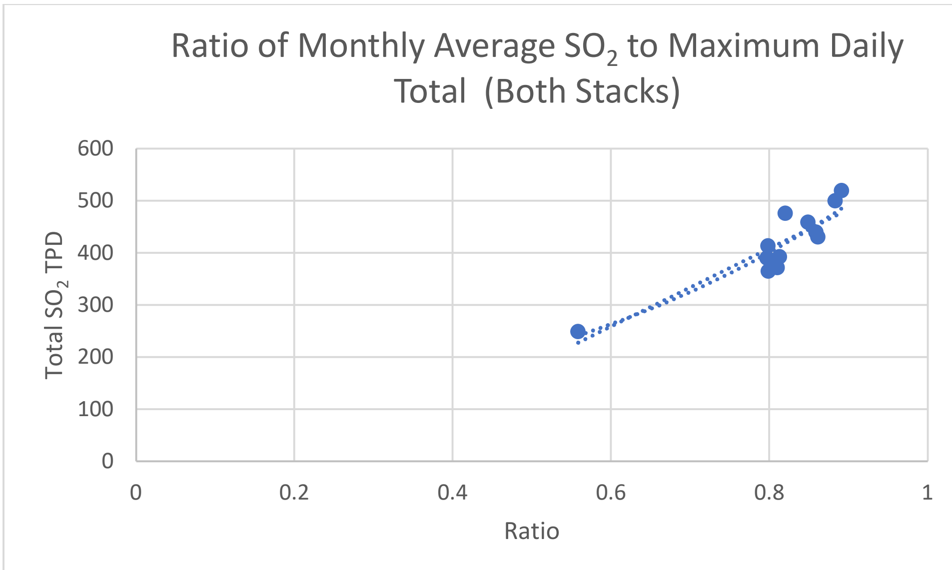
a) Overall Comments

The Just Share technical comments on the Sasol appeal suffer from two serious flaws. The first of these is that all the calculations provided by the Just Share expert showing concentrations are incorrect since they fail to account for moisture and to correct for oxygen. The minimum emissions standards document, in paragraph 3, states that unless otherwise specified, minimum emissions standards (MES) are expressed on a daily average basis under normal conditions of 273K, 101.3 kPA, specific oxygen percentage and dry gas. The MES for combustion sources references the concentration to 10 percent oxygen. A concentration standard not referenced to an oxygen level is meaningless since a source could simply dilute its exhaust to achieve practically any level desired with no reduction in the pollution emitted. The failure to correct for moisture results in relatively minor errors on the order of 5% to 7%, but the failure to correct for oxygen concentration results in serious errors, on the order of 45% over the correct calculation. Additionally, the Just Share expert uses the scientifically more precise conversion from Celsius to Kelvin of °K = °C +273.15, where the regulation regarding concentrations defines standard conditions to be °C +273. This slight difference in correction results in very small differences but is pointed out to show where my calculations differ very slightly from the Just Share calculations, but this correction amounts to little more than a rounding error.

The second overall flaw is that the Just Share expert attempts to calculate the effect that going to a 30-day compliance period would have on the maximum daily emission rate using statistical analysis that is not defensible. The Just Share expert states (comment 66) that "due to the statistical variability of day-to-day emissions, the multi-day average is **always** (my emphasis) 20-30% less than the maximum allowed daily emission limit of 2000 mg/Nm^3, if the plant is compliant." As an initial point of rebuttal, the statement is patently false. A review of the 2019 SO_2 data shows the **average** ratio between the monthly average and the daily maximum was 79% for the east stack and 81% for the west stack. But most importantly, the months where the boilers ran at higher loads had significantly higher ratios.

In March 2019, the Eastern stack's ratio of average monthly load to maximum daily load was 88.1% and in September 2019, the western stack's ratio was 95.8%. The relationship between the monthly average load to the maximum daily load based on the total monthly load for 2019 is shown below.

Figure 8.a-1



Thus, we see that as the emissions increase, the ratio between the average daily load and the maximum daily load increases. And this analysis is based on current operations with a concentration limit of 2,000 mg/Nm^3. It is obvious that as Sasol begins to comply with more stringent load limits the ratios between average monthly loads and maximum daily loads will increase.

This is a result of the commonsense fact that as an emission limit increases in stringency, the source will need to operate more consistently closer to that limit to achieve the same levels of production. As you eliminate the higher emissions from the data set because of lower allowed limits, the ratio of the average monthly to the maximum daily will increase.

In summary the Just Share comments incorrectly and significantly overestimate the concentrations that Sasol will operate under in any of the proposed scenarios and significantly and incorrectly inflate the variations that will occur with a longer compliance period

Responses to individual comments are included below:

b) Just Share Comment 66

The baseline average concentrations of SO2 in stacks B1 and B2, based on Table 4-1 and 4-2 AIR data, are 1 782 and 1 397 mg/Nm3 respectively, equivalent to total (B1 and B2) emissions of ***459 tSO2/d.*** *Due to the statistical variability of day-to-day emissions, the multi-day (more than 20-30 days or monthly) average is always 20-30% less than the maximum allowed daily emission limit of 2000 mg/Nm3, if the plant is compliant. If the plant operates at the maximum allowed SO2 concentration of 2000 mg/Nm3 , the emission rate would be* ***584 t/d*** *of SO2.*

The concentration calculations are incorrect. Respondent's expert does not adjust for moisture in the stack nor reference the measured concentration to a corrected oxygen standard of 10%. The actual baseline average concentrations, when adjusted for moisture and oxygen content are considerably lower, 1,317 mg/Nm^3 and 1,008 mg/Nm^3, the latter just slightly above the upcoming 2025 MES concentration limit. The same conversion errors result in an incorrect calculation of the baseline daily mass emissions at 2,000 mg/Nm^3. The correct baseline loading is 799 t/d, not 459 t/d. And the Just Share attempt to convert from monthly limits to daily maxima is not defensible, for reasons discussed previously. (Note: The correct calculations are included in the tables at the end of Section 8 of this report.)

c) Just Share Comment 67

If the boilers operated at a constant 1000 mg/Nm3 , the emission rates would be 292 t/d of SO2. If the boiler plants complied with the MES SO2 daily limit of 1000 mg/Nm3 , the average emission rates would be about 79% of this value or 229 t/d.

Again, the calculations are incorrect for the reasons stated above. If the boilers operated at 1,000 mg/Nm^3 at the baseline average flows, the average emission loads would be 400 t/d. And it appears the second sentence attempts to quantify the difference between a monthly average limit and a daily average limit by using a value in the 20-30% range discussed in their Comment 66 above, in this case, a factor of 27.5%. Please see discussion above on why this assessment is invalid even under current limits and how it will be increasingly irrelevant as more stringent emission limits become applicable. There is, however, a valid point in this and similar comments regarding the differences between the MES daily limit and the Sasol proposal of monthly mass limits, which I believe could be rolling 12-month limits with equal justification. The legitimate concern, apart from the erroneous estimates of magnitude of difference, is that moving to a longer-term standard raises the possibility of daily excursions which could threaten the NAAQS. This concern can be effectively addressed by maintaining the existing 2,000 mg/Nm^3 limit in conjunction with the longer-term mass-based limit. The existing limit has been demonstrated not to result in daily NAAQS exceedances and the 4% reduction in loading will lower the maximum daily impact if this standard remains in effect.

d) Just Share Comment 68

Emission rates defined as concentration limits are directly proportional to normalised gas flow rates. Gas flow rates are approximately in proportion to the load (production rates). Total emission rates would therefore decline as the load on the boiler plants decline. At the load reductions of 4% by 2025 and "30%" by 2030, mooted by the Appellant (as explained below, even the Appellant's flawed calculations show a 25% and not a 30% load reduction), the MES-compliant emission rates would decrease proportionately. MES-compliant average emission rates will decline from 229 t/d at current loads to 173 t/d at Sasol's "30% load reduction" However, when calculating the scenarios in its AIR, the Appellant erroneously assumes that the MES emissions will remain constant while the load decreases. As a result, its comparative emission estimates reflect incorrectly-inflated emissions for MES compliance.

As an initial point of response, I find that the Appellant's calculations are not flawed; that is a descriptor more appropriately applied to the Just Share figures, a situation which, if not apparent from the above responses, will become clearer as we progress through the issues raised. In discussing percentage reductions, it is critical to define the two terms you are comparing. The Sasol motivation report is crystal clear that the proposal is to deliver a 30 percent reduction from the baseline emissions calculated at the 95th percentile of SO_2. The numbers offered in the proposal are 526 t/d at the 95P baseline and 364 t/d at the final reduction, and that, by my calculation is a reduction of over 30%.

Furthermore, the discussion on MES compliant emission loads is flawed for the same reasons discussed above, i.e., failure to correct for moisture and oxygen content. If the comment meant to quantify the MES compliant emission loads at the baseline average levels used in the application, the emission load would be 400 t/d, not 229. And as to MES compliant emission rates at the 30% reduced load, that would be 301 t/d, not 173. But the very point of the alternative load limit made available under Clause 12A of the MES is to find alternative approaches to achieving compliance. Offering a reduced load AND meeting the MES is not a regulatory requirement and consequently this analysis is meaningless. The last two sentences are difficult to decipher. These comments seem to be suggesting that the AIR should have been conducted to evaluate MES compliant emissions at the 30% load reduction, which would have been favorable to the Appellant and not reflective of the actual ambient impact of the proposed alternative emission limit, truly a bizarre statement.

e) Just Share Comment 69

The Appellant also seeks to be regulated on a monthly average limit basis. This would relieve the Appellant from managing and reporting daily spikes in SO2 emissions, which give rise to short-term excursions in ambient concentrations, with possible adverse health effects that include respiratory mortality and asthma exacerbation. The MES-based regulatory system has an internationally well established system of measuring and monitoring stack concentrations and flow rates, including lists of approved instruments and methods. In contrast, the Appellant's proposal is ill-defined and represents a significant weakening of regulatory control of emissions.

Nowhere in the application for an alternative emission standard does Sasol imply or suggest that it would change any of its existing monitoring or reporting requirements. Those data would be available for regulators to track any potential issues with shorter term emissions. If the concern meant to be expressed here was that a monthly average standard doesn't protect short term NAAQS, that concern is legitimate. However, the dispersion model submitted with the application shows that at the emission limits proposed, Sasol does not cause or contribute to any NAAQS violations. If the short-term NAAQS have been shown to be protected by the worst-case emissions, there is no reason why a longer-term standard is not protective, even up to as long as a running 12-month total limit. And any concerns that a longer-term compliance period would not protect shorter-term NAAQS could be backstopped by including, along with a 30-day or even running 12-month mass-based limit, a daily concentration limit of the current 2,000 mg/Nm^3, a level which dispersion modeling and ambient monitoring, has shown does not cause or contribute to NAAQS violations. Clause 12A would clearly allow for that approach since it provides for alternative emission limit(s) or emission load.

f) Just Share Comment 70

The Appellant, under its load-based SO2 emissions scheme, proposes a limit of 503 t/d from 1 April 2025 to 31 March 2030 and 365 t/d from 1 April 2030 onwards, based on a monthly averaging period. Due to the statistical variability of daily-averaged emissions, these monthly average values would be equivalent to daily average limit values of 634 and 460 t/d respectively. The proposed load-based limit values from April 2025 to 31 March 2025 are therefore 8% higher than the corresponding current AEL 2000 mg/Nm3 value, equivalent to 584 t/d, and 217% higher than the MES 1000 mg/Nm3 limit value, equivalent to 292 t/d at 100% load. Sasol's proposed 365 t/d emission rate, at a nominally 30% (actual 25%) reduction in load from 1 April 2030 onwards is 211% higher than the MES emissions, 173 t/d, at 25% load reduction.

This comment reminds me of my high school calculus professor, Mr. Clauser, who used to say, "There are lies, damn lies, and then there are statistics". Statistics are an important tool of analysis, but they must be grounded in ultimate reality. The daily SO_2 emissions are ultimately limited by the amount of coal that can be burned in the boilers and the sulphur content of the coal. And statistical analysis must be rigidly conducted. Although not quantified in this comment, it appears that the Just Share expert used the earlier erroneous assertion that daily emission limits always exceed monthly limits by 20-30% and then simply inflated the proposed monthly average limits by 26% to arrive at the projected daily emissions. That doesn't pass the straight-faced test for a statistical analysis. Please see my introductory comments on the relationship between shorter-term and longer-term limits.

Consequently, the type of average analysis presented in the Just Share comment is not a valid analytical tool. And to put some real-world empirical data up against the Just Share assertions, the **maximum** daily total emissions that occurred during 2019 were 279.9 tons for the East Stack and 329.7 tons for the West Stack, for a total of 609.6 tons total, considerably less than the Just Share calculation that the **average** daily limit would be 634. And remember this is before any load reductions have occurred. Also importantly, the possibility that both stacks would have the highest daily emissions occurring on the same day is extremely unlikely, which is the very reason Sasol conducted the stochastic analysis to provide a more reasonable estimate of maximum emissions. A review of the 2019 actual emissions data shows that the maximum SO_2 emissions from both stacks was 573 tons. The Just Share analysis is not supported by actual data, even before load reductions occur.

And I hate to keep repeating myself, but errors must be pointed out; the correct daily mass emissions at 2,000 mg/Nm^3 and baseline flows is 799 t/d, not 584, and assuming the 4% reduction proposed by Sasol in the 2025-2030 timeframe that would project a maximum daily loading of both stacks combined of 504 t/d. That is 63% of the current MES, not 8% more, as alleged by Just Share. Similarly, the baseline flows at 1,000 mg/Nm^3 would have a mass loading of 400 t/d, and admittedly, even with the 4% short-term reduction, the SO_2 emissions could, based upon these data, exceed the equivalent MES in that time frame, by a factor of a little over 25%, but clearly not 217% as miscalculated by Just Share.

Finally, the last sentence in this comment is again incorrect. The reduced load proposed by Sasol is indeed 30% as explained above and is proposed as an alternative to meeting the MES as provided for in Clause 12a of the MES. There is no requirement to reduce the load and meet the MES. And just to keep the record straight, if Sasol wanted to reduce the load and meet the MES, their daily load would be 300.7 t/d, not 173. But this comparison is irrelevant to the proposal.

g) Just Share Comment 71 Table 1 A

The 95th percentile value is not an acceptable estimator of maximum expected value as it implies that this value would be exceeded about 18 times per year. The 99th percentile value, with expected 4 exceedances per year, would better approximate the AIR regulatory requirement to use the maximum expected emission rate.

I agree with this comment. Since the annual NAAQS is based on a 99% compliance rate, it makes sense to use the same rate to calculate the projected worst-case emissions and to conduct the dispersion modeling at the 99% expected level. From a compliance standpoint, using the 95% level as the level to establish the equivalent daily loading limit risks non-compliance on 18 days every year. Monthly averaging helps ameliorate this problem, but I still think Just Share is correct on this point. To implement this suggestion, Sasol should be asked to evaluate the ambient impact of the 99-percentile emission rate. If the dispersion model still shows no violations of the NAAQS at that higher level, the mass based equivalent load would represent even greater reductions than Sasol claims in their proposal. That is to say that as far as this issue is concerned, the Sasol proposal is conservative and underestimates the applicable reduction that will be realized by their load reduction. I have included an analysis of that approach in Section 9 of this report "Alternative Analysis at the 99th Percentile of Operations".

h) Just Share Comment 71 Table 1 D

These emission rates are incorrect because they result in stack concentrations 50% in excess of the MES limit. An MES-compliant plant operating at current loads would have maximum and average emission rates of 292 t/d and 229 t/d respectively. Refer to Table 2 below for the relevant calculations. At 15% lower loads, the maximum and average emission MES-compliant rates would be 15% lower, 248 t/d and 195 t/d respectively.

As explained previously, the Just Share expert fails to include moisture and oxygen correction in this analysis. Consequently, the calculation of 292 t/d is in error. The correct calculation shows the mass loading at the P95 flow of 449 t/d. The mass loading is the same at average flows since Sasol used the conservative assumption of the P95 SO_2 emission rate in g/sec for both the P95 flow and the average flow. Thus, the emission rate remains the same with either average or maximum flow and only the concentration changes, as shown in the table below.

Table 8.h-1

Mass Emissions and Stack Concentration for Scenario 2

Stack	Average (Avg. flows, P95 SO2)		Maximum (P95 flows, P95 SO2)	
	Mass Rate (t/d)	Conc. (mg/Nm^3) @10% O_2	Mass Rate (t/d)	Conc. (mg/Nm^3) @10% O_2
B1	209	1153	210	997
B2	239	1097	239	1000
Total	449		449	

These data show that the facility, with P95 flows, complies with the MES standard under Scenario 2, which is being used to establish what the equivalent mass loading would be for the alternative standard.

And again, I'm not sure of the point of the discussion of reduced loads and MES compliant equivalent limits (again incorrectly calculated). If the boilers are shut down completely (100% reduced loads), the equivalent mass limit would be zero; but what's the point? And if the intent was to assess the mass-based limits at the 30% reduction (not 25%) proposed by Sasol, that issue was addressed previously – there is no regulatory justification for requiring MES compliance and reducing loads.

i) Just Share Comment 71 Table 1 E

The stack gas flow rate (the load), Scenario 3 was reduced by 25%, not 30%. At 25% lower loads, the maximum and average emission MES-compliant rates would be 25% lower, 219 t/d and 173 t/d respectively.

It is correct that the flows that the Just Share expert thinks are the correct flows are in fact reduced by 25% from the baseline 2,537 Nm^3/sec. vs. 3,370 Nm^3/sec. However, the corrected flows which are the flows used for comparison to compliance with the MES standard are in fact reduced by 30%, 4,217 Nm^3/sec. vs. 6,092 Nm^3/sec. And to be clear, the Sasol proposal was to reduce the emissions load by 30%, not the total flows, although in practice, that is how they propose to achieve the emission load reduction. The 219 t/d is incorrect, the correct value is the 364 t/d shown in the corrected table below and Just Share's average emission calculation is not defensible for reasons cited previously.

j) Just Share Comment 72 – (their Table 2)

All the calculations to the right of the column labeled "flow Am^3/s" are incorrect with substantial errors due to the failure to correct for oxygen concentration.

Just Share Table 2, with my comments is included below, followed by a corrected Table 2 using average flows and a second corrected Table 2 using P95 flows.

Table 2: Calculation[21] of stack SO_2 concentrations for Sasol AIR scenarios

Sasol AIR scenarios	Stack	Temperature (^oC)	Stack tip diameter, m	Exit velocity, m/s	Volumetric flow rate, Am^3/s	Volumetric flow rate, Nm^3/s	SO_2 emissions (g/s)	SO_2 emissions, t/d	Stack concentrations, mg/Nm^3	SO_2 emissions relative to Baseline- average
Baseline-95th percentile	B1 (MSW)	168	13,6	20,9	3036	1550	3197	276	2063	
	B2 (MSE)	176	14,4	22,3	3632	1821	2895	250	1590	
				TOTALS-->		**3370**	**6092**	**526**	**1808**	115%
Baseline-average	B1 (MSW)	168	13,6	20,9	3036	1550	2766	239	1785	
	B2 (MSE)	176	14,4	22,3	3632	1821	2547	220	1399	
				TOTALS-->		**3370**	**5313**	**459**	**1576**	100%
Scenario 1: Interim load, 4% reduced load, 95th percentile	B1 (MSW)	168	13,6	20,9	3036	1550	3211	277	2072	
	B2 (MSE)	176	14,4	22,3	3632	1821	2621	226	1440	
				TOTALS-->		**3370**	**5832**	**504**	**1731**	110%
Scenario 2: "Compliance with MES, at 1000 mg/Nm^3, 15% reduced"	B1 (MSW)	168	13,6	20,9	3036	1550	2421	209	**1562**	
	B2 (MSE)	176	14,4	22,3	3632	1821	2771	239	**1522**	
				TOTALS-->		**3370**	**5192**	**449**	**1541**	
Scenario 3: Load based, 30% load reduction	B1 (MSW)	**162**	13,6	**14,6**	2121	1097	2164	187	1972	
	B2 (MSE)	**170**	14,4	**17,4**	2834	1440	2053	177	1426	
				TOTALS-->		**2537**	**4218**	**364**	**1662**	79%

(Site barometric pressure: 83,5 kPa.a)

These flow calculations fail to account for moisture in the stack and correction for oxygen. The MES specifies O2 at 10, dry flow, and correction to C + 273.

The correct stack velocity for the 4% reduced load is 21.1 m/s

This is incorrect, it should be 105%, using the erroneous flow calculations.

73 The stack concentrations for the Appellant's "Compliance with MES" scenario, corresponding to an emission rate of 449 t/d, are more than 1500 mg/Nm^3, **clearly not compliant with a 1000 mg/Nm^3 limit value.**

74 Table 3 below (also included in Annexure 3) summarises the calculation of stack SO_2 concentrations for AEL and MES-compliant scenarios.

Initial/s:

Table 2: Calculation of stack SO_2 concentrations for Sasol AIR scenarios - ***Corrected, Average Flows***

Sasol AIR scenarios	Stack	T (°C)	Stack dia. (m)	Exit vel. (m/s)	Flow Am^3/s	Flow Nm^3/s (wet)[1]	H_2O (%)	Flow Nm^3/s (dry)	O_2 (%) (dry)	[2]Flow Nm^3/s 10% O_2	SO_2 (g/s)	SO_2 t/d	Stack conc. mg/Nm^3	% Baseline
Baseline-95th percentile														
B1 (MSW)		168	13.6	20.9	3036	1549	7%	1441	5.01	2,100	3197	276	1522	
B2 (MSE)		176	14.4	22.3	3632	1820	5%	1729	4.98	2,526	2895	250	1146	
						3369				-	**6092**	**526**	**1317**	115%
Baseline -average														
B1 (MSW)		168	13.6	20.9	3036	1549	7%	1441	5.01	2,100	2766	239	1317	
B2 (MSE)		176	14.4	22.3	3632	1820	5%	1729	4.98	2,526	2547	220	1008	
						3369				-	**5313**	**459**	**1149**	**100%**
Scenario 1: 4% reduced load														
B1 (MSW)		168	13.6	20.9	3036	1549	7%	1441	5.01	2,100	3211	277	1529	
B2 (MSE)		176	14.4	21.1	3436	1722	5%	1636	4.98	2,390	2621	226	1097	
						3271				-	**5832**	**504**	**1299**	113%
Scenario 2: Compliance with MES at 1000 mg/Nm^3										-				
B1 (MSW)		168	13.6	20.9	3036	1549	7%	1441	5.01	2,100	2421	209	1153	
B2 (MSE)		176	14.4	22.3	3632	1820	5%	1729	4.98	2,526	2771	239	1097	
						3369				-	**5192**	**449**	**1122**	
Scenario 3: Load based, 30% load reduction														
B1 (MSW)		**162**	13.6	14.6	2121	1097	7%	1020	5.01	1,487	2164	187	1455	
B2 (MSE)		**170**	14.4	17.4	2834	1439	5%	1367	4.98	1,997	2053	177	1028	
						2537					**4217**	**364**	**1210**	105%

Site barometric pressure: 83.5 kPa

[1] Actual volumetric flow rate (Am3/s) = (stack area x exit velocity)

2Normalised volumetric flow rate (Nm^3/s) = (Am3/s)x(273/(273+exit temperature, °C)x(barometric pressure/101.3)x(1-%H_2O)x $(20.9-O_2)/(20.9-10)$

Stack concentrations = emission rate (g/s)/(Nm3/s)

Table 2: Calcula ti on of stack SO_2 concentra ti ons for Sasol AIR scenarios - ***Corrected, P95 Flows***

Sasol AIR scenarios	Stack	T (°C)	Stack dia. (m)	Exit vel. (m/s)	Flow Am^3/s	Flow Nm^3/s (wet)[1]	H_2O (%)	Flow Nm^3/s (dry)	O_2 (%) (dry)	[2]Flow Nm^3/s 10% O_2	SO_2 (g/s)	SO_2 t/d	**Stack conc. mg/Nm^3**	% Baseline
Baseline-95th percentile														
B1 (MSW)		168	13.6	20.9	3036	1549	7%	1441	5.01	2,100	3197	276	1522	
B2 (MSE)		176	14.4	22.3	3632	1820	5%	1729	4.98	2,526	2895	250	1146	
						3369				4,626	**6092**	**526**	**1317**	115%
Baseline -average														
B1 (MSW)		168	13.6	20.9	3036	1549	7%	1441	5.01	2,100	2766	239	1317	
B2 (MSE)		176	14.4	22.3	3632	1820	5%	1729	4.98	2,526	2547	220	1008	
						3369				4,626	**5313**	**459**	**1149**	**100%**
Scenario 1: 4% reduced load														
B1 (MSW)		168	13.6	20.9	3036	1549	7%	1441	5.01	2,100	3211	277	1529	
B2 (MSE)		176	14.4	21.1	3436	1722	5%	1636	4.98	2,390	2621	226	1097	
						3271				4,490	**5832**	**504**	**1299**	113%
Scenario 2: Compliance with MES at 1000 mg/Nm^3										-				
B1 (MSW)								1665	5.01	2,427	2421	209	**997**	
B2 (MSE)								1897	4.98	2,771	2771	239	**1000**	
										-	**5192**	**449**	999	
Scenario 3: Load based, 30% load reduction														
B1 (MSW)		**162**	13.6	14.6	2121	1097	7%	1020	5.01	1,487	2164	187	1455	
B2 (MSE)		**170**	14.4	17.4	2834	1439	5%	1367	4.98	1,997	2053	177	1028	
						2537				**3485**	**4217**	**364**	**1210**	105%

Site barometric pressure: 83.5 kPa

[1] Actual volumetric flow rate (Am3/s) = (stack area x exit velocity)

2Normalised volumetric flow rate (Nm^3/s) = (Am3/s)x(273/(273+exit temperature, °C)x(barometric pressure/101.3)x(1-%H_2O)x ($20.9-O_2$)/(20.9-10)

Stack concentrations = emission rate (g/s)/(Nm3/s)

k) Just Share Comment 73

The stack concentrations for the Appellant's "Compliance with MES" scenario, corresponding to an emission rate of 449 t/d, are more than 1500 mg/Nm3 , clearly not compliant with a 1000 mg/Nm3 limit value.

As explained above, the MES Compliant Scenario used average flows to model ambient impacts since use of the P95 flows would have improperly diluted the average ambient impact. Using average flows, the concentrations are 1,153 mg/Nm^3 for the west stack and 1,097 mg/Nm^3 for the east stack, both over the MES but not by over 50% as alleged by Just Share.

But more importantly, the point of the calculation of the alternative load-based emission limit was to evaluate the emission load that Sasol would emit at the 95^{th} percentile SO_2 concentration and the 95^{th} percentile flow, and in that scenario the stack concentrations are 997 mg/Nm^3 for the west stack and exactly 1,000 mg/Nm^3 for the east stack.

l) Just Share Comment 74 – (their Table 3)

All the calculations to the right of the column labeled "Volumetric flow rate, Am^3/s" are incorrect with substantial errors due to the failure to correct for oxygen concentration.

Besides the usual computational errors, the Just Share Table 3 also suffers from flaws in logic. It is difficult to determine what they are trying to show in their analyses. Table 3 calculates stack concentrations and daily emission loads for four different scenarios. Then, for three of those scenarios, it compares the results with the baseline average emissions presented by Sasol in their alternative emission limit proposal. It is difficult to understand the relevance of an upcoming requirement being compared to an existing requirement from a regulatory standpoint. If the intent was simply to show general relationships between past actual emissions and future required emissions, there may be some general value in that analysis, but it has no regulatory applicability.

To properly review what Just Share intended to present, it is first necessary to correct the errors in their analyses. I have included, below, the Just Share spreadsheet with my comments and then I include a spreadsheet replicating the same analysis Just Share intended to do, but with corrected data.

Table 3: Calculation of stack SO_2 concentrations for AEL and MES- compliant scenarios

AEL compliant scenario	Stack	Temperature (°C)	Stack tip diameter, m	Exit velocity, m/s	Volumetric flow rate, Am^3/s	Volumetric flow rate, Nm^3/s	SO_2 emissions (g/s)	SO_2 emissions, t/d	**Stack concentrations, mg/Nm³**	SO_2 emissions relative to Baseline- average
At AEL limit of 2000 mg/Nm³, current load	B1 (MSW)	168	13,6	20,9	3036	1550	3099	268	2000	
2000	B2 (MSE)	176	14,4	22,3	3632	1821	3641	315	2000	
			TOTALS-->			**3370**	**6740**	**582**	**2000**	
MES compliant scenarios	Stack	Temperature (°C)	Stack tip diameter, m	Exit velocity, m/s	Volumetric flow rate, Am^3/s	Volumetric flow rate, Nm^3/s	SO_2 emissions (g/s)	SO_2 emissions, t/d	**Stack concentrations, mg/Nm³**	SO_2 emissions relative to Baseline- average
MES, 1000 mg/Nm³ limit, current load	B1 (MSW)	168	13,6	20,9	3036	1550	1550	134	1000	56%
1000	B2 (MSE)	176	14,4	22,3	3632	1821	1821	157	1000	71%
			TOTALS-->			**3370**	**3370**	**291**	**1000**	63%
MES compliant, **average** concentrations, current load	B1 (MSW)	168	13,6	20,9	3036	1550	1218	105	786	44%
1000	B2 (MSE)	176	14,4	22,3	3632	1821	1431	124	786	56%
			TOTALS-->			**3370**	**2649**	**229**	**786**	50%
MES compliant @1000 mg/Nm³ limit, 75% load, **average** emissions	B1 (MSW)	162	13,6	14,6	2121	1097	863	75	786	31%
1000	B2 (MSE)	170	14,4	17,4	2834	1440	1132	98	786	44%
			TOTALS-->			**2537**	**1994**	**172**	**786**	38%

These Flow Calculations fail to account for moisture in the stack and correction for O2 AT 10%.

This calculation is irrelevant since it attempts to calculate the stack concentration and load with both a 30% (not 25%) load reduction and MES limits and additionally uses unsubstantiated estimates to convert from monthly limits to daily limits.

75 This analysis makes clear that the **Appellant's claims that its proposed load-based regulatory scheme would somehow result in a long-term net reduction in SO_2 emissions compared to MES compliance is not correct. All of the Appellant's future reduced load emissions scenarios result in t/d emissions that are about twice those of corresponding MES-compliant scenarios**.

76 The assertion that the Appellant is offering a better SO_2 emission reduction measure compared with MES compliance, at any time in the future, is strongly disputed.

[21] Actual volumetric flow rate (Am^3/s) = (stack area x exit velocity); normalised volumetric flow rate (Nm^3/s) = (Am3/s)x(273,15/(273,15+exit temperature, °C)x(101,3/barometric pressure). Stack concentrations = emission rate (g/s)/(Nm^3/s)

24 Initial/s:

Table 3: Calcula ti on of stack SO_2 concentra ti ons for AEL and MES- compliant scenarios

AEL compliant scenario / Stack	T (°C)	Stack dia. (m)	Exit vel. (m/s)	Flow Am^3/s	Flow Nm^3/s (wet)[1]	H_2O (%)	Flow Nm^3/s (dry)	O_2 (%) (dry)	[2]Flow Nm^3/s 10% O_2	SO_2 (g/s)	SO_2 t/d	**Stack conc. mg/Nm^3**	SO_2 % Baseline
At AEL limit of 2000 mg/Nm3													
current load													
B1 (MSW)	168	13.6	20.9	3036	1549	7%	1441	5.01	2,100	4201	363	2000	
B2 (MSE)	176	14.4	22.3	3632	1820	5%	1729	4.98	2,526	5051	436	2000	
					3369				-	**9252**	**799**	**2000**	
MES, 1000 $mg/Nm^{3, current}$													
current load													
B1 (MSW)	168	13.6	20.9	3036	1549	7%	1441	5.01	2,100	2100	181	1000	76%
B2 (MSE)	176	14.4	22.3	3632	1820	5%	1729	4.98	2,526	2526	218	1000	99%
					3369				-	**4626**	**400**	**1000**	87%
MES Compliant													
Average													
B1 (MSW)	168	13.6	20.9	3036	1549	7%	1441	5.01	2,100	1701	147	810	62%
B2 (MSE)	176	14.4	21.1	3436	1722	5%	1636	4.98	2,390	1344	116	562	53%
					3271				-	**3045**	**263**	**678**	57%
Scenario 2: Compliance with MES at 1000 mg/Nm^3									-				
B1 (MSW)	168	13.6	20.9	3036	1549	7%	1441	5.01	2,100	2421	209	1153	
B2 (MSE)	176	14.4	22.3	3632	1820	5%	1729	4.98	2,526	2771	239	1097	
					3369				-	**5192**	**449**	**1122**	
Scenario 3: Load based, 30% load reduction													
B1 (MSW)	**162**	13.6	14.6	2121	1097	7%	1020	5.01	1,487	2164	187	1455	
B2 (MSE)	**170**	14.4	17.4	2834	1439	5%	1367	4.98	1,997	2053	177	1028	
					2537					**4217**	**364**	**1210**	121%

Site barometric pressure: 83.5 kPa

[1] Actual volumetric flow rate (Am3/s) = (stack area x exit velocity)

2Normalised volumetric flow rate (Nm^3/s) = (Am3/s)x273/(273+exit temperature, °C)x(barometric pressure/101.3)x(1-%H_2O)x ($20.9-O_2$)/(20.9-10)

Stack concentrations = emission rate (g/s)/(Nm^3/s)

The first calculation attempts to show the current daily emissions limit at the existing MES of 2,000 mg/Nm^3 at the average air flows used in the dispersion model. The correct daily mass load for that scenario is 799 t/d, not 582 as reported by Just Share.

The second scenario in Table 3 attempts to calculate what those same emissions would be at 1,000 mg/Nm^3. Unsurprisingly, when you cut the concentration in half, the mass emissions are also cut in half for the same flows. So, while this calculation is trivial, the correct answer is 400 t/d, not 291.

The third scenario appears to be attempting to calculate what the average loading would be over multiple days if the maximum day operated at the MES limit. Here Just Share uses a factor of 78.5%, which is in the range they quoted in their Comment 66 and which I argued in my opening comments, may be reflective of average operation when the MES is 2,000 mg/Nm^3, but is not necessarily applicable to increasingly more stringent emission limits going forward. Nevertheless, I present Just Shares' argument, correcting the flows and rather than the 78.5%, using the actual ratios that were observed in the 2019 baseline period, 79% for the east stack and 81% for the west stack.

That analysis shows that the average concentrations at an MES of 1,000 mg/Nm^3, assuming the same relationship between average monthly concentration and maximum daily concentration (which in my opinion is not a valid assumption, see opening comments) would result in average concentrations about 57% of the standard and average daily loads around 263 t/d. Just Share then compares these numbers to the average baseline values. Not surprisingly, this shows that when the MES concentration is reduced by 50%, the actual emission reduction from baseline is in the same ballpark. The reason it is above 50% is simply because, as Just Share accurately observes, facilities do not operate at their maximum emissions limit every hour they are operational.

Just Share's final scenario was discussed earlier. It is the scenario where the boilers operate at 1,000 mg/Nm^3 and also reduce load by 25%. There is no basis for even considering this scenario from a regulatory perspective. Sasol may comply with the regulations by either meeting the MES or proposing, and by complying with an alternative emission limit or emission load granted by the National Air Quality Office, they need not do both.

Since the final scenario is meaningless, I did not do the flow corrections I have presented with the other scenarios.

m) Just Share Comment 75

This analysis makes clear that the Appellant's claims that its proposed load-based regulatory scheme would somehow result in a long-term net reduction in SO2 emissions compared to MES compliance is not correct. All of the Appellant's future reduced load emissions scenarios result in t/d emissions that are about twice those of corresponding MES-compliant scenarios

A review of the corrected tables above will show that this assertion is simply not true. The 30% load reduction will result in a daily emission load of 365 t/d, compared to the MES compliant load without any load reduction of 449 t/d, this is a reduction of 19% and a reduction of 30.6% from the baseline 95th percentile emissions.

n) Just Share Comment 76

The assertion that the Appellant is offering a better SO2 emission reduction measure compared with MES compliance, at any time in the future, is strongly disputed.

Just Share is free to dispute whatever they wish to dispute, and however strongly, but facts matter, and using correct calculations shows that this position is not based on facts.

9. Alternative Analysis at the 99th Percentile of Operations

Just share argues that the analysis should have been conducted at the 99th percentile of emissions rather than the 95th percentile, and their position is buttressed by the fact that the NAAQS is based on a 99% compliance rate. Their argument that there needs to be a correspondence between the NAAQS statistic and the statistic used to calculate the Sasol emissions is sound. If Sasol could demonstrate, through a revised dispersion model, that emissions at that level would not cause violations of the NAAQS, the argument in favor of Sasol's proposed alternative emission limits would be even stronger.

The Sasol proposal is thus, in my opinion, a conservative analysis. The issue goes back to the concept of "air resource" that was discussed earlier in this report. In the field of air pollution control, one often comes across licensed facilities that have license emission limits far above what they ever emit. This makes air quality planning very difficult since these sources are not impacting ambient measurements at the limits at which they are lawfully allowed to operate.

One method of addressing this issue is to require, when certain modifications are made and license revisions are needed, an evaluation of the levels at which the source has demonstrated actual operation. This concept is called "capable-of-accommodating", and it requires a facility to demonstrate it has operated at the levels authorized by their license. In the case of the Secunda boilers, the 99th percentile flows from the two boiler stacks are

7,931,631 Nm^3/hr for the West Stack and 6,077,105 Nm^3/hr for the East Stack. That demonstrates that Sasol has shown they are capable of accommodating operations at that level. When those flows are corrected to 10% oxygen, in accordance with the standard, the current emission limit of 2,000 mg/Nm^3 results in actual P99 baseline emissions that equate to 278 t/d for the west stack and 212 t/d for the east stack for a total of 490 t/d. If Sasol commits to meeting the same reduced mass-based limits in their proposal based on their P95 analysis, the evaluation is even more favorable to allowing the alternative emission limit. Under that scenario, Sasol has offered 277 t/d for the west stack (a ton lower than the MES based mass loading) and 226 t/d for the east stack for a total of a mass-based limit of 503 t/d. This is a value only 2.85% above the MES equivalent rate starting in 2025. The analysis starting in 2030 is even more favorable with Sasol proposing a 365 t/d limit, which is less than 75% of the MES equivalent in the P99 calculation. In terms of daily mass loadings, Sasol would have an excess of 13 t/d in the 2025-2030 compliance period but then would start mitigating those excess emissions at the rate of 125 t/d in 2030, nearly an order of magnitude above the excess in the 2025-2030 compliance period. A graphical comparison of the differences between the conservative P95 analysis proposed by Sasol and the P99 analysis, which comports with the NAAQS, is shown in the tables on the next page.

Figure 9-1

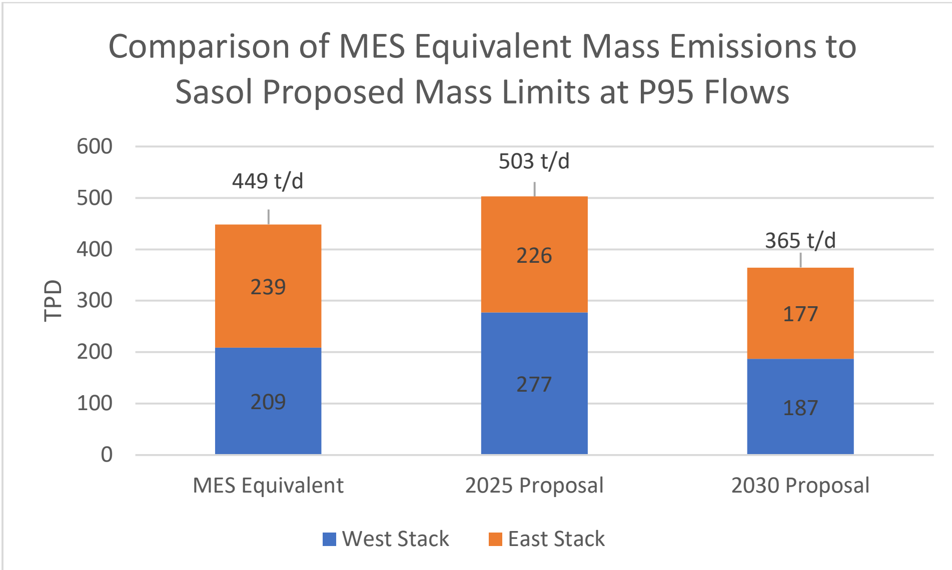
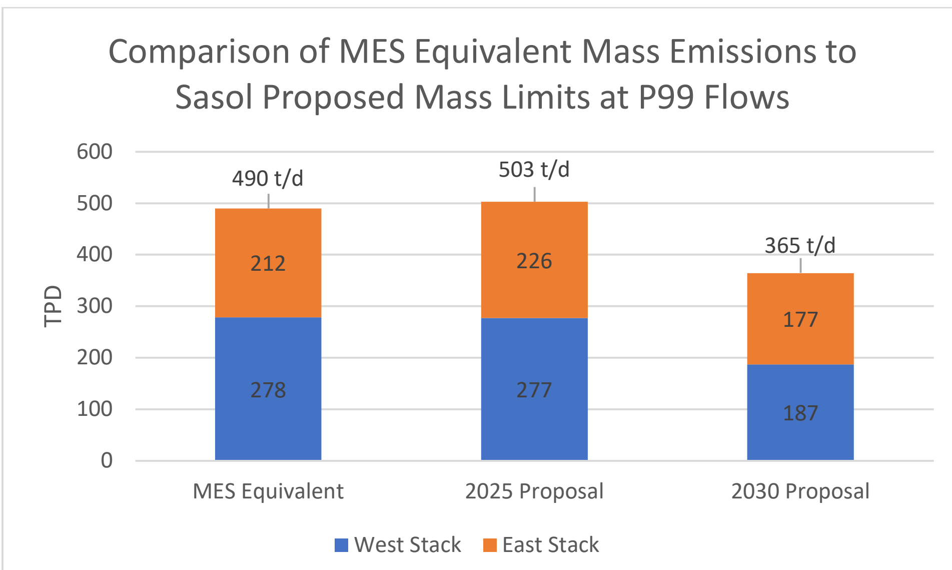


Figure 9-2



10. Conclusion

In my professional opinion, the Sasol Proposal for alternative mass-based SO_2 emission limits for the Secunda coal-fired boilers was conservatively prepared using a P95 analysis and, under that assumption, accurately reflects the differences between meeting the MES concentration limit, and the mass-based limits in their 4% and 30% curtailment models.

Mass-based limits are practically enforceable and superior to concentration limits in environmental protection because they relate more directly to environmental burden than do concentration limits and are more transparent to the impacted community.

Decision makers may ponder the relative merits of the reductions offered by Sasol along with the time frames in which they are proposed, with assurances that public health is protected regardless of the decision made. In making a final decision, it should be remembered that the 2030 scenario proposed by Sasol is a more beneficial compliance method than would be the MES at full load because the environmental burden is less under this scenario.

Additionally, and assuming Sasol can demonstrate that P99 operations do not cause NAAQS violations, decision makers should review Section 9 above to evaluate the small excess Sasol is requesting in the near term under that analysis, compared to the large reductions starting in 2030.

Moving to a monthly or an annual mass-based limit represents no disadvantage to environmental quality provided that any 12A alternative load-based emission limit approved also maintains the current MES of 2,000 mg/Nm³ on a 24-hour basis as an additional requirement to any mass-based limit authorized.

The Just Share technical comments regarding calculations of concentrations and equivalent t/d limits should be thoroughly disregarded due to the major analytical errors discussed previously.

Respectively Submitted,

10/03/2023

Fred P. Osman, BCEE

President, Osman Environmental Solutions, LLC

Appendix A

Examples of Permits that Contain Mass- Based Limits

SECTION E. Source Group Restrictions.

Group Name: SG01

Group Description: Overhead Line

Sources included in this group

ID	Name
031	SPACE HEATERS/OVENS
102	SPRAY BOOTH 1 (#2/#3)
103	SPRAY BOOTH 2 (#4/#5)
104	SPRAY BOOTH 3 (#6/#7)
105	SPRAY BOOTH 4 (#8/#9)
106	PARTS SPRAY BOOTH 5 (#10)
107	UV FLAT LINE
110	CLEAN-UP SOLVENTS
112	PRE-STAIN SPRAY BOOTH 6 (#1)
114	OFFLINE SPRAY BOOTH (#11/#12)
115	FLAT LINE BOOTHS
116	FRAME EDGING OFF BOOTH

I. RESTRICTIONS.

Emission Restriction(s).

 # 001 [25 Pa. Code §127.441]

Operating permit terms and conditions.

The VOC emissions from the above source group shall not exceed 225 tons per year, based on any consecutive 12-month rolling period.

 # 002 [25 Pa. Code §127.441]

Operating permit terms and conditions.

The permittee shall not permit the emission into the outdoor atmosphere of particulate matter from the spray booths, at any time, in a manner that the concentration of particulate matter in the effluent gas exceeds 0.02 grains per dry standard cubic foot.

II. TESTING REQUIREMENTS.

No additional testing requirements exist except as provided in other sections of this permit including Section B (Title V General Requirements).

III. MONITORING REQUIREMENTS.

No additional monitoring requirements exist except as provided in other sections of this permit including Section B (Title V General Requirements).

IV. RECORDKEEPING REQUIREMENTS.

 # 003 [25 Pa. Code §127.511]

Monitoring and related recordkeeping and reporting requirements.

The permittee shall maintain records of all EPA Method 24 certification testing performed for the most recent five year period. These records shall be made available to the Department representatives upon request.

V. REPORTING REQUIREMENTS.

 # 004 [25 Pa. Code §127.441]

Operating permit terms and conditions.

Annual VOC emission reports shall be submitted to the Department's Air Quality District Supervisor. The report for January 1 through December 31 is due no later than March 1 of the following year for each operating year authorized by the operating permit or its renewal. Each report shall include the following information:

SECTION C. Site Level Plan Approval Requirements

 # 006 [25 Pa. Code §127.12b]
Plan approval terms and conditions.
The permitte shall limit the facility Volatile Organic Compound (VOC) and Hazardous Air Pollutants(HAPs) emissions at the following quantities, based on a 12-month rolling total:

(a) VOC less than 50 tons
(b) Any single HAP less than 10 tons
(c) Total HAPs less than 25 tons

 # 007 [25 Pa. Code §129.14]
Open burning operations
(a) No person shall conduct the open burning of materials in such a manner that:

(1) The emissions are visible, at any time, at the point such emissions pass outside the property of the person on whose land the open burning is being conducted.

(2) Malodorous air contaminants from the open burning are detectable outside the property of the person on whose land the open burning is being conducted.

(3) The emissions interfere with the reasonable enjoyment of life and property.

(4) The emissions cause damage to vegetation or property.

(5) The emissions are or may be deleterious to human or animal health.

(b) The requirements of Section (a), above, do not apply when the open burning operations result from:

(1) A fire set to prevent or abate a fire hazard, when approved by the Department and set by or under the supervision of a public officer.

(2) A fire set for the purpose of instructing personnel in fire fighting, when approved by the Department.

(3) A fire set for the prevention and control of disease or pests, when approved by the Department.

(4) A fire set solely for recreational or ceremonial purposes.

(5) A fire set solely for cooking food.

(c) This permit does not constitute authorization to burn solid waste pursuant to Section 610 (3) of the Solid Waste Management Act, 35 P.S. Section 6018.610 (3), or any other provision of the Solid Waste Management Act.

II. TESTING REQUIREMENTS.

 # 008 [25 Pa. Code §127.12b]
Plan approval terms and conditions.
The Department reserves the right to require exhaust stack testing of the sources as necessary during the permit term to verify emissions for purposes including emission fees, malfunctions or permit condition violations.

 # 009 [25 Pa. Code §139.1]
Sampling facilities.
Upon request of the Department, the person responsible for a source shall provide adequate sampling ports, safe sampling platforms and adequate utilities for the performance by the Department of tests on such sources. The Department will set forth, in the request, the time period in which the facilities shall be provided as well as the specifications for such facilities.

SO_2 Emissions	Averaging Period
0.60 lb/mmBtu[1] *	30-day Rolling Average
2,206.5 Tons	365-Day Rolling Average

[1] Based on the maximum allowable 30-Day Rolling Average given under the "National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units – Subcategory of Certain Existing Electric Utility Steam Generating Units Firing Eastern Bituminous Coal Refuse for Emissions of Acid Gas Hazardous Air Pollutants"

[45CSR14, R14-0005, A.1.a., A.1.b., B.1., B.2., B.6.and B.8.; 45CSR§2-4.1.a.; 45CSR16; 40 CFR §60.42Da(a); 40 CFR §63.9991(a)(1), Table 2, Item #7.b.]

4.1.4. The aggregate sulfur dioxide reduction efficiency of the two (2) circulating fluidized bed boilers shall be as follows for each operating 24-hour period:

24-hour Potential Uncontrolled SO_2 Emission Rate (lb/MMBTU)	**Reduction Efficiency Required (%)**
15.96	96.24
6.0or less	90.0

The required SO_2 reduction efficiency for each 24 hour period in which the uncontrolled SO_2 emission rate falls between 6.0 lb/MMBTU and 15.96 lb/MMBTU shall be determined by linear interpolation.

For 40 CFR §60.43Da(j)(3)(iii), the 10 percent of the potential combustion concentration (90 percent reduction) is on a 30-day rolling average basis. Compliance with applicable SO_2 percentage reduction requirements is determined based on the "as fired" total potential emissions and the total outlet SO_2 emissions for the 30 successive boiler operating days.

[45CSR14, R14-0005, A.1.c., B.1., and B.6.; 45CSR16; 40 CFR §§60.43Da(j)(3)(iii) and–60.48Da(e); 45CSR34]

4.1.5. The addition of sulfur oxides to a combustion unit exit gas stream for the purpose of improving emissions control equipment efficiency is prohibited unless written approval for such addition is provided by the Director.
[45CSR14, R14-0005, B.1. and B.2.; 45CSR§2-4.4.]

4.1.6. The visible emission standards of condition 4.1.1. shall apply at all times except in periods of start-ups, shutdowns, and malfunctions. Where the Director believes that start-ups and shutdowns are excessive in duration and/or frequency, the Director may require an owner or operator to provide a written report demonstrating that such frequent start-ups and shutdowns are necessary.
[45CSR14, R14-0005, B.1. and B2.; 45CSR§2-9.1.]

4.1.7. Any fuel burning unit(s) including associated air pollution control equipment, shall at all times, including periods of start-up, shutdowns, and malfunctions, to the extent practicable, be maintained and operated in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Director which may include, but is not limited to, monitoring results, visible emission observations, review of operating and maintenance procedures and inspection of the source.
[45CSR14, R14-0005, B.1. and B.2.; 45CSR§2-9.2.; 45CSR16; 40 CFR §60.11(d)]

SECTION C. Site Level Requirements

(1) When the presence of uncombined water is the only reason for failure of the emission to meet the limitations.
(2) When the emission results from the operation of equipment used solely to train and test persons in observing the opacity of visible emissions.
(3) When the emission results from sources specified in § 123.1(a)(1) -- (9) (relating to prohibition of certain fugitive emissions).
(4) When arising from the production of agricultural commodities in their unmanufactured state on the premises of the farm operation.

 # 006 [25 Pa. Code §127.512]
Operating permit terms and conditions.

(a) The total facility emission limit for each of the following pollutants shall not be exceeded in any 12 - consecutive month period (12 month rolling sum):

(1) 1,454.0 tons per year of carbon monoxide
(2) 1,500.0 tons per year of nitrogen oxides
(3) 2,592.0 tons per year of sulfur dioxides
(4) 54.0 tons per year of non-methane hydrocarbons
(5) 415.0 tons per year of particulates, 10 microns and smaller
(6) 751.0 tons per year of particulates.
(7) 49.0 tons per year of VOC's.

 # 007 [40 CFR Part 63 NESHAPS for Source Categories §40 CFR 63.1340]
Subpart LLL -- National Emission Standards for Hazardous Air Pollutants From the Portland Cement Manufacturing Industry
What parts of my plant does this subpart cover?

(a) The provisions of this subpart apply to each new and existing portland cement plant which is a major source or an area source as defined in § 63.2.

(b) The affected sources subject to this subpart are:
(1) Each kiln including alkali bypasses and inline coal mills, except for kilns that burn hazardous waste and are subject to and regulated under subpart EEE of this part;
(i) Source ID No. 102 and 122.
(2) Each clinker cooler at any portland cement plant;
(i) Source ID No. 113 and 125.
(3) Each raw mill at any portland cement plant;
(i) Source ID. No. 118
(4) Each finish mill at any portland cement plant;
(i) Source ID No. 103, 104, 123, 124, 127, 128, and 129.
(5) Each raw material dryer at any portland cement plant;
(i) Source ID No. NA
(6) Each raw material, clinker, or finished product storage bin at any portland cement plant that is a major source;
(i) Source ID No. 108,114, 119, 120, 121, 126, 136, 137,139, 140, 141, 148, 149, 150, and 153.
(7) Each conveying system transfer point including those associated with coal preparation used to convey coal from the mill to the kiln at any portland cement plant that is a major source;
(i) Source ID No. 116, 117, 142, 143, 144, 145, 146, 147.
(8) Each bagging and bulk loading and unloading system at any portland cement plant that is a major source;
(i) Source ID No. 130, 131, 132, 133, 159, 160, 161 and 162.
(9) Each open clinker storage pile at any portland cement plant.

(c) Onsite sources that are subject to standards for nonmetallic mineral processing plants in subpart OOO, part 60 of this chapter are not subject to this subpart. Crushers are not covered by this subpart regardless of their location.
(i) Source ID No. NA

SECTION C. Site Level Requirements

 # 006 [25 Pa. Code §127.441]

Operating permit terms and conditions.

[Additional authority for part (a) of this permit condition is also derived from Plan Approval No. 67-05042]

The permittee shall limit the facility's annual emissions to less than the following thresholds during any consecutive 12-month period:

(a) 100 tons per year (TPY) of nitrogen oxides (NOx).
(b) 100 TPY of carbon monoxide (CO).
(c) 50 TPY of volatile organic compounds (VOC).
(d) 100 TPY of sulfur oxides (SOx).
(e) 100 TPY of PM-10 (particulate matter having an effective aerodynamic diameter less than or equal to a nominal 10 micron body).
(f) 100 TPY of PM-2.5 (particulate matter having an effective aerodynamic diameter less than or equal to a nominal 2.5 micron body).
(g) 10 TPY of any individual hazardous air pollutant (HAP).
(h) 25 TPY of aggregate HAPs.

 # 007 [25 Pa. Code §129.14]

Open burning operations

(a) The permittee shall not allow the open burning of material on the permittee's property in a manner such that:

(1) The emissions are visible, at any time, at the point such emissions pass outside the permittee's property.

(2) Malodorous air contaminants from the open burning are detectable outside the permittee's property.

(3) The emissions interfere with the reasonable enjoyment of life or property.

(4) The emissions cause damage to vegetation or property.

(5) The emissions are or may be deleterious to human or animal health.

(b) The requirements of part (a), above, do not apply when the open burning operations result from:

(1) A fire set to prevent or abate a fire hazard, when approved by the Department and set by or under the supervision of a public officer.

(2) A fire set for the purpose of instructing personnel in fire fighting, when approved by the Department.

(3) A fire set for the prevention and control of disease or pests, when approved by the Department.

(4) A fire set solely for recreational or ceremonial purposes.

(5) A fire set solely for cooking food.

(c) This plan approval condition does not constitute authorization to burn solid waste pursuant to Section 610(3) of the Solid Waste Management Act (SWMA), contained at 35 P.S. Section 6018.610(3), or any other provision of the SWMA.

II. TESTING REQUIREMENTS.

 # 008 [25 Pa. Code §127.441]

Operating permit terms and conditions.

The Department reserves the right to require exhaust stack testing of the sources referenced in this operating permit to measure emissions for purposes including verification of operating permit condition compliance and estimation of annual air emissions.

SECTION C. Site Level Requirements

 # 006 [25 Pa. Code §127.441]
Operating permit terms and conditions.
Total annual facility VOC emissions from all activities shall not exceed 1,700 lb/day and 119 tons per consecutive 12-month period. These values constitute a Federally Enforceable Emissions Cap (FEEC) in accordance with 25 Pa. Code Section 127.448(d).

[The above requirement was instituted under Plan Approval No. 22-05013A]

 # 007 [25 Pa. Code §129.14]
Open burning operations
(a) No person shall conduct the open burning of materials in such a manner that:

(1) The emissions are visible, at any time, at the point such emissions pass outside the property of the person on whose land the open burning is being conducted.

(2) Malodorous air contaminants from the open burning are detectable outside the property of the person on whose land the open burning is being conducted.

(3) The emissions interfere with the reasonable enjoyment of life and property.

(4) The emissions cause damage to vegetation or property.

(5) The emissions are or may be deleterious to human or animal health.

(b) The requirements of Section (a), above, do not apply when the open burning operations result from:

(1) A fire set to prevent or abate a fire hazard, when approved by the Department and set by or under the supervision of a public officer.

(2) A fire set for the purpose of instructing personnel in fire fighting, when approved by the Department.

(3) A fire set for the prevention and control of disease or pests, when approved by the Department.

(4) A fire set solely for recreational or ceremonial purposes.

(5) A fire set solely for cooking food.

(c) This permit does not constitute authorization to burn solid waste pursuant to Section 610 (3) of the Solid Waste Management Act, 35 P.S. Section 6018.610 (3), or any other provision of the Solid Waste Management Act.

II. TESTING REQUIREMENTS.

 # 008 [25 Pa. Code §127.441]
Operating permit terms and conditions.
The Department reserves the right to require exhaust stack testing of the sources and control devices referenced in this permit to measure emissions for purposes including verification of permit condition compliance and estimation of annual air emissions.

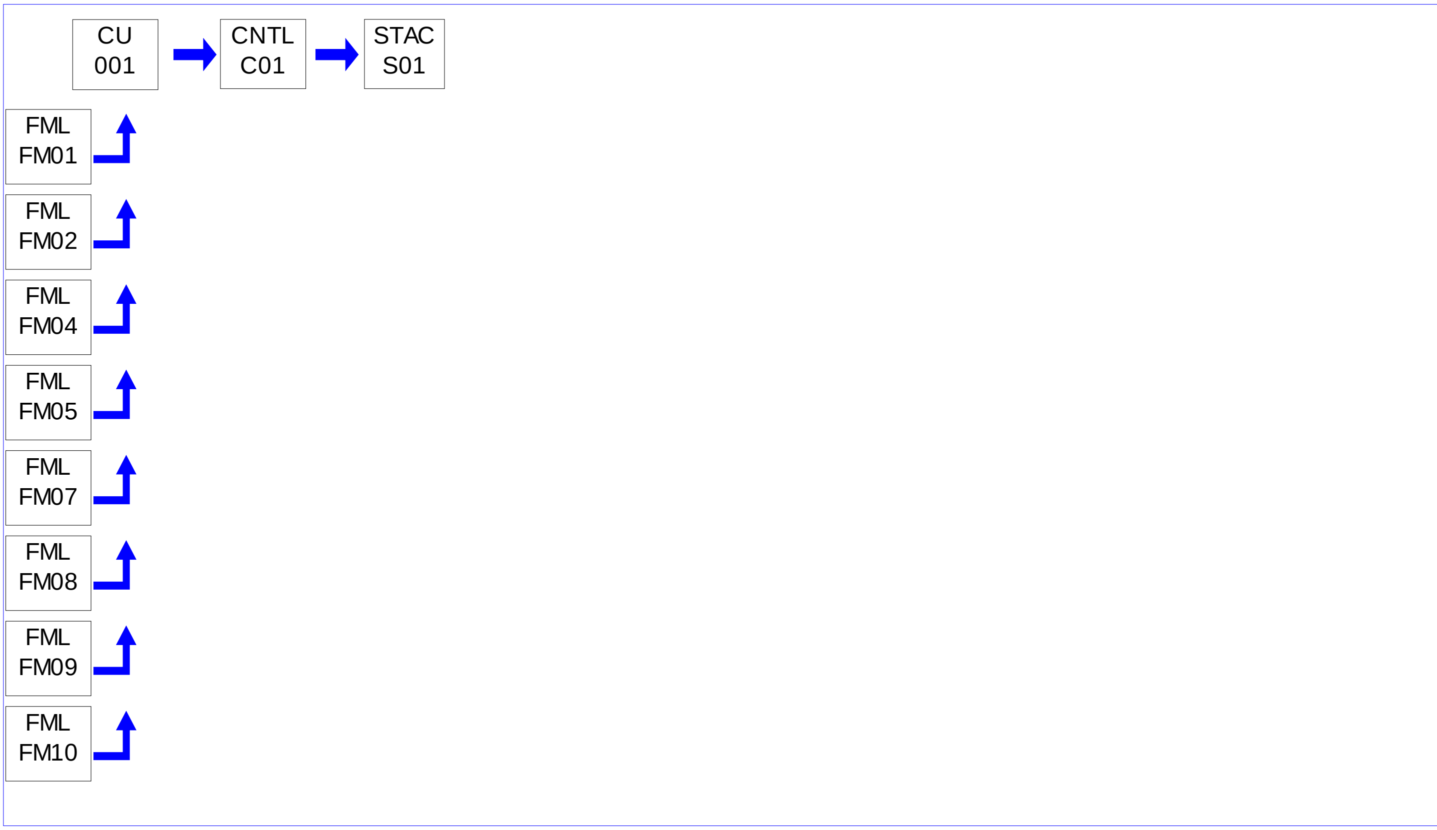
 # 009 [25 Pa. Code §139.1]
Sampling facilities.
Upon the request of the Department, the permittee shall provide adequate sampling ports, safe sampling platforms and adequate utilities for the performance by the Department of tests on such sources. In the request, the Department will set forth the time period in which the facilities shall be provided, as well as the specifications for the facilities.

SECTION D. Source Level Requirements

Source ID: 001 Source Name: CFB BOILER

Source Capacity/Throughput: 1,146.000 MMBTU/HR

Conditions for this source occur in the following groups: GROUP 04



I. RESTRICTIONS.

Emission Restriction(s).

 # 001 [25 Pa. Code §127.512]
Operating permit terms and conditions.

[Authority for this condition is also derived from 25 Pa. Code, Section 127.83 and 40 CFR Part 53, Section 52.21(j)(2) for Control Technology Review]

(1) During normal operation, as defined in Condition #012(a), the concentration of Carbon Monoxide (expressed as CO) in the effluent gases from CFB boiler shall not exceed 0.15 pounds per million BTU heat input and 172.0 pounds per hour on a 4-hour average.

(2) During periods of transitional operation, as defined in Condition #012(a), CO in the effluent gases from the CFB boiler shall not exceed 7,700 pounds per hour on a 4-hour average and 31,240 pounds per hour on a 1-hour maximum basis.

The total CO emission shall not exceed 753.4 tons per year on a 12 month rolling sum basis.

 # 002 [25 Pa. Code §127.512]
Operating permit terms and conditions.

[Authority for this condition is also derived from 25 Pa. Code, Section 127.83 and 40 CFR Part 53, Section 52.21(j)(2) for Control Technology Review.

(1) The maximum concentration of Sulfur Dioxides (expressed as SO_2) in the effluent gases from the CFB boiler shall not exceed 0.129 pounds per million BTU heat input and 147.8 pounds per hour on 24-hour average. The total SO_2 emission

shall not exceed 557.8 tons per year on a 12-month rolling sum basis.

 # 003 [25 Pa. Code §127.512]
Operating permit terms and conditions.

[Authority for this condition is also derived from 25 Pa. Code, Section 127.83 and 40 CFR Part 53, Section 52.21(j)(2) for Control Technology Review.

(1) The concentration of Nitrogen Dioxides (expressed as NOx) in the effluent gases from CFB boiler shall not exceed 0.1 pounds per million BTU heat input and 115.0 pounds per hour, on a 24-hour average, and 449.6 tons per year on a 12-month rolling sum basis.

 # 004 [25 Pa. Code §127.512]
Operating permit terms and conditions.

[Authority for this condition is also derived from 25 Pa. Code, Section 127.83 and 40 CFR Part 53, Section 52.21(j)(2) for Control Technology Review].

(1) The concentration of Volatile Organic Compounds (expressed as VOC) in the effluent gases from CFB boiler shall not exceed 0.005 pounds per million BTU heat input and 5.74 pounds per hour on a 1-hour average, and 23.4 tons per year on a 12-month rolling sum basis.

 # 005 [25 Pa. Code §127.512]
Operating permit terms and conditions.

[Authority for this condition is also derived from 25 Pa. Code, Section 127.83 and 40 CFR Part 53, Section 52.21(j)(2) for Control Technology Review.

Visible air contaminants shall not be emitted in such a manner that the opacity of the emissions is equal to or greater than 10 % for a period or periods aggregating more than 3 minutes in any hour or equal to or greater than 30 % at any time.

 # 006 [25 Pa. Code §127.512]
Operating permit terms and conditions.

[Authority for this condition is also derived from 25 Pa. Code, Section 127.83 and 40 CFR Part 53, Section 52.21(j)(2) for Control Technology Review.

The concentration of total filterable particulate matter [total particulate matter including particulate matter with an aerodynamic diameter of 10 micrometers or less (PM10) (excluding condensables)] in the effluent gases from CFB boiler shall not exceed the following rate:

(1) 0.0088 pounds per million BTU heat input on an hourly average, and 10.1 pounds per hour, and 34.7 tons per year on a 12-month rolling sum basis as measured and replaced in accordance with the PADEP Source Testing Manual.

 # 007 [25 Pa. Code §127.512]
Operating permit terms and conditions.

OBTAINED FROM PLAN APPROVAL #48-306-012 ISSUED 09/18/2007.

The operation of the CFB boiler, when fired with tire-derived fuel, as specified in Condition #012, shall at no time result in the emission of the following contaminants at rates exceeding the limits identified in pounds per hour and verified by stack testing as specified in Condition #015 (1).

Arsenic -	0.000743 pounds/hour
Cadmium -	0.0106 pounds/hour
Hexavalent Chromium -	0.00265 pound/hour
Lead -	0.0027 pounds/hour

SECTION C. Site Level Plan Approval Requirements

I. RESTRICTIONS.

Emission Restriction(s).

 # 001 [25 Pa. Code §127.12b]

Plan approval terms and conditions.

(Authorization for this condition is also derived from 40 CFR 52.21 (aa) and 25 Pa. Code Section 127.218)

1. The Plantwide Applicability Limits (PALs) for regulated NSR pollutants PM- filterable particulate, PM10- filterable and condensable particulate, PM2.5- filterable and condensable particulate, SO2, NOx, CO, Pb, Flourides minus HF, H2S04 and greenhouse gases (GHGs) and Non Attainment Pollutant NOX are established for the following sources at the facility:

AIMS Source ID #	Emission Source
031	PYROPOWER UNIT 1
032	PYROPOWER UNIT 2
DFP	DIESEL FIRE PUMP
ALS	ASH LOADING SYSTEM
ASL	ASH SILO
BAC	BOTTOM ASH CONVEYOR
CC	CULM CRUSHER
CT	COOLING TOWER
FFS1	FLY ASH FILTER SEPARATOR #1
FFS2	FLY ASH FILTER SEPARATOR #2
FS	FUEL SILO/REVERSING CONVEYOR
FTD	FUEL TRUCK DUMP/RECLAIM HOPPER
FTR	FUEL TRUCK UNLOADING
LBN	LIME BIN
LSB	LIMESTONE BIN
PKH	PORTABLE KEROSENE HEATERS
RDW	ROADWAYS
SAB	SODA ASH BIN
SP1	DAILY USE COAL REFUSE STORAGE PILE
SP2	STRATEGIC RESERVE COAL REFUSE STORAGE PILE

 # 002 [25 Pa. Code §127.12b]

Plan approval terms and conditions.

1. Pursuant to the requirements of 40 CFR § 52.21 (aa)(1), 40 C.F.R. 52.21(aa)(4) and 25 Pa. Code §127.218 (f), the following Plantwide Applicability Limit (PAL) is established for emissions of pollutants from the sources listed above at the facility.

PAL Pollutant	Emission Limitation TPY (12- month rolling sum)
PM Filterable	113.81
PM10 Filt + Condensable	86.12
PM2.5 Filt + Condensable	35.55
SO2	603.65
NOx	586.85
CO	381.05
Fluorides (not including HF)	3.0
H2SO4	15.15
Pb	0.03
CO2e	1,116,217.64

i. Emissions shall include fugitive emissions, to the extent quantifiable, from all emissions units that emit or have the potential to emit the pollutant under the PAL limitations. (40 C.F.R. 52.21(aa)(4)(i)(d)), 25 Pa. Code §127.218 (g)

ii. Emission calculations for compliance purposes must include emissions from startups, shutdowns, and malfunctions. (40 C.F.R. 52.21(aa)(7)(iv)) &.25 Pa. Code §127.218 (g)

C. LIMITATIONS, MONITORING AND REPORTING CONDITIONS
(S.C. Regulation 61-62.1, Section II; S.C. Regulation 61-62.70.6.a.3.i.B)

<table>
<tr><th>Condition Number</th><th>Conditions</th></tr>
<tr><td></td><td>the Director of the Air Permitting Division.</td></tr>
<tr><td>C.46</td><td>Emission Unit ID: 05
Equipment ID: RHF-1, RHF-2
Control Device ID: CD-RNOX

(S.C. Regulation 61-62.5, Standard No. 7) The Reheat Furnaces are subject to the following limits from S.C. Regulation 61-62.5, Standard No. 7:

<table>
<tr><th>Equipment ID</th><th>Pollutant</th><th>Limit</th></tr>
<tr><td>RHF-1</td><td rowspan="2">PM</td><td>2.0 lb/hr and 8.8 TPY</td></tr>
<tr><td>RHF-2</td><td>0.6 lb/million BTU</td></tr>
<tr><td>RHF-1</td><td rowspan="2">NO_X</td><td>13.7 lb/hr and 60.0 TPY</td></tr>
<tr><td>RHF-2</td><td>0.075 lb/million BTU</td></tr>
<tr><td>RHF-1</td><td rowspan="2">SO_2</td><td>0.12 lb/hr and 0.53 TPY</td></tr>
<tr><td>RHF-2</td><td>0.0006 lb/million BTU</td></tr>
<tr><td>RHF-1</td><td rowspan="2">CO</td><td>27.6 lb/hr and 120.9 TPY</td></tr>
<tr><td>RHF-2</td><td>0.084 lb/million BTU</td></tr>
<tr><td>RHF-1</td><td rowspan="2">VOC</td><td>None</td></tr>
<tr><td>RHF-2</td><td>0.0055 lb/million BTU</td></tr>
</table>
</td></tr>
<tr><td>C.47</td><td>Emission Unit ID: 05
Equipment ID: RHF-1
Control Device ID: None

(S.C. Regulation 61-62.5 Standard No. 7) The Reheat Furnace No. 1 is permitted to burn 1,150 million SCF per year at established BTU contents of 1,000 BTU/ft^3 of Natural Gas. The owner/operator must record fuel consumption monthly and calculate yearly fuel consumption on a twelve-month rolling sum. Reports of the calculated values and the twelve-month rolling sum, calculated for each month in the reporting period, shall be submitted semiannually.

Natural gas usage is restricted to an equivalent of 1,150 million SCF per year at established BTU contents of 1,000 BTU/ft^3. Natural gas usage shall be based on a twelve (12) month rolling average

The owner/operator shall record natural gas usage on a 12-month rolling sum. Reports of the calculated values and the 12-month rolling sum shall be submitted semiannually.</td></tr>
<tr><td>C.48</td><td>Emission Unit ID: 05
Equipment ID: RHF-2
Control Device ID: CD-RNOX</td></tr>
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