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July 29, 2019

Ms. Carey Bylin
Mr. Brian Cook
California Air Resources Board

Re: Comments Regarding: Draft Amendments to the Regulation for Reducing Sulfur Hexafluoride (SF6) Emissions from Gas Insulated Equipment (GIE)

Dear Ms. Bylin and Mr. Cook,

Thank you for the August 15 workshop in which you described the draft amendments to the regulation addressing SF_6 emissions from GIE.

3M is a global science company that never stops inventing. Using 46 technology platforms, our integrated team of scientists and researchers works with customers to create breakthroughs and improve the daily life for hundreds of millions of people. With over $30 billion in sales, our 90,000 employees connect with customers all around the world.

As previously communicated to CARB, 3M has commercialized two substitutes for SF6 in gas insulated equipment:

3M™Novec™ 5110 Insulating Gas	GWP = <1
3M™Novec™ 4710 Insulating Gas	GWP = 2100

Both products have superior dielectric strength compared to SF6 which enables their use in dilute gas mixtures and substantial reduction in greenhouse gas (GHG) emissions. As an example, typical use concentrations for Novec 4710 insulating gas will be less than 10 volume % of SF_6 concentration, resulting in >99% reduction in GHG emissions.

Material	Measured Global Warming Potential (100-yr)	Dielectric breakdown strength relative to SF_6	Volume % formulation example	GWP of gas mixture	% GHG reduction* vs. SF_6
3M™ Novec™ 4710	2100	2	4	322	99.3
3M™ Novec™ 5110	<1	1.3	14	<1	99.99
Sulfur Hexafluoride (SF_6)	23,500	1	100	23,500	

*Greenhouse gas emission reduction taking into account the GWP and reduced density of the gas mixtures

3M appreciates the changes made to the last discussion draft which addressed the definition of "Covered GIE", to GIE that contains a gas with a GWP>1.

Disparity in Reporting Requirements

3M's primary concern moving forward, however, continues to be the disparity in reporting, and the associated cost of reporting, that would be required for SF_6 replacement technologies, all of which reduce greenhouse gas emissions by more than 95 %, compared to baseline SF_6 emissions.

3M is interested in any economic analysis CARB has conducted that addresses the difference in reporting costs between the various SF_6 substitute technologies relative to the potential future CO_2e contributions of the replacement technologies. That is, the draft reporting requirements may have made sense for SF_6 containing GIE due to the total GHG contributions of the sector but if all the replacement technologies substantially reduce the GHG contributions of the sector, the cost of the same type of reporting requirements needs to be reconsidered. For context, it would be interesting to compare how the projected total CO_2e emissions from mature SF6 substitute technologies compares to other sectors that are being regulated or to sectors for which it has been determined that no regulation is necessary. If an economic analysis that sheds light on these issues has been conducted, 3M requests that that analysis be made public. If the analysis has not yet been conducted, please consider conducting that analysis.

Maintaining a Competitive Landscape and Incenting Adoption of SF6 Substitutes

CARB's current draft addresses the need for a competitive landscape for GIE equipment. Although this is an important consideration, 3M has concerns regarding potential inconsistencies in how the issue is currently addressed. On one hand CARB appears to be willing to grant exemptions for SF_6 containing GIE where competition for replacement equipment is not robust but, on the other hand, CARB reporting

requirements will create competitive inequity by requiring reporting for gas mixtures containing Novec 4710, but not other insulating gases.

The cost effectiveness of low GWP alternative technologies to SF_6 is an important consideration and the analysis needs to conducted in the context of CO_2e abatement costs. 3M believes CO_2e abatement cost should be CARB's primary consideration of whether or not to grant exemptions rather than on the basis of whether or not non-SF_6 equipment is available from more than one vendor. 3M is concerned that as written, the draft amendments will penalize market innovators, leaders, and risk takers for taking the risk that comes with introducing market changing low GWP solutions.

Gas mixtures containing Novec 4710, including GE g3, are primarily used in high voltage GIE where, at the highest voltages, other alternatives are limited or non-existent. GIE utilizing gas mixtures containing Novec 4710 have already been deployed and installed and are proven cost effective solutions for reducing greenhouse gas emissions from the GIE sector. Allowing the continued use of SF_6 for applications where there are not two substitute technologies will slow the adoption of low GWP alternatives and harm those innovators attempting to bring solutions to this market.

3M is concerned that the reporting requirements that CARB proposes to impose on gas mixtures containing Novec 4710 may slow the replacement of SF_6 equipment because entities contemplating a changeout to gas mixtures containing Novec 4710 would not benefit from reduced reporting requirements. This consequence appears to be contrary to CARB's stated objectives of moving from an emission rate-based limit to an emission limit, i.e. "Incentivizes transition to low-GWP or zero-GHG technologies."

Reconsider Reporting Requirements for Low GWP Substitutes for SF6

3M appreciates that CARB needs transparency on the pace of market conversion away from SF_6 and the choices made for alternative technologies. Since all the alternatives currently being considered substantially reduce GHG emissions from the sector, 3M asked that CARB regulations be crafted in such a manner so as to monitor the transition to low GWP substitutes rather than influence the transition.

Again, the draft reporting requirements may have made sense for SF_6 containing GIE due to the total GHG contributions of the sector but if all the replacement technologies substantially reduce the GHG contributions of the sector, requiring the same reporting requirements, and associated cost, should be reconsidered. 3M estimates that the cost of reporting a ton of CO_2e gas mixture containing Novec 4710 will be more than 50 times greater than the cost of reporting a CO_2e ton of SF_6. 3M requests CARB to consider alternative reporting requirements for all replacement gases that substantially reduce GHG emissions from the sector such as:

- Greatly minimizing reporting requirements for low GWP alternative gases so as to provide the necessary transparency on market transition away from SF_6 but dramatically reducing the cost of such reporting.
- Changing the definition of "covered GIE" to a GIE that uses a gas with a composite GWP >500

- Changing the definition of "covered GIE" to be expressed in CO_2e rather than GWP so that a threshold can be established for a de minimis CO_2e contribution. Establishing a CO_2e threshold for "covered GIE" would be consistent with how CARB defines and excludes covered entities. A 5500 MTCO2e threshold has been established for operator reporting. For consistency, please consider establishing a CO_2e threshold for GIE? Also, CARB assesses cost based on CO_2e reduction, not GWP reduction.

CARB's economic analysis acknowledged one of the consequences of the difference in reporting requirements is a cost disadvantage for equipment using an insulating gas versus equipment that does not use an insulating gas. This cost disadvantage creates an unlevel playing field for low GWP innovative technologies without providing a meaningful environmental benefit. 3M asks that CARB reconsider this issue and assess whether CARB gets the transparency it needs by requiring reporting of the number of each type of replacement equipment installed, the gas used, if any, and the volume of that gas?

3M, and our customers of low GWP substitutes for SF_6, have invested substantially over the last 15 years to bring low GWP solutions to the GIE market. We share CARB's interest in regulation that incents transition to low GWP substitutes for SF_6. We request, however, that CARB make the necessary changes to the reporting requirement to create a level competitive landscape for all low GWP substitutes for SF_6.

Thank you for your consideration of these comments and please let me know if you have any questions.

Sincerely,

Kurt T. Werner

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