

March 11, 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 Switchgear

Dear Ms. Bylin and Mr. Cook,

Thank you for the February 25<sup>th</sup> workshop in which you described the draft amendments to the regulation addressing SF6 emissions from Gas Insulated Switchgear (GIS).

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<sub>6</sub> concentration, resulting in >99% reduction in GHG emissions.

Material	Measured Global Warming Potential (100-yr)	Dielectric breakdown strength relative to SF <sub>6</sub>	Volume % formulation example	GWP of gas mixture	% GHG reduction* vs. SF <sub>6</sub>
3M™ Novec™ 4710	2100	2	4	322	99.3
3M™ Novec™ 5110	<1	1.3	14	<1	99.99
Sulfur Hexafluoride (SF <sub>6</sub> )	23,500	1	100	23,500	

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

3M's primary concern with the draft amendments to the regulation is the different reporting requirements for Novec 5110 and vacuum technology. The regulation treats all insulating gases as GHGs and accordingly has reporting requirements for all insulating gases. On this basis, even an insulating gas with a GWP of <1 needs to meet the reporting requirements under the draft regulation. This requirement is in contrast with vacuum equipment which does not have any reporting requirement under the proposed amendments to the regulation. The rulemaking record does not disclose CARB's rationale for treating these two technologies differently, and 3M does not believe there is a reasonable basis for this disparate treatment. Therefore, the draft regulation arbitrarily differentiates the climate impact of a technology that does not use an insulating gas from a technology that uses an insulating gas that has a GWP of <1.

Many other considerations would need to be evaluated to determine the difference in the environmental impact between vacuum equipment and equipment that uses Novec 5110. For instance, the difference in the installation footprint between these two technologies is an important consideration in the difference in climate impact.

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 insulating gas. This cost disadvantage creates an unlevel playing field between two innovative technologies, both of which have been developed to enable essentially equivalent GHG reductions from the electrical sector.

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The cost disadvantage for Novec 5110 gas mixtures, and the regulatory incentive to choose vacuum technology that the draft amendments would create, does not provide a measurable environmental benefit.

3M is concerned that the reporting requirements that CARB proposes to impose on Novec 5110 may slow the replacement of SF6 equipment because entities contemplating a changeout to Novec 5110 equipment 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."

For example, based on 3M's understanding, vacuum technology has technical limitations in replacing SF6 equipment. First, the increased footprint of vacuum technology, especially at > 145 kV ratings will be a barrier for replacing SF6 equipment in many existing enclosures. Second, vacuum technology has been a commercial technology for many years but there is still no approved equipment for voltages greater than 145kV. The proposed reporting requirements for Novec 5110 gas mixtures thereby may serve as an unintentional disincentive for transition away from SF6 in many installations.

On the basis of these considerations, 3M requests that CARB adjust the definitions of greenhouse gas and/or insulating gas in a manner that would preclude the reporting requirements for Novec 5110 gas mixtures. 3M believes one way to achieve this outcome is to adjust the definition of insulating gas as follows:

**"Insulating Gas"** means the gas used in GIE to interrupt electrical currents "that has a GWP > 10 or contains a gas, as part of a mixture, that has a GWP > 10."

Please consider "10" as a placeholder for amending this definition. CARB may want to set this threshold higher, but the definition should encourage adoption of low GWP insulating gases.

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

Sincerely,



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