The Electric Transmission & Distribution SF_6 Coalition

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Ms. Bylin,

The Electric Transmission & Distribution SF_6 Coalition (the Coalition) respectfully submits the following comments in response to the California Air Resources Board's (CARB) August 2019 DISCUSSION DRAFT (August Draft) of Potential changes to the Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear. In general, the Coalition views the August Draft as an improvement over the February 2019 DISCUSSION DRAFT and we commend CARB staff for their willingness to work with industry stakeholders to incorporate recommendations thus far. In response to requests by CARB for comments to specific sections of the August Draft, and due to sections of the August Draft that we still feel merit changes for improvement, we submit the following comments and recommendations.

Phase-out Dates

The proposed dates and corresponding voltage, current and application classifications do not allow for enough depth in market availability and, in some case, raise safety issues[1]. Accordingly, we propose the following schedule for phase-out of SF_6 in gas-insulated equipment (GIE):

Phase-out Dates for Distribution-level GIE

Configuration	Voltage (kV)	Short-circuit Current (kA)	Phase-out Date	SF6 Coalition Proposal
Aboveground	< 38	< 25	January 1, 2025	January 1, 2025
		≥ 25	January 1, 2025	January 1, 2025
	≥ 38	< 25	January 1, 2025	January 1, 2031
		≥ 25	January 1, 2025	January 1, 2031
Belowground	< 38	< 25	January 1, 2025	January 1, 2031
		≥ 25	January 1, 2025	January 1, 2031
	≥ 38	< 25	January 1, 2025	January 1, 2031
		≥ 25	January 1, 2025	January 1, 2031

Phase-out Dates for All Other GIE

[1] For further information on market availability and safety concerns, please see the Coalition's Position Paper on CARB's Proposed SF_6 Phase-Out, attached as Annex 1.

Voltage (kV)	Short-circuit Current (kA)	Phase-out Date	SF6 Coalition Proposal
≤ 72.5	< 63	January 1, 2025	January 1, 2025
72.5 < kV ≤ 145	< 63	January 1, 2025	January 1, 2025
72.5 < kV ≤ 145	≥ 63	January 1, 2025	January 1, 2029
145 < kV ≤ 245	All	January 1, 2029	January 1, 2033
> 245	All	January 1, 2031	January 1, 2036

Clearinghouse

The complexities associated with this concept are such that the Coalition is not prepared to offer a position or recommendation at this time. We are open to further discussion with CARB on this topic to identify ways to address the concerns below:

- The utility of such a clearinghouse depends on its comprehensiveness. How would CARB encourage/incentivize GIE manufacturers to participate?
- While simple in concept, providing up-to-date product information will be a laborious effort for GIE manufacturers. Assuming CARB's clearinghouse moves forward, other jurisdictions may follow suit, creating multiple reporting channels and multiplying needed resources to provide what could become several reports. How might CARB address this?
- To make the clearinghouse searchable, input fields would need to be standardized. Standardization will be extremely difficult for so many variables including voltage and current ratings, size, connection type, insulating medium and application.
- Given that CARB does not have on staff GIE expertise, how will CARB verify that the information is accurate?
- Will there be a dispute process and, if so, what will be the parameters to attain standing and what will be the procedures?
- How long will the clearinghouse need to be maintained?

Nameplate Profiling

In the final regulations, CARB states that it intends to allow for nameplate adjustment but require that "GIE owners who choose to undertake the process must perform the process on all GIE that meet [certain] criterion." While the desire to profile GIE at risk of inaccurate nameplate is understandable, it is not possible because there is no single parameter or combination of parameters that make nameplate inaccuracy more or less likely. Given manufacturing supply chain realities and the logistical purpose of the GIE nameplate, the latter of which pre-dates its use for emissions tracking by decades, any given nameplate is at risk of being imprecise.

Instead of attempting to profile GIE parameters to identify potentially inaccurate nameplates, the Coalition recommends that the regulation profile fill values. For example, under this approach a reporting entity would still have the option to choose whether to adjust nameplates or not, but if it chooses to do so it must perform the nameplate adjustment process on all non-hermetically sealed GIE whose as-filled value (after installation) varies from the nameplate by X%. We are open to discussion on what this value should be but suggest as a starting point 10%. GIE with an actual fill value that differs from nameplate to this extent are more likely to have a material nameplate inaccuracy, thereby incentivizing reporting entities to be vigilant while limiting the number of nameplates required to be adjusted.

Given that the GIE at issue under this approach are already in-service, we recommend allowing reporting entities to perform the adjustment for 10 years or up until the applicable phase-out date, whichever comes first if the adjustment is made during the service life of the GIE (i.e. during maintenance). If the process is performed at decommissioning, then CARB should allow enough time for all currently installed SF_6-insulated GIE to reach the anticipated end of life: 40 years[2].

Since new GIE are often shipped only partially filled or with another gas, we recommend that CARB exempt nameplate adjustment from the above "all or nothing" approach and allow reporting entities to adjust nameplates pre-installation on an ad hoc basis, with documentation and reporting requirements. Given the potential for exemptions, we recommend allowing reporting entities to perform the nameplate adjustment for new GIE prior to installation indefinitely.

Nameplate Verification

The August Draft includes the following language at §95355.2 Nameplate Capacity Adjustments

> Revised nameplate capacity values shall be determined through the following process
>
> (a) Provide an electronic notification to CARB of the intent to determine a revised nameplate capacity at least seven days before beginning the process described below.

The Coalition recommends revising this language to read

> ~~Revised~~ ~~n~~Nameplate capacity values shall be ~~determined~~ verified through the following process
>
> (a) Provide an electronic notification to CARB of the intent to ~~determine a revised~~ verify nameplate capacity at least seven days before beginning the process described below.

As we mentioned in our comments to the February Draft, reporting entities will not know whether a nameplate adjustment is merited prior to performing the procedure. Ultimately, we feel that tracking and enforcement principles are fulfilled if CARB is notified in advance when a reporting entity intends to undertake the nameplate verification procedure. But the outcome of that procedure in some cases will be that the nameplate is accurate and, therefore, does not need to be adjusted. It shouldn't be necessary (and, in fact, is not possible) for CARB to know whether a nameplate will be revised before the reporting entity has performed the procedure.

Nameplate Accuracy Methodology

CARB also requests stakeholder input on the proposed methodology to verify nameplate accuracy. We believe that the most accurate method to identify the precise nameplate is the one currently proposed in the 2019 Discussion Draft. We are open to considering limited variances from the proposed method, one of which would be to allow reporting entities to follow the OEM procedures for the Torr values since 3.5 Torr is difficult to achieve. That said any such method allowed by CARB should require use of a calibrated mass flow device or calibrated cylinder scales. To accommodate this level of flexibility we

[2] The Coalition actually believes the end-of life for some equipment exceeds 40 years, but we are willing to stipulate to the greater of CARB's two estimates. See slide 17 of the February 25 presentation for *Draft Amendments to the Regulation for Reducing sulfur Hexafluoride (SF_6) Emission from Gas Insulated Switchgear*.

recommend moving the formula from the regulation itself to an appendix or separate guidance document.

Permanently Decommissioned

§95351. Definitions and Acronyms defines "Permanently decommissioned" as follows:

> [A] GIE device owned by a GIE owner that can never again be placed into active service. Any GIE device which was in active service at some point in time that has been consecutively out of active service for 3 years has been permanently decommissioned.

This definition is problematic because it requires reporting entities to know whether a given GIE will be used at any point in the future, which is not always knowable when GIE is taken out of service. This is particularly challenging given the current market for refurbished or second-hand equipment. Given these market dynamics, the language causes logistical and reporting issues for reporting entities that acquire GIE from another party; how will the former know whether a GIE has been permanently decommissioned (or when it should be decommissioned based on the three-year timeline) absent proactive notification from the latter? These difficulties are amplified when GIE is sold from a reporting entity to a non-reporting entity for refurbishing, then back to a reporting entity. In this case, the middle party may not have records or be willing to disclose the date the GIE was taken out of service.

Further, it is common practice for working GIE in good order to be taken out of service for over three years and stored as spares, only to be re-installed for temporary or permanent use at some point thereafter. CARB's proposed definition is an effective (albeit perhaps inadvertent) prohibition of this practice and, accordingly, stretches far beyond the purview of this regulation.

To address both of the above issues, the Coalition recommends that the final regulation include a revised definition of "permanently decommissioned" as follows:

> [A] GIE device owned by ~~a~~ the original GIE owner that has not been placed into active service for five years. ~~can never again be placed into active service. Any GIE device which was in active service at some point in time that has been consecutively out of active service for 3 years has been permanently decommissioned.~~

In addition to the above, CARB would need to make other revisions in the emissions calculation formula definitions under §95355.1 to account for non-hermetically sealed GIE that is not active but not yet permanently decommissioned. The Coalition would welcome the opportunity to discuss what these changes might be with CARB staff.

2019 Baseline Year

CARB's use of 2019 as a baseline year which reporting entities must use to calculate a static average system nameplate capacity is overly burdensome and inequitable. The constraints of a 2019 baseline will compromise grid reliability by limiting reporting entities options to adequately respond to load growth without undue penalty risk. California utilities, for example, plan projects 3-5 years in advance which means that SF_6 GIE acquisition post-2019 is highly likely (given that parties may already be under contract). These SF_6 GIE acquisitions could range well into double-digit growth as a percentage of total system nameplate capacity (particularly if in the high-voltage space where few, if any, SF_6 alternatives exist and SF_6 nameplate capacity comes in high volumes) but, unfortunately, would not be counted as

part of the average system nameplate capacity. Any emissions from these same acquisitions, however, will be included among the emissions calculations.

Aside from the equity at stake, there is the issue of accuracy. Including future acquisitions of SF_6 insulated equipment in the average system nameplate capacity will allow for a more accurate representation of emissions per GIE. Greater accuracy is in the interest of manufacturers, reporting entities and, presumably, CARB.

If CARB feels strongly that it must use a static year for calculation of average system nameplate capacity, then the baseline year should be commensurate with the proposed phase-out dates for SF_6 GIE. This will have no adverse effect on the environment, is more equitable for reporting entities with firm growth plans, and constitutes a much more representative picture of GIE emissions.

Thank you for your time in reviewing these comments, which we feel will make further improvements in terms of equity, feasibility and accuracy in the regulatory requirements. We look forward to further discussion on the points raised above. Please do not hesitate to contact me at your earliest convenience to do so.

Thank you,

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About the Coalition

The Electric Transmission & Distribution SF_6 Coalition is comprised of 16 members who are producers and distributors of SF_6 and SF_6 alternatives, manufacturers of gas-insulated equipment (GIE), California utilities using GIE, and other SF_6 stakeholders.

ANNEX 1

Position Paper

CARB's Proposed SF_6 Phase-Out

The Electric Transmission & Distribution SF_6 Coalition supports the California Air Resources Board's (CARB) proposal to allow nameplate adjustment when the manufacturer's nameplate capacity of devices is determined to be imprecise by the GIE owner. Our general support for the concept of nameplate adjustment notwithstanding, we maintain concerns related to the proposed restriction that no GIE utilizing SF_6 as an insulating medium be installed after January 1, 2025. We maintain the same concerns for a similar restriction related to conversion of existing equipment. The proposed requirement does not take into account several market realities discussed below that make this date infeasible in a variety of applications. In addition to discussing these issues, we also offer solutions in the spirit of compromise that would alleviate our concerns while (we hope) fundamentally preserving CARB's objectives.

Challenges and Uncertainties

As the industry looks to the future of electrical transmission and distribution with regards to alternatives to SF_6 insulation, there are challenges and uncertainties. Among the challenges are those related to industry performance standards for some GIE applications. Most standards include a range of temperatures in which the product must meet the technical testing requirements; some ranges go as low as -30°C. All products, no matter where they are sold, must meet these requirements. While some GIE designs can currently meet those requirements with alternative insulations, some cannot without the installation of a heating device. For some applications the addition of a heating device is a viable workaround. But for others, where no power supply is available or that operate in an enclosed space, it is not.

For some voltages there are also concerns related to space constraints. Due to its innate properties SF_6 often allows insulated equipment components (i.e. bushings or busbar) to be closer together, reducing the overall size of the GIE. This is particularly important in densely populated urban areas where there is no room to install larger equipment.

Equally as important as the above challenges are the potential safety risks for utility workers. Due to the insulating nature of gases, SF_6 -insulated equipment often includes operating functions which are not available in other alternatives for use in vault applications (e.g. confined spaces). These functions include visible break and integrated grounding mechanisms which are often part of safety procedures. Not only does this create safety concerns but potentially runs afoul of California Division of Occupational Safety and Health Administration regulations.

For utilities, who are ultimately liable for product failure, the list of internal processes to be undertaken to accommodate an SF_6 phase-out is lengthy and challenging. It includes: specification development; purchasing; maintenance procedure and monitoring requirements development; special operating procedure development; substation construction and installation protocols; as well as application site testing. Finalizing and

implementing these processes poses immense challenges in terms of timing and resources. While these challenges can ultimately be overcome, attempting to do so for all GIE at every rating contemporaneously is not viable.

There are plenty of uncertainties as well related to an SF_6 phase-out. For example, the time it will require for both OEMs and utilities to evolve from an SF_6-centric insulation industry to one relying on other insulations is unknown. For OEMs, many of whom make dozens of SF_6-insulated products, research is still ongoing as to whether proprietary operating mechanisms and other design components will continue to function when used with an alternative medium let alone with the same reliability and longevity as with SF_6. Product re-designs and changes to the manufacturing processes also must be taken into account.

To be sure, OEMs and utilities have been considering these issues and performing provisional testing for several years now, but not all of them have proceeded to pilot product testing. Shifting an entire industry in a manner that this phase-out anticipates will require an exponentially greater effort and lead to a variety of unknown factors requiring further analysis, testing and resolution before products are market-ready.

Tiered Regulation

In order to truly understand the portion of the GIE market that is ready for alternative insulation now while accurately predicting what will be ready by 2025 would require a market analysis that is beyond the scope of this position paper and likely more in-depth than any regulatory agency has performed. To do so, one would need to consider at least five elements: voltage and current rating, functional mechanism, installation and manufacturer. And one would need to perform this analysis for each SF_6 alternative: oil, air, vacuum, alternative gas (and various mixtures), and solid dielectric.

Even if the above task were undertaken, any regulation correlated to the findings would be unnecessarily lengthy and complex. That said, this position paper does recommend a tiered approach that reflects current market realities as well as take into account those we anticipate to be present moving forward.

We recommend moving the effective date from 2025 to 2030 for all GIE that operate at ≤72.5kV and are rated to ≤40kA. Although there are some alternative insulating media for these applications, not all applications have replacements for SF_6 insulated equipment.

We recommend moving the effective date from 2025 to 2035 for all GIE that operate at a max voltage range above 72.5kV up to 170kV and are rated to ≤40kA. These ratings exist today from multiple manufacturers but only in a few pilot installations overseas. We believe this goal could be safely achieved by 2035.

We recommend moving the effective date from 2025 to 2040 for all GIE that operate at a max voltage range above 170kV up to 550kV and are rated above 40kA up to 63kA. This encompasses the majority of California's transmission infrastructure and would take at least a decade to test and pilot effectively.

We recommend adding an exemption for GIE that operates at a max voltage range above 550kV (not used in CA currently but may be future expansions that include this voltage) and are rated above 63kA. To our knowledge, no industry participants has even begun to

analyze or test the implications of non-SF_6 insulation technologies for this range and it would be impossible at this point to offer an educated guess as to the viability or safety. We recognize that California does not currently use transmission voltages at this level, but this may change with future expansions. Including this exemption now will avoid having to revise the regulation at a later date.

To simplify this proposal, we offer the following table:

Max Voltage Range	Rating	Phase Out Date
Less than or equal to 72.5kV	Less than or equal to 40kA	2030
Above 72.5kV up to 170kV	Less than or equal to 40kA	2035
Above 170kV up to 550kV	Above 40kA up to 63kA	2040
Above 550kV	Above 63kA	N/A

Waivers

Aside from the nuances of voltages and ratings, there are other important considerations that would merit exemption (i.e. ad hoc waivers) from the phase-out. We recommend that CARB include language in the regulation allowing utilities to apply for and be granted a waiver due to one or more of the following circumstances:

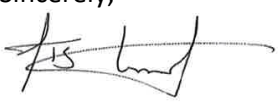
- Spacing constraints: When GIE must be installed in a location with immutable space constraints and non-SF_6 insulated equipment does not offer a viable or safe alternative.
- Compliance: If GIE cannot comply with standard testing and performance in a particular installation.
- Market availability: If there is only one supplier of equipment with appropriate ratings and specifications for the installation at issue.
- Cost: If alternative insulated equipment on the market is only available at a cost of 10% more than the SF_6-insulated equivalent.

We offer the above waivers as conceptual examples only, recognizing that further work is necessary to define the parameters. But ultimately, the decision to grant the waiver would be left to CARB or a party designated by CARB.

We feel that our proposed approach offers a fair and realistic timeframe to achieve CARB's goal to phase out installation of SF_6 equipment. We appreciate CARB's willingness to solicit feedback from industry.

Please contact Jonathan Stewart at jonathan.stewart@nema.org with questions or to discuss further.

Sincerely,



Jonathan Stewart
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About the Coalition

The Electric Transmission and Distribution SF_6 Coalition, hosted by the National Electrical Manufacturers Association (NEMA), is an industry organization for discussion of SF_6 related issues focused on electric transmission and distribution equipment as well as a forum for industry interaction with public officials surrounding SF_6 reporting and emissions reduction regulations. Current Coalition membership includes representatives of electrical T&D equipment manufacturers, SF_6 and alternatives producers and distributors, utilities, regulatory agencies and industry-related service companies.