



The Electric Transmission & Distribution SF<sub>6</sub> Coalition

## Position Paper

### *CARB's Proposed SF<sub>6</sub> Phase-Out*

The Electric Transmission & Distribution SF<sub>6</sub> 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<sub>6</sub> 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<sub>6</sub> 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<sub>6</sub> 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<sub>6</sub>-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<sub>6</sub> 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<sub>6</sub> phase-out. For example, the time it will require for both OEMs and utilities to evolve from an SF<sub>6</sub>-centric insulation industry to one relying on other insulations is unknown. For OEMs, many of whom make dozens of SF<sub>6</sub>-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<sub>6</sub>. 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<sub>6</sub> 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  $\leq 72.5$ kV and are rated to  $\leq 40$ kA. Although there are some alternative insulating media for these applications, not all applications have replacements for SF<sub>6</sub> 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  $\leq 40$ kA. 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<sub>6</sub> 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<sub>6</sub> 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<sub>6</sub>-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<sub>6</sub> equipment. We appreciate CARB's willingness to solicit feedback from industry.

Please contact Jonathan Stewart at [jonathan.stewart@nema.org](mailto:jonathan.stewart@nema.org) with questions or to discuss further.

Sincerely,



Jonathan Stewart  
Industry Director  
National Electrical Manufacturers Association

### About the Coalition

The Electric Transmission and Distribution SF<sub>6</sub> Coalition, hosted by the National Electrical Manufacturers Association (NEMA), is an industry organization for discussion of SF<sub>6</sub> related issues focused on electric transmission and distribution equipment as well as a forum for industry interaction with public officials surrounding SF<sub>6</sub> reporting and emissions reduction regulations. Current Coalition membership includes representatives of electrical T&D equipment manufacturers, SF<sub>6</sub> and alternatives producers and distributors, utilities, regulatory agencies and industry-related service companies.