



Commonwealth of Massachusetts  
Executive Office of Energy & Environmental Affairs

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### **Background Information and Technical Support Document for:**

#### **310 CMR 7.72**

### **Reducing Sulfur Hexafluoride Emissions from Gas-Insulated Switchgear**

#### **Regulatory Authority**

**M.G.L. c. 111, sections 142A and 142B, and M.G.L. c. 21N**

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## I. INTRODUCTION

The Massachusetts Department of Environmental Protection (MassDEP) is proposing a new regulation to control emissions of sulfur hexafluoride (SF<sub>6</sub>) from gas-insulated switchgear (GIS). The regulation, 310 CMR 7.72: *Reducing Sulfur Hexafluoride Emissions from Gas-Insulated Switchgear*, would limit all companies that purchase new GIS to a 1% emission rate for such equipment, and require appropriate handling of SF<sub>6</sub> when GIS is removed from service. The proposed regulation would also require the two companies that own, lease, operate, or control the largest amount of GIS in Massachusetts to comply with a declining emission rate standard until a rate of 1% or less is achieved by 2020. To minimize regulatory burden, the regulation allows flexibility with regard to choosing how the reductions are achieved.

## II. BACKGROUND AND PURPOSE

Chapter 298 of the Acts of 2008, the Massachusetts Global Warming Solutions Act (GWSA), was passed by the legislature and signed into law by Governor Patrick in August 2008 to address the challenges of climate change. Subsequently, as required by GWSA, the Secretary of the Massachusetts Executive Office of Energy and Environmental Affairs issued the Massachusetts Clean Energy and Climate Plan for 2020 (CECP) in 2010. One of the policies included in the plan is titled *Reducing SF<sub>6</sub> Emissions from Gas-Insulated Switchgear*. The provision at 310 CMR 7.72 would implement the regulatory component of that policy and reduce emissions of a greenhouse gas (GHG) that contributes to climate change.<sup>1</sup>

SF<sub>6</sub> is of particular concern as a GHG because of its potency and long atmospheric lifetime. A commonly used metric to express the impact of a GHG on the Earth's climate is its global warming potential (GWP). By this measure, SF<sub>6</sub> is 23,900 times more potent than carbon dioxide, the most common GHG, which is assigned a GWP of 1. The term GIS refers to equipment that is used in high-voltage electrical systems to control the flow of electrical current. SF<sub>6</sub> is used in GIS because of its unique electrical and thermal properties that make it an excellent insulator; however, SF<sub>6</sub> routinely leaks from closures and joints in the equipment and is released into the atmosphere. MassDEP is confident that the leakage of SF<sub>6</sub> from GIS can be reduced over time because participants in the United States Environmental Protection Agency's (EPA's) voluntary SF<sub>6</sub> Emission Reduction Partnership for Electric Power Systems have successfully demonstrated a number of strategies, including equipment replacement and the deployment of new technology to detect and repair leaks, that have yielded significant emission reductions.<sup>2</sup>

In order to learn more about SF<sub>6</sub>-containing equipment in Massachusetts, MassDEP distributed a survey to electric utilities, municipal light plants, competitive suppliers of electricity, and power plants. MassDEP received more than eighty responses, representing a response rate of approximately 65%. Six surveys reported 2010 emissions totaling approximately 5300 pounds of SF<sub>6</sub> which, accounting for the global warming potential of SF<sub>6</sub>, represents 57,000 metric tons of

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<sup>1</sup> The CECP is available at <http://www.mass.gov/eea/air-water-climate-change/climate-change/mass-clean-energy-and-climate-plan.html>. The SF<sub>6</sub> policy is described on pp. 77 - 78.

<sup>2</sup> See <http://www.epa.gov/electricpower-sf6/>. MassDEP appreciates the fact that the three largest users of SF<sub>6</sub> in GIS in Massachusetts, National Grid, NSTAR, and Northeast Utilities, all participate in this program.

carbon dioxide equivalents. Nearly 90% of reported emissions were from two respondents: National Grid and NSTAR (now part of Northeast Utilities). Reported SF<sub>6</sub> emission leak rates ranged from 0 – 7%, with all rates below 3.5% in 2010. Because surveys were received from the largest utilities operating in MA, MassDEP believes that a majority of the SF<sub>6</sub> emissions from GIS occurring in MA were documented in the survey responses. Survey responses also documented a variety of practices that GIS owners are using to detect, repair, and prevent leaks. MassDEP held a stakeholder meeting to discuss the survey responses, and received and considered written comments after that meeting. As a direct result of these comments, MassDEP is proposing abbreviated requirements for all but the two largest emitters, and including a provision to address emissions that are caused by sudden or unforeseen events, such as emissions that result from floods or fires.

Another data source that MassDEP reviewed to learn more about SF<sub>6</sub> emissions in Massachusetts is data reported to the MA GHG Registry, the electronic emissions registry that facilities use to comply with MassDEP’s GHG reporting regulation, pursuant to 310 CMR 7.71. This data confirmed the survey results showing that some businesses (e.g. power plants) operate small numbers of GIS that may emit SF<sub>6</sub>, and also showed that several electronic manufacturers in Massachusetts each emitted 500 pounds or more of SF<sub>6</sub> in 2010. MassDEP will consider addressing emissions from electronic manufacturers when developing strategies to reduce GHG emissions in the future. However, MassDEP is not including electronic manufacturers in this rulemaking for two reasons: (1) These emissions are not from GIS, and MassDEP does not have sufficient information regarding the nature of these emissions to require that they be controlled, and (2) the purpose of this rulemaking is to implement a specific policy to address SF<sub>6</sub> emissions from GIS included in the CECP.

In evaluating the most appropriate approach to reducing SF<sub>6</sub> emissions from GIS in Massachusetts, MassDEP considered the requirement in Chapter 21N, § 3(d), that “[t]he department shall promulgate regulations establishing a desired level of declining annual aggregate emission limits for sources or categories of sources that emit greenhouse gas emissions,” and concluded that a declining emission rate would be most appropriate, at least for the largest sources.

### **III. DESCRIPTION OF THE PROPOSED REGULATION**

#### **A. Applicability**

Any person that owns, leases, operates, or controls GIS in Massachusetts would be required to comply with 310 CMR 7.72. The definition of *person* in 310 CMR 7.00: *Definitions* in 7.00 would apply to 310 CMR 7.72, and *person* includes, but is not limited to, companies and municipalities. The regulation refers to these persons as “GIS owners.” GIS is defined to include switches, stand-alone gas-insulated equipment, and any combination of electrical disconnects, fuses, electrical transmission lines, transformers and/or circuit breakers used to isolate gas-insulated electrical equipment.

#### **B. General Requirements for GIS Owners**

MassDEP is proposing several requirements that would apply to all GIS owners. These requirements provide necessary assurance that SF<sub>6</sub> emissions from GIS in MA will gradually decrease to very low levels over time. Because these requirements are consistent with the capabilities of current GIS technology, they are not expected to be burdensome. The general requirements are:

- GIS purchased after January 1, 2014 must be able to comply with a 1% maximum annual leakage rate of SF<sub>6</sub>.
- GIS owners must maintain GIS purchased after January 1, 2014 in accordance with any procedures recommended by the manufacturer that may affect the SF<sub>6</sub> emission rate.
- For GIS purchased after January 1, 2014, if, after the first time that a GIS owner adds SF<sub>6</sub> to a GIS unit (or group of commonly-owned, leased, operated, or controlled GIS), and the GIS owner becomes aware that the annual average leakage rate for the new equipment is greater than 1%, the GIS owner must inform MassDEP and describe actions taken or anticipated actions that are expected to reduce the emission rate in the future.
- GIS owners that take GIS out of service must do so in a way that will ensure that any SF<sub>6</sub> in the GIS is re-used, recycled, or destroyed within six months of the date on which it was taken out of service.

The burden of compliance with these requirements would be on the GIS owner, not the manufacturer, maintenance contractor, or SF<sub>6</sub> provider. GIS owners can demonstrate compliance with the new equipment rate, maintenance, and out-of-service requirements by retaining records showing that they have taken steps to ensure compliance. For example, retention of technical product specifications showing a leak rate of less than 1%, or a receipt indicating that SF<sub>6</sub> was removed for re-use, recycling, or destruction would be sufficient to demonstrate compliance. With the exception of the requirement to report documented exceedances of the 1% maximum leakage rate for new equipment and subsequent actions taken to reduce emissions, no other reporting is required unless MassDEP requests a review of required records (except for GIS owners subject to the reduction requirement below). Once the reporting requirement is triggered, no further action, other than continued maintenance, is necessary.

MassDEP is seeking comment on all aspects of the above proposal, including whether it is realistic and appropriate to require that GIS containing SF<sub>6</sub> be reused, recycled or destroyed within six months of its retirement.

### **C. Emission Reduction Requirement for GIS Owners Subject to 40 CFR Part 98**

MassDEP is proposing an additional emission reduction requirement for GIS owners that are defined as “Federal Reporting GIS Owners,” i.e., those entities required to report SF<sub>6</sub> emissions from GIS pursuant to EPA’s GHG reporting regulation, 40 Code of Federal Regulations (CFR) Part 98. The only two GIS owners in Massachusetts that are subject to this requirement are Northeast Utilities and National Grid, both of which operate large transmission and distribution networks that include significant numbers of GIS in Massachusetts. Because applicability criteria for 40 CFR Part 98 are based on the amount of SF<sub>6</sub> contained in GIS in transmission and distribution networks, as reported in the surveys discussed above, MassDEP is confident that no

other current GIS owner in Massachusetts is likely to be subject to the reduction requirement in the future.

The annual SF<sub>6</sub> emission rate will be calculated by dividing the number of pounds of SF<sub>6</sub> emitted during the year by the total SF<sub>6</sub> nameplate capacity (the amount of SF<sub>6</sub> contained in fully-charged GIS<sup>3</sup>) of GIS owned, leased, operated, or controlled by the GIS owner. Emissions are calculated based on a mass balance approach specified in 40 CFR Part 98, Subpart DD. Any SF<sub>6</sub> present in the GIS owner’s inventory at the beginning of the year, but missing at the end of the year, is assumed to have been emitted unless otherwise accounted for.

Because reporting requirements will closely match EPA’s, MassDEP expects to be able to streamline the reporting process by obtaining much information directly from EPA. For information that cannot be obtained directly from EPA, MassDEP will work with stakeholders to explore other options. For example, depending on the format of EPA submittals, it may be possible for MassDEP to allow facilities to submit information to MassDEP in a format similar or identical to the format accepted by EPA. Proposed regulatory language allowing MassDEP to require that reports be “submitted electronically in a format specified by MassDEP” is intended to allow flexibility to consider options and streamline reporting as much as possible.

GIS owners subject to the emission reduction requirement will be subject to the following emission limits.

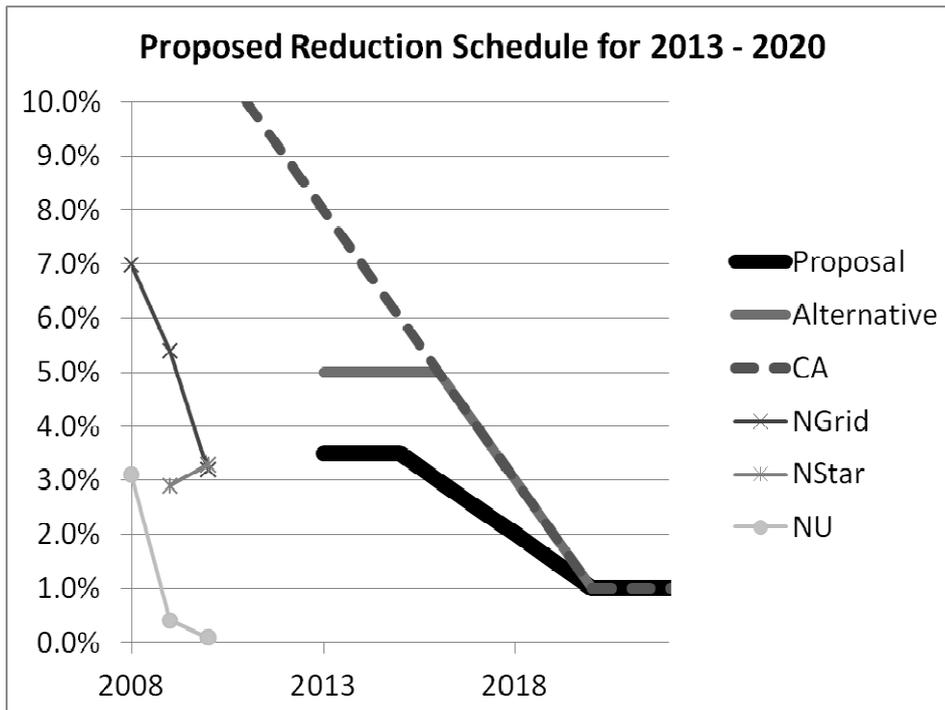
Maximum Annual SF <sub>6</sub> Emission Rate	
Calendar Year	Maximum Allowable SF <sub>6</sub> Emission Rate
2013	3.5%
2014	3.5%
2015	3.5%
2016	3.0%
2017	2.5%
2018	2.0%
2019	1.5%
2020, and each calendar year thereafter	1.0%

The proposed reduction schedule would initially ensure that emission rates do not increase above the maximum reported 2010 rate of 3.5%, then require a steady 0.5% annual reduction between 2015 – 2020. MassDEP believes that the 1.0% rate is achievable by 2020 because GIS owners have already demonstrated the ability to achieve reductions through their participation in EPA’s SF<sub>6</sub> Emission Reduction Partnership for Electric Power Systems. Significantly, one GIS owner in Massachusetts with a large SF<sub>6</sub> inventory (Northeast Utilities) achieved an emission rate of less than 1% for two consecutive years (2009 – 2010). Also, the same 2020 requirement is already in place for a much larger number of GIS owners in the state of California. (Title 17 of the California Code of Regulations, sections 95350 – 95359.)

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<sup>3</sup> The SF<sub>6</sub> nameplate capacity is calculated in a manner consistent with 40 CFR Part 98, Subpart DD. The calculation does not include GIS that is in storage or GIS that is sealed at the factory and not refillable by its user.

The graph below illustrates the proposed schedule and additional information that MassDEP considered in developing the proposal. This information includes survey results, the schedule that has been adopted by California, and an alternative proposal that would allow emission rates to remain at 5.0% until 2016, then decline by 1.0% annually until 2020. MassDEP is seeking comments on whether the proposed reduction schedule is appropriate and achievable. Commenters who believe that the proposed schedule may not be appropriate and achievable are encouraged to propose a specific alternative schedule and submit supporting technical data.



MassDEP is also seeking comments on whether this reduction schedule should also be applied to GIS owners that are not currently required to report SF<sub>6</sub> emissions from GIS to EPA. The reduction requirement is appropriate for GIS owners that report emissions to EPA because these GIS owners have the following three characteristics: (1) they are subject to detailed recordkeeping and reporting requirements; (2) they have the flexibility to manage emissions over a large inventory of equipment to achieve a specified percentage emission rate; and (3) they have gained relevant expertise and experience through EPA's voluntary reporting program. MassDEP is not proposing to apply this reduction schedule to GIS owners that do not report to EPA because they do not share any of these three characteristics, and because MassDEP received stakeholder comment from some facilities that the 1% rate may not be achievable for facilities that do not have a large inventory of GIS.

MassDEP understands that, in rare cases, emissions that could not have been prevented by the exercise of prudence, diligence, and care may occur and significantly impact the emission rate for a GIS owner. The regulation includes a provision to address such circumstances by excluding such emissions from the emission rate, provided that a detailed report is included in the GIS owner's annual report.

Lastly, the regulation includes a general enforcement clause to provide notice that the new regulation is subject to the standard penalty statute and regulations.

#### **IV. ECONOMIC IMPACTS**

GIS owners could incur some additional costs to comply with the regulation, especially in the later years during which emission rates must be reduced relative to current levels for GIS owners subject to an emission reduction requirement. To some degree, these costs would be balanced by savings associated with the reduced need to purchase SF<sub>6</sub>. Not enough information is available about likely costs and savings in the later years to explicitly estimate the magnitude of any economic impacts associated with the regulation. MassDEP notes that all known GIS owners are generally large businesses, such as power plants and electric utilities (either privately or municipal owned), and that California estimated the likely costs to electricity consumers of a similar but broader regulation to be less than \$0.000025 per kilowatt-hour (kWh).<sup>4</sup> As typical retail residential electricity prices in Massachusetts have ranged from \$0.13 to \$0.18 per kWh, this would correspond to an increase of 0.02% or less, or \$0.18 per year for the average household that uses 7200 kilowatt hours per year. (7200 kWh is the average annual household electricity consumption in Massachusetts, as recently calculated by the Massachusetts Department of Energy Resources.)

#### **V. SMALL BUSINESS IMPACT STATEMENT**

The proposed regulations are not expected to have any negative impact on small businesses because SF<sub>6</sub>-insulated GIS are only used in high-voltage circuits of a type rarely or never owned, leased, operated, or controlled by small businesses.

#### **VI. AGRICULTURAL IMPACTS**

The proposed regulations are not expected to have any negative impacts on agricultural production in Massachusetts. Positive impacts may result from reduced GHG emissions. For example, it is possible that increases in the frequency of extreme weather events that can destroy crops could be avoided if GHG emissions are reduced.

#### **VII. IMPACT ON MASSACHUSETTS MUNICIPALITIES**

The proposed regulations will not negatively affect cities or towns. While some communities that own electric power plants and utilities would be subject to the regulation, significant compliance costs are not anticipated because none of these entities would be subject to the reduction requirement. Furthermore, MassDEP notes that ownership and operation of a power plant, which municipalities may voluntarily undertake, is not a mandated municipal service. Therefore, costs associated with operation of a power plant are not mandated costs subject to the restrictions of Proposition 2 ½ (Town of Norfolk v. Department of Environmental Quality Engineering, 407 Mass 233 (1990)).

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<sup>4</sup> As documented on p. 78 of the CECP.

## **VIII. MASSACHUSETTS ENVIRONMENTAL POLICY ACT (MEPA)**

Pursuant to 301 CMR 11.03(12) (MEPA Regulations), these proposed regulations will not reduce standards for environmental protection, opportunities for public participation in permitting or other review processes, or public access to information generated or provided in accordance with these regulations. Promulgation of these regulations, therefore, does not require the filing of an Environmental Notification Form under MEPA.

## **IX. IMPACTS ON OTHER PROGRAMS – AIR TOXICS**

Air toxics are a group of chemical air contaminants that are associated with significant environmental impacts or adverse health effects such as cancer, reproductive effects and birth defects. The federal Clean Air Act requires EPA to promulgate source-specific controls based on Maximum Achievable Control Technologies (MACT) for air toxics. MassDEP implements MACT standards for major sources as EPA promulgates them. In addition, MassDEP controls air toxics through reductions of criteria pollutants and through its Toxics Use Reduction Program. Toxics use reduction is a MassDEP priority. Toxics use reduction is defined as in-plant practices that reduce or eliminate the total mass of contaminants discharged to the environment. The proposed regulations will not affect toxics.

## **X. PUBLIC PARTICIPATION**

M.G.L. Chapter 30A requires MassDEP to give public notice and provide an opportunity to review the proposed regulations at least 21 days prior to holding a public hearing. The hearing will be held in accordance with the procedures of M.G.L. Chapter 30A. The public hearing notice, proposed regulations and background document are available on MassDEP's website at: [www.mass.gov/dep/public/publiche.htm](http://www.mass.gov/dep/public/publiche.htm).

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