State of California
AIR RESOURCES BOARD

Final Statement of Reasons for Rulemaking
Including Summary of Comments and Agency Responses

THE ADOPTION OF A REGULATION TO REDUCE SULFUR HEXAFLUORIDE EMISSIONS IN NON-SEMICONDUCTOR AND NON-UTILITY APPLICATIONS

Public Hearing Date: February 26, 2009
Agenda Item No.: 09-2-4

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PUBLIC HEARING TO CONSIDER THE ADOPTION OF A REGULATION TO REDUCE SULFUR HEXAFLUORIDE EMISSIONS IN NON-SEMICONDUCTOR AND NON-UTILITY APPLICATIONS

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I. GENERAL

In this rulemaking, the Air Resources Board (ARB or Board) has adopted a new regulation that phases out the use of sulfur hexafluoride for non-semiconductor and non-utility applications. The regulation was developed pursuant to the requirements of the California Global Warming Solutions Act of 2006, also known as Assembly Bill 32 (the Act or AB 32). The regulation is codified in sections 95340 to 95346, title 17, California Code of Regulations (CCR).

On January 8, 2009, ARB issued a notice of public hearing to consider the proposed regulation at the Board's February 26, 2009 hearing. A "Staff Report: Initial Statement of Reasons for Rulemaking" (Staff Report or ISOR) was also made available for public review and comment starting January 8, 2009. The Staff Report, which is incorporated by reference herein, described the rationale for the proposal. The text of the proposed regulation was included as Appendix A to the Staff Report. These documents were also posted on the ARB's internet website at: http://www.arb.ca.gov/regact/2009/nonsemi09/nonsemi09.htm

On February 26, 2009, the Board conducted a public hearing to consider staff's proposal for adoption. Written and oral comments were received at the hearing. The Board adopted Resolution 09-23, approving the proposed regulation for adoption. The Board also directed staff to modify the regulation by adding an exemption for limited research and an extended phase-out date for a specific military tracer gas application. Resolution 09-23 directed the Executive Officer to adopt the modified regulations after making the modified regulatory language available for public comment for a period of at least 15 days, in accordance with Government Code section 11346.8(c), and to make such additional modifications as may be appropriate in light of the comments received, or to present the

regulation to the Board for further consideration if warranted in light of the comments.

A "Notice of Public Availability of Modified Text" together with a copy of the full text of the regulation modifications, with the modifications clearly indicated, was mailed on July 27, 2009 to each of the individuals described in subsections (a)(1) through (a)(4) of section 44, title 1, California Code of Regulations. By this action, the modified regulation was made available to the public for a 15-day comment period from July 27 to August 11, 2009, pursuant to Government Code section 11346.8. The Executive Officer then determined that no additional charges should be made to the regulations, except for the nonsubstantial change described in the following page in the paragraph entitled “Document Incorporated by Reference.” The Executive Officer issued an executive order by which the modified regulation was adopted.

This Final Statement of Reasons for Rulemaking (FSOR) updates the Staff Report by identifying and explaining the modifications that were made to the original proposal. The FSOR also summarizes the written and oral comments received during the rulemaking process, and contains ARB's responses to those comments. Modifications to the original proposal are described in Section II of this FSOR entitled "Modifications Made to the Original Proposal."

The Executive Officer issued Executive Order R-09-008 the regulation with the modifications described in Section II of this FSOR.

Economic and Fiscal Impacts

The ARB Executive Officer has determined that the proposed regulatory action will not create costs or savings, as defined in Government Code section 11346.5(a)(5) and 11346.5(a)(6), in federal funding to the state. It is also not expected to create costs to state or local agencies.

The Board’s Executive Officer has also determined that pursuant to Government Code section 11346.5(a)(5), the proposed regulatory action will affect small businesses. Staff estimates that profitability for these businesses could decline by about 2 percent for most businesses but up to 7 percent for specialized firms, in order to comply with the proposed regulations. A detailed description of these impacts is included in the ISOR.

Consideration of Alternatives

The Board has determined that no reasonable alternative considered by the agency or that has otherwise been identified and brought to the attention of the agency, would be more effective in carrying out the purpose for which the regulatory action was proposed, or which would be as effective and less burdensome to affected private persons or business, than the action taken by ARB.

Document Incorporated by Reference
Staff incorporated by reference in the regulation Technical Specifications Task Force (TSTF) Specification 448, January 2007. The incorporated document was part of the official rulemaking file from the time of publication of the hearing notice and was available to the public. However, the words "incorporated by reference herein" were inadvertently omitted from the text of the regulation and were inserted after the close of the 15-day comment period. Because the incorporated document will be used by a limited number of people, as well as its length and complexity, it would be cumbersome and impractical to publish the contents in their entirety in the California Code of Regulations.

II. MODIFICATIONS MADE TO THE ORIGINAL PROPOSAL

Various modifications were made to the original proposal to address comments received during the 45-day public comment period, and to clarify the regulatory language. A description of these modifications follows. In addition, the Board directed staff to modify the regulation by adding an exemption for limited research and an extended phase-out for a specific military tracer gas application. A Notice of Public Availability of Modified Text, together with a copy of the regulation with changes indicated, was posted on July 27, 2009 for period of public review and comment through August 11, 2009.

Summary of Modifications to the Originally Proposed Text

A. <u>In section 95341(a), the medical exemptions was modified to include veterinary practices.</u>

The regulation originally included an exemption for medical applications. Section 95341 was amended to include the use of sulfur hexafluoride in veterinary medicine.

B. <u>In section 95341(a), a date was added for Technical Specifications Task Force (TSTF) Specification 448.</u>

ARB clarified the version of the Technical Specifications Task Force (TSTF) Specification 448 that the regulation refers to by adding the reference date of January 2007.

C. <u>In section 95341(a), an exemption for research purposes was added.</u>

An exemption for use of sulfur hexafluoride in research applications was added. Research uses are hard to both define and anticipate and this exemption will allow researchers to utilize sulfur hexafluoride without the need to apply to ARB for the exemption in section 95341(b). Research facilities must register with ARB and monitor and report the sulfur hexafluoride usage including the total quantity

of sulfur hexafluoride purchased and used as well as the quantity used for each individual research activity and an explanation of each activity and any efforts undertaken to minimize emissions. The added exemption is designed for quick access to sulfur hexafluoride for research where the use is necessary. Since alternatives for tracer gas applications and magnesium casting are available, these uses are not exempt for research purposes. This exemption is limited to accredited educational institutions and United States Government National Laboratories.

D. In section 95341(b), the exemption language was modified to include possession of sulfur hexafluoride when there is no alternative.

Section 95341(b) was amended to allow for the storage of sulfur hexafluoride. This change was made in response to a comment made during the 45-day comment period and will allow the exemption process to cover storage for an out-of-state use or other potential storage needs.

E. In section 95342, definitions were added for "Military Tracer Gas Array," "Research," "Research Facility," "Tracer ES&T Model 2600 Tracer Gas Analyzers," and "User," and modifying definition for "Military Applications."

Definitions were added to section 95342(a) for the terms "Military Tracer Gas Array," "Research," "Research Facility," and "Tracer ES&T Model 2600 Tracer Gas Analyzers." These terms are new terms that are being included for the exemption for research purposes and the extended phase-out date for the military tracer gas array application. In addition, the term "User" is defined. The definition for military applications in section 95342 was modified to remove unnecessary language.

F. In section 95343(b), a phase-out date was added for the military tracer gas array application.

The originally proposed regulation required military applications to be phased out by January 1, 2013. Section 95343(b) was modified to include a separate phase-out date of January 1, 2020, for military use of sulfur hexafluoride in a tracer gas array application. The United States military needs this time to fully develop an alternative method and has stated that the tracer gas array application is of vital importance to national security.

G. In Section 95344, enforcement provisions were modified for consistency.

As originally drafted, section 95344(a) specified that violations of the regulation may subject a violator to revocation of an Executive Order, penalties prescribed by chapter 1.5 of part 5, division 26 of the Health and Safety Code commencing with section 42400, and/or the issuance of an injunction pursuant to section 41513 of the Health and Safety Code. For purposes of clarity this section was

segregated into three new sections that separately restate the revocation, penalty, and injunctive provisions.

New section 95344(a) specifies that penalties may be assessed for violations of this subarticle pursuant to Health and Safety Code section 38580, and that each day, during any portion of which a violation occurs, is a separate offense. Although this new section appears to specify different penalty provisions than those currently in section 95368(a), this is not the case, as explained below. Health and Safety Code section 38580(b)(1) states, in the pertinent part:

> "[a]ny violation of any rule, regulation, order … or other measure adopted by the [ARB] pursuant to [Division 25.5 of the Health and Safety Code] … is subject to those penalties set forth in Article 3 (commencing with Section 42400) of Chapter 4 of Part 4 of, and Chapter 1.5 (commencing with Section 43025) of Part 5 of, Division 26."

Subsequent to the hearing, staff realized it would be more accurate to cite Health and Safety Code section 38580, because section 38580(b)(2) specifies that violations of AB 32 regulations ". . . shall be deemed to result in an emission of an air contaminant for the purposes of the penalty provisions of Article 3 (commencing with section 42400)." This provision alters the penalty structure set forth in article 3, and it is therefore more accurate and informative to cite Health and Safety Code section 38580, instead of the Health and Safety Code sections contained in article 3 (commencing with section 42400).

Sections 42400(e), 42400.1(c), 42400.2(d), 42400.3(d), 42402(d), 42402.1(c), 42402.2(c), and 42402.3(d) provide that "each day during any portion of which a violation … occurs is a separate offense," so the new section 95344 (a) language stating that "each day during any portion of which a violation occurs is a separate offense" merely restates existing law.

New section 95344(b) restates the availability of injunctive relief pursuant to Health and Safety Code section 41513.

New section 95344(c) restates that the Executive Officer may revoke an Executive Order based on a violation of this subarticle.

New section 95344(d) was added to maintain consistency with the language of other discrete early action greenhouse gas measures.

Current section 95344(b) was removed to maintain consistency with other greenhouse gas measures.

H. In section 95345(d), reporting requirements was added for research facilities.

Staff added an exemption for use of sulfur hexafluoride in research applications in section 95341(a). Section 95345(d) adds requirements for the exempted research facilities to monitor and report the sulfur hexafluoride usage, including the total quantity of sulfur hexafluoride purchased and used, as well as the quantity used for each individual research activity and an explanation of each activity and any efforts undertaken to minimize emissions.

III. CORRECTIONS TO THE INITIAL STATEMENT OF REASONS

Staff has identified a few typographical errors and other minor problems in the ISOR. For clarity, the following is an identification of these errors and the necessary corrections.

1. The term CDA is incorrectly defined on page 20.

   On page 20 of the ISOR, CDA is defined as Completely Denatured Alcohol. This was an error and CDA stands for Clean Dry Air.

2. The reference (NIOSH, 2005) cited in the reference list on page 50 was corrected as follows:

   The correct reference should be as follows:

   NIOSH, 2005. Pocket Guide on Hydrogen Fluoride. September 2005. http://www.cdc.gov/niosh/npg/npgd0334.html

IV. SUMMARY OF COMMENTS AND AGENCY RESPONSES

The Board received written and oral comments during the 45-day and 15-day comment periods for this regulatory action. A list of commenters is shown below, along with an abbreviation for each commenter. Following the list, staff has summarized each comment provided regarding the proposal with an explanation of how the proposed action has been changed to accommodate the comment, or the reasons for making no change.

All comments are labeled in this document to allow both identification of the comment and the submitter of the comment. In the text that follows, each comment is first labeled by group and comment number (e.g. A-1, B-2) and then each comment is appended with an abbreviation such as “CMC(1)” to identify the commenter and corresponding letter/testimony. Because comments were

received through various mechanisms, we have tagged comments received as shown below.

Key:

# only	Comments that are numbered with a number only are written comments received during the initial 45-day comment period.
T#	Comment numbers prefixed with "T" were public testimony provided verbally at the Board hearing on February 26, 2009.
F#	Comment numbers prefixed with "F" were received during the 15-day comment period.

All public comments received are posted at:
http://www.arb.ca.gov/regact/2009/nonsemi09/nonsemi09.htm

List of Commenters and Abbreviations

Commenter Abbreviation	Comment Number	Commenter/Testimony
CMC		James Simonelli Executive Director California Metals Coalition
	1	Written Comments: February 5, 2009
	T3	Oral Testimony: February 26, 2009
Lagus		Peter Lagus President Lagus Applied Technology Inc.
	2	Written Comments: February 23, 2009
	F2	Written Comments: August 11, 2009
TracerEST		Thomas Rappolt President Tracer Environmental Sciences & Technologies, Inc.
	3	Written Comments: February 25, 2009
	4	Written Comments: February 25, 2009
UCOP		Lawrence Wong UC Office of the President

		Coordinator Environmental Health & Safety
	T1	Oral Testimony: February 26, 2009
DoD		Michael McGhee Department of Defense
	5	Written Comments: February 23, 2009
		Randal Friedman Department of Defense
	T2	Oral Testimony: February 26, 2009
LLNL		David Armstrong Lawrence Livermore National Laboratory
	T4	Oral Testimony: February 26, 2009
3M		Kurt Werner 3M
	T5	Oral Testimony: February 26, 2009
PFC		Michael Bailey People First California
	F1	Written Comments: August 1, 2009

Comments and Agency Responses: 45-day Comment Period

A. General Comments

A – 1 The modifications seem to have a good balance and will be a great help in protecting public health and the environment.

Comment: The modifications for reducing sulfur hexafluoride emissions seem to have a good balance and will be a great help in protecting public health and the environment. There are some very limited legitimate uses of this that are outlined in the proposal. But those exceptions should be phased out as suitable but less damaging alternatives come on line. … this is a good proposal; a good step forward. It should be implemented. [PFC F1]

A - 2 **Comment**: I appreciate you listening to and considering our perspectives. Furthermore, I would like to thank all the ARB staff that worked on this draft rule for their cooperative spirit and working approach to this important regulation. I stand eager to continue to work with the ARB on this and other issues to find common ground in regulations that benefit our state. [TracerEST 4]

Response to A-1 and A-2: Comments noted. The Board approved staff's proposal with staff's suggested modifications.

B. Compliance – Magnesium

B – 1 The alternatives for magnesium casting may not be viable.

Comment: CMC is concerned about the use of SO_2 in the metalworking industry due to safety, health, and odor concerns. CMC believes that SO_2 can be highly corrosive for the manufacturing facility and building, causing safety issues and shortening the lifespan of equipment. SO_2 also has odor issues for employees and the surrounding neighborhoods. The SCAQMD has been very strict on odor issues, and expanded use of SO_2 could be an odor violation. CMC would like to see ARB information on how these issues would be handled by air districts and Cal-OSHA.

For fluorinated ketone, CMC cites one test at a sand caster in Asia but states there is no information on critical variables (e.g. temperature, core usage, casting complexity). CMC members have been prepared to test fluorinated ketone in a real-world setting, but they feel it is premature to state that this is a viable alternative.

Finally, CMC would like to note that the use of alternatives in investment castings is different than sand castings due to differences in critical variables; thus an alternative viable in sand casting does not translate into a direct acceptance in investment casting. [CMC 1]

B - 2 **Comment**: The industry impacted in California is sand or investment casting with no ingot processing or die casters left in the state. The current competition, even though it is worldwide, is currently Mexico. Nogales, Mexico last year took about $3 million of our work.

The first point CMC has is that there are concerns about the alternatives. There is limited or no data available on the fluorinated ketone in the sand and investment casting industry. Therefore, it will be difficult to determine if it will be viable. CMC also does not have information on the price or availability of this alternative.

CMC states that the other option of SO_2 has odor, safety, and health concerns and that it will not be able to be diluted in sand and investment casters. It is corrosive to equipment and buildings, as used in the industry in the past. CMC states that they would have to put workers on respirators because it is an inhalation issue. It may also be an odor concern for the South Coast Air Quality Management District (SCAQMD), especially facilities near a school or in an environmental justice zone.

The last point is that customers may not accept the alternative. [CMC T3]

Response to B-1 and B-2: ARB does not advocate one alternative over another. The choice of alternative is up to the company. EPA studies have proven that the available alternatives are acceptable for similar industries. Although there are differences in the process, it is expected that the alternatives will work for sand and investment casting. If alternatives are not effective or not accepted by the SCAQMD, then the casters can apply for an exemption provided they have conducted research and can provide the necessary proof.

B - 3 **Comment:** I want to support the measure and thank the staff for their work. 3M manufactures the fluorinated ketone that is now being used in ingot casting and die casting that's used in the largest dye caster in North America. We have every reason to believe that it can be used in investment casting and sand casting.

And I just want to reiterate the comments from Mr. Simonelli that the trials will start at a local sand caster -- California sand caster next week. And we will work with the staff to report those results and optimize use of material as necessary, but we have every expectation that it can be made to work in those operations as well. [3M T5]

Response: Comments noted. The Board approved staff's proposal with staff's suggested modifications

B – 4 Reference to Completely Denatured Alcohol

Comment: The ARB report references the use of completely denatured alcohol (CDA) as an acceptable cover gas mixture. CMC has great concern with mixing CDA and molten metal. [CMC 1]

Response: This was a misprint and CDA should refer to clean dry air.

C. Compliance – Tracer Gas

C – 1 Sulfur hexafluoride is available at a higher purity level

Comment: Sulfur hexafluoride is available at very high purity (99.99%). This fact is undoubtedly due to the substantial industrial demand. The availability of high purity sulfur hexafluoride in tracer gas testing is important since preparation of cylinders of diluted emission gases as well as calibration standards requires the use of initially pure gas.

The perfluorocarbons (PFCs) in particular are not generally available at certified purities exceeding 95%. Thus, any use of a PFC incurs a 5% uncertainty in any initial mass emission rate. This lack of purity also implies that ANY calibration gas generated using these substances also exhibits an initial 5% uncertainty. Thus in any subsequent PFC concentration measurement this additional calibration uncertainty contributes to further overall measurement uncertainty. The existence of these two large uncertainties in turn, results in an unacceptable level of overall measurement uncertainty.

Since the industrial demand for PFCs is essentially negligible there is no economic incentive for a PFC manufacturer to incur the expense of improving existing production methods to produce a material of higher purity. [Lagus 2]

C - 2 **Comment:** This difference in purity produces a substantial increase in measurement uncertainty when using a PFC due to the compounding of concentration uncertainties in both the source gas mixture(s) and in analyzer calibration gas mixtures. This will be elaborated in an appendix to this letter [Lagus F2]

Response to C-1 and C-2: DuPont Chemical Company has several PFCs listed on their website at purities over 99% (http://www.dupont.com/Directories/en_US/Products_Services_Index/Chemicals/Fluorochemicals.html). There is industrial demand for PFCs, which are used extensively in the semiconductor and electronics industry. They are also used in medical applications, which require very high purity.

C - 3 Sulfur hexafluoride is a very useful tracer gas

Comment: Due to the detectability of sulfur hexafluoride at very low concentrations, the lack of appreciable SF_6 background in the atmosphere, the lack of sulfur hexafluoride toxicity, and the commercial availability of very pure aliquots of gas, sulfur hexafluoride has historically been an extremely useful gaseous tracer.

As a further indicator of the industrial usefulness of sulfur hexafluoride, I have provided a list of Test Standards most of which have been promulgated using the consensus process by a number of standards organizations. These test and measurement standards use sulfur

hexafluoride as a tracer gas, either directly by name or by implication. [Lagus 2]

C – 4 **Comment**:
Sulfur hexafluoride is a very powerful tool in assessing dispersion and transport characteristics of the atmosphere. It can be used as a surrogate for hazardous and toxic materials to assess local and distant population exposure to future, present and past pollutant emissions. We also use sulfur hexafluoride as a ground-truthing tool for new or modified measurement systems for hazardous and toxic materials.

The small amount of sulfur hexafluoride used in the above mentioned programs has virtually a zero contribution to global climate change, but offers very helpful information for gauging health -related impacts related to pollutant emissions. However, sulfur hexafluoride does have a very long lifetime.

Tracer ES&T has voluntarily reduced our usage of SF_6 and relied on using perfluorocarbon (PFC) chemicals as atmospheric tracers. This has been coincident with the federal government's national labs (i.e. Brookhaven National Laboratory) progression to entirely utilize PFC tracers in their programs as they continue to perform atmospheric tracer studies for many federal agencies. In fact, Tracer ES&T has not used SF_6 in California as a tracer gas for nearly 5 years. We have found much success in using PFC's for tracer studies due to the fact that they have a natural background that is much less than SF_6 and that allows us to detect the PFC's at much lower concentrations (about 1,000 times less than SF_6). Furthermore, the PFC's we use in tracer studies are safe and present no toxicological threat to humans and the environment as supported by numerous accounts of its mutagenic and toxicological affects. This translates into a net benefit to the environment in that for the same study, we can usually use about 100 to 500 times less PFC tracer than SF_6. We are fortunate to be able to make this change. But the ability to change to PFCs is not as simple for some other stakeholders of this rule due to the physical characteristics and purity issues. [TracerEST 4]

Response to C-3 and C-4: Sulfur hexafluoride is a useful tracer gas but in most applications there are alternatives. PFCs have many of the same useful characteristics as sulfur hexafluoride and, as mentioned above, there are no identified toxicological threats from PFCs. The inclusion of sulfur hexafluoride in a standard or guidance does not mean that no other gas could serve the same purpose. We have identified some uses with no alternatives and, if there is an additional tracer use with no alternative, the user may apply for an exemption under the criteria of no alternative.

C- 5 **Comment**: In an attached appendix LAT has attempted to clarify issues regarding the use of sulfur hexafluoride as a tracer that directly affect its continuing business in three particular areas. These include flow rate measurements, ventilation performance measurements for energy conservation, indoor air quality hazardous containment integrity testing within the semiconductor industry, and safe haven testing. In particular, the inability to continue providing flow rate calibration of in-situ flow measurement stations will directly lead to a loss of between 10% and 15% in yearly revenues. It is difficult to estimate the effect on other business segments of the loss of sulfur hexafluoride measurement capability in California since measurement service demands can be variable from year-to-year. [Lagus F2]

Response: Although ARB attempted to identify all uses with no alternatives available, there may be some that have not been identified. The exemption process was designed for this scenario. The uses identified above may fall under this scenario and users can apply for an exemption.

D. Emissions

D-1 Emissions of sulfur hexafluoride from other sectors is high in comparison to emissions from non-utility and non-semiconductor applications.

Comment: If electric utilities inside the State of California release comparable amounts of sulfur hexafluoride [as in New England (10% loss rate per year] it seems that the argument for eliminating the occasional minimal release of sulfur hexafluoride in non-semiconductor and non-electrical applications loses its environmental and technical justification…I came away with the impression that completely eliminating sulfur hexafluoride releases from electrical substations was essentially impossible. [Lagus 2]

Response: A separate regulation will consider sulfur hexafluoride at utilities. There are significant differences, one of which is mentioned in the comment. The sources covered in this regulation have cost-effective alternatives while the utility sector does not and completely eliminating emissions is impossible for that sector.

E. Research Exemption

E – 1 Include de minimis for research uses

Comment: The UC system attracts leaders scholars and researchers through laboratories and innovative research, improving lives and driving the economy for the State of California. The UC system's considered one

of the leading public universities in the United States. We're world leaders in terms of research. In one year, the UC system brings over $4.3 billion of research funds into the state of California. That is approximately ten percent of total academic research dollars in the entire United States.

As currently proposed in the regulations, UC researchers would not be allowed to use small quantities of sulfur hexafluoride for research purposes but in order to continue its role as a leader in academic research, UC must be able to have access to all types of chemicals. Banning the storage and use of sulfur hexafluoride in research applications will negatively impact the UC's leadership role in attracting research projects and attract and keep researchers. Therefore, University of California requests the Air Resources Board to include an exemption for the storage or use of small or de minimis quantities of sulfur hexafluoride for research purposes. They're using small de minimis quantities. So what we'd like to be able to do is continue to use small quantities, which we would track. [UCOP T1]

E-2 **Comment**: "research is international. On any given day, there could be a break-through experiment somewhere in the world, China, Russia. It could be a cancer cure. It could be alternative fuel. It could be anything from under the sun.

As soon as that kind of break through happens, researchers want to replicate the experiment that they saw published. But if that experiment involved even a microgram of sulfur hexafluoride, there is no university or laboratory in the State of California that would be able to replicate that experiment without waiting six months for approval -- roughly six months for approval of that replication.

Therefore, I'm requesting that there be some sort of de minimis allowance for research in this regulation." [LLNL T4]

Response to E-1 and E-2: As directed by the Board, staff has included an exemption for research uses. It requires the research facility to register with ARB and report usage activities but does not limit the amount of sulfur hexafluoride that can be used.

E-3 Addition to section 95341(a) adding an exemption for research purposes

Comment: The thrust of this section is that only government laboratories or universities can conduct acceptable research using tracer gases. This ignores the fact that large, well respected private companies have been capable in the past of undertaking serious research using tracer gases. This section precludes participation by the private sector in appropriate research.

To cite a few examples, in the 1980s, Aerovironment Corporation and Meteorology Research Incorporated performed significant research into using tracer gases for meteorological and pollution studies. The S-Cubed Division of Maxwell Laboratories, Incorporated developed the basic techniques which are used in both the nuclear power industry and the semiconductor fabrication industry under contract for the Army Toxic and Hazardous Materials Agency. A blanket preclusion of appropriate private sector firms does not seem appropriate given the history of this subject. [Lagus F2]

Response: ARB recognizes private sector expertise in tracer gas research. The research exemption does not include tracer gas or magnesium casting. Therefore, any research facility wishing to use sulfur hexafluoride for a tracer gas purpose would be subject to the same restrictions and exemption process. Additionally, outside of those two uses, a private company may apply for an exemption for research purposes.

F. Exemption Process

F - 1 Exemption Process is not clear

Comment: Although mentioned several times in the ARB report, providing an exemption for "Essential use with no alternative" is still unclear. Metalworking companies are investing in testing alternatives, but if faced with the situation of no alternative we would like ARB to expound on this topic so there is a clear path forward. [CMC 1]

Response: ARB believes the exemption process is clear as written. It is flexible and any additional information would unnecessarily limit the exemption applicability.

G. Military Phase-Out

G - 1 Include exemption for military and/or homeland security uses

Comment: The draft regulation allows some blanket exemptions for sulfur hexafluoride usage. We strongly feel that military and homeland security usage of sulfur hexafluoride should also be added to the exemption list in that their applications have national security implications. [TracerEST 4]

Response: As requested by the Board, ARB has included an extended phase-out date for military applications in general and another for one specific military use. These dates were reached with discussion and agreement with the Department of Defense.

G - 2 Include a phase-out date of 2020 for military tracer gas use.

Comment: Michael F. McGee, Acting Deputy Secretary of the Air Force submitted a letter and supporting paper seeking an extension of time until 2020 for military tracer gas use. The Air Force supporting paper documents the need for this tracer gas use as a result of early above-ground nuclear weapons testing, the ability to detect and analyze the long ranging effects of atmospheric transport into fusion of airborne particles became an area of interest of the federal government in the 1940s. In order to meet these needs, the Air Force performs global nuclear treaty monitoring and nuclear event detection and conducts field test programs to obtain empirical data needed to validate, transport, and disperse computer and modeling simulation efforts.

While the Air Force is actively looking at alternatives and has committed to cease use of sulfur hexafluoride by 2020, and sooner, if possible, maintaining current emissions capabilities will require a number of years of field testing, revalidation of atmospheric models, and extensive retooling of the existing sulfur hexafluoride base system. Such field testing, revalidation of models, and retooling will take a number of years and the results are uncertain and unpredictable at this time. A premature and unqualified prohibition of sulfur hexafluoride use in military tracer gas applications would be imprudent for its serious national security implications. Staff suggests that we use the existing exemption process post-2013, but we think this would be very difficult, given the surrounding security classification requirements. Per the proposed process, we must include documentation that supports the exemption claim, including the data and test methods to generate the data. All of this documentation would be highly classified. DOD classification requirements are much more stringent than your confidential process and would make this exemption process very difficult at best. Finally, AB 32's milestone year's 2020. We would be obligated to cease use of sulfur hexafluoride by then and have committed to try to replace our sulfur hexafluoride basis system sooner if possible.

We have supplied our 2001 to 2007 use data as well. We believe that our proposal is mindful of the State's need, but respectful of our nation's security needs. We ask that you provide the requested extension of time to comply through 2020. There is ongoing work to comply with our proposed 2020 date. We are asking for an item relating to military tracer gas use, to have a phase out date at 2020. We're not looking for a permanent exemption. [DoD T2]

G - 3 Include a phase-out date of 2020 for military tracer gas use.

Comment: I am writing to share U.S. Air Force concerns with one aspect of the proposed Air Resources Board's (ARB's) regulations to *Reduce*

Sulfur Hexafluoride Emissions In Non-Semiconductor And Non-Utility Applications; and recommend a solution to our problem. In short, we recommend an additional category of applications - "Military Tracer Gas Use" -- with an effective compliance date of 1 January 2020. This will allow the Air Force atmospheric tracer program to continue to meet its national security requirements until an effective substitute tracer gas and analyzer system can be tested, certified, and become fully operational.

The useful life of the existing Air Force sulfur hexafluoride tracer gas analyzer system is expected to be reached within several years of the proposed ARB regulation 1 January 2013 compliance deferral date. Because of the appealing performance characteristics of alternative systems that utilize perfluorocarbons (PFCs) as tracer gases, the Air Force has already begun working on the phase-out of its existing sulfur hexafluoride tracer gas analyzer system. While full system replacement is presently not forecast to be achieved until 2020, the Air Force is committed to seeking additional funding to help expedite the turnover to an alternative PFC system.

In light of the national security function of the Air Force tracer gas program, the periodic use of only small quantities of sulfur hexafluoride, the remaining functional life of the existing tracer gas analyzer system, and a commitment to expedite the turnover to an alternative PFC based system, the Air Force requests and recommends the proposed ARB regulation include a new line item at §95343(b) for "Military Tracer Gas Use" with an effective date of 1 January 2020. [DoD 5]

Response to G-2 and G-3: ARB has included an extended phase-out date of 2020 for specific military tracer gas use mentioned above. The date and definition were reached with discussion and agreement with the Department of Defense.

H. Magnesium Phase-Out

H - 1 A phase-in period does not address the magnesium sector's concerns.

Comment: A phase-in date is appreciated by industry as we work to fulfill our customer requirements. CMC thanks ARB for this consideration. But phase-in dates are a non-factor if the concerns of cost impacts, sulfur hexafluoride alternatives and consequential customer requirements are not settled.

A phase-in period is most effective when used by industry for equipment installation, equipment changes, training employees, conducting safety tests and customer notification. In the case of sulfur hexafluoride alternatives, testing needs to be done before the phase-in period begins or a regulation is finalized. [CMC 1]

Response: The phase-in period should allow for alternative testing and the equipment change, training, and other needs. The testing has already begun and it is not anticipated to take an extensive length of time. If alternatives are not effective, then the casters could apply for an exemption provided they have conducted research and can provide the necessary proof.

H - 2 Suggest a phase-out date of 2020 for the magnesium industry

Comment: "The phase out in 2020 is something that we can work towards. I've already met with staff and said we're willing to start to share the data with the fluorinated ketone.

If that works, our next step is to take all the thousands of products that we make and go to our customers and see if they are willing to accept this as a change out. And we'll share that information. But I think we just want to see that there's an openness on both sides to pursue this." [CMC T3]

Response: ARB believes that a 2013 date provides enough time to test with the promising alternatives. EPA studies have proven that the available alternatives are acceptable for similar industries. Although there are differences in the process, it is expected that the alternatives will work for sand and investment casting. If alternatives are not effective, then the casters can apply for an exemption provided they have conducted research and can provide the necessary proof.

I. Possession of Sulfur Hexafluoride

I - 1 It appears that possession of sulfur hexafluoride for out of state use is not allowed.

Comment: Even if a quantity of sulfur hexafluoride is destined to be used outside of California, [section 95343] precludes LAT from storing the gas at our facility in California – an untenable situation given our client needs. [Lagus 2]

Response: ARB has modified the language to allow users to apply for an exemption to store sulfur hexafluoride for an out-of-state use.

J. Enforcement

J – 1 Recommend keeping original Right of Entry clause

Comment: The one [weak] point was deleting the "Right of Entry" provision because that would have made sure the regulation was being followed by manufacturers, distributors, sellers and users. [PFC F1]

Response: The change in the enforcement language revises the language to be consistent with the language used in other ARB greenhouse gas regulations. The change in language does not eliminate or restrict the right of entry which is authorized by Health and Safety Code section 41510 and remains in effect regardless of whether the right of entry is specifically mentioned in the regulation.

K. Regulatory Alternatives – De minimus

K - 1 Urge the incorporation of a de minimus level of use

Comment: [I] urge the ARB to consider a mechanism to continue to allow the *de minimis* use of this very useful tracer gas within the State of California. [Lagus 2]

K - 2 *De minimus* quantities

Comment: Small release quantities coupled with a carbon offset tax would encourage the use of PFCs whenever their use is technically feasible. It should be noted that allowance of a single-event fume hood test using SF_6 per the ASHRAE 110 Standard releases a considerably greater quantity of SF_6 than any single ventilation or flow rate test using SF_6 tracer gas.

Parenthetically it should be noted that during a meeting of the Working Group a staff member of the University of California system stated (via telephone) that he had approximately 1,500 fume hoods that required testing. Based on this alone, since each ASHRAE test utilizes approximately 2/3 Kg (1.5 pounds) of SF_6, it is difficult to understand the Board's apparent unwillingness to allow *de minimus* releases of SF_6 in other applications. [Lagus F2]

Response to K-1 and K-2: ARB decided not to include a de minimus level of use. Sulfur hexafluoride emissions are essentially permanent in the atmosphere and emissions from numerous small sources add up to a significant level. Even a small usage of 1.5 pounds per fume hood test is significant in terms of climate impact (~15 metric tonnes of carbon dioxide equivalent). Since there are cost-effective and safe alternatives, including a de minimus level of SF_6 use is not appropriate given the climate impact from even a small emission. The fume test is only allowed if the test is required for the use of the fume hood in an energy saving mode, which results in lower lifecycle greenhouse gas emissions.

L. Regulatory Alternatives - Mitigation Fee

L - 1 Provide more detail on the Mitigation Fee on gases with High Global Warming Potentials.

Comment: CMC is unclear whether this fee would be placed on the distributors of SF_6 or the end user of SF_6. What would the fee be collected for? If the fee does not have a specific use, then it would be assumed to be a tax. Finally, if the rule allows for an "essential use with no alternative" exemption would an upstream fee on SF_6 still apply? [CMC 1]

L - 2 Urge adoption of a mitigation fee.

Comment: Based on the substantial likely future release quantities of SF_6 from electric utilities within California compared to the minimal release in the ventilation testing/flow characterization area, as well as the documented historical usefulness of SF_6 as a gaseous tracer, I would like to propose that the ARB impose a carbon offset tax for such as described at the EPA workshop. Such a course of action might make more economic and technical sense than eliminating most uses of SF_6 as a gaseous tracer.

I would strongly urge the adoption of Alternative Two as discussed in Section C of the above referenced document in conjunction with a de minimis exception to the strictures of the proposed regulation. A suggested cost matrix that was provided at the above mentioned EPA SF_6 workshop and is reproduced below.

Carbon Offset Price of SF_6
(EPA SF_6 Workshop February 2009)

$/metric ton CO_2	**$5**	**$10**	**$20**
CO_2 (One metric ton) 1 X $	$5	$10	$20
SF_6 (one lb.) 10.8 CO_2 eq X $	$54	$108	$216

It is my understanding that there is only one domestic primary manufacturer of SF_6. Since this manufacturer undoubtedly sells other gases into the State of California, it would be possible to obtain the names of SF_6 gas purchasers as well as the amounts purchased. From these

names it would be possible to assess a carbon offset fee such as provided for in the above table for each pound or kilogram of SF_6.

A similar fee-based licensing mechanism is already in place for the possession and use of radioactive sources within California. Licensing of radioactive sources is handled by the California Department of Health Services Radiologic Materials Licensing Branch. I believe the fee structure in this program pays for the bulk of the radioactive source licensing activity within the state. [Lagus 2]

L - 3 Complete mitigation fee before enacting this regulation

Comment: In order for Tracer ES&T to support adoption of the proposed rule, we would like assurances from the ARB in the form of language in the proposed rule, that PFC tracers will be allowed and viewed as a "green" alternative to SF_6. Unlike SF_6, we understand that a usage fee is being considered for certain PFC's and at this time we have no idea what the magnitude of that fee is. Therefore, before enacting this rule, I strongly recommend completing the PFC rule in draft form in order to see if tracer study applications using these inert gases are unfairly and disproportionately impacted with no other reasonable alternative. [TracerEST 4]

Response to L-1, L-2, and L-3: A mitigation fee on High Global Warming Potential gases will be considered under a separate public process. This process will evaluate whether a fee is feasible and how it could best be imposed. It is not appropriate to delay the SF_6 regulation until the details of a potential fee regulation are worked out, because the SF_6 regulation is feasible, cost-effective, and will achieve necessary emission reductions now.

M. Economic Impacts

M - 1 Leakage is expected to be a concern for the magnesium industry

Comment: Leakage is more apparent than the ARB report considers. Purchase orders of nearly $2,000,000 in magnesium metal castings have already been sourced to Mexico in 2008. The customer is in Connecticut. While this is just one documented case, CMC can confirm that other US states, India and China are vying to compete for similar business. Competition is significant to California's magnesium metal casting industry, and poses a serious threat to the state's metal casting industry. Worldwide competition, leakage of jobs, and an increased use of SF_6 outside of California are very real.

Leakage is not based on how many sand casters remain in North America. "…*there are less than 10 magnesium sand casters within North America and the three in California produce high quality items that are not easily transitioned to other casters. This limits the potential for leakage and limits the economic impact*." (pg 18 [of the ISOR]) Cost and customer requirements are primary drivers for whether items can be transitioned to other casters. If the customer demands SF_6, then the industry is forced to react or lose business. CMC would like to see any reports on how ARB has assessed the reaction of prime customers to the proposed elimination of SF_6. [CMC 1]

Response: We disagree. The sand casters in California have stated in workgroup meetings that the casting must be done in certain climatic regions and that they have superior knowledge and highly skilled workers necessary to meet customer requirements. In addition, the long-standing customer relationships mean that the customers trust the sand casters to deliver a quality product for sensitive industries. The mention of the number of sand casters is to note the limited nature of the business and when combined with the specialized nature of the casting and the climate (humidity, etc) needs, the possibility of leakage is limited. Additionally, there is no evidence that the customers will be resistant to the use of an alternative to SF_6 in the casting process. Although a new operation has begun in Mexico, the Aerocast website states that there is a backlog in magnesium aerospace parts, meaning the CA companies would not have been able to meet the orders (http://www.aerocastinc.com).

M - 2 The cost impact is underestimated.

Comment: The ARB report grossly underestimates the cost impact on the magnesium casting industry…The economic assessment is narrow as it only covers the general cost of a new equipment mixer. A full assessment would include freight, installation, calibration, energy costs, maintenance and ongoing supplies for this equipment.

But more importantly, the ARB report does not factor the cost of prequalifying a part. A mandated elimination of SF_6 would likely mandate the magnesium metal caster to prequalify parts for their customer for a first article. Use of an alternative to SF_6 by a metal caster is not unilaterally accepted by their customers…manufacturers have to notify their customers of any process changes and cognizant engineering organizations decide the requirements for a first article. If California metal casters are required to use an alternative to SF_6, businesses will be faced with reprocessing, rebuilding, and possibly retooling parts to the acceptable standards of their customers. The new part would also have to go through rigorous engineering standards, point testing to part specification, non-destructive testing, and other methods. CMC's internal

study of the cost to re-qualify a part for a first article is $40,000 – 80,000 per part, depending on the molding and material combination. Most facilities have hundreds of part numbers. It is very realistic for this cost impact to exceed $1,000,000+ - and none of these costs can be passed-on to the customer. ARB's mandated elimination of SF_6 must include the direct cost impact on California's magnesium metal casting industry. This cost impact will significantly impact leakage, job loss, and displacement of greenhouse gases to other geographical regions. [CMC 1]

Response: ARB is aware of the first article process but there is no evidence that the customers will require a first article for every piece or even any piece. Additionally, ARB attempted to obtain information on the cost for re-qualification and no information was provided by the magnesium industry through the survey or other efforts. Based on the information in this comment letter, ARB did a worst case analysis, estimating the total cost to be $1,000,000 and the change in return on equity was approximately 7 percent. This is still below a level where significant adverse impacts are expected. ARB does not think that the cost will reach this worst case scenario.

M - 3 ARB does not supply cost of SF_6 alternatives.

Comment: The ARB report (pg. 20, 36) does not report the cost of SF_6 alternatives. CMC requests that ARB share its cost data on SF_6 alternatives from distributors. This cost data is critical for stakeholders to calculate the cost impact on their company. [CMC 1]

Response: ARB states that the alternative costs are the same or lower than the cost for sulfur hexafluoride and therefore ARB used a zero cost/savings to be conservative. The exact costs are not available but the rationale for zero cost is supported both by the manufacturer (Werner 2008) and by EPA analysis (EPA 2007).

M - 4 There would be a significant statewide adverse economic impact.

Comment: CMC disagrees with the statement that there would not be a significant adverse economic impact because the ARB report does not take into account all of the economic impact factors. ARB's proposed elimination of SF_6 in California has already sent waves of concern through all customer bases. These concerns are rooted in the cost increases and process changes anticipated by this rule. [CMC 1]

Response: We disagree. Even if the worst case scenario is realized, the change in return on equity is below a level that signifies significant adverse economic impact. There is no evidence that the worst case scenario for costs would ever be reached. Additionally, the low number of

sand casters in North America and the environmental climate necessary for the casting of these parts limits competition and leakage.

N. Health and Environmental Impacts

N-1 SF_6 is non-toxic and PFCs have limited data

Comment: SF_6 is demonstrably non-toxic. There exists at least 60 years of peer-reviewed toxicological information available on the properties of SF_6. For instance, it has been used in pulmonary ventilation studies in both humans and dogs. It is used currently in humans for some types of eye surgery.

The vapors of some Perfluorocarbon liquids (PFCs) have been suggested as complete replacement tracers as several of them exhibit detection sensitivities that are comparable to SF_6. None of these PFC substances possess accepted, published exposure limits (threshold limit value (TLV) or permissible emission levels (PEL)). Most PFC liquids have little or no published toxicological information of any kind. Furthermore, the quantity of peer-reviewed toxicological data for the PFCs is minimal at best. If the ARB desires it, I can provide copies of many of the MSDS sheets provided by several PFC manufacturers. For the sake of brevity I have not appended them to this letter.

SF_6 possesses an *established TLV* (Threshold Limit Value) limit in the American Conference of Government Industrial Hygienists (ACGIH) TLV Handbook as well as an *established PEL* (Permissible Exposure Level) value in 29CFR1910 Table Z-1. *None* of the PFC substances are so listed.

A corollary of this absence of established exposure limits is that in some legal proceedings, the existence of a medical grade of SF_6 (i.e. capable of use within the human body) provides assurance to the court that allowing use of SF_6 in occupied settings will not result in a hazard to participants involved in potential litigation.

I have participated in a number of lawsuits as an expert witness in which I was called upon to measure air infiltration rates in occupied structures. I believe it is likely that use of a PFC would be contested by opposing counsel due to absence of published exposure limit information. In one case in which I was involved, the presiding judge allowed the use of SF_6 tracer gas only after it was pointed out that a *medical* grade of SF_6 would be used for the testing.

As a parenthetical note, the existence of an MSDS document for a substance is *NOT* the same as a peer reviewed health and safety limit or an exposure limit (either a threshold limit value (TLV) or permissible

emission levels (PEL)). Often for the suggested substitute PFC tracers the published MSDS sheets contain NO exposure limit information. [Lagus 2]

N-2 <u>There are no published threshold limit value (TLV) or permissible emission levels (PEL) for PFCs</u>

<u>Comment</u>: The absence of a threshold limit value (TLV) or permissible emission levels (PEL) for any of the PFCs does not imply that the chemical/substance is unsafe. PFCs do not possess listed TLVs/PELs since little to no toxicological data exist with which to support publishing a TLV or PEL value. SF_6 exhibits the highest TLV/PEL value (1000 ppm) attached to any man-made chemical. Many toxicological studies as well as the extensive use of SF_6 in certain medical and veterinary procedures have shown that there are no known adverse health effects. Often clients desiring a tracer gas test may be legally or ethically bound to use a tracer that has a published PEL/TLV.

One should also note that the ASTM standard for tracer gas ventilation testing (E741) specifically cautions against using any gas *for which no OSHA PEL exists*. [Lagus F2]

<u>Response to N-1 and N-2</u>: The PFCs used for tracer studies are inert and currently used in numerous applications including medical applications where PFCs are introduced into the body. Therefore, there is a medical grade of PFCs as well. Additionally a working group member who is a tracer specialist provided significant documentation on the safety of PFCs including toxicological studies and considers PFCs a green alternative to SF_6. See Comment Letter 3.

The federal government and several independent tracer firms are moving voluntarily to PFCs. PFCs can be detected at much lower levels than SF_6, thus saving additional greenhouse gas emissions through reduced use.

If sulfur hexafluoride is required by a law or otherwise necessary for a specific application, then users can apply for an exemption.