



DEPARTMENT OF THE AIR FORCE
WASHINGTON DC

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OFFICE OF THE ASSISTANT SECRETARY

Mary D. Nichols
Chairman, California Air Resources Board
Headquarters Building
1001 "I" Street
P.O. Box 2815
Sacramento, CA 95812

Dear Ms. Nichols,

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 Air Force faces unique challenges in that we must perform our national security mission while simultaneously satisfying our environmental obligations. We appreciate the ARB's acknowledgement of the special national security concerns of the Department through the inclusion of a compliance deferral for military applications until 1 January 2013, and note the date is identical to that proposed for tracer gas testing. As currently structured, however, the proposed 1 January 2013 restrictions on the use of SF₆ in military tracer gas applications would have unanticipated, unacceptable national security impacts, and jeopardize the ability of the Air Force to perform vital national defense and security functions.

In performance of our national defense and security mission the Air Force conducts periodic tracer gas testing with SF₆ in California. In the 2001-2008 timeframe the Air Force used approximately 2,422 kilograms (5339 pounds) of SF₆ in tracer gas applications; with actual releases of SF₆ occurring only during 2004 and 2005. The small quantity and periodic use are consistent with a mission planning and execution process that is influenced by geopolitical conditions and can take several years to accomplish.

The useful life of the existing Air Force SF₆ 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 SF₆ 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.

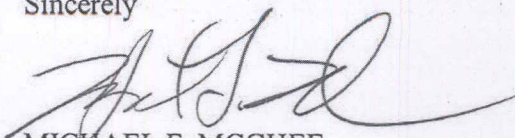
Please be assured that the Air Force recognizes the close linkages between greenhouse emissions, energy security, and environmental stewardship, and has assumed a Federal government leadership role in the areas of understanding and managing greenhouse gas emissions in a manner that is both environmentally and operationally sustainable. To that end, we have embarked on a voluntary policy initiative to develop a comprehensive, top-down inventory of Air Force greenhouse gas emissions. The voluntary inventory is being developed to maximize consistency with The Climate Registry protocol, and the Global Reporting Initiative (GRI) sustainability framework employed by the Air Force in its Energy, Environment, Safety, and Occupational Health (EESOH) Operational Sustainability Report.

Air Force energy initiatives such as the 14 megawatt photovoltaic system at Nellis AFB, Nevada (the largest in the Americas); the continued recognition received by the Air Force under the U.S. Environmental Protection Agency's Green Power Program as the top federal government buyer of green power and among the largest buyers on EPA's National Top 50 list; and the Air Force requirement that 100% of new military construction projects be designed to be capable of achieving the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Silver certification are but several examples that demonstrate the national leadership role we have assumed in improving energy efficiency and reducing greenhouse gas emissions. The Air Force EESOH Operational Sustainability Report (which includes a preliminary summary of the greenhouse gas inventory initiative) and the Air Force energy strategy and policies are publicly accessible at <http://www.safie.hq.af.mil/esoh/index.asp>.

In light of the national security function of the Air Force tracer gas program, the periodic use of only small quantities of SF₆, 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.

We remain vigorously committed to meeting the challenges posed by greenhouse gases while accomplishing our national security imperatives. If you have any questions concerning these comments please do not hesitate to contact me at (703) 697-1019 or email at michael.mcghee@pentagon.af.mil. I would also be happy to meet personally with you at your convenience at any time to address any questions or concerns you may have regarding this request.

Sincerely



MICHAEL F. MCGHEE
Acting Deputy Assistant Secretary
(Energy, Environment, Safety & Occupational Health)

**BACKGROUND PAPER ON AIR FORCE USE OF
SF₆ IN TRACER GAS APPLICATIONS**

1. Implications of a Ban on Air Force Use of SF₆ as a Tracer Gas

Unlike non-military entities, the Air Force faces unique challenges in that we must perform our national defense and security missions while simultaneously satisfying our environmental obligations. California's proposed regulations to restrict the use of sulfur hexafluoride (SF₆) in tracer gas applications after 1 January 2013 would gravely jeopardize planned Air Force field test efforts and render our existing tracer gas analyzer (TGA) measurement array obsolete before its time. Maintaining equivalent mission capability would require an extensive retooling of the existing SF₆-based system to accommodate the use of alternative perfluorocarbon (PFC) tracer gas. Such a retooling would take several years to accomplish and additional field tests would have to be performed in order to revalidate already mature atmospheric dispersion models with the new system. The additional field tests would certainly compromise national security capabilities by negating years of cumulative data already obtained in the tracer gas program. An unqualified prohibition of the use of SF₆ in military tracer gas applications is imprudent not only for its national security implications, but would also result in a time intensive and costly new learning curve.

2. Historical Perspective and Applications of Tracer Gases

a. The electron capture detector (ECD) arguably helped usher in the age of environmentalism with its selective sensitivity to pesticides and chlorofluorocarbons (CFCs). The ECD also opened the door to the use of SF₆ as a conservative gaseous tracer with limits of detectability in the previously unattainable parts-per-trillion by volume (PPTv) range.

b. Short range tracer experiments (such as for odor complaint resolution) are frequently performed to define local source-receptor relationships as well as to characterize building ventilation systems. Additionally, tracers have been used to locate leaks in underground storage tanks and underground cabling. Longer range transport studies have been carried out in urban areas, within geographical regions and across continents.

c. Increasing background concentrations of SF₆ and its classification as a greenhouse gas (GHG) have prompted the recent development of alternative methods that utilize PFCs as atmospheric tracers. PFCs exhibit extremely low global background levels and are detectable at concentrations of parts per quadrillion (PPQv) by volume. While PFCs are themselves recognized as GHGs, as a class of chemicals they exert less of a global warming impact than does SF₆. PFCs have recently become the tracer of choice for most atmospheric dispersion studies where a combination of sensitivity and/or the need to simultaneously tag multiple sources is required, and are also used in vadose zone groundwater contamination partitioning studies.

3. U.S. Air Force Atmospheric Tracer Programs

a. As a result of early above-ground nuclear weapons testing, the ability to detect and analyze the long-ranging effects of atmospheric transport and diffusion of airborne particles became an area of interest to the Federal government as early as 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 dispersion computer and modeling simulation efforts.

b. Air Force Tracer program investments have focused primarily on a TGA network that facilitates real-time measuring and reporting of SF₆ concentration levels during field tests. Comprised of 36 portable, ultra-sensitive SF₆ gas analyzers and a central control base station, the

TGA network is available to (and has been used by) other U.S. government agencies in support of their individual missions. The expected remaining functional life of the TGA network suggests equipment replacement activities will need to commence by approximately 2018, and will take 2-3 years to complete.

c. The Air Force tracer gas program has evaluated federal test sites nationwide for terrain suitability compatible with our national security-driven Air Force requirements. Because of ideal terrain and meteorological conditions, California was chosen as the optimum location for the conduct of our tracer gas studies. Accordingly, the Air Force has conducted tracer gas studies in California after consultation with local Air Pollution Control District personnel. As indicated in the table below, since 2001 the Air Force has used approximately 2422 kg of SF₆ in field tests in California on a periodic basis. This periodic use is consistent with a mission planning and execution process that, depending on the complexity of the particular mission and the field tests required supporting it, may take from 2-5 years to accomplish. It is important to note that the TGA equipment possesses a real-time monitoring mechanism of SF₆ release. This allows tests to be automatically discontinued after release starts due to uncontrollable changes in atmospheric/meteorological conditions, thus preventing unnecessary amounts of SF₆ to be released.

Air Force SF₆ Tracer Gas Use in California	
Year	Quantity Used (kg)
2001	0
2002	0
2003	0
2004	622
2005	1800
2006	0
2007	0

d. The Air Force has already begun investigating the use and performance of PFC alternatives to SF₆ in related field test activities. The PFC ECD is 500–1000 times more sensitive than similar SF₆ ECDs, meaning one could perform an equivalent test using 2 kg of a PFC instead of 1000 kg of SF₆. The increased sensitivity of PFC ECDs, and background atmospheric concentrations of PFCs that are lower than those of SF₆, are appealing characteristics for the Air Force atmospheric tracer program.

e. In tests conducted in California in 2007, approximately 60 kg each of three distinct PFCs (perfluoromethylcyclopentane, perfluoromethylcyclo-hexane, and perfluoro-1,3,5-trimethylcyclohexane) were used by the Air Force. The tests were conducted using traditional bag samplers. The use of bag samplers reduces the ability of the Air Force to dynamically alter test activities to meet changing environmental conditions. The consequence of not having real-time data includes having to re-accomplish logistically complex and expensive tests.

4. Request for Waiver

a. In light of the national security function of the Air Force atmospheric tracer program, the periodic use of small quantities of SF₆, and the expected remaining functional life of the existing TGA network, the Air Force requests and recommends the proposed ARB regulation to restrict the use of SF₆ in non-electricity and non-semi-conductor applications include a new line item at §95343(b) for “Military Tracer Gas Use”, with an effective date of 1 January 2020. Inclusion of such a provision will provide continuity to the tracer program by allowing the Air Force to: execute field test efforts for which planning has already commenced; evaluate alternative technologies; and begin planning for the replacement of the existing TGA network equipment with more sensitive PFC or other ECD technologies.