THE REGULATION OF HALONS AND HALON SUBSTITUTES: *AN* UPDATE

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I. INTRODUCTION

Although halons comprised only 2 percent of ozone depleting substances (ODS) produced in the U.S. in 1986, they represented 23% of the destruction to the stratospheric ozone layer from all ozone depleting substances due to their high ozone depletion potential (ODP). Halon 1301 has an ODP of 10 to 16; Halon 1211 has an ODP of 3 to 4; and Halon 2402 has an ODP of 7. Thus, this sector presents a well-targeted opportunity to make significant progress in protecting the ozone layer. The fire protection community plays a key role in this regard, and is to be congratulated and applauded for their efforts.

The Stratospheric Protection Division (SPD) is part of the Office of Air and Radiation of the U.S. Environmental Protection Agency. SPD is undertaking several activities to ease the transition to the 100 percent ban on the production of halons. Chief among its activities is the 'SNAP' program, or Significant New Alternatives Policy Program. Under Title VI of the U.S. Clean Air Act of 1990 (Public Law 101-549), EPA has been mandated to evaluate alternatives to Class I ozone depleting substances, including halon fire and explosion protection agents, in order to reduce the overall risk to human health and the environment. EPA realizes that the imminent January 1, 1994 ban poses many challenges to both users and manufacturers of fire protection systems. To assist in the transition, EPA is also participating in several other activities, including halon banking, essential

use nominations, and the development of procurement regulations and guidelines.

II. PRODUCTION BAN OF OZONE DEPLETING SUBSTANCES

The United States is a signatory to the Montreal Protocol, the international treaty which obligates the U.S. to phase out the production of ozone depleting substances. Originally signed in 1987, the Montreal Protocol called for a 50 percent reduction in production of ODSs by 1998, based on 1986 production levels. In 1990, the London Amendments were adopted, accelerating the 100 percent phaseout of Class I ODSs (including halon) to the year 2000, and of Class II ODSs to 2030. Then, in November 1992, the Parties to the Protocol met in Copenhagen and again agreed to accelerate the production phaseout. Now, halons may no longer be produced after January 1, 1994, and other Class I substances after January 1, 1996. In addition, HCFC production will be frozen by 1996 based on 3.1 percent of 1989 CFC consumption, plus 100 percent of 1989 HCFC consumption.

The U.S. Clean Air Act, Sections 604 and 605, requires the U.S. to comply with such accelerated terms under the Montreal Protocol. To actually do so, the EPA must publish a Rulemaking which codifies the U.S. phaseout into public law. The latest acceleration was recently published as a Proposed Rulemaking in the Federal Register (58 FR 15014). The public comment period for this notice ended on May 3, 1993. The Final Rulemaking will

be published by the end of 1993, in time to comply with the Copenhagen Amendments.

In this new Rulemaking, the US proposes to follow the revised phaseout schedule for Class I substances established in Copenhagen. In addition, EPA proposes to phase out the production of the pesticide and fumigant methyl bromide by 2000. HCFC-141b will be phased out by 2003, HCFC-22 and HCFC-142b by 2020, other Class II substances by 2030.

III. SIGNIFICANT NEW ALTERNATIVES POLICY (SNAP) PROGRAM

Rulemaking

Under Section 612 of the Clean Air Act, EPA is required to publish lists of approved and unapproved substitute agents and processes for Class I substances. EPA has designated the program that will make these determinations the Significant New Alternative Policy (SNAP) Program. The proposed SNAP rule was signed April 23, 1993 by EPA Administrator Carol Browner and was published May 12, 1993 in the Federal Register (58 FR 28095). The public has 45 calendar days from publication in the Federal Register to submit written comments. The comment period will close June 28, 1993.

When submitting comments, parties are advised to adhere to the following guidelines. All comments must be submitted in writing by the close of the public comment period, June 28, 1993. EPA is only obligated to respond to comments submitted in writing during this period. Also, EPA requests both positive and

negative comments be submitted. Positive comments regarding specific aspects of the Rule will provide support for retaining sections that might otherwise be amended in response to other negative comments. Last but certainly not least, criticisms of, and objections to, the proposed SNAP program or to the proposed acceptability determinations should include supporting data, to assist EPA in its response.

After receiving comment on the Proposed Rule, EPA staff will address the issues raised by the public. We anticipate publication of the SNAP Final Rulemaking by early 1994.

The Administrative Procedures Act (APA) was developed to ensure a fair and unbiased rulemaking process. Generally, the APA prevents EPA from acting in a capricious, arbitrary, or unlawful manner, while ensuring equal access to the rulemaking process for all individuals and groups.

Under the APA, once a Proposed Rulemaking is published, EPA staff may freely discuss information contained in the proposal and answer questions the public has concerning the SNAP program or proposed listings of substitute agents. However, EPA staff may not guarantee confidentiality of any conversation or private meeting. Summaries of private discussions and meetings with EPA staff will be added to the public docket. In addition, EPA staff cannot promise any particular outcome in the Final Rule.

SNAP Program

The most significant element of the Proposed Rulemaking published May 12 is the section which establishes the SNAP

program and describes how it will actually work once it is established. Until the rule is made final, there is no SNAP program.

Several sections of the Proposed Rulemaking describe the individual sectors being regulated by SNAP, including the halon sector, so named because halons are widely used in fire and explosion protection. Once the SNAP program is established, EPA may list a substitute as acceptable at any time, upon receipt of sufficient data, and may proceed to communicate the determination to interested parties. However, to list a substitute as unacceptable, EPA must go through a formal rulemaking process which provides for public comment.

EPA has included in the Proposed Rulemaking the proposed listing decisions for all substitutes submitted to date. These decisions are included in order to communicate as much information as possible to the public, which is especially critical in light of the accelerated phaseout. EPA encourages public comment on the SNAP program itself, as well as on the sector-specific listing decisions.

SNAP Listing Decisions

The guiding philosophy of SNAP is embodied in Section 612 of the Clean Air Act, which states: "To the maximum extent practicable, Class I and Class II substances shall be replaced by chemicals, product substitutes or alternative manufacturing processes that reduce overall risks to human health and the environment...and [are] currently or potentially available."

This clause implies that a) not just chemical substitutes but also alternative processes must be evaluated; b) any substitute for halon must be evaluated; and 3) evaluations must involve a 'risk balance' in order to reduce the overall risks to human health and the environment.

In light of this language, EPA will evaluate not only halocarbon agents, but also non-halocarbon agents and alternative processes. For example, while EPA is not intending to restrict existing fire protection technologies such as water sprinklers, carbon dioxide, or dry chemical, technologies such as water mist systems, inert gas mixtures, and pyrotechnically generated aerosols which involve new processes will be evaluated as halon replacements. Further, EPA must evaluate blended agents as a blend, and not simply as the average of its constituents, since the blend may act differently than the individual constituents. Finally, since EPA is charged with assessing all substitutes that replace a Class I substance, any substitute for halon must be assessed, including substitutes for discharge testing and training.

Under the SNAP program, EPA will not evaluate existing fire extinguishing agents and processes such as water sprinklers, foam, dry chemical, and CO_2, but will include them in the lists of acceptable substances for the purpose of public education.

Further, EPA does not intend to overshadow the work of the National Fire Protection Association (NFPA). Rather, EPA relies on NFPA to qualify how and when substitutes should be used. EPA

is simply broadly qualifying the agents as acceptable from a health and environment perspective, and does not intend to imply that they may be used without applicable NFPA technical standards, UL or FM listings, and other industry mechanisms for ensuring safe and effective use.

EPA evaluates several criteria related to environmental impact, health and safety, efficacy, and market potential. Environmental Impact criteria include ODP, Global Warming Potential (GWP), atmospheric lifetime, status as Volatile Organic Compound (VOC), and where appropriate aquatic toxicity. Human Health and Safety include several chronic as well as acute exposure risks. With regard to efficacy, EPA simply notes manufacturers' data for weight and volume storage equivalent, which has a bearing on the agents' marketability, along with other technical aspects of the substitute.

In fire and explosion protection, the typical route of exposure is acute rather than chronic. After examining many different agents for fire and explosion protection, cardiotoxicity has emerged as the factor which most affects the suitability of an agent for use in occupied areas. In an emergency situation, such as a fire, a person's adrenaline (epinephrine) level is elevated. In such an epinephrine-enhanced state during an acute, episodic exposure to halon or a halocarbon substitute, the agent could cause cardiac sensitization, a condition which could result in heart arrhythmias possibly resulting in a heart attack. Thus, only agents with an

extinguishment design concentration which is less than its cardiotoxicity level are suitable for use in occupied areas.

Because agents are stored in sealed systems, long-term exposure from fire agents is a secondary issue. Leaks from the storage containers are minimal and would be unlikely to expose personnel to toxic levels of the agent. However, possible long-term exposure is assessed for carcinogenic and non-carcinogenic effects, especially for personnel involved in the manufacture of systems.

To date, **EPA** has reviewed approximately 100 agents across eight use sectors (comprising over 300 applications), of which less than 10 percent are listed as unacceptable. In the fire and explosion protection sector--also known as the 'halon' sector--**EPA** has reviewed **17** substitute agents. Only one of the submitted alternatives is listed as unacceptable. This is because it is formulated with a Class I substance, making it an inappropriate substitute for a market niche in which Class I substances are not currently being used. However, the fact that only one agent is listed as unacceptable in this sector does not imply that all of the other acceptable submissions are unrestricted. While **EPA** does not frequently list an agent as unacceptable, it is likely that **EPA** will impose restrictions or conditions on use to limit particular risks which are characterized in the analysis of each agent, such as its potential environmental and human health impacts, or routes of exposure. For example, since cardiotoxicity is of prime concern in total flooding occupied

areas, EPA has imposed restrictions that would prevent exposure to toxic levels of the agent. Also, in cases where there is an environmental concern such as GWP, EPA is setting restrictions on its potential uses in order to limit environmental effects of widespread use.

Streaming Agents

Streaming Agents have been subdivided into three use areas to aid EPA in making a 'risk balanced' decision: consumer applications, commercial/industrial applications, and military applications. For example, the risk associated with a military application may warrant the use of an agent whereas the same agent could not be so justified in a residential setting where other alternatives are available. "Consumer" means a private individual who uses a chemical substance or any product containing the chemical substance in or around a permanent or temporary household or residence, during recreation, or for any personal use or enjoyment. "Commercial use" means the use of a chemical substance or any mixture containing the chemical substance in a commercial enterprise providing saleable goods or a service to consumers.

In the evaluation of streaming agents, EPA requires personal monitoring data. This is gathered by attaching a filter near the nose, which collects actual levels of agent that come within breathing range. This data is then compared to the cardiotoxicity level of the agent.

In the proposed SNAP rule, most use limitations on streaming agents are imposed in consumer applications. For example, HBFC-22B1 does pose a risk of developmental toxicity, and thus EPA believes it is inappropriate to allow its use in residential settings because children and pregnant women could be exposed to concentration levels resulting in potential developmental effects. CFC blends are restricted from use in residential settings to avoid continued reliance on a Class I substance where other alternatives exist. For PFCs, as alluded to earlier, where there is an environmental concern over atmospheric lifetimes, EPA is setting restrictions on its potential uses in order to minimize environmental impacts. Approved streaming agents are listed in Table 1.

Total Flooding Agents

When total flooding agents are used in normally unoccupied areas, the main considerations in the evaluation process are environmental impact and efficacy, and thus most agents proposed to EPA for this use are considered acceptable. In normally occupied areas, however, human health and safety considerations dominate, and the issue of cardiotoxicity is paramount. In order to control exposure, EPA patterned use restrictions after the Occupational Safety and Health Administration (OSHA) standards for the use of Halon 1301 in fixed systems *(29* CFR 1910.162). EPA will withdraw its conditions when OSHA amends its regulations to include the new substitute agents.

Agent	Status
[CFC Blend] (NAF-P)	Acceptable for non-residential uses (until 1996 phaseout)
HBFC-22B1 (FM-100)	Acceptable for non-residential uses (until 1996 phaseout)
[HCFC Blend] B (Halotron)	Acceptable
HCFC-123	Acceptable
HFC-227ea	Pending
PFC-614*	Acceptable (specific uses only)
Dry Chemical	Acceptable
Carbon Dioxide	Acceptable
Water	Acceptable
Foam	Acceptable

Table 1. Streaming Agents

* Global warming concerns - further evaluation pending

The primary requirement of OSHA is that all personnel must be evacuated before the concentration of the agent exceeds the Lowest Observed Adverse Effect Level (LOAEL), i.e. the cardiotoxic effect level. If personnel can egress in less than one minute, the system may be designed to the LOAEL. If

personnel cannot egress in less than a minute, the design concentration may not exceed the No Observed Adverse Effect Level (NOAEL). While EPA has listed as acceptable all of the proposed alternatives, the design concentration of many agents exceeds safe cardiotoxic levels, thus narrowing the actual usable list.

The NFPA requires discharge of the total flooding agent within 10 seconds for normally occupied areas. Therefore, after comparing the cardiotoxicity to design concentration, and considering NFPA requirements, the agents that emerge as the feasible halon substitutes are clearly identified. See Table 2.

Agent	Occupied Areas
HCFC Blend (NAF S-III)	Acceptable
HFC-23 (FE-13)*	Acceptable
HFC-227ea (FM 200)	Acceptable
PFC-410*	Acceptable: specific uses only
Inert Gas Blend (Inergen)	Acceptable
Water Mist	Pending
SF6 (discharge test agent)	Pending

Table 2. Total Flooding Agents
* Global warming concerns - further evaluation pending

Explosion Inertion

The data submitted to EPA on alternative explosion inertion agents are much less complete than for the other halon use sectors. Therefore, EPA is particularly interested in receiving

comment on the explosion inertion sections of the SNAP Proposed Rule.

Since there is no parallel regulatory authority like that under OSHA for fixed extinguishment systems, EPA did not include use conditions. Obviously, since these agents pose a risk of cardiotoxic effects, designers should not design a system above the NOAEL or LOAEL, unless they are sure occupants can easily leave. The proposed acceptability determination are listed in Table 3.

Acceptable for Occupied Areas	Acceptable for Unoccupied Areas Only
HFC-23 (FE-13)*	HBFC-22B1 (FM 100) (until 1996 phaseout)
HF-227ea (FM-200)	HFC-125
PFC-410*	
Inert Gas Blend (Inergen)	

Table 3. Explosion Inertion Agents
* Global warming concerns - further evaluation pending

Next Steps for SNAP

EPA is operating under a court-ordered deadline to promulgate the final SNAP Rulemaking by February, 1994. To this end, EPA will concentrate on addressing public comments about the structure of the SNAP program, as well as about its analysis of alternatives and the consequent listing decisions. EPA will also continue analysis of new data for existing substitutes in

order to ensure accurate depiction in the Final Rulemaking. In addition, EPA expects to receive submissions for new agents and alternative technologies, and will continually update the acceptability lists based on the new data.

EPA's goal in evaluating alternative fire and explosion protection agents is to reduce the overall impact on the environment. EPA seeks guidance from NFPA and the professional fire and explosion protection community on how best to protect the environment while ensuring safety to life and property. Therefore, EPA encourages written comments on this proposed rule by June 28, 1993.

IV. Halon Banking

There are two organizations in the United States that have begun halon banks: the Halon Recycling Corporation and the Defense Logistics Agency. In addition, many private organizations are creating their own internal banks to serve their critical needs.

The Halon Recycling Corporation (HRC) is a non-profit information clearinghouse; it is not a physical halon bank. HRC was established to assist sellers who want to dispose of Halon 1301 in a responsible manner, and to help buyers with critical uses locate supplies of Halon 1301 for recharging their existing systems.

Under the HRC system there are two categories of critical users: 'registered' and 'certified.' To be registered, a buyer

must sign a self-certification form provided by HRC. This form includes statements assuring HRC that the user is taking steps to find alternatives to halon, that no alternatives are currently technically, economically or legally available, that steps are being taken to redeploy existing stocks of the chemicals from non-critical uses, and that the user has incorporated emission controls into the system design and management practices. To be "certified," a buyer must submit a detailed application addressing these issues to the independent Critical Halon Use Committee (CHUC). CHUC is comprised of three rotating subcommittees with two appointees from Halon Alternatives Research Corporation, one appointee from EPA, one appointee from an environmental NGO, and one paid fire protection consultant. *An* appeals process is also available.

Buyers and sellers will be matched by HRC according to the following provisions. Certified buyers will receive a list of sellers willing to sell to either level. Registered buyers will receive a list of sellers only willing to sell to registered buyers. Finally, sellers will receive a list of all buyers.

The Defense Logistics Agency (DLA), on the other hand, is coordinating the development of an actual physical bank for the Department of Defense in order to establish and maintain a reserve of ODSs for the U.S. military. The DLA bank is especially interested in obtaining reserves of Halon 1301, CFC-11, CFC-12, and CFC-114. EPA encourages and supports this effort and urges cooperation between DLA and HRC.

V. ESSENTIAL USES

As opposed to "critical use", the term "essential use" is a legal term defined in the Montreal Protocol. The Parties to the Protocol have established a mechanism whereby national governments may apply for an essential use exemption, in order to obtain permission to have Class I substances newly produced. Applications are subject to a review process administered by the United Nations Environment Programme (UNEP). To designate a specific halon use essential, a detailed application must be submitted to EPA describing the vital nature of the use. In order to have a particular use established as essential, the applicant must demonstrate that: 1) it is necessary for human health and safety or is critical for the functioning of society; and 2) there are no technically and economically feasible alternatives that are acceptable from the standpoint of environment and health. In order to have new halon produced after the January 1, 1994 ban, users must demonstrate that: 1) all economically feasible steps have been taken to minimize the essential use and any associated emissions; and 2) the controlled substance is not available from existing stocks of banked or recycled controlled substances.

If EPA accepts the application, EPA, in coordination with the U.S. State Department, will nominate the use to the Parties to the Protocol. UNEP's Technical Options Committee will evaluate the technical merits of the nomination and pass its recommendation to the UNEP Technology and Economics Panel, which

in turn will make a recommendation to the Working Group of the Parties. Once a decision has been made by the Parties, EPA must review the decision to ensure that it complies with the Clean Air Act.

With the production ban quickly approaching, users of halon must conduct an objective assessment of their needs with a realistic understanding of implications of the phase out measures, It is imperative for users to realize that UNEP essential use exemptions will be difficult to obtain. Economically, new Halon 1301 will be expensive to produce in small quantities, and under the U.S. Tax Code beginning January 1, 1994, a tax of $43.50 per pound will be added for all newly produced halon, (Recycled halon is exempt from this tax,) In addition to rising costs, supply for essential uses is unpredictable. Outside the military, users cannot compel manufacturers to produce halon, In fact, after the year 2000 there may be no one in the world producing halon. In lieu of these uncertainties, EPA is strongly advising users to perform aggressive research to identify suitable alternatives.

VI. PROCUREMENT REGULATIONS

Manufacturers and resellers of the new replacements should note the changes underway in military and federal agency procurement, Three separate events are converging to speed the replacement of ODSs,

EPA is required to write procurement regulations governing all federal and quasi-federal agencies, per section 613 of Title VI of the CAA. The proposed rule was published in the Federal Register on April 12, 1993 (58 FR 19080) and will be final by late 1993. However, similar requirements have already been implemented through an Executive Order, signed by President Clinton on April 21 and effective May 21, 1993. The Executive Order alerts all federal and quasi-federal agencies that they must comply with the terms of Title VI (including the accelerated phaseout, Motor Vehicle Air Conditioning servicing, labeling, and recycling and emission reduction), and that they must rewrite procurement regulations (including the Federal Acquisition Regulations) to incorporate the substitute agents. Specifically, the Executive Order instructs federal agencies to: 1) conform procurement regulations to Title VI; 2) maximize the use of safe alternatives; 3) assess need for ODSs and evaluate plans for use and recycling; 4) modify specifications and contracts to substitute non-ODSs; and 5) exercise leadership, develop exemplary practices, and disseminate information to phase out ODSs.

In an even quicker effort to modify contracts and implement non-ODSs agents and processes, a DOD order was issued under the National Defense Authorization Act for FY 93, Title 111, Section 326. This order prohibits the procurement of ODSs after June 1, 1993 without specific high level permission. It also mandates the amendment of contracts and procurement regulations.

To assist agencies in quickly modifying procurement regulations, EPA is initiating an outreach program to develop and disseminate sample regulation language and specifications. For more information, contact Peter Voigt at (202) 233-9185.

VII. CONCLUSION

In summary, EPA's efforts to protect the stratospheric ozone encompass not just regulatory activity, but include a significant commitment to encourage and cooperate with industry. While the phaseout of ODSs is the impetus for EPA programs, SNAP provides a focused avenue for evaluating the many different substitute agents and describing their characteristics in common terms. While the SNAP program's goal is to reduce the overall risk to human health and the environment, it is not attempting to supersede the technical judgement of the professional fire protection community, and therefore EPA staff participate cooperatively as much as possible with industry organizations. In addition, EPA realizes that the national interest is served by the development of halon banking mechanisms, and EPA staff work to encourage and facilitate industry efforts. Such efforts will also assist EPA in supporting the U.S. national interest before the Parties to the Montreal Protocol. Finally, by developing an aggressive outreach campaign to assist procurement officials to rewrite procurement regulations, contracts, and specifications, EPA is hoping to speed the successful deployment of the new substitute agents and technologies that are being developed to replace ODSs.