**UNITED STATES**
**CONSUMER PRODUCT SAFETY COMMISSION**
**4330 EAST WEST HIGHWAY**
**BETHESDA, MD 20814**

This document has been electronically approved and signed.

**DATE:** December 14, 2016

**THIS MATTER IS NOT SCHEDULED FOR A BALLOT VOTE.**
**A DECISIONAL MEETING FOR THIS MATTER IS SCHEDULED ON: TBD**

**TO:** The Commission
Todd A. Stevenson, Secretary

**THROUGH:** Mary T. Boyle, General Counsel
Patricia H. Adkins, Executive Director

**FROM:** Patricia M. Pollitzer, Assistant General Counsel
Meridith L. Kelsch, Attorney, OGC

**SUBJECT:** Proposed Rule: Amendments to Fireworks Regulations

The Office of the General Counsel is providing for Commission consideration the attached draft notice of proposed rulemaking for publication in the *Federal Register*. The proposed rule would amend the current regulations regarding fireworks in 16 C.F.R. parts 1500 and 1507 under the Federal Hazardous Substances Act (15 U.S.C. §§ 1261-1278).

Please indicate your vote on the following options:

I. Approve publication of the attached document in the *Federal Register*, as drafted.

_____ _____
(Signature) (Date)

II. Approve publication of the attached document in the *Federal Register*, with changes. (Please specify.)

_____

_____

_____

_____

_____ _____

(Signature) (Date)

III. Do not approve publication of the attached document in the *Federal Register*.

_____ _____

(Signature) (Date)

IV. Take other action. (Please specify.)

_____

_____

_____

_____

_____ _____

(Signature) (Date)

Attachment: Draft *Federal Register* Notice of Proposed Rulemaking to Amend Fireworks Regulations

**Billing Code 6355-01-P**

**CONSUMER PRODUCT SAFETY COMMISSION**

**16 CFR Parts 1500 and 1507**

**[Docket No. CPSC-2016-XXXX]**

**Amendments to Fireworks Regulations**

**AGENCY:** Consumer Product Safety Commission.

**ACTION:** Notice of proposed rulemaking.

**SUMMARY:** The Consumer Product Safety Commission (Commission or CPSC) proposes to amend its regulations regarding fireworks devices under the Federal Hazardous Substances Act. The proposed amendments are based on the Commission's review of its existing fireworks regulations, the current fireworks market, changes in technology, existing fireworks standards, and safety issues associated with fireworks devices. The proposed amendments would create new requirements and modify or clarify existing requirements. Some of the proposed revisions would align with existing fireworks standards or codify the Commission's existing testing practices. The Commission believes that the proposed requirements would improve consumer safety by codifying limits, test procedures, and requirements that would reduce the risk of injury to consumers and clarifying existing requirements to promote compliance.

**DATES:** Submit comments by [INSERT DATE 75 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER**]**.

**ADDRESSES:** Comments, identified by Docket No. CPSC-2016-XXXX, may be submitted electronically or in writing:

Electronic Submissions: The Commission encourages you to submit electronic comments by using the Federal eRulemaking Portal. You may submit electronic comments to the Federal

eRulemaking Portal at: http://www.regulations.gov, by following the instructions for submitting comments. The Commission does not accept comments submitted by electronic mail (e-mail), except through www.regulations.gov.

Written Submissions: Submit written comments by mail, hand delivery, or courier to: Office of the Secretary, Consumer Product Safety Commission, Room 820, 4330 East West Highway, Bethesda, MD 20814; telephone (301) 504-7923.

Instructions: All submissions must include the agency name and docket number for this proposed rulemaking. All comments may be posted to http://www.regulations.gov without change, including any personal identifiers, contact information, or other personal information. Do not submit confidential business information, trade secret information, or other sensitive or protected information that you do not want to be available to the public. If you submit such information, the Commission recommends that you do so by mail, hand delivery, or courier.

Docket: To read background documents or comments regarding this proposed rulemaking, go to: http://www.regulations.gov, insert docket number CPSC-2016-XXXX in the "Search" box, and follow the prompts.

**FOR FURTHER INFORMATION CONTACT:** Rodney Valliere, Project Manager, Directorate for Laboratory Sciences, U.S. Consumer Product Safety Commission, 5 Research Place, Rockville, MD 20850; telephone: 301-987-2526; e-mail: RValliere@cpsc.gov.

**SUPPLEMENTARY INFORMATION:**

**I. Background**

The Federal Hazardous Substances Act (FHSA; 15 U.S.C. 1261-1278) authorizes the CPSC to regulate hazardous substances, which include fireworks devices. 15 U.S.C. 1262. The Commission assumed responsibility for administering the FHSA on May 14, 1973. *Id*.

at 2079(a). Previously, the U.S. Department of Health, Education, and Welfare exercised this authority and the U.S. Food and Drug Administration (FDA), an agency within that department, issued regulations governing fireworks and other hazardous substances. When the Commission assumed responsibility, it adopted the existing FDA regulations, transferring them from 21 CFR part 191 to 16 CFR part 1500. 38 FR 27,012 (Sept. 27, 1973). These regulations included requirements limiting the pyrotechnic composition of fireworks devices "intended to produce audible effects" to two grains; carving out an exception to that regulatory limit for wildlife management purposes; and exempting certain packaged fireworks assortments from full labeling requirements for hazardous substances under the FHSA.

Since assuming responsibility for the FHSA, the Commission has added provisions to the fireworks regulations, which are now in 16 CFR parts 1500 and 1507. These additions include labeling requirements; prohibitions of certain chemicals; performance requirements for specific devices and features; bans (except for wildlife management purposes) on firecrackers that contain more than 50 milligrams (mg) (0.772 grains) of pyrotechnic composition, specific devices, and devices that do not comply with part 1507; bans on reloadable tube aerial shell devices with shells larger than 1.75 inches in outer diameter; requirements for a stability test for large multiple-tube fireworks devices; and an increase in the longest permissible time for a fuse to burn to 9 seconds. 61 FR 67,197 (Dec. 20, 1996); 61 FR 13,084 (Mar. 26, 1996); 56 FR 37,831 (Aug. 9, 1991); 49 FR 50,374 (Dec. 28, 1984); 41 FR 22,931 (June 8, 1976).

The Commission has also taken steps to review the fireworks regulations, generally, in more recent years. CPSC issued an advance notice of proposed rulemaking (ANPR) in

2006 to explore alternatives for addressing fireworks-related injuries. 71 FR 39,249 (July 12, 2006). In 2015 and 2016, the Commission reviewed all of its fireworks regulations to identify revisions or clarifications that would make them more effective at protecting the public, reflect the current market and technology, reduce burdens, and coordinate with other federal and industry standards. This notice of proposed rulemaking (NPR) is the result of that assessment.

In addition, on September 6, 2016, the Commission issued a proposed interpretive rule regarding the method of determining whether a fireworks device is "intended to product audible effects," for purposes of 16 CFR 1500.17(a)(3). 81 FR 61,146 (Sept. 6, 2016). The Commission requested comments regarding its proposed interpretation, and Commission staff considered those comments in developing the proposed regulatory change to 1500.17(a)(3), described in this NPR.

**II. Statutory Authority, Procedure, and Other Legal Considerations**

Under the FHSA, the Commission may classify a "hazardous substance" as a "banned hazardous substance" if the substance is intended or packaged in a form suitable for household use or is intended to be used by children and the Commission finds that, notwithstanding cautionary labeling required under the FHSA, the degree or nature of the hazard associated with the substance is such that public health and safety can only be adequately served by keeping the substance out of interstate commerce. 15 U.S.C. 1261(q)(1). As part of this authority, the Commission may also create design and performance standards for products that qualify as "hazardous substances," effectively banning products that do not conform to those standards. *Forester v. Consumer Product Safety Comm'n*, 559 F.2d 774, 783 (D.C. Cir. 1977).

Fireworks are "hazardous substances," as that term is defined in the FHSA. 15 U.S.C. 1261(f). Therefore, to ban fireworks devices or create design or performance requirements for fireworks devices, the Commission must follow the requirements for rulemaking outlined in the FHSA. Under the FHSA, the Commission must make four substantive findings to ban fireworks devices or create design or performance requirements. The first of these four findings is described in the previous paragraph and involves the adequacy of cautionary labeling to protect the public from the degree or nature of the hazard. This finding need not be included in the regulatory text. There are three additional findings that the Commission must make under the FHSA. These three findings are described in detail in the following paragraphs, and the Commission must include them in the regulations. 15 U.S.C. 1262(i)(2).

First, the Commission must find that when the entities that would be subject to the regulation have adopted a voluntary standard that relates to the risk of injury that the regulation seeks to address, either compliance with the voluntary standard is not likely to adequately reduce that risk, or there is not likely to be substantial compliance with the voluntary standard. 15 U.S.C. 1262(i)(2)(A). For the first prong of this finding, whether compliance with a voluntary standard is likely to adequately reduce a risk of injury depends on whether the risk will be reduced to such an extent that there would no longer be an unreasonable risk of injury. *See* H.R. Rep. No. 208, 97th Cong., 1st Sess. 875 (1981) (discussing the identical provision in the Consumer Product Safety Act (15 U.S.C. 2051-2089). As for the second prong, several factors are relevant to the Commission's assessment of compliance with a voluntary standard, including the magnitude and speed of compliance, the severity of potential injuries, the frequency of injuries and deaths, and the vulnerability of the population at risk. *See* H.R. Rep. No. 208, 97th Cong., 1st Sess. 875 (1981) (discussing the identical provision in the Consumer Product Safety

Act); *see also* 64 FR 71,888 (Dec. 22, 1999) (finding that 90% compliance with a voluntary standard for bunk beds was not "substantial"); 16 CFR part 1213, Appendix.

Second, the Commission must find that the benefits expected from the regulation bear a reasonable relationship to its costs. 15 U.S.C. 1262(i)(2)(B). The benefits of a regulation include the extent to which the regulation would reduce the likelihood and severity of injury that may result from the product. The costs include increases to the price of the product and decreases to the availability or usefulness of the product. H.R. Rep. No. 208, 97th Cong., 1st Sess. 875 (1981) (citing *Southland Mower Co. v. Consumer Product Safety Comm'n*, 619 F.2d 499 (5th Cir. 1980)).

Third, the Commission must find that the regulation imposes the least burdensome requirement that adequately reduces the risk of injury that the regulation aims to address. 15 U.S.C. 1262(i)(2)(C). To evaluate this, the Commission must compare the relative compliance costs of alternatives it considered during the rulemaking process. H.R. Rep. No. 208, 97th Cong., 1st Sess. 875 (1981).

These findings are required only for regulatory changes or additions that would ban a hazardous substance. This includes an express ban, as well as a design, performance, or other requirement that has the effect of banning a device that is not already banned. For amendments that merely clarify or ease existing requirements, these findings are not necessary because the rulemaking would not classify a substance or device as banned. *See, e.g.,* 15 U.S.C. 1261(q)(1)(B), 1262(h), 1262(i)(2) (discussing requirements to create a regulation classifying a substance as a "banned hazardous substance"). Nevertheless, such changes or additions must conform to the Administrative Procedure Act (5 U.S.C. 551-562) requirements for rulemaking, which apply to all of the changes proposed in this NPR. The Administrative Procedure Act

requires the Commission to provide interested parties with notice of a proposed rule and an opportunity to comment on it. 5 U.S.C. 553(b), (c).

In addition to the statutory requirements in the FHSA and Administrative Procedure Act that apply to rulemakings, several federal directives are relevant to this NPR. Specifically, a number of Executive Orders (E.O.s) set out rulemaking priorities, including promoting compliance by creating simple and clear regulations and eliminating requirements that are ineffective or outdated. These E.O.s also emphasize the goals of facilitating economic growth, by minimizing burdens, harmonizing with voluntary or international standards, and promoting innovation. *See* E.O. 13609, *Promoting International Regulatory Cooperation*, 77 FR 26,413 (May 4, 2012); E.O. 13563, *Improving Regulation and Regulatory Review*, 76 FR 3,821 (Jan. 18, 2011); E.O. 12866, *Regulatory Planning and Review*, 58 FR 51,735 (Oct. 4, 1993); *see also* E.O. 13579, *Regulation and Independent Regulatory Agencies*, 76 FR 41,587 (July 11, 2011). Similarly, the Office of Management and Budget's OMB Circular A-119 (OMB Circular A-119) directs agencies, including independent commissions, to use voluntary consensus standards, rather than develop new standards, whenever appropriate. OMB Circular A-119, *Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities* (1998), revised on January 27, 2016. The goal of OMB Circular A-119 is for the federal government to benefit from the expertise and innovation of the private sector, eliminate costs associated with agency development of new standards, reduce the costs of industry compliance, and to support the priorities outlined in E.O.s 13609, 13563, and 12866. As an independent agency, CPSC is not required to comply with E.O.s; however, E.O. 13579 urges independent agencies to pursue the objectives expressed in E.O. 13563, and as a general matter, the Commission strives to support the principles expressed in these E.O.s to construct

streamlined and effective regulations. The requirements and revisions proposed in this NPR are intended to align with these directives by clarifying requirements, updating requirements to reflect current technology and products, and harmonizing with a recognized industry standard and other federal requirements.

**III. Other Existing Fireworks Standards**

There are three international or voluntary standards regarding fireworks:

- The American Pyrotechnics Association Standard 87-1: Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics (APA Standard 87-1);
- The American Fireworks Standards Laboratory's voluntary standards for consumer fireworks (AFSL Standard); and
- The European Standard EN 15947-1 to 15947-5: Pyrotechnic Articles—Fireworks, Categories 1, 2, and 3 (European Standard).

The American Pyrotechnics Association (APA) is a fireworks trade group made up of various fireworks industry members, including manufacturers, importers, and distributors. According to the group's website, its members represent approximately 85 percent of the domestic fireworks industry. APA Standard 87-1, last issued in 2001, provides definitions and requirements for various types of fireworks including consumer fireworks, novelties, theatrical pyrotechnics, and display fireworks.

The American Fireworks Standards Laboratory (AFSL) is an independent, nonprofit corporation that develops voluntary standards for consumer fireworks and serves as a third party laboratory, offering testing and certification for compliance with its standards. According to AFSL's website, its members represent 85 to 90 percent of domestic fireworks

importers. The AFSL standard, last updated in 2009, includes safety and quality standards for various types of fireworks devices, including design, performance, labeling, and shipping.

The European Standard was developed through the consensus of numerous European national standard bodies, as facilitated by the European Committee for Standardization, and reflects European legislation. This standard includes definitions, fireworks categories, labeling requirements, test methods, and construction and performance requirements.

Additionally, the U.S. Department of Transportation (DOT) has regulations relevant to consumer fireworks. DOT has jurisdiction over the transportation in commerce of hazardous materials, including consumer fireworks. 49 U.S.C. 5101-5128. Under this authority, DOT has specific regulatory requirements for fireworks and incorporates by reference APA Standard 87-1 into its regulations, insofar as it is relevant to transportation safety. 49 CFR 171.7; *see also*, 49 CFR 173.59, 173.64, 173.65.

The APA has continued to review APA Standard 87-1 and is working to issue an updated version of the standard, which DOT subsequently may incorporate by reference into its regulations, supplanting the 2001 version. The Commission is proposing to incorporate by reference portions of APA Standard 87-1 into 16 CFR parts 1500 and 1507, or otherwise align with provisions in that standard. If the APA updates APA Standard 87-1 before the Commission adopts a final rule, the Commission may adopt provisions consistent with or from the 2001 version of the standard, as proposed in this NPR, or may adopt or incorporate by reference provisions of the updated standard that are consistent with the requirements proposed in this NPR.

## IV. Proposed Requirements

The Commission proposes several additions and modifications to the fireworks regulations to clarify existing requirements and to improve consumer safety. These proposed requirements fall into three categories—new hazardous substance bans, changes to ease the burdens associated with existing requirements, and clarifications. As discussed, the statutory requirements for these categories differ. To ban a hazardous substance that is not prohibited under the existing regulations, the Commission must make the findings required by the FHSA. To ease or clarify existing requirements, the Commission need not make these findings, but must comply with Administrative Procedure Act rulemaking requirements. The sections below describe the three categories of proposed requirements.

### *A. New Hazardous Substances Bans*

The following proposed requirements would effectively ban hazardous substances that are not currently banned under CPSC's fireworks regulations by adopting mandatory test methods, limiting device content, prohibiting particular chemicals, and adding performance requirements.

#### *1. Adopt a Quantifiable Method of Identifying Devices that Are Limited to Two Grains of Pyrotechnic Composition (16 CFR 1500.17(a)(3))*

*a. Current Regulatory Requirement and Rationale*

Section 1500.17(a)(3) states: "fireworks devices intended to produce audible effects" are banned hazardous substances if the audible effect is produced by a charge of more than 2 grains of pyrotechnic composition. There are essentially two parts to this requirement—first, identifying whether a fireworks device is "intended to produce audible effects," and second, if so, measuring the pyrotechnic composition to determine if it exceeds 2 grains.

As the rulemaking that adopted this provision explained, the misuse of devices "whose audible effect is produced by a charge of more than 2 grains of pyrotechnic composition . . . [had] been the cause of most of the firework deaths and serious injuries" and the goal of the regulation was to prohibit "dangerously explosive fireworks." 38 FR 4,666 (Feb. 20, 1973); 35 FR 7,415 (May 13, 1970); *see also*, 34 FR 260 (Jan. 8, 1969). Similarly, the Commission considered the safety need for limiting the pyrotechnic content in certain fireworks devices when it adopted the 50 mg limit for firecrackers in 1977. In the deliberations leading up to that limit, the Commission explained that incident and injury data showed a correlation between the degree of injury and the explosive power of the device involved in the injury. Most cases that resulted in death or severe injuries involved devices with "large powder accumulations." 41 FR 9,512, 9,517 (Mar. 4, 1976). Thus, the purpose of 1500.17(a)(3) is to address injuries resulting from increased explosive power; the reference to "audible" effects was a method of identifying these devices through the type of sound the devices make and not an indication of any safety purpose relating to the loudness of devices or hearing injuries.

This regulatory history and more recent fireworks incident data demonstrate the importance of industry compliance with 1500.17(a)(3) for protecting consumers. As the 2015 Fireworks Annual Report (Fireworks Annual Report; CPSC Directorate for Epidemiology, Division of Hazard Analysis, *Fireworks-Related Deaths and Emergency Department-Treated Injuries During 2015*, June 2016, available at: http://www.cpsc.gov//Global/Research-and-Statistics/Injury-Statistics/Fuel-Lighters-and-Fireworks/Fireworks_Report_2015FINALCLEARED.pdf) demonstrates, the injuries that can result from devices that are subject to the 2-grain limit can be severe and can result in

death. Overall, nine of the 11 deaths that related to fireworks in 2015, involved devices that are commonly subject to the 2-grain limit; and over the course of 1 month in 2015, an estimated 1,200 injuries (based on a nationwide probability sample) involved devices commonly subject to the 2-grain limit. Of these estimated 1,200 injuries, 100 involved children under the age of 4 years. These incidents included deaths resulting from mortar tubes held by consumers; burns requiring a 1-month hospitalization after a reloadable aerial shell landed in a bystander's lap; and various other injuries affecting all regions of the body.

To identify devices that had a greater explosive power, and therefore, needed a limit to protect consumer safety, the FDA and the Commission opted to apply the 2-grain limit to "devices intended to produce audible effects." At the time the limit was adopted, the focus on "devices intended to produce audible effects" was a useful way of identifying devices that had a greater explosive or energetic force. However, the fireworks industry has reported, and Commission testing indicates, that fireworks devices on the market today contain metallic fuel when they are "intended to produce an audible effect." These metallic fuels create an explosive that is more energetic per volume than an explosive without metallic fuel.

*b. Current CPSC Test Method and Alternative Test Methods*

The regulations do not specify a method for identifying whether a device is "intended to produce audible effects," and therefore, subject to the 2-grain limit. However, the CPSC Consumer Fireworks Testing Manual (CPSC Testing Manual; CPSC Directorate for Laboratory Sciences, Division of Chemistry, *Consumer Fireworks Testing Manual*, 4th ed. (Aug. 17, 2006), available at: https://www.cpsc.gov/PageFiles/121068/testfireworks.pdf), specifies how Commission staff

identifies these devices during field testing. In accordance with the CPSC Testing Manual, staff listens for a "loud report" when the device functions, which indicates it is "intended to produce an audible effect." *See* section (IV)(C)(11)(e) of CPSC Testing Manual, p. 29. This involves staff listening for a sound and assessing whether that sound has the qualities characteristic of an intentional effect. It is not the noise level that is determinative; rather, staff listens for a crisp sharpness that is related to the pressure pulse associated with the ignition of flash powder. If staff hears this "loud report," then they weigh the pyrotechnic material in the break charge (which causes the audible effect) to determine whether it exceeds the 2-grain limit. The CPSC Testing Manual does not carry the force of law; rather, it describes one option for identifying devices that are subject to the 2-grain limit. However, other options may also be valid. The Commission believes that specifying an appropriate identification method in the regulations would provide for transparency and consistency in testing, which facilitates compliance and consumer safety.

To accomplish this, Commission staff has considered the makeup and design of fireworks devices on the market today and reviewed alternative methods of identifying devices that are subject to the 2-grain limit. Based on these assessments, the Commission proposes to set forth, in the regulations, a method for identifying devices that are subject to the 2-grain limit and replace the phrase "intended to produce audible effects" to reflect that method.

Fireworks devices have evolved since CPSC adopted 1500.17(a)(3) in 1973, and now use different types of powders, which impact the sounds devices produce. The fireworks industry has moved away from using black powder in break charges, and instead, often uses hybrid powders. In addition, fireworks devices generally are made by hand,

resulting in variability in devices from the same manufacturer and lot. Different samples of the same device may not produce the same audible effects. Depending on the shell construction, packing density, and amount of powder, hybrid powders may produce audible effects intentionally or incidentally to disperse visual effects. Significant training and experience are necessary to distinguish between sounds that are an intentional effect of a fireworks device and sounds that are merely a byproduct of other effects or functions of a fireworks device. CPSC staff has substantial training and experience to make this distinction, but the Commission believes that a simpler and more quantitative test would be preferable and would facilitate consistent and accurate industry testing.

To identify a method that reflects the current design of fireworks devices, reduces the variability in judgments of whether a device is "intended to produce audible effects," and is simple and repeatable enough for regulated entities to follow easily and consistently, the Commission has reviewed other existing methods of identifying devices subject to the 2-grain limit. The European Standard does not include any equivalent limit to 1500.17(a)(3), and many of the devices listed in the European Standard are not comparable to those sold in the United States. As such, the European Standard does not offer an alternative method that the Commission could adopt. The AFSL Standard limits the explosive composition of various devices "intended to produce reports" to 2 grains of pyrotechnic composition ("reports" is a synonym for "audible effects"). The AFSL Standard also limits break charges to containing only black powder, an equivalent nonmetallic fuel, or fuel that is empirically demonstrated to perform similarly to black powder. Thus, while the AFSL Standard provides similar limits to APA Standard 87-1, described below, it is less quantifiably precise because it provides flexibility for empirical analysis to permit various fuel types.

APA Standard 87-1, section 2.5, provides the same 2-grain (130 mg) limit as 1500.17(a)(3) on the pyrotechnic content of fireworks devices "intended to produce audible effects," but also includes a definition, or method of identifying whether a device is "intended to produce audible effects." If a fireworks device includes a burst charge that contains a metallic powder less than 100 mesh in particle size, then the device is "intended to produce audible effects." Section 2.5 elaborates, stating the inverse of this test method and providing examples. This is a straightforward and objectively measurable method of determining whether a device is subject to the 2-grain limit; under this method, testers need only examine and measure the contents of the burst charge. This definition is consistent with 1500.17(a)(3), which lists devices that traditionally include metallic fuel as examples of devices "intended to produce audible effects," such as devices that generally use flash powder, which is a mixture of an oxidizer (typically potassium perchlorate) and a metallic fuel (typically aluminum). This method is also consistent with the intended purpose of the regulation to protect consumers from the greater energetic power of certain devices and the associated safety risks.

Commission staff has conducted preliminary testing to examine the relationship between metallic content in break charges and the energy or explosive power of the fireworks device. As an example, staff examined the effect of adding aluminum, a metallic powder, to fireworks devices. As the Division of Chemistry (Chemistry) memorandum in the briefing package for this NPR explains, a quadratic analysis reveals that a 1 percent addition of aluminum increases the energy of a device by 3 percent, and that as aluminum content increases, the amount of explosive power increases, up to 25 percent aluminum content, at which point the explosive power begins to diminish. This demonstrates the

consistency between limiting metallic content in break charges and the intended safety purpose of 1500.17(a)(3)—namely, to limit the explosive power of devices, in order to reduce injuries associated with more explosive devices. Additionally, adding aluminum or other metallic content to an energetic material may increase sensitivity to impact, spark, and friction, which may present additional safety hazards.

*c. Proposed Regulatory Requirement*

Accordingly, the Commission proposes to adopt a method for identifying devices that are subject to the 2-grain limit that is consistent with the method in APA Standard 87-1. However, unlike APA Standard 87-1, the Commission proposes to state the criteria directly in the regulation, without referencing "devices intended to produce audible effects"; in addition, the Commission proposes to state only the general criteria for identifying these devices (*i.e.*, metallic fuel greater than 100 mesh in particle size), without the additional details in APA Standard 87-1. Although at the time it was adopted, the phrase "intended to produce audible effects" was a useful way to identify devices with greater explosive power and a correspondingly greater risk of injury, because of the current design and composition of fireworks devices, it is clearer and more direct to refer simply to their content.

To assess the CPSC Testing Manual method and the APA Standard 87-1 method, Commission staff randomly tested fireworks samples collected from the Office of Compliance from fiscal years 2014, 2015, and 2016. Using the CPSC Testing Manual method, staff found that 17 percent of the samples were "intended to produce audible effects" and exceeded the 2-grain limit. In contrast, while using the APA Standard 87-1 method, staff found that 84 percent of the samples were "intended to produce audible effects" and exceeded the 2-grain limit. Although the sample size is too small to be

conclusive, these results show a notable difference between the number of devices that qualify as "intended to produce audible effects" using the CPSC Testing Manual method and the APA Standard 87-1 method. This may be because the APA Standard 87-1 method relies on precise and quantifiable measurements, rather than experienced observation, leaving less room for interpretation.

The Commission does not propose to modify the overall requirement in 1500.17(a)(3); rather the Commission proposes to specify the composition that identifies a device as subject to the 2-grain limit and otherwise retain the 2-grain limit. For consistency, the Commission also proposes to replace references to "audible effects" throughout the regulations. Because the regulations currently do not require any particular method of identifying which devices are subject to the 2-grain limit, requiring the use of a specific method creates a new requirement. Additionally, consistent with the comparative test data, the proposed method likely would identify more devices as subject to the 2-grain limit than the current CPSC Testing Manual method. Therefore, the practical effect of adopting the proposed method of identifying whether a device is "intended to produce audible effects" is that the Commission would ban more devices than it currently considers banned.

It is important to note that the proposed revision to 1500.17(a)(3), which focuses on the metallic content of the device, would reduce the scope of fireworks devices that are subject to the 2-grain limit because the proposed revision does not limit the content of devices containing black powder only. However, the Commission believes that reducing the scope will not decrease the level of protection that the regulation provides because the Commission is not aware of any devices on the market that fall within the scope of the current regulation, but outside the scope of the proposed regulation. Under the current

method CPSC staff uses, devices that produce a "loud report" are limited to 2 grains of pyrotechnic composition; this limit applies whether the device contains metallic fuel or only black powder. Under the proposed regulation, only devices that contain metallic fuel less than 100 mesh in particle size are limited to 2 grains of pyrotechnic composition. Therefore, the proposed provision does not limit the content of devices that contain only black powder. However, Commission staff's extensive experience observing and testing fireworks devices indicates that there are no devices currently on the market that contain only black powder and produce a "loud report," subjecting them to the 2-grain limit. Consequently, like the proposed regulation, the current method, in effect, does not limit the pyrotechnic composition of devices that contain only black powder. Nevertheless, to address this difference, and because a device containing large amounts of only black powder could potentially pose a safety hazard to consumers, the Commission is proposing limits to the pyrotechnic weight in various aerial and ground devices. These limits are discussed in Section IV.A.2., below.

In addition, the Commission is considering limiting metallic powders with larger particle sizes in break charges or reports, possibly by limiting the permissible size and/or the permissible percentage of such metal powders.

*d. FHSA Findings*

*i. Finding 1: Public Health and Safety*

In previous rulemakings supporting the 2-grain limit in 1500.17(a)(3), the Commission has found that the degree and nature of the hazard associated with the devices subject to that limit are such that public health and safety necessitate the Commission banning devices that exceed that limit. The proposed method of identifying these devices

supports and furthers that necessary ban by providing a quantifiable and reliable method of identifying these particularly explosive devices. As the Fireworks Annual Report indicates, serious injuries and deaths still occur that are associated with devices commonly subject to this limit, including injuries to young children. In addition, as staff's testing indicates, the current test method identifies fewer devices as being subject to the 2-grain limit than the APA Standard 87-1 method. Therefore, the Commission believes that the proposed method is necessary to protect consumer safety because a more straightforward, quantifiable, and repeatable test method that does not require extensive training and experience will more-consistently identify devices that need to be limited to 2 grains of pyrotechnic composition. Consequently, this method will be more effective in keeping such devices off the market.

*ii. Finding 2: Voluntary Standards*

The Commission evaluated compliance with the 2-grain limit provision in APA Standard 87-1. The Commission believes that the test method is effective since it is a consistent and reliable method for identifying more explosive devices, such that the Commission is proposing to adopt the same method. However, the Commission does not believe that there is likely to be substantial compliance with that provision of APA Standard 87-1. The Commission's preliminary testing of samples collected from the Office of Compliance revealed that 84 percent (54 of 64) of devices analyzed using the APA Standard 87-1 method met that standard's definition of devices "intended to produce audible effects" and exceeded the 2-grain limit, in violation of the standard. Moreover, the severity of the potential injuries shown in CPSC's incident data (including severe burns and death) and the vulnerability of the population at risk (including young children, as indicated in the Fireworks Annual Report) indicate the need for a high level of compliance. As discussed

above, these factors are relevant to assessing whether there is likely to be "substantial compliance" with a voluntary standard. Therefore, the Commission believes that there is not likely to be substantial compliance with the voluntary standard, so a regulatory requirement is necessary.

*iii. Finding 3: Costs and Benefits*

The Commission believes that the benefits of the proposed requirement bear a reasonable relationship to its costs. The benefits include reducing the likelihood and severity of injury by providing a simpler and more consistent means of identifying devices that have comparatively high explosive powers. As the Directorate for Economic Analysis (EC) memorandum in the briefing package for this NPR indicates, the costs of this requirement are likely to be low. Based on CPSC testing of fireworks samples, there may be a low level of compliance with the comparable provision in APA Standard 87-1; however, the costs associated with changes that would bring noncompliant devices into compliance are likely to be low. Any entities that do not already comply with the provision in APA Standard 87-1 would need to replace metallic powders with nonmetallic powder, or reduce the amount of metallic powders in their devices. Because manufacturers already use both types of powders in devices, and the costs of the two types are comparable, the costs are likely to be low.

*iv. Finding 4: Alternatives*

The Commission believes that the proposed requirement is the least burdensome option that meets the safety goal of this provision. The Commission examined several test methods, including the method in the CPSC Testing Manual, a method based on explosive force, APA Standard 87-1, the AFSL Standard, and the European Standard. The method in the CPSC Testing Manual requires highly experienced and trained testers to distinguish

devices by listening to them; this requires highly-specialized testers, and as the testing data suggests, this leads to comparatively fewer devices being identified as subject to the 2-grain limit. The AFSL Standard is more stringent than APA Standard 87-1, limiting break charges to black powder; but it is also less precise, allowing for equivalent nonmetallic fuel or fuel that is empirically shown to be like black powder. This less-defined standard creates a burden for testing various powders or strictly limits devices to black powder. The European Standard limits pyrotechnic composition differently for various devices, but these devices do not all correlate with devices available on the U.S. market. Consequently, the method the Commission proposes in this NPR is the least burdensome alternative because it provides a simple, precise, and quantifiable method of identifying devices that are subject to the 2-grain limit, minimizing the training needed, and eliminating the need to test the characteristics of various powders.

*e. Enforcement Discretion for Minimal Contamination*

The proposed requirement would ban devices that contain any amount of metallic powder less than 100 mesh in particle size in the burst charge, when the burst charge is produced by more than 2 grains of pyrotechnic content. However, the Commission recognizes that it may be difficult to ensure that there is no such metallic powder present due to potential contamination from visual effects or environmental contamination, and it may be difficult to consistently identify the presence of metallic powder because of detection limitations and variation. Consequently, the Commission will allow for minimal contamination of up to, but not exceeding, 1.00 percent of metallic powder in burst charges that are subject to 1500.17(a)(3).

The Commission believes that the presence of a metal, such as aluminum, in trace amounts would not pose an increased safety risk to consumers because a scarce amount of contaminant would not significantly add to the energy of the explosive. . As the Chemistry memorandum in the briefing package for this NPR explains, staff's preliminary testing revealed that metallic content used in visual effects may inadvertently contaminate break charge content at very low levels. Staff found that when contamination occurred, the contamination level in the break charge was generally less than 1 percent. In addition, different detection instruments can vary in the particle sizes and metallic content levels they detect. Staff evaluated the detection levels of Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES) and X-Ray Fluorescence (XRF) and found that they produced largely similar results but can identify metallic content at slightly different levels. Commission staff believes that both ICP-OES and XRF are viable instruments for assessing compliance with proposed 1500.17(a)(3).

To account for these variables, the Commission will exercise enforcement discretion to allow up to, but not exceeding, 1.00 percent contamination of metallic powder in a burst charge. The Commission believes that 1.00 percent is an appropriate level for two reasons. First, 1.00 percent would allow for unintentional contamination at the levels Commission staff has seen are common in fireworks devices. As the Chemistry memorandum explains, staff's preliminary testing reveals that when metallic content present in visual effects inadvertently contaminates a break charge, it is generally at levels below 0.4 percent; a 1.00 percent allowance should adequately allow for inadvertent contamination. Second, the increase in explosive force from 1.00 percent metallic fuel contamination is minimal, and the Commission believes that it does not present a notable increase in the safety risk to the

public. As staff's preliminary testing indicates, a 1.00 percent increase in metallic content increases the energy of a device by 3 percent (using aluminum as an example), and further increases in metallic content correspondingly increase the explosive power of the device up to 25 percent, at which point the explosive power begins to diminish. Thus, contamination up to 1.00 percent likely does not notably increase the risk to consumers.

*2. Limit Chemical Composition and Pyrotechnic Weight (16 CFR 1500.17(a))*

*a. Rationale for Limiting Chemical Composition and Pyrotechnic Weight and Relevant Provisions in Voluntary Standards*

As discussed, the amount of pyrotechnic material in a fireworks device directly relates to the energetic power of the device, and greater energetic power presents increased safety risks to consumers. To mitigate this risk, 1500.17(a)(3) limits the pyrotechnic material in fireworks devices that are "intended to produce audible effects." However, this risk also exists for devices that do not fall within that category. To address this, each of the voluntary and international standards on fireworks also limits the chemical composition and pyrotechnic weight of various devices. The specific limits vary with the type of device. For certain devices, the pyrotechnic weight limits address the proportion of break charge relative to the chemical composition or effects. This protects the public because a large proportion of break charge relative to effects may disperse the effects further and injure bystanders or ignite nearby property.

Currently, CPSC's fireworks regulations do not include such limits, except for certain devices, such as party poppers and firecrackers. The Commission proposes to adopt such limits to reduce the safety risks associated with higher levels of particular chemical compositions and ratios of pyrotechnic weight in specific devices.

Each of the voluntary and international standards limits different devices (some of which overlap), and some of the limits differ. These limits are in section 3.1.1 and 3.1.3 (ground devices) and 3.1.2 (aerial devices) of APA Standard 87-1; in sections 2-1.8, 2-2, 2-3, and 2-4 of the AFSL Standard; and in Table 1 in part 5 of the European Standard. The APA Standard 87-1 limits specify a maximum chemical composition for components, lift charges, and devices, and a maximum ratio of burst charge to total weight of chemical composition. The AFSL Standard does the same, but with some different limits and with allowances for alternate lesser ratios and different device designs. The European Standard lists 30 different devices with corresponding net explosive content limits. However, the devices listed in the European Standard do not fully correspond with devices available in the U.S. market.

*b. Proposed Regulatory Requirements*

The Commission proposes to incorporate by reference the limits in APA Standard 87-1 for mine and shell devices, aerial shell kits (reloadable tube), cylindrical fountains, cone fountains, illuminating torches, wheels, and chasers, with one modification. The categories of devices listed in APA Standard 87-1 are similar to the device delineations in the regulations with which regulated entities are already familiar. They also largely comply with APA Standard 87-1 for transportation purposes, and the Commission believes these limits provide for consumer safety by limiting the explosive power of devices.

The Commission proposes to modify the provisions in APA Standard 87-1, which it proposes to incorporate by reference into the regulation, by including an additional provision that limits the explosive force of certain aerial devices. For mine and shell devices and aerial shell kits (reloadable tube), the Commission proposes to specify, in addition to the provisions in APA Standard 87-1, that the lift charge of each shell is limited to black powder (potassium nitrate,

sulfur, and charcoal) or similar pyrotechnic composition without metallic fuel. This aligns with the safety rationale regarding metallic fuel discussed above—namely, that metallic fuels can make an explosive more energetic per volume than devices that do not contain metallic powder; so limiting the lift charge of certain aerial devices to contain only black powder (*i.e.*, nonmetallic fuel), would limit the explosive power of those devices.

Although the provisions that the Commission proposes align with APA Standard 87-1's limits on chemical composition and pyrotechnic weights for aerial and ground devices, they differ from the voluntary standard in three ways. First, the Commission's proposed requirement does not include details about specific devices (*e.g.*, descriptions) that it believes are unnecessary for these limits. Second, the Commission's proposed requirement includes additional information that clarifies the scope of the limits. The Commission believes that these differences are necessary to establish a clear requirement. Third, the Commission proposes to adopt limits for only some ground devices, excluding some of the ground devices listed in APA Standard 87-1, including ground spinners, flitter sparklers, toy smoke devices, and sparklers. The Commission is omitting these devices because, based on incident and injury data, the Commission does not believe these devices pose significant safety hazards to consumers to necessitate limits on their compositions.

As discussed, the proposed revision to 1500.17(a)(3), which focuses on the metallic content of devices, would reduce the scope of fireworks devices that are subject to the 2-grain limit. Specifically, under the current regulation and CPSC staff's current test method, the 2-grain limit applies to any device that produces a "loud report," whether it contains metallic fuel or only black powder; under the proposed requirement, the 2-grain limit would apply only to devices that contain metallic fuel and not devices that contain only black

powder. The proposed pyrotechnic weight limits for aerial devices fills the gap created by this change, by limiting the explosive force of devices regardless of whether they contain metallic fuel or only black powder. To provide comparable limits for ground devices, the Commission also proposes to adopt the pyrotechnic weight limits for ground devices that are in APA Standard 87-1. Limits for ground devices will also compensate for the reduced scope that the proposed 1500.17(a)(3) creates, by preventing ground devices from containing large amounts of black powder. The Commission believes that these limits are necessary to protect the public because devices containing a large amount of black powder can pose a safety hazard; therefore, it is necessary to limit the power of devices that contain only black powder, as well as devices containing metallic powder.

The proposed limits on chemical composition and pyrotechnic weight would create new limits on fireworks devices that do not currently exist in the regulations, thereby creating a new ban of hazardous substances that currently are not prohibited.

*c. FHSA Findings*

*i. Finding 1: Public Health and Safety*

Fireworks devices with greater explosive content may contribute to more severe injuries and deaths than devices with less explosive power and labeling required by section 2(p)(1) of the FHSA is not adequate to protect the public health and safety. *See* 15 U.S.C. 1261(p)(1). Therefore, for the same reasons supporting the 2-grain limit in 1500.17(a)(3), the Commission believes that chemical composition and pyrotechnic weight, including content ratios, need to be limited in devices that are not subject to 1500.17(a)(3) to protect the public from the safety risks of devices with high explosive content and those containing only black powder.

*ii. Finding 2: Voluntary Standards*

With respect to the first prong of this finding, the Commission believes that compliance with the voluntary standard is likely to reduce the risk of injury, because the limits in the voluntary standard effectively reduce the explosive power of devices, which is why the Commission proposes to incorporate by reference the limits in the voluntary standard. As for the second prong of the finding, however, the Commission believes that there is not likely to be substantial compliance with the voluntary standard. Commission staff randomly tested fiscal year 2014 and 2015 fireworks samples collected by the Office of Compliance to evaluate compliance with the various limits in APA Standard 87-1. Staff analyzed 42 devices in total (12 reloadable aerial shell devices and 30 multiple-tube mine and shell devices). Although the sample size of this testing is insufficient to draw definitive conclusions, the results, nevertheless, are informative. Two (17%) of the 12 reloadable aerial shell devices and 8 (27%) of the 30 multiple-tube mine and shell devices staff tested exceeded the permissible break charge-to-effect ratio specified in APA Standard 87-1. None of either type of device exceeded the maximum lift charge provided in APA Standard 87-1. Additionally, none of the reloadable aerial shell devices exceeded the total pyrotechnic composition limits in APA Standard 87-1, while 6 (20%) of the multiple-tube mine and shell devices exceeded those limits. The Commission does not have information regarding industry compliance with the limits on ground devices set forth in APA Standard 87-1, and requests such information and relevant data.

As the preliminary testing staff conducted showed, between 15 percent and 30 percent of tested devices did not comply with some portion of APA Standard 87-1's limits on chemical composition and pyrotechnic weight. Moreover, the potential severity of injuries and death

associated with devices with greater explosive power, described in the previous section, indicate the need for particularly high compliance levels.

*iii. Finding 3: Costs and Benefits*

The Commission believes that the benefits and costs of the proposed requirement bear a reasonable relationship because the minimal costs associated with limiting the content of fireworks devices are reasonable in light of the benefits to consumer safety. Benefits include reducing the presence of more-energetic devices on the market, which pose an increased safety risk to consumers. Anticipated costs include implementing quality control measures to ensure devices do not contain more than the proscribed limits; these quality control measures may include acquiring smaller measuring devices, which is likely low in cost. The proposed requirements are not expected to eliminate any products from the market because devices that are noncompliant could function as well if they complied with the proposed limits, and the Commission does not expect that manufacturers will have to redesign their products.

*iv. Finding 4: Alternatives*

Given the minimal burden this requirement would create, the Commission believes that the proposed limits on chemical composition and pyrotechnic weight are the least burdensome way to achieve the safety purpose of the proposed requirement. In comparison to the AFSL and European Standards, the categories of devices listed in APA Standard 87-1 are similar to the device delineations in the regulations with which regulated entities are already familiar. They also largely comply with APA Standard 87-1 for transportation purposes because DOT incorporates that standard by reference into its regulations. The only substantial difference between APA Standard 87-1 and the proposed requirement is that the proposed requirement does not include all of the ground devices that APA Standard 87-1 lists. This is because the

Commission does not have data indicating that those ground devices pose significant safety hazards to consumers. As such, the Commission does not believe that limits for those devices are necessary, and there would not be adequate support to justify the FHSA findings.

*3. Add Hexachlorobenzene and Lead Tetroxide and Other Lead Compounds to the List of Prohibited Chemicals (16 CFR 1507.2)*

*a. Proposed Requirements and Rationale*

The Commission proposes to add hexachlorobenzene (HCB) and lead tetroxide and other lead compounds to the list of prohibited chemicals in 1507.2. Various studies indicate that fireworks devices contain HCB and lead tetroxide or other lead compounds. Specifically, studies have found HCB in 25 percent to 53 percent of fireworks samples, depending on the study and in concentrations up to 4.4 percent. *See* Fireworks NPR Briefing Package, Health Sciences Memorandum (Tab A of NPR Briefing Package), for further discussion of these studies. Testing by AFSL and CPSC has found lead compounds in 9 percent to 38 percent of fireworks samples, depending on the study, and in concentrations greater than 0.25 percent.

HCB and lead tetroxide and other lead compounds can be released into the environment when fireworks containing them explode; and although the Commission has not conducted an exposure analysis, the public can absorb both chemicals into their bodies through inhalation or surface contact. Moreover, both of these chemicals are likely carcinogenic and are toxic to humans. HCB is associated with numerous serious health effects, including developmental and reproductive toxicity, liver toxicity, and cancer, and can be passed to offspring. Absorption of lead compounds also can have serious impacts on neurological, reproductive, renal, cardiovascular, gastrointestinal, and hematological functions, particularly in children, and can be

passed to offspring. For these reasons, the Commission proposes to prohibit fireworks devices from containing these chemicals.

The FHSA authorizes the Commission to declare a substance or mixture of substances to be a hazardous substance within the scope of the FHSA, if it finds that the substance meets one of the categories described in section 2(f)(1)(A) of the statute. 15 U.S.C. 1262(a)(1). Section 2(f)(1)(A) of the FHSA lists various characteristics that qualify a substance as a "hazardous substance." *Id.* at 1261(f)(1)(A). One of these characteristics is that the substance is "toxic," which the FHSA defines as a substance "which has the capacity to produce personal injury or illness to man through ingestion, inhalation, or absorption through any body surface." *Id*. at 1261(f)(1)(A), 1261(g). In addition to meeting the definition of "toxic," the Commission must also determine that the substance "may cause substantial personal injury or substantial illness during or as a proximate result of any customary or reasonably foreseeable handling or use" in order to be a "hazardous substance" under the FHSA. *Id*. at 1261(f)(1).

As described in the Health Sciences memorandum in Tab A of the briefing package for this NPR, Commission staff believes that fireworks devices containing HCB or lead tetroxide or other lead compounds present toxicological hazards that can be absorbed into the human body; these substances have been demonstrated to be harmful to human health; and fireworks devices have been found to contain these chemicals. Therefore, the Commission believes that there is support to find that fireworks devices containing HCB or lead tetroxide or other lead compounds are "toxic" within the definition in the FHSA and may cause substantial illness (such as cancer) as a result of reasonably foreseeable handling, use, or contact with such devices.

All three voluntary and international standards regarding fireworks include some prohibition of lead compounds, HCB, or both. Although the three standards are similar, each

addresses limits on HCB and lead compounds differently. Table 1 outlines the relevant requirements in each of the three standards, as well as the current CPSC regulations.

TABLE 1. *Limits on HCB and Lead Compounds in Fireworks Devices.*

| | **HCB** | **Lead Compounds** |
|---|---|---|
| Current § 1507.2 | Not listed | No limit |
| APA Standard 87-1[1] | Not listed | Prohibited at concentrations of 0.25% by weight or more |
| AFSL Standard[2] | Prohibited at concentrations above 0.01% by weight | Prohibited |
| EU Standard[3] | Prohibited | Prohibited |

[1] Section 3.7.
[2] Appendix A, Table I, para. (e), (f).
[3] EN 15947-5, pt 1.

As discussed in Section IV.B.1., below, the Commission also proposes to allow for trace contamination with these and other prohibited chemicals, consistent with the voluntary standards. Section IV.B.1. discusses the various trace contamination limits the Commission is considering for these chemicals and other prohibited chemicals in further detail. Nevertheless, the Commission believes that there is a need, generally, to prohibit HCB and lead tetroxide and other lead compounds.

The proposed requirement would constitute a new hazardous substance ban under the FHSA because it would ban chemicals that are not currently prohibited in CPSC's fireworks regulations.

*b. FHSA Findings*

*i. Finding 1: Public Health and Safety*

The Commission believes that HCB and lead tetroxide and other lead compounds in fireworks present a serious hazard to consumers, justifying prohibiting these chemicals. As the Health Sciences memorandum in the briefing package for this NPR discusses, testing indicates that HCB and lead are present in some fireworks devices and bystanders can absorb these

chemicals from the environment when they are released from fireworks. Moreover, both chemicals are associated with severe health problems.

*ii. Finding 2: Voluntary Standards*

As for the first prong of this finding, the Commission believes that compliance with the voluntary standard would adequately reduce the risk of injury because the voluntary standard limits the explosive power of devices, which is why the Commission proposes to incorporate these limits by reference into the regulations. With respect to the second prong of this finding, the Commission believes that there is not likely to be substantial compliance with the voluntary standards. As the data shows, studies have found devices containing HCB or lead compounds and at levels above the limits permitted in the voluntary standards, indicating a lack of compliance. Because of the serious health effects, such as cancer, associated with HCB and lead compounds, these two chemicals pose a particularly serious risk to consumers, necessitating a particularly high level of compliance.

*iii. Finding 3: Costs and Benefits*

The Commission believes that the benefits of the recommended requirement bear a reasonable relationship to its costs. The benefits would include reducing consumer exposure to two chemicals that pose serious health effects, including developmental toxicity and cancer. Comparatively, the costs are likely low because HCB and lead compounds are not necessary components of fireworks, they are not commonly used, and the effects they create can be replicated with other safer and less-costly materials.

*iv. Finding 4: Alternatives*

The Commission believes that the recommended requirement is the least burdensome means of achieving the safety purpose. Prohibiting these two chemicals in unsafe levels is necessary to protect consumer safety; any alternative may not accomplish this purpose.

*4. Adopt a Test Method to Evaluate Side Ignition (16 CFR 1507.3)*

*a. Proposed Requirement and Rationale*

Section 1507.3(a)(1) requires fireworks devices that use a fuse (with the exception of certain smaller fireworks devices) to use a fuse that is treated or coated to "reduce the possibility of side ignition." Section 1500.17(a)(9) bans any fireworks device that does not comply with applicable requirements of part 1507 (except as specified in 1500.17(a)(9)), thereby making devices that do not meet the fuse requirements in 1507.3 "banned hazardous substances." The regulation does not detail how to evaluate compliance with 1507.3(a)(i), nor does it specify what qualifies as "reduc[ing] the possibility of side ignition." The CPSC Testing Manual, APA Standard 87-1, and the AFSL Standard provide additional details about this requirement. The CPSC Testing Manual provides a test for evaluating fuse side-ignition resistance. The testing involves holding a lit cigarette against the side of the fuse and measuring how long the fuse resists ignition. The CPSC Testing Manual directs testers to measure whether side ignition occurs within 5 seconds; and CPSC currently considers a device to have failed the fuse side-ignition resistance requirement in 1507.3(a)(1) if the fuse ignites within 3 seconds. APA Standard 87-1 and the AFSL Standard provide similar restrictions to 1507.3(a)(1) and similar test methods to the CPSC Testing Manual, each requiring the fuse not to ignite within 3 seconds.

Between 2005 and 2015, the Commission found 28 violations of 1507.3(a)(1). In addition, Commission staff assessed 211 fireworks device samples for side ignition in fiscal year

2015. Staff found that 1 sample (0.5%) ignited in less than 3 seconds; 12 samples (5.7%) ignited in 3 to 5 seconds; and 198 (93.8%) did not ignite within 5 seconds.

The potential for injury when a fireworks device inadvertently ignites is serious and could severely injure or kill a person attempting to light the fireworks device or harm bystanders. If a device lights quickly without the user deliberately lighting it, the user could be holding the device or be close to it when it explodes. Although incident and injury reports listed in the Fireworks Annual Report do not specifically reference side ignition of fireworks devices (which may be difficult to identify), the report does include numerous incidents in which users or bystanders died or sustained serious injuries when a fireworks device exploded while the user was holding it or when the device was lit too close to bystanders or to other fireworks or explosives. Injuries resulting from these incidents included severe burns, bone fractures, and lacerations.

Because of the potential severity of injuries that can result if a device inadvertently ignites, the Commission proposes to adopt the test method for evaluating fuse side ignition described in the CPSC Testing Manual as part of the regulations and to specify that fuses must resist side ignition for at least 3 seconds. Because this test method is part of the CPSC Testing Manual, it is not a requirement, but rather, is simply one method available for assessing compliance with 1507.3(a)(1). A clear and consistent understanding of the side ignition resistance requirement may improve safety because industry members would evaluate the side ignition resistance of fuses uniformly, allowing them to consistently and reliably identify fuses that risk side ignition, thereby posing a safety risk to consumers. Moreover, specifying that devices must resist side ignition for 3 seconds provides a clear threshold for determining the safety of the device.

As explained, the proposed requirement, in effect, would create a new hazardous substance ban, triggering the findings required under the FHSA because it would require all manufacturers to test their devices and use that evaluation method, which may be different or more stringent than the method they currently use.

*b. FHSA Findings*

*i. Finding 1: Public Health and Safety*

The Commission believes that the degree and nature of the hazards associated with side ignition are such that the public health and safety necessitate banning devices that exceed the proposed side ignition resistance limit. Inadvertent side ignition presents a serious safety hazard to consumers who may be near the device when it functions. Although incident data does not specifically capture side-ignition incidents, the Fireworks Annual Report references deaths and serious injuries that resulted when a fireworks device fired too close to a user or bystander or when a user was holding it, which are among the circumstances likely to occur when a device inadvertently lights by side ignition. A quantifiable test for all regulated entities to follow would improve consumer safety by promoting consistent assessment of devices to screen for unsafe devices entering the market.

*ii. Finding 2: Voluntary Standards*

In considering the first prong of this finding, the Commission believes that compliance with the voluntary standard would likely adequately reduce the risk of injury because it specifies a test for evaluating side ignition and specifies a reasonable time in which fuses should resist side ignition, which is why the Commission proposes to adopt a comparable test method and limit. But with respect to the second prong of this finding, the Commission believes that there is not likely to be substantial compliance with the APA Standard 87-1 test method and 3-second

threshold. Although CPSC's preliminary testing indicates that a high percentage of devices satisfy the APA Standard 87-1 fuse side-ignition resistance provisions, given the severity of the potential injuries that can result when a fireworks devices inadvertently lights, the Commission believes that a particularly high level of compliance is necessary to adequately reduce this risk. As discussed above, the severity of potential injuries is a factor the Commission considers relevant in assessing the level of compliance necessary to constitute "substantial compliance" with a voluntary standard. *See* H.R. Rep. No. 208, 97th Cong., 1st Sess. 875 (1981). Moreover, the test method that the Commission proposes includes additional details that APA Standard 87-1 does not, making the proposed test method clearer, which facilitates compliance and uniformity of testing and results.

*iii. Finding 3: Costs and Benefits*

Third, the Commission believes that the benefits of the proposed requirement bear a reasonable relationship to its costs. Anticipated costs include developing a testing program to evaluate product compliance in order to issue certificates of compliance, modifying devices to resist side ignition for a longer period, and potentially removing a small proportion of devices from the market. The Commission does not expect the costs associated with these options to be high, particularly because testing costs can be allocated across all devices with fuses. Benefits include the reduced risk of injury to consumers, including a reduced risk of serious injuries associated with devices firing close to users.

*iv. Finding 4: Alternatives*

Fourth, the Commission believes that the proposed requirement is the least burdensome way to achieve the targeted safety purpose. The proposed test method and 3-second threshold are

consistent with the voluntary standards and the CPSC Testing Manual and would facilitate compliance and consumer safety.

*5. Require Bases to Remain Attached to Devices (16 CFR 1507.4)*

*a. Proposed Requirement and Rationale*

Section 1507.4 provides a minimum base-to-height ratio for fireworks devices that aims to reduce the likelihood of devices tipping over. The ratio test is intended to prevent devices from tipping over, but it is a static test that does not evaluate whether a device will tip over when firing. When firing, a device may tip over if there is no base, or if the base is not securely attached. If a device tips over when firing, it presents a serious safety hazard because it could fire in the direction of bystanders or nearby property, or users may return to a lit device to correct the tip over. Although the Fireworks Annual Report does not specifically track incidents or injuries that involve detached bases, the report does indicate that during a 1-month period in 2015, 6 percent of incidents involved devices tipping over, and 13 percent of incidents involved errant flight paths (including devices firing at bystanders rather than directly upwards), which resulted in severe burns. Although these incidents are not attributable to base detachments, specifically, incidents involving devices tipping over or having errant flight paths are the types of incidents that can occur when a base detaches from a device.

Commission staff has observed that several devices on the market do not have bases, or they have bases that became detached before or during use. Although staff does not systematically check for base attachment issues because that currently is not a requirement, staff nevertheless, may record these issues in notes on test reports during routine testing. Because staff does not systematically check and record base attachment issues, the reports that do reflect such issues represent the minimum number of base attachment issues that staff has witnessed.

Between fiscal year 1999 and 2016, staff reports indicate that 88 devices had no base, or the base detached before or during operation; 32 devices tipped over during testing; and 76 devices had compromised tube integrity. More than half of the base separations that staff observed were between fiscal years 2010 and 2016. This could suggest a decline in quality control, although there are other possible explanations as well. In some of these cases, staff noted that the base was detached or broken when received; in others, the base detached during handling; and in others, the base detached or cracked when the device fired. Staff has identified 111 samples (2.4%) out of 4,554 devices that have, or could have bases and that contained notes indicating that bases were either missing or functioned improperly during operation. This indicates that there are a large number of devices on the market that potentially pose a safety hazard if a device tips over.

Because of the safety risk associated with devices tipping over, the role base attachment can play in tip-over incidents, staff's observations of devices that rely on bases to operate properly, and staff's observation of devices on the market that do not have bases that are attached securely, the Commission proposes to require bases to remain attached to devices during storage, handling, and normal operation.

This proposed requirement is similar to provisions in the AFSL Standard and APA Standard 87-1 that require bases to remain attached to devices during transportation, handling, and normal operation. However, because Commission staff has observed devices that arrive with no base or a detached or broken base, the Commission proposes to extend this requirement to storage as well. Because DOT has jurisdiction over transportation safety, the Commission's proposed provision does not address transportation.

This proposal would create a new hazardous substance ban because it would add a requirement to 1507.4 that would require bases to remain attached during storage, handling, and

normal operation. As noted, any fireworks device that does not comply with part 1507 constitutes a banned hazardous substance under 1500.17(a)(9).

*b. FHSA Findings*

*i. Finding 1: Public Health and Safety*

The Commission believes that the degree and nature of the hazard associated with bases detaching and devices tipping over when firing are such that the public health and safety necessitates the Commission banning devices that do not have bases that are attached securely. Commission testing has found numerous devices that do not have bases that are attached securely and have tipped over during firing. Moreover, the proportion of these devices has increased in recent years. If a device tips over when firing, it can result in serious injuries. Although the incident reports do not address base detachments specifically, tip overs and other incidents can result when a base detaches and have resulted in serious burns to users and bystanders.

*ii. Finding 2: Voluntary Standards*

The Commission also believes that the voluntary standard provisions regarding base detachment are not adequate. For one, the voluntary standards include requirements relevant to transportation, which falls with DOT's purview. In addition, the Commission believes that the voluntary standards are not likely to adequately reduce the safety risk associated with base detachments because they do not address detachment that occurs during storage. Commission staff has observed fireworks devices with bases that were missing, broken, or detached before staff handled and operated them. As such, staff concluded that it is necessary to require attachment during storage. Finally, the Commission believes that there is not substantial compliance with the voluntary standards. In recent years, Commission staff has observed devices

with missing, broken, or detached bases. This suggests that there is not substantial compliance with the voluntary standards. The presence of devices on the market that do not comply with the voluntary standards and the serious injuries that can result when such noncompliant devices tip over during firing, support the Commission's finding that there is not sufficient compliance with the voluntary standards.

*iii. Finding 3: Costs and Benefits*

The Commission believes that the costs associated with the proposed requirement are reasonable, relative to the safety benefits. These costs include affixing bases to devices; designing them as a single piece; and incurring the time, materials, and shipping costs associated with those modifications. Although the Commission cannot estimate the safety benefits of improving the stability of devices, the general occurrence of tip-over incidents, and the potentially serious injuries that can result, supports the need for safety measures that would reduce them.

*iv. Finding 4: Alternatives*

The Commission believes that the proposed requirement is the least burdensome way to achieve the safety goal. The proposed requirement is performance-based, rather than prescriptive, allowing manufacturers numerous ways to comply. The proposal also is consistent with requirements in the voluntary standards.

*6. Prohibit Devices from Projecting Fragments when Functioning*

*a. Proposed Requirement and Rationale*

Incident data reported to the Commission for 2005 to 2015 indicate that some incidents may have involved fireworks that projected fragments when they fired, injuring bystanders. Although it was not clear in all of these incidents whether the fragments were part of a consumer

fireworks device or debris in the surrounding area, the resulting injuries demonstrate the risk to consumers. The reported incidents included debris in a bystander's eye; third-degree burns on a bystander's foot; a metal shard lodged in a bystander's ankle when the device fired sideways; and first-degree burns and a corneal abrasion from a piece of metal in a bystander's eye. As these incidents demonstrate, fragments of hard materials from a firing fireworks device can cause serious injuries. Moreover, during routine compliance testing, Commission staff has observed hard plastic, metal, or other fragments expelled when fireworks devices function.

To address this safety hazard, the Commission proposes to prohibit fireworks devices from projecting sharp debris when functioning. Section 3.7.2 of APA Standard 87-1 prohibits fireworks devices from propelling sharp fragments of specific materials when set off. The AFSL Standard includes a similar, more general requirement, prohibiting devices from projecting flaming or glowing pieces (section 2-1.11). The Commission proposes to incorporate by reference the APA Standard 87-1 provision because it provides a more detailed requirement, listing specific types of materials that a fireworks device may not project, including metal, glass, and brittle plastic. However, the Commission requests comments on whether this provision should be limited to certain sizes or amounts of these fragments, rather than a strict general ban, because devices may include these materials as necessary components.

Because the regulations do not currently prohibit devices that project sharp fragments, this would be a new ban, subject to the FHSA findings.

*b. FHSA Findings*

*i. Finding 1: Public Health and Safety*

The Commission believes that this ban is necessary to adequately protect the public from the risk of serious injury that can result when fireworks devices project sharp fragments.

Commission staff has observed devices project fragments when firing and incident data demonstrates the occurrence and severity of these incidents.

*ii. Finding 2: Voluntary Standards*

The Commission believes that APA Standard 87-1 would adequately reduce the risk of injury associated with projected fragments because it prohibits devices from projecting fragments that can injury bystanders, which is why the Commission proposes to incorporate by reference this provision of the voluntary standard. But the Commission does not believe that there is likely to be substantial compliance with that standard, given the severity of potential injuries. As discussed above, the severity of potential injuries is a factor the Commission considers relevant in assessing the level of compliance necessary to constitute "substantial compliance" with a voluntary standard. *See* H.R. Rep. No. 208, 97th Cong., 1st Sess. 875 (1981). Although there are only eight reported incidents, the reported injuries demonstrate the potential severity of injuries that projected fragments can cause, including first-degree burns and eye injuries. Accordingly, the level of compliance must be particularly high.

*iii. Finding 3: Costs and Benefits*

The Commission believes that the benefits of the proposed requirement bear a reasonable relationship to the costs. The benefits include increased consumer safety. The costs include possibly redesigning devices to eliminate parts that may be dispersed or expelled as fragments or potentially implementing greater quality control to ensure that such parts are not dispersed or expelled as fragments. Commission staff does not have sufficient information to determine the expected costs of these modifications, but anecdotal evidence indicates that less than 10 percent of the market does not comply with the proposed requirement.

*iv. Finding 4: Alternatives*

The Commission believes that the proposed requirement is the least burdensome way to achieve the safety goal. The AFSL Standard and APA Standard 87-1 provide similar alternatives, and the proposed requirement is a performance-based standard that prohibits devices that project fragments and does not otherwise limit the design of devices.

*B. Easing Existing Regulatory Requirements*

The following proposed provision would not create any new requirements or ban any hazardous substances. Rather, the proposed provision would ease the existing regulatory requirements applicable to fireworks devices.

*1. Allow Trace Amounts of Prohibited Chemicals (16 CFR 1507.2)*

Section 1507.2 prohibits the presence of certain chemicals in fireworks devices. This requirement has existed in CPSC's regulations since 1976. 41 FR 9,512 (Mar. 4, 1976); 41 FR 22,931 (June 8, 1976). However, technology has advanced significantly since CPSC adopted this provision, and now testing can identify previously undetectable trace amounts of a chemical. This precision can make it difficult and burdensome to demonstrate the absence of prohibited chemicals in any amount because instruments often can quantify the presence of a chemical at parts per billion or parts per trillion, but not zero. Instruments and analyses that can test for the presence of chemicals at infinitesimal levels are costly and often require significant sample preparation, while simpler and less costly test methods (*e.g.*, X-Ray Fluorescence spectroscopy) are available to identify the presence of chemicals.

Given the nature of the chemicals prohibited in fireworks devices and the manner in which these chemicals appear in fireworks devices in trace amounts, the Commission believes that their presence is not intentional. In large enough amounts, these chemicals are

unstable or pose health or environmental risks, so manufacturers would not deliberately add them to devices. Rather, when they are present, it is likely the result of their inadvertent presence in the environment during production. The Commission believes that trace amounts of these chemicals do not present a risk to consumers because such minimal levels would not affect the rate of reaction and consequent explosive power.

To reflect current technological capabilities, the relative difficulty and cost of identifying and eliminating all trace amounts of prohibited chemicals, the unintentional nature of trace contamination, and the negligible safety implications of trace contamination, the Commission proposes to allow trace amounts of the chemicals prohibited in 1507.2 to be present in fireworks devices.

Existing standards and Commission testing and research provide some options for selecting an appropriate trace allowance limit. APA Standard 87-1 and the AFSL Standard both allow for small amounts of prohibited chemicals as impurities. APA Standard 87-1, section 3.7.1, allows for trace amounts of all prohibited chemicals, if the trace amount is less than 0.25 percent by weight. The AFSL Standard, Appendix A, Table 1, allows for trace contamination of HCB at the limit of 0.01 percent by weight, but does not include a general allowance for all prohibited chemicals. There are also limits on lead content in other consumer products. The Consumer Product Safety Improvement Act (CPSIA; Pub. L. No. 110-314, 122 Stat. 3016) limits the lead content of most children's products to 0.01 percent by weight and limits lead compounds in consumer surface-coating materials to 0.009 percent by weight.

Additionally, Commission staff conducted preliminary testing to identify prohibited chemicals in fireworks devices. Examining samples collected from the Office of

Compliance from fiscal years 2014 and 2015, staff found that 90 percent of the samples (29 of 32) contained titanium with 100-mesh particle size or smaller, in violation of 1507.2(j), and 38 percent of the samples (12 of 32) contained lead, which the Commission proposes to prohibit in this NPR. However, applying a trace contamination allowance of 0.25 percent by weight (consistent with APA Standard 87-1), only 9 percent (3 of 32) exceeded this limit for titanium with 100-mesh particle size or smaller and only 3 percent (1 of 32) exceeded this limit for lead compounds. Applying an even lower contamination allowance of 0.05 percent by weight, only a few samples (between 9 percent% and 16 percent) exceeded this threshold for titanium with 100-mesh particle size or smaller, and none of the samples exceeded this limit for lead compounds. As discussed, various studies have found HCB in fireworks devices in ranges less than and greater than 0.01 percent, 0.05 percent, and 0.25 percent by weight.

Based on this information, there are several options that the Commission may adopt as a general allowance for all prohibited chemicals or as trace allowances for particular chemicals, such as HCB and lead tetroxide and other lead compounds. These options include:

- allowing trace amounts:
    - less than 0.25 percent by weight (consistent with the general limit in APA Standard 87-1);
    - less than 0.01 percent by weight (consistent with CPSIA lead limits);
    - less than 0.05 percent by weight (since CPSC's initial testing indicates that most devices comply with this level);

- less than 0.01 percent by weight (consistent with the most stringent allowance in the voluntary standards); or
- less than 0.009 percent by weight (consistent with the CPSIA limit on lead compounds in certain consumer materials); or

- adopting no allowance for certain chemicals.

The Commission does not have exposure data regarding the relative safety of the various trace contamination levels identified.

With the exception of HCB, the Commission proposes to allow for trace amounts up to 0.25 percent of each of the prohibited chemicals listed in 1507.2, including lead tetroxide and other lead compounds, which the Commission proposes to add to 1507.2 in this NPR. This contamination level is consistent with the level provided in APA Standard 87-1. The Commission proposes to allow for trace amounts of 0.01 percent for HCB. This contamination level is consistent with the level provided in the AFSL Standard.

The Commission also may opt to adopt trace contamination allowances in the regulations, in compliance guidance, or in the CPSC Testing Manual. Incorporating trace allowance limits into compliance guidance or the CPSC Testing Manual would maintain the strict prohibition in the regulations but give the Commission flexibility in enforcing violations of the prohibited chemicals ban. Including these allowances in compliance guidance or the CPSC Testing Manual would not create or modify the current requirement in 1507.2, but would serve only as an option available for Commission flexibility.

*C. Clarifications of Existing Regulations*

The following proposed requirements would not create any new requirements or ban any hazardous substances; rather they would facilitate regulated entities' understanding of the

existing or proposed regulations by providing definitions and eliminating inconsistencies. Because these proposed requirements would not create new hazardous substance bans, they do not require the Commission to make the FHSA findings.

*1. Define "Burst Charge" (16 CFR 1500.3)*

The proposed modifications to 16 CFR 1500.17(a)(3) regarding the method of identifying devices that are limited to 2 grains of pyrotechnic composition (discussed in Section IV.A.1.) focus on the content of the "burst charge" of the device. Additionally, "burst charge" appears in the proposed chemical composition and pyrotechnic weight limits (discussed in Section IV.A.2.). Consequently, the meaning of the term "burst charge" is central to these proposed requirements, and regulated entities need a clear understanding of the term to comply with the proposed requirements. Therefore, the Commission proposes to define "burst charge."

The proposed requirements in which the term "burst charge" would appear are consistent with provisions in APA Standard 87-1. APA Standard 87-1 defines "burst charge" in section 2.5, describing its function and the effects it produces—namely, that it is a chemical composition that breaks open an aerial device—and identifying "expelling charge" and "break charge" as common synonyms for "burst charge." The Commission believes that this definition accurately describes the term "burst charge." For that reason, and to align with the industry standard, the Commission proposes to incorporate by reference the definition of "burst charge" as it appears in the first two sentences of APA Standard 87-1, section 2.5.

*2. Define "Chemical Composition" (16 CFR 1500.3)*

The term "chemical composition" is central to the proposed chemical composition and pyrotechnic weight limits (described in Section IV.A.2.). The Commission proposes to define "chemical composition" so that regulated entities have a clear and precise understanding of this term to comply with the proposed limits.

The chemical composition limits that the Commission proposes are similar to those in APA Standard 87-1. APA Standard 87-1 defines "chemical composition" in section 2.6, describing it as pyrotechnic and explosive compositions and detailing its components. The Commission believes that this definition accurately describes "chemical composition." For this reason, and to align with the industry standard, the Commission proposes to incorporate by reference the definition of "chemical composition" as set forth in APA Standard 87-1, section 2.6.

In addition, the Commission proposes to specify that "chemical composition" consists of lift charge, burst charge, and visible and audible effect materials. This additional information is not in APA Standard 87-1, but the Commission believes it clarifies information, which facilitates industry compliance with the proposed chemical composition and pyrotechnic weight limits.

*3. Define "Explosive Composition" (16 CFR 1500.3 and 1507.1)*

The proposed definition of "chemical composition" includes the term "explosive composition." In addition, the proposed definition of "firecrackers," discussed below, also includes this term. To facilitate clear and consistent industry understanding of this term, the Commission proposes to define "explosive composition."

APA Standard 87-1 defines "explosive composition" in section 2.6.1, describing the function and effect. The Commission believes that this definition accurately describes the term. For this reason, and for consistency with this recognized standard, the Commission proposes to incorporate by reference APA Standard 87-1, section 2.6.1.

*4. Define "Lift Charge" (16 CFR 1500.3)*

The chemical composition limits that the Commission proposes (described in Section IV.A.2., above) include limits on the chemical composition of "lift charges." The Commission proposes to define the term "lift charge" so that regulated entities have a clear and consistent understanding of the components to which these limits apply.

The chemical composition limits that the Commission proposes are similar to those in APA Standard 87-1. Standard APA Standard 87-1 also defines "lift charge" in section 2.10, describing its function (lifting or propelling a device into the air) and composition. The Commission believes that this definition accurately describes this term. For this reason, and for consistency with the comparable requirements in APA Standard 87-1, the Commission proposes to incorporate by reference section 2.10 of APA Standard 87-1.

However, the APA Standard 87-1 definition of "lift charge" refers only to mine or shell devices, not all fireworks devices. As an alternative to the APA Standard 87-1 definition, the Commission believes that it may be appropriate to define "lift charge" in a manner that applies to all fireworks devices. The Commission requests comments on this alternative.

*5. Define "Pyrotechnic Composition" (16 CFR 1500.3 and 1507.1)*

The term "pyrotechnic composition" appears in several existing CPSC fireworks regulations, as well as in several of the requirements proposed in this NPR. Specifically, the

term appears in the proposed definitions of "burst charge" and "chemical composition"; the proposed chemical composition and pyrotechnic weight limits (described in Section IV.A.2., above); and 16 CFR 1507.3, 1507.5, 1507.9, and 1507.11 (in reference to fuse requirements, pyrotechnic leakage, toy smoke and flitter devices, and party poppers, respectively). The Commission proposes to define "pyrotechnic composition" so that the regulated industry has a clear and uniform understanding of this term and the related requirements. Such an understanding facilitates proper testing and regulatory compliance, which, in turn, promotes consumer safety.

Section 2.6.2 of APA Standard 87-1 defines "pyrotechnic composition," describing how it functions and the effects it produces. The Commission believes that this definition accurately describes "pyrotechnic composition." For that reason, and for consistency with the industry standard, the Commission proposes to incorporate by reference APA Standard 87-1, section 2.6.2.

*6. Clarify Requirements for "Aerial Bombs" (16 CFR 1500.3, 1500.17(a)(3) and 1500.17(a)(8))*

The term "aerial bomb" appears twice in CPSC's fireworks regulations—in 16 CFR 1500.17(a)(3) and in 1500.17(a)(8). Section 1500.17(a)(3) bans fireworks devices intended to produce audible effects if the audible effect is produced by more than 2 grains of pyrotechnic composition. This section lists examples of devices that are "intended to produce audible effects," including "aerial bombs." As a result, 1500.17(a)(3) bans aerial bombs only if they contain more than 2 grains of pyrotechnic composition. In contrast, 1500.17(a)(8) bans various devices, listing each one, including "aerial bombs." This provision does not limit the ban to devices containing more than 2 grains of pyrotechnic

composition; rather, it bans all of the listed devices outright, including "aerial bombs." As such, 1500.17(a)(3) and 1500.17(a)(8) are inconsistent.

To eliminate this inconsistency, the Commission proposes to remove "aerial bombs" from 1500.17(a)(3) and retain it, as written, in 1500.17(a)(8). The Commission believes that it is appropriate to ban aerial bombs entirely because they present a serious risk of injury to consumers. The proposed removal of "aerial bombs" from 1500.17(a)(3) would not create any new requirements or ban any new hazardous substances. Rather, the Commission would merely be maintaining one of the two existing provisions.

In addition, the Commission proposes to define "aerial bombs" to provide regulated entities with clarity about which devices are banned. None of the existing voluntary or international standards define "aerial bombs." The Commission proposes to define "aerial bomb" as "a tube device that fires an explosive charge into the air without added visual effect."

*7. Define "Firecrackers" (16 CFR 1500.3 and 1507.1) and Rephrase References to Firecrackers (16 CFR 1500.17(a)(3), 1500.17(a)(8), 1500.83(a)(27)(i), and 1500.85(a)(2))*

The Commission proposes two revisions to clarify the regulations regarding firecrackers. First, the Commission proposes to define "firecrackers." The term "firecrackers" appears in 1500.17, 1500.85, and 1507.1. The Commission believes that a definition of "firecrackers" would provide a clear understanding of what these devices include, and thereby, facilitate compliance with requirements that apply to them.

Both APA Standard 87-1 (section 3.1.3.1) and the AFSL Standard (section 1-1.7) define "firecrackers" in largely the same way, describing the materials and effects of a firecracker and specifying limits that apply to firecrackers. The Commission believes that

both definitions are clear and accurate, but proposes to incorporate by reference the APA Standard 87-1 definition for consistency with other proposed requirements that would incorporate that standard by reference and to reduce industry burdens by requiring compliance with one voluntary standard, rather than two.

Second, the Commission proposes to revise the references to firecrackers in the regulations so that they are consistent and more straightforward. CPSC's regulations refer to "firecrackers," "firecrackers designed to produce audible effects," and "devices designed to produce audible effects." *See* 1500.17(a)(3), 1500.17(a)(8), 1500.83(a)(27)(i), and 1500.85(a)(2). As the proposed definition of "firecrackers" indicates, these devices create a noise (or audible effect) when they function. This noise is an intentional effect that firecrackers are designed to produce. Therefore, "designed to produce audible effects" is an unnecessary qualifier for "firecrackers." To make the regulations clearer and less cumbersome, the Commission proposes to replace the references to devices "designed to produce audible effects" in 1500.17(a)(3), 1500.17(a)(8), 1500.83(a)(27)(i), and 1500.85(a)(2) with appropriate descriptions of the term that are not redundant. This revision may also minimize confusion with the similar phrase "intended to produce audible effects" in 1500.17(a)(3), which refers to a different category of devices.

*8. Move the Exemption for Firecrackers from the Scope Section of Part 1507 to the Individual Sections of Part 1507 that are Relevant to Firecrackers (16 CFR 1507.1, 1507.2, and 1507.3)*

Section 1507.1 establishes the scope of part 1507, stating that any fireworks devices, other than firecrackers, that are not otherwise banned, are subject to the requirements in part 1507. Only two sections within part 1507—1507.2 and 1507.3—could apply to firecrackers.

In a previous rulemaking, the Commission concluded that 1507.2 should not apply to firecrackers because 1507.2 prohibits chlorates, which are common and adequately safe in firecrackers containing flash powder. 41 FR 9,520 (Mar. 4, 1976). Similarly, the Commission decided that firecrackers need not be subject to the fuse requirements in 1507.3 because the type of fuses those requirements aim to address—namely, those that create a safety hazard—are not used in firecrackers. *Id*. The remaining sections of part 1507 are specific to particular devices (none of which are firecrackers) or particular features that firecrackers do not have and, therefore, are not relevant or applicable to firecrackers. Consequently, there is no need to exempt firecrackers from the scope of those provisions.

In order to streamline the regulations, the Commission proposes to remove the exemption for firecrackers from 1507.1 and, instead, place it in the only two sections to which the exemption is relevant—1507.2 and 1507.3. This does not alter the substantive requirements or the scope of the exemption in this part. Rather, it simply lists the exemption where it is actually applicable, rather than applying it unnecessarily broadly to the entire part.

*9. Make Editorial Correction to Language Regarding Fuse Attachment (16 CFR 1507.3)*

Section 1507.3(b) requires fuses to remain securely attached to fireworks devices. To evaluate whether a fuse is securely attached to the device, the regulation requires the fuse to support the lesser of: (1) the weight of the fireworks device plus 8 ounces, or (2) double the weight of the device, without separating from the device. However, in describing the two alternate weight options, the regulation states: "whether is less," rather than, "whichever is less." Although the meaning of the regulation is apparent, the Commission proposes to correct this typographical error.

*10. Define "Base" (16 CFR 1507.4)*

Section 1507.4 specifies requirements relevant to bases of fireworks devices and, as described in Section IV.A.5., above, the Commission proposes additional requirements regarding bases in this NPR. To facilitate a clear understanding of the features subject to those requirements, the Commission also proposes to define the term "base."

APA Standard 87-1 does not define "base," but section 1-2.1 of the AFSL Standard does, describing it as a platform from which a fireworks device functions and to which tubes are attached. The Commission proposed to adopt a definition that is consistent with the AFSL Standard, but includes more detail to provide greater precision and clarity.

*11. Define "Burnout" and "Blowout" (16 CFR 1507.6)*

Section 1507.6 requires the pyrotechnic chamber in fireworks devices to be constructed "to allow functioning in a normal manner without burnout or blowout." The Commission proposes to adopt definitions for "burnout" and "blowout" in order to provide a clear and consistent understanding of the existing requirement.

APA Standard 87-1 defines "blowout" in section 2.3 and "burnout" in section 2.4, describing the observable effects of these phenomena. The Commission believes that these definitions accurately capture the meaning of these terms and reflect the understanding of the fireworks industry. Therefore, the Commission proposes to incorporate by reference APA Standard 87-1, sections 2.3 and 2.4.

**V. Incorporation by Reference**

This NPR proposes to incorporate by reference several provisions of APA Standard 87-1. The Office of the Federal Register sets out specific procedural and content requirements to incorporate a material by reference in 1 CFR part 51. Under these regulations, an NPR must

summarize the material it proposes to incorporate by reference and discuss how that material is available to interested parties. 1 CFR 51.3(a), 51.5(a). In accordance with this requirement, Sections III. and IV. of this preamble summarize the provisions of APA Standard 87-1 that the Commission proposes to incorporate by reference. Additionally, by permission of APA, interested parties may view the standard as a read-only document during the comment period of this NPR at: http://www.americanpyro.com/. Interested parties may also purchase a copy of APA Standard 87-1 from American Pyrotechnics Association, 7910 Woodmont Ave., Ste. 1220, Bethesda, MD 20814; http://www.americanpyro.com/. Interested parties may also inspect copies of the standard at CPSC's Office of the Secretary, U.S. Consumer Product Safety Commission, Room 820, 4330 East West Highway, Bethesda, MD 20814, telephone 301-504-7923.

## VI. Paperwork Reduction Act

The proposed requirements do not include any provisions that would constitute a collection of information under the Paperwork Reduction Act of 1995 (PRA; 44 U.S.C. 3501–3521). The proposed requirements do not request or require any parties to create or maintain records or disclose or report information to the Commission, any government body, the public, or third parties. Therefore, the requirements of the PRA do not apply to this NPR.

## VII. Regulatory Flexibility Act

### *A. Introduction*

The Regulatory Flexibility Act (RFA; 5 U.S.C. 601–612) requires agencies to consider the impact of proposed rules on small entities, including small businesses. Section 603 of the RFA requires the Commission to prepare an initial regulatory flexibility analysis (IRFA) and make it available to the public for comment when the NPR is published. The IRFA must describe the impact of the proposed rule on small entities and identify significant alternatives that

accomplish the statutory objectives and minimize any significant economic impact of the proposed rule on small entities. Specifically, the IRFA must discuss:

- the reasons the agency is considering the action;
- the objectives of and legal basis for the proposed rule;
- the small entities that would be subject to the proposed rule and an estimate of the number of small entities that would be impacted;
- the reporting, recordkeeping, and other requirements of the proposed rule, including the classes of small entities subject to it and the skills necessary to prepare the reports or records; and
- the relevant federal rules that may duplicate, overlap, or conflict with the proposed rule.

5 U.S.C. 603.

In addition, the IRFA must describe any significant alternatives to the proposed rule that accomplish the stated objectives of applicable statutes and minimize any significant economic impact on small entities. *Id*. This section summarizes the IRFA for this proposed rule. The complete IRFA is available in the briefing package for this NPR, available at https://www.cpsc.gov/Newsroom/FOIA/ReportList?field_nfr_type_value=commission. To summarize, the Commission does not have enough information to determine whether all of the provisions in the proposed rule would not have a significant economic impact on a substantial number of small entities. The Commission does not expect the costs of compliance with several of the provisions to pose a significant impact to a substantial number of small entities; however, the Commission does not have enough information to estimate the costs of compliance with the provisions regarding base attachment and fragments, with precision. To further inform its

decision and analysis, the Commission requests comments on the costs of complying with the provisions regarding base attachment and fragments.

*B. Reasons the Agency is Considering the Action*

The Commission is considering the proposed rule to update its existing fireworks regulations to reflect the current fireworks market, changes in technology, existing fireworks standards, and safety issues associated with fireworks devices in order to reduce the risk of injury that fireworks devices present to consumers and align with other voluntary and federal standards.

*C. Objectives of and Legal Basis for the Proposed Rule*

The objective of the proposed rule is to update CPSC's fireworks regulations to reflect the current fireworks market, changes in technology, existing fireworks standards, and safety issues associated with fireworks devices in order to reduce the risk of injury that fireworks devices present to consumers.

The legal authority for the proposed rule is the FHSA, which authorizes the Commission to adopt regulations regarding hazardous substances and regulatory provisions necessary to enforce those requirements.

*D. Small Entities Subject to the Proposed Rule*

The U.S. Small Business Administration (SBA) size guidelines define manufacturers categorized under North American Industry Classification System (NAICS) codes that apply to fireworks manufacturers as "small" if they have fewer than 500 employees. The SBA defines importers as "small" if they have fewer than 100 employees (wholesalers) or less than $7.5 million in sales (retailers). AFSL, which conducts testing and certification for a substantial portion of the fireworks industry, maintains a public list of U.S. importers and Chinese manufacturers that participate in its programs. Its list includes 165 importers, of which 121 are

small, six are large, and the remaining 38 are of unknown size (but likely are small). AFSL asserts that its members represent 85 percent to 90 percent of U.S. importers, indicating a total market size of 183 to 194 importers. Although some U.S. firms continue to manufacture fireworks, the vast majority of the market is imported.

*E. Requirements of the Proposed Rule and the Potential Impact on Small Entities*

The proposed rule includes three categories of requirements. First, the proposed rule adds definitions for various terms that appear in the regulations or in requirements proposed in this NPR and clarifies existing requirements. The proposed definitions are based on the common understanding of these terms within the fireworks industry, and are consistent with the voluntary standards; as such, they do not create any new requirements or impose any burdens on the fireworks industry. Similarly, the clarifications would not change the regulations and would not create any additional burdens.

Second, the proposed rule includes provisions to reduce burdens on the fireworks industry by allowing trace amounts of prohibited chemicals. The burdens related to this proposed requirement are discussed below.

Third, the proposed rule includes new hazardous substances bans. The burdens related to these requirements are discussed in further detail below. To summarize, the following proposed requirements may impact small entities:

- banning fireworks devices with break charges containing metallic powder less than 100 mesh in particle size when the break charge is produced by more than 2 grains of pyrotechnic composition;
- limiting total pyrotechnic weight and chemical composition by firework type;
- prohibiting HCB and lead tetroxide and other lead compounds in fireworks devices;

- requiring the testing of fuses for side ignition;
- requiring bases remain attached to devices during storage, handling, and use; and
- banning fireworks from expelling fragments when functioning.

Typically, fireworks are manufactured overseas and imported into the United States. For this reason, most of the potential impact of this proposed rule would fall on small domestic importers, rather than small domestic manufacturers. Because the proposed rule includes changes intended to align Federal regulations with voluntary standards, many foreign manufacturers already comply with the proposed regulations. Consequently, for many importers, finding a new supplier may be a low-cost option to comply with the proposed rule.

*1. Allow for Trace Contamination of Prohibited Chemicals*

The proposed rule would amend 1507.2 to allow for trace amounts of prohibited chemicals in fireworks. The Commission proposes various contamination levels that align with the voluntary standards, compliance rates, and other federal standards. Because of advancements in technology, testers can now identify chemicals in such low levels that they do not pose safety hazards to consumers. Between fiscal years 2000 and 2015, CPSC found 41 violations of 1507.2. Of these violations, four came from samples that contained prohibited chemicals in concentrations below the proposed allowance limit of 0.25 percent. The total lot value of those four lots was $7,109, which represents the theoretical reduction in burden for the fireworks industry. In addition, the proposed requirement may reduce burdens by no longer requiring manufacturers to ensure the absolute absence of prohibited chemicals. Therefore, this requirement should not have a significant economic impact on a substantial number of firms.

*2. Ban Fireworks Containing Metallic Powder Less than 100 Mesh in Particle Size with Greater Than Two Grains of Pyrotechnic Material*

The proposed rule would adopt a new method of identifying devices that are subject to the two-grain limit, replacing the identifier "devices intended to produce audible effects" with a description of the content of the devices. CPSC's preliminary testing revealed that more than 85 percent of samples do not comply with the proposed standard. Although the sample size of this testing was too small to generalize these findings, it suggests that a significant number of firms may not comply with the proposed requirement. This indicates that fireworks manufacturers may incur some costs to comply with the proposed regulation.

To comply with the proposed requirement, the Commission expects fireworks producers to replace metallic and hybrid powders with black powder formulations. The cost of switching from metallic and hybrid powders to black powder should not create a significant impact for firms that have to change formulations. Commission staff examined retail prices of aluminum, other popular powders, and black powder kits and found that aluminum ranges from $18.35 per pound to $38.67 per pound and black powder kits sell for approximately $5.20 per pound. Therefore, a firework producer switching from 2 grains of aluminum powder purchased for $18.35 per pound to 15 g of black powder purchased for $5.20 per pound would incur a material cost increase of $0.17 per shell. As these mine or shell devices typically sell for $4 to $5 per shell, the difference in fuel costs could represent up to 4 percent of retail revenues. However, because fireworks manufacturers are unlikely to pay retail prices for fuels and the applicable devices represent only a portion of a fireworks manufacturer's product line, the impact of this proposed provision on the total revenue of any manufacturer or importer is likely to be less than one percent and may not be to be significant for the affected small firms.

*3. Limit the Total Pyrotechnic Weight and Chemical Composition of Fireworks Devices*

The proposed rule limits the total amount of pyrotechnic material and the chemical composition in various fireworks devices. These provisions align with the limits in APA Standard 87-1. The limits in APA Standard 87-1 are high enough to allow sufficient explosive force for a fireworks device to function, even accounting for switching from flash powder and hybrid formulations to exclusively black powder. CPSC's initial testing found several devices that do not comply with the proposed limits for aerial devices. To comply with the proposed requirements, non-compliant producers would likely implement quality control measures to ensure devices comply with the specified limits. Given that many fireworks devices are made by hand, a quality control system could consist of a one-time transition to smaller measuring devices for filling fireworks with pyrotechnic material. Thus, this proposed requirement is not likely to produce a significant impact on affected small firms. The Commission does not have information about the level of compliance with the proposed limits for ground devices.

*4. Ban HCB and Lead Tetroxide and Other Lead Compounds in Fireworks Devices*

The proposed rule would ban HCB and lead tetroxide and other lead compounds, either entirely or in concentrations above a certain threshold for trace contamination. Although both chemicals were once prominent in fireworks formulations, they have since largely fallen out of use. The voluntary and international standards ban both chemicals, in some combination, and testing indicates that there is a fairly high level of compliance with these bans. Although studies indicate that there are fireworks devices that contain HCB or lead tetroxide and other lead compounds, those devices do not represent a large portion of the devices on the market. Thus, although the availability of such devices poses a substantial risk to consumers, if exposed to

those chemicals, the devices make up a small enough portion of the market that banning those chemicals likely would not create significant costs.

While lead was traditionally used to create "crackle" effects, bismuth trioxide has largely replaced it to achieve that effect because it is less expensive and more effective. HCB was prevalent in fireworks as a color enhancer, but since some standards have banned HCB, fireworks manufacturers have reduced its use. Because of the industry's limited use of these chemicals, the Commission expects that the proposed requirement would pose minimal burden to industry.

*5. Require Testing for Side Ignition of Fuses*

The proposed rule would amend 1507.2 to include a test for side ignition of fuses. The test is currently specified in the CPSC Testing Manual. The test requires placing the lit end of a cigarette against the side of a fuse and observing how much time elapses before it ignites. Under the proposed requirement, a device fails if it ignites within 3 seconds.

CPSC testing indicates that 99.5 percent of fireworks pass the proposed test for side ignition. The remaining 0.5 percent of fireworks may fail the test because they have not been treated to prevent side ignition or have not been sufficiently treated or coated to prevent side ignition within 3 seconds. By not defining a metric for reducing the possibility of side ignition, the current regulations leave open the question of whether those fuses that have been treated, but treated insufficiently to pass CPSC's test method, meet the standard in the regulation.

The proposed test method would require fireworks manufacturers and importers to conduct the test to issue a certificate of compliance with their products. The Commission does not know how many fireworks are currently tested for side ignition of fuses. However, a reasonable testing program associated with this requirement is unlikely to create a significant

economic impact on fireworks producers. Conceivably, a producer could test the treatment or coating on a sample of fuses, conclude the treatment or coating is effective, and use the same test results for all fireworks that use the same type of fuse. Thus, a producer could amortize the costs of fuse testing across all fireworks sold with fuses.

*6. Require Bases to Remain Attached During Storage, Handling, and Operation*

The proposed rule requires bases to remain attached to fireworks during storage, handling, and operation. The Commission expects this requirement to have a minimal impact on manufacturers. CPSC does not test for base attachment when testing samples of fireworks, but on occasions where bases are detached, staff may note this in the testing report. In fireworks tested between Fiscal Year 1999 and the present, out of 4,554 relevant samples, 111 samples (2.4%) contained notes that bases were either missing or functioned improperly during operation.

For devices that do not meet the proposed requirement, the Commission expects firms to adapt their designs so that the device and base are one piece or to secure the base to the device with an adhesive. The potential costs of complying with the proposed regulation include additional time to affix the base to the fireworks device (seconds per device), materials for affixing the base, and potential shipping costs associated with the higher volume per device when the base is attached. Additionally, some quality control efforts may be needed to ensure that bases are attached correctly so as not to detach during storage, handling, or operation. Because only a small portion of products do not meet the proposed requirement, and the activities necessary to comply with it are low in cost, the Commission does not expect this provision to have a significant economic impact on a substantial number of small firms.

*7. Ban Fireworks That Disperse Fragments*

The proposed rule bans fireworks that disperse fragments when operating. This ban is also in APA Standard 87-1 and the AFSL Standard. CPSC staff has observed fragments falling from detonated fireworks during testing and incident data from 2005 through 2015 reveals eight potential incidents associated with fragments in fireworks. CPSC believes the fragments expelled from fireworks are typically due to manufacturers' intentional use of metal, glass, or brittle plastic parts. These components are not part of the effects associated with the device, but may play a role in the functioning of the device. To comply with the proposed rule, fireworks producers would have to redesign their products to not use these components or would have to implement quality control measures to ensure the device does not project these components when firing. CPSC has little information about the costs of these changes.

*F. Other Relevant Federal Rules*

DOT incorporates by reference APA Standard 87-1 into its regulations, which apply to fireworks when transported in commerce. Because all fireworks sold to consumers are, at some point, transported in commerce, all consumer fireworks fall under the jurisdiction of DOT and are subject to the requirements of APA Standard 87-1. However, DOT's enforcement program is limited to its jurisdiction over the transportation of hazardous materials in commerce and provisions relevant to safety during such transportation.

In estimating the burdens to manufacturers imposed by the proposed rule, the Commission relied on estimates of current compliance with APA Standard 87-1 because it is incorporated by reference into DOT's regulations. The provisions of this proposed rule aim to eliminate conflict between DOT regulations and CPSC regulations for fireworks, where it exists.

*G. Alternatives*

The Commission considered alternatives to the proposed requirements that impose new bans on the fireworks industry, in the interests of reducing the compliance burden.

*1. Alternatives to Banning Fireworks Containing Metallic Powder Less than 100 Mesh in Particle Size with Greater Than Two Grains of Pyrotechnic Material*

Rather than adopt the proposed method of identifying devices that are limited to two grains of pyrotechnic content, the Commission could take no action. This alternative would be less burdensome than the proposed requirement, as compliance with the current regulation is higher than with the proposed requirement. However, the Commission believes that the proposed provision provides additional clarity and consistency and more-regularly identifies the more-explosive devices, thereby furthering compliance with an important safety provision. Additionally, the Commission believes that the cost of meeting the proposed requirement is low.

An additional alternative is to eliminate the 2-grain limit in more-powerful fireworks devices. However, without this limit, fireworks devices could be manufactured with greater explosive power, presenting serious safety risks for consumers.

*2. Alternatives to Limiting the Total Pyrotechnic Weight and Chemical Composition of Fireworks Devices*

The Commission considered taking no action to limit the total pyrotechnic weight and chemical composition of certain fireworks devices. However, for those regulated entities that already comply with the limits in APA Standard 87-1 limits, the proposed rule would create only a minimal burden. Moreover, the proposed rule aims to limit the explosive power of fireworks devices to reduce the potential for injuries to users, and CPSC believes there is some benefit in aligning its requirements with the voluntary standards.

*3. Alternatives to Banning HCB and Lead Tetroxide and Other Lead Compounds in Fireworks Devices*

The Commission considered taking no action to add HCB and lead tetroxide and other lead compounds to the list of prohibited chemicals in 1507.2. However, that alternative likely would not reduce the burden of the proposed requirement substantially because many regulated entities already exclude these chemicals from their devices. The Commission also considered only prohibiting either HCB or lead tetroxide or other lead compounds, as well as various allowance levels for trace contamination. When considering the trace contamination allowance that the Commission proposes in this NPR, the burden of the proposed requirement is particularly low and aligns with the voluntary standards, and is justified given the highly hazardous nature of these chemicals.

*4. Alternatives to Requiring Testing for Side Ignition of Fuses*

The Commission considered taking no action to require specific testing of fuses. However, this alternative would not significantly reduce the burden of the proposed requirement on firms because CPSC already uses the proposed test for compliance testing. Additionally, the burden of testing fuses is minimal when amortized across all fireworks sold with fuses.

*5. Alternatives to Requiring Bases to Remain Attached During Storage, Handling, and Operation*

The Commission considered taking no action concerning base attachment. However, the proposed requirement is intended to address a specific hazard. Therefore, the Commission believes that the potential benefit of the proposed requirement outweighs the potential costs, which are unlikely to be significant for a substantial number of firms.

*6. Alternatives to Banning Fireworks That Disperse Fragments*

The Commission considered taking no action to ban fireworks that project fragments when firing. However, given the potential for severe injury, the Commission believes that taking no action does not sufficiently protect consumer safety.

## VIII. Preemption

Section 18 of the FHSA provides that no state or political subdivision of a state may establish or continue in effect a cautionary labeling requirement or a requirement for a hazardous substance that is designed to protect against the same risk of illness or injury unless the requirement is identical to the FHSA requirement or the requirement the Commission adopts under the FHSA. 15 U.S.C. 1261n(b)(1); Section 231 of the CPSIA. However, a state or political subdivision of a state may establish or continue in effect a requirement applicable to a hazardous substance for the state or political subdivision's own use that is designed to protect against a risk of illness or injury associated with fireworks devices if it provides a higher degree of protection from that risk than the requirement in effect under the Commission's regulations. 15 U.S.C. 1261n(b)(2) and 1261n(b)(4). This allowance does not extend to labeling requirements. In addition, a state or political subdivision may apply for exemption from preemption in the circumstances specified in section 18(b)(3) of the FHSA.

Consequently, if the Commission adopts a final rule regarding fireworks under the FHSA, that rule would preempt non-identical state or local requirements if the state or local provisions specify requirements that deal with the same risk of injury CPSC's regulations aim to address. However, because the FHSA applies to requirements the Commission may impose on fireworks devices and labeling, a final rule would not prevent states and political subdivisions of a state from regulating the sale of fireworks.

## IX. Effective Date

The Administrative Procedure Act requires the effective date of a rule to be at least 30 days after publication of the final rule. 5 U.S.C. 553(d). To support the Commission's goals to update the fireworks regulations to reflect the current market and technology, provide clarity and consistency, and promote consumer safety, the Commission proposes that the updated fireworks regulations take effect 30 days after a final rule is published in the *Federal Register*. The Commission believes that this effective date is reasonable because many of the proposed requirements align with existing standards, the Commission expects the costs associated with the proposed requirements to be low, and CPSC's regulatory review briefing package, published on the Commission's website on December 30, 2015, provided advance notice of the potential for these requirements.

The Commission requests comments on the proposed effective date.

## X. Environmental Considerations

Rules that have "little or no potential for affecting the human environment" fall within a "categorical exclusion" under the National Environmental Policy Act (NEPA; 42 U.S.C. 4231-4370h) and the regulations implementing NEPA (40 CFR Parts 1500-1508) and do not normally require an environmental assessment (EA) or environmental impact statement (EIS). As the Commission's regulations state, CPSC actions generally do not produce significant environmental effects and, therefore, generally do not require an EIS. 16 CFR 1021.5(a). The regulations further specify that rules or safety standards that provide design or performance requirements fall within the categorical exclusion from NEPA because they have little or no potential effect on the human environment. 16 CFR 1021.5(c)(1). Consequently, such rules do not require an EA or an EIS.

Because the proposed rule would create design and performance requirements for fireworks devices, the proposed rule falls within the categorical exclusion and no EA or EIS is required. Moreover, although the proposed requirements may render some fireworks non-compliant and therefore, require their disposal, the Commission believes that this impact would be minimal, particularly in light of existing standards and the time provided before the final rule would take effect. *See* 16 CFR 1021.5(b)(2). Therefore, the Commission believes that the proposed rule has "little or no potential for affecting the human environment" and does not require an EA or EIS.

**XI. Request for Comments**

The Commission requests comments on all aspects of this proposed rule, specifically regarding:

- the method of identifying devices that are subject to the 2-grain limit, including:
    - the need and usefulness of including a method of identifying in the regulations which devices are subject to the 2 grain limit;
    - the usefulness, effectiveness, costs, and benefits of the proposed method of identifying these devices, including supporting data;
    - the level of compliance with the comparable requirement in APA Standard 87-1;
    - whether there are devices that contain only black powder that should be limited to 2 grains of pyrotechnic composition because of the safety hazard they pose to consumers; and
    - whether the Commission should limit larger particle sizes of metallic powder in break charges or reports, relevant data and justifications for doing so, and

the appropriate method and limit;

- the implications of the Commission electing, at times, to use its enforcement discretion to permit up to 1.00 percent contamination of metallic content in break charges, including:
    - the safety implications of such an allowance;
    - the impact of such an allowance on the costs and burdens of testing and analysis, relative to compliance with the absolute ban in the regulation;
    - a reasonable allowance level that still provides for consumer safety, along with supporting data; and
    - the implications of adopting the allowance in the regulations, as opposed to exercising it as enforcement discretion;
- the proposed limits to chemical composition and pyrotechnic weight of fireworks devices, including:
    - the benefits and costs associated with the proposed requirement;
    - the level of compliance with the requirements in APA Standard 87-1 with which the proposed requirements align;
    - whether the specific limits proposed are appropriate in light of consumer safety and fireworks devices currently on the market; and
    - the safety hazards that the ground devices that would be subject to the proposed requirement pose to consumers and any relevant incident or injury data;
- prohibiting HCB and lead tetroxide and other lead compounds from fireworks devices, including:
    - the benefits and costs associated with banning these chemicals;

    - the level of compliance with the limits for these chemicals in the AFSL Standard and APA Standard 87-1;
    - the presence of HCB in fireworks devices in the U.S. market and the corresponding frequency and levels;
    - the presence of lead tetroxide or other lead compounds in fireworks devices in the U.S. market and the corresponding frequency and levels; and
    - and exposure data regarding the impact of these chemicals in fireworks devices;
- resistance to side ignition, including:
    - information and data about incidents involving side ignition;
    - whether a test method for evaluating side ignition would improve consumer safety; and
    - the level of compliance with the requirement in APA Standard 87-1.
- bases detaching from fireworks devices, including:
    - whether base detachment is involved in devices tipping over, incidents, injuries, or deaths and applicable data;
    - the relative benefits and costs associated with the recommended requirement; and
    - the level of compliance with the similar requirements in APA Standard 87-1 and the AFSL Standard;
- the proposed ban of fireworks devices that project fragments when functioning, including:
    - data regarding the types and frequency of incidents and injuries associated with fragments projected from fireworks devices;

- the types of materials fireworks devices project as fragments that present a safety risk to the public (*e.g.*, metal, hard plastic, glass, wood);
- whether the Commission should specify a size or amount limit for projected fragments and, if so, the appropriate size or amount and corresponding rationale;
- the relative benefits and costs associated with the proposed requirement; and
- the level of compliance with section 3.7.2 of APA Standard 87-1;

- a trace contamination allowance for prohibited chemicals, including:
  - whether allowing trace amounts of prohibited chemicals adequately protects consumers from the risks associated with these chemicals;
  - which chemicals the Commission should provide trace allowances for;
  - what level of trace contamination should be permitted in light of consumer safety and inadvertent contamination;
  - the relative costs of complying with an absolute ban of prohibited chemicals and trace contamination allowances;
  - the alternatives of adopting trace contamination allowances in the regulations, in compliance guidance, or in the CPSC Testing Manual; and
  - exposure data regarding the impact of trace contamination on consumer safety;
- the usefulness and content of the proposed definitions for:
  - burst charge;
  - chemical composition;
  - explosive composition;

    - lift charge;
    - pyrotechnic composition;
    - firecrackers;
    - bases;
    - burnout; and
    - blowout;
- aerial bombs, including:
    - the proposed definition of aerial bombs; and
    - incident and injury data regarding aerial bombs;
- the estimated costs and benefits associated with each of the proposed requirements; and
- the estimated costs to small entities for each of the proposed requirements.

During the comment period, APA Standard 87-1 is available for review. Please see Section V. of this NPR for instructions on viewing it.

Please submit comments in accordance with the instructions in the **ADDRESSES** section at the beginning of this NPR.

**List of Subjects**

**16 CFR Part 1500**

Consumer protection, Hazardous materials, Hazardous substances, Imports, Incorporation by reference, Infants and children, Labeling, Law enforcement, and Toys.

**16 CFR Part 1507**

Consumer protection, Explosives, Fireworks, and Incorporation by reference.

For the reasons discussed in the preamble, the Commission proposes to amend Title 16 of the Code of Federal Regulations as follows:

**PART 1500—HAZARDOUS SUBSTANCES AND ARTICLES: ADMINISTRATION AND ENFORCEMENT REGULATIONS**

1. The authority citation for part 1500 continues to read as follows:

   **Authority:** 15 U.S.C. 1261-1278, 122 Stat. 3016; the Consumer Product Safety Improvement Act of 2008, Pub. L. 110-314, §104, 122 Stat. 3016 (August 14, 2008).

2. Amend § 1500.3 to renumber paragraph (a)(2) and to add paragraphs (a)(2), (a)(3), (a)(4), (a)(6), (a)(7), (a)(8), (a)(9), and (d) to read as follows:

**§ 1500.3 Definitions.**

(a) * * *

(2) *Aerial bomb* means a tube device that fires an explosive charge into the air without added visual effect.

(3) *Burst charge*, also known as *expelling charge* or *break charge*, is as defined in section 2.5 of APA Standard 87-1 (incorporated by reference, see paragraph (d) of this section).

(4) *Chemical composition*, includes lift charge, burst charge, and visible/audible effect materials and is as defined in section 2.6 of APA Standard 87-1 (incorporated by reference, see paragraph (d) of this section).

(5) *Commission* means the Consumer Product Safety Commission established May 14, 1973, pursuant to provisions of the Consumer Product Safety Act (Pub. L. 92-573, 86 Stat. 1207-33 (15 U.S.C. 2051-81)).

(6) *Explosive composition*, is as defined in section 2.6.1 of APA Standard 87-1 (incorporated by reference, see paragraph (d) of this section).

(7) *Firecracker*, is as defined in section 3.1.3.1 of APA Standard 87-1 (incorporated by reference, see paragraph (d) of this section).

(8) *Lift charge*, is as defined in section 2.10 of APA Standard 87-1 (incorporated by reference, see paragraph (d) of this section).

(9) *Pyrotechnic composition*, is as defined in section 2.6.2 of APA Standard 87-1 (incorporated by reference, see paragraph (d) of this section).

* * * * *

(d) Certain portions, identified in this section, of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 (APA Standard 87-1) are incorporated by reference into this section with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51 (IBR approved for paragraph (a)). You may obtain a copy of the approved material from American Pyrotechnics Association, 7910 Woodmont Avenue, Suite 1220, Bethesda, MD 20814; telephone 301-907-8181; http://www.americanpyro.com/. You may inspect a copy of the approved material at the U.S. Consumer Product Safety Commission, Office of the Secretary, 4330 East West Highway, Room 820, Bethesda, MD 20814; telephone 301-504-7923; or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030 or go to http://www.archives.gov/federal_register/code_of_federal regulations/ibr_locations.html.

3. Amend § 1500.17 to revise paragraphs (a)(3) and (a)(8) and to add paragraph (a)(14) to read as follows:

**§ 1500.17 Banned Hazardous Substances.**

(a) * * *

(3)(i) Fireworks devices that contain a burst charge containing metallic powder less than 100 mesh in particle size (including but not limited to cherry bombs, M-80 salutes, silver salutes, and kits and components intended to produce such fireworks) if the burst charge is produced by a charge of more than 2 grains (~ 130 mg) of pyrotechnic composition; except that this provision shall not apply to such fireworks devices if all of the following conditions are met:

*  *  *  *  *

(ii) *Findings.*

(A) *General.* In order to issue a rule under section 2(q)(1) of the Federal Hazardous Substances Act (FHSA), 15 U.S.C. 1261(q)(1), classifying a substance or article as a banned hazardous substance, the FHSA requires the Commission to make certain findings and to include these findings in the regulation. These findings are discussed below.

(B) *Voluntary standards.* The Commission believes that it is unlikely that there will be substantial compliance with APA Standard 87-1, *Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics*, December 1, 2001 edition, based on the Commission's preliminary testing indicating that there is a high proportion of devices that do not comply with the comparable requirements in APA Standard 87-1 and the injury data showing the severe injuries and deaths that have resulted from devices that do not comply with this provision and vulnerability of the population at risk.

(C) *Relationship of benefits to costs.* The benefits expected from the rule, including increased public safety, bear a reasonable relationship to its costs, including minimal costs associated with modifying the contents of fireworks devices or limiting the pyrotechnic composition of devices to 2 grains.

(D) *Least-burdensome requirement.* The Commission considered less burdensome alternative methods of identifying devices that are subject to a two-grain limit on pyrotechnic composition, but concluded that none of these alternatives would adequately reduce the risk of injury.

* * * * *

(8) Firecrackers, if the explosive composition is produced by more than 50 mg (.772 grains) of pyrotechnic composition, (not including firecrackers included as components of a rocket), aerial bombs, and devices that may be confused with candy or other foods, such as "dragon eggs," and "cracker balls" (also known as "ball-type caps"), and including kits and components intended to produce such fireworks except such devices which meet all of the following conditions:

* * * * *

(14)(i) Fireworks devices that do not conform to the following chemical composition and pyrotechnic weight limits:

(A) *Sky Rockets, Bottle Rockets, Missile-Type Rockets, Helicopters (Aerial Spinners), and Roman Candles.* Each of these devices shall not contain more than 20 grams of chemical composition.

(B) *Mine and Shell Devices*. Devices shall conform to section 3.1.2.5 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference herein, except that:

(1) The lift charge of each shell is limited to black powder (potassium nitrate, sulfur, and charcoal) or similar pyrotechnic composition without metallic fuel.

(2) Reserved

(C) *Aerial Shells with Reloadable Tubes*. Devices shall conform to section 3.1.2.6 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference herein, except that the lift charge of each shell is limited to black powder (potassium nitrate, sulfur, and charcoal) or similar pyrotechnic composition without metallic fuel.

(D) *Cylindrical Fountains.* Devices shall conform to section 3.1.1.1 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference herein.

(E) *Cone Fountains.* Devices shall conform to section 3.1.1.2 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference herein.

(F) *Illuminating Torches.* Devices shall conform to section 3.1.1.3 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference herein.

(G) *Wheels.* Devices shall conform to section 3.1.1.4 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference herein.

(H) *Chasers.* Devices shall conform to section 3.1.3.2 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference herein.

(ii) *Incorporation by reference*. Certain portions, identified in this section, of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks,

Novelties, and Theatrical Pyrotechnics, December 1, 2001 (APA Standard 87-1) are incorporated by reference into this section with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51 (IBR approved for paragraph (a)(14)). You may obtain a copy of the approved material from American Pyrotechnics Association, 7910 Woodmont Avenue, Suite 1220, Bethesda, MD 20814; telephone 301-907-8181; http://www.americanpyro.com/. You may inspect a copy of the approved material at the U.S. Consumer Product Safety Commission, Office of the Secretary, 4330 East West Highway, Room 820, Bethesda, MD 20814; telephone 301-504-7923; or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030 or go to http://www.archives.gov/federal_register/code_of_federal regulations/ibr_locations.html.

(iii) *Findings.*

(A) *General.* In order to issue a rule under section 2(q)(1) of the Federal Hazardous Substances Act (FHSA), 15 U.S.C. 1261(q)(1), classifying a substance or article as a banned hazardous substance, the FHSA requires the Commission to make certain findings and to include these findings in the regulation. These findings are discussed below.

(B) *Voluntary standards.* The Commission believes that it is unlikely that there will be substantial compliance with APA Standard 87-1, *Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics*, December 1, 2001 edition, based on the Commission's preliminary testing indicating that a high proportion of devices does not comply with the device limits in APA Standard 87-1 and the injury data showing the severe injuries and deaths that can result from devices with particularly high pyrotechnic or chemical compositions.

(C) *Relationship of benefits to costs.* The benefits expected from the rule, including increased public safety, bear a reasonable relationship to its costs, including minimal costs associated with modifying or reducing the pyrotechnic or chemical composition of fireworks devices.

(D) *Least-burdensome requirement.* The Commission considered less burdensome alternative methods of limiting the pyrotechnic or chemical composition of fireworks devices, but concluded that none of these alternatives would adequately reduce the risk of injury.

4. Revise § 1500.83(a)(27)(i) to read as follows:

**§ 1500.83 Exemptions for small packages, minor hazards, and special circumstances.**

(a) * * *

(27) * * *

(i) The package contains only fireworks devices suitable for use by the public and designed primarily to produce visible effects by combustion, except that small devices with an explosive composition that includes metallic fuel less than 100 mesh in particle size may also be included if the burst charge or explosive composition is produced by not more than 2 grains of pyrotechnic composition;

* * * * *

5. Revise § 1500.85(a)(2) to read as follows:

**§ 1500.85 Exemptions from classification as banned hazardous substances.**

(a) * * *

(2) Firecrackers, if the explosive composition is produced by no more than 50 milligrams (.772 grains) of pyrotechnic composition. (See also § 1500.14(b)(7); § 1500.17(a) (3), (8) and (9); and part 1507).

*  *  *  *  *

**PART 1507—FIREWORKS DEVICES**

6. The authority citation for part 1507 continues to read as follows:

**Authority:** 15 U.S.C. 1261-1262, 2079(D); 21 U.S.C. 371(e).

7. Amend § 1507.1 to revise the title, to number and revise the introductory paragraph, and to add paragraph (b) to read as follows:

**§ 1507.1 Scope and definitions.**

(a) *Scope*. This part 1507 prescribes requirements for those fireworks devices not otherwise banned under the act. Any fireworks device that fails to conform to applicable requirements is a banned hazardous substance and is prohibited from the channels of interstate commerce. Any fireworks device not otherwise banned under the act shall not be a banned hazardous substance by virtue of the fact that there are no applicable requirements prescribed herein.

(b) *Definitions*. As used in this part:

(1) *Explosive composition* is as defined in section 2.6.1 of APA Standard 87-1 (incorporated by reference, see § 1507.14).

(2) *Firecracker* is as defined in section 3.1.3.1 of APA Standard 87-1 (incorporated by reference, see § 1507.14).

(3) *Pyrotechnic composition* is as defined in section 2.6.2 of APA Standard 87-1 (incorporated by reference, see § 1507.14).

8. Amend § 1507.2 to revise and number the introductory paragraph, to revise and renumber paragraphs (a) through (k), and to add paragraph (b) to read as follows:

**§ 1507.2 Prohibited chemicals.**

(a) Fireworks devices, other than firecrackers, shall not contain any of the following chemicals:

(i) Arsenic sulfide, arsenates, or arsenites, except in trace amounts less than 0.25% by weight.

(ii) Boron, except in trace amounts less than 0.25% by weight.

(iii) Chlorates, except in trace amounts less than 0.25% by weight and:

* * * * *

(iv) Gallates or gallic acid, except in trace amounts less than 0.25% by weight.

(v) Hexachlorobenzene, except in trace amounts less than 0.01% by weight.

(vi) Lead tetroxide and other lead compounds, except in trace amounts less than 0.25% by weight.

(vii) Magnesium, except in trace amounts less than 0.25% by weight (magnesium/aluminum alloys, called magnalium, are permitted).

(viii) Mercury salts, except in trace amounts less than 0.25% by weight.

(ix) Phosphorus (red or white), except in trace amounts less than 0.25% by weight. Except that red phosphorus is permissible in caps and party poppers.

(x) Picrates or picric acid, except in trace amounts less than 0.25% by weight.

(xi) Thiocyanates, except in trace amounts less than 0.25% by weight.

(xii) Titanium, except in particle size greater than 100-mesh or in trace amounts less than 0.25% by weight.

(xiii) Zirconium, except in trace amounts less than 0.25% by weight.

(b) *Findings.*

(1) *General.* In order to issue a rule under section 2(q)(1) of the Federal Hazardous Substances Act (FHSA), 15 U.S.C. 1261(q)(1), classifying a substance or article as a banned hazardous substance, the FHSA requires the Commission to make certain findings and to include these findings in the regulation. These findings, with respect to hexachlorobenzene and lead tetroxide and other lead compounds, are discussed below.

(2) *Voluntary standards.* The Commission believes that it is unlikely that there will be substantial compliance with the provision prohibiting lead tetroxide and other lead compounds in APA Standard 87-1, *Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics*, December 1, 2001 edition, because testing indicates that there are devices on the market that do not comply with this provision in APA Standard 87-1, the public can absorb the chemical when it is released into the environment through fireworks devices, and the health risks associated with the chemical are severe. The Commission believes that it is unlikely that there will be substantial compliance with the provision prohibiting hexachlorobenzene and lead tetroxide and other lead compounds in the American Fireworks Standards Laboratory's voluntary standard for consumer fireworks because testing indicates that there are devices on the market that do not comply with this provision in the standard, the public can absorb these chemicals when they are released into the environment through fireworks devices, and the health risks associated with these chemicals are severe.

(3) *Relationship of benefits to costs.* The benefits expected from the rule, including increased public safety, bear a reasonable relationship to its costs, including minimal costs associated with modifying the chemical content of fireworks devices.

(4) *Least-burdensome requirement.* The Commission considered less burdensome alternatives to the rule, but concluded that none of these alternatives would adequately reduce the risk of injury.

9. Amend § 1507.3 to revise paragraph (a), to revise and renumber paragraphs (a) and (b), and to add paragraph (c), to read as follows:

**§ 1507.3 Fuses.**

(a) Fireworks devices, other than firecrackers, that require a fuse shall use a fuse that has been treated or coated in such manner as to reduce the possibility of side ignition.

(1) The following test must be conducted to evaluate whether a fuse has been treated or coated in such manner as to reduce the possibility of side ignition:

(i) Cut the fuse at the point where the fuse enters the fireworks device. If the fuse is wrapped in paper, plastic, or taped to the device, remove the fuse with the paper, plastic, and/or tape intact; and

(ii) Place the glowing tip of a lit standard NIST (SRM 1196) cigarette directly on the side of the fuse (or the paper, plastic, or tape attached to the fuse) and time, in seconds, how long it takes for the fuse to ignite.

(2) The fuse must not ignite within 3 seconds.

(3) The following devices are exempted from § 1507.3(a)(1) and (2):

(i) Devices such as ground spinners that require a restricted orifice for proper thrust and contain less than 6 grams of pyrotechnic composition.

(ii) Devices with fuses that protrude less than ½ inch from the device, because the end of the fuse may ignite during testing.

(4) *Findings*.

(i) *General.* In order to issue a rule under section 2(q)(1) of the Federal Hazardous Substances Act (FHSA), 15 U.S.C. 1261(q)(1), classifying a substance or article as a banned hazardous substance, the FHSA requires the Commission to make certain findings and to include these findings in the regulation. These findings are discussed below.

(ii) *Voluntary standards.* The Commission believes that there is not likely to be substantial compliance with the side ignition test method in APA Standard 87-1, *Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics*, December 1, 2001 edition, because the severity of injuries that can result from side ignition of fuses are such that a particularly high level of compliance is necessary.

(iii) *Relationship of benefits to costs.* The benefits expected from the rule, including increased public safety, bear a reasonable relationship to its costs, including minimal costs associated with treating fuses to resist side ignition and testing fuses for compliance with the requirement.

(iv) *Least-burdensome requirement.* The Commission considered less burdensome alternatives to the rule, but concluded that none of these alternatives would adequately reduce the risk of injury. The rule is consistent with voluntary standards and the Commission's current testing and enforcement practices.

(b) Fireworks devices, other than firecrackers, that require a fuse shall use a fuse that will burn at least 3 seconds but not more than 9 seconds before ignition of the device.

(c) For fireworks devices, other than firecrackers, that require a fuse, the fuse shall be securely attached so that it will support either the weight of the fireworks device plus 8 ounces of dead weight or double the weight of the device, whichever is less, without separation from the fireworks device.

10. Amend § 1507.4 to number the paragraphs and to add paragraphs (a)(2) and (b) to read as follows:

**§ 1507.4 Bases.**

(a) The base of fireworks devices that are operated in a standing upright position shall:

(1) Have the minimum horizontal dimensions or the diameter of the base equal to at least one-third of the height of the device including any base or cap affixed thereto; and

(2)(i) Remain securely attached to the device during handling, storage, and normal operation.

(ii) *Findings.*

(A) *General.* In order to issue a rule under section 2(q)(1) of the Federal Hazardous Substances Act (FHSA), 15 U.S.C. 1261(q)(1), classifying a substance or article as a banned hazardous substance, the FHSA requires the Commission to make certain findings and to include these findings in the regulation. These findings are discussed below.

(B) *Voluntary standards.* The Commission believes that compliance with APA Standard 87-1, *Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics*, December 1, 2001 edition or the American Fireworks Standards Laboratory's voluntary standard for consumer fireworks is not likely to adequately reduce the risk of injury and that it is unlikely that there will be substantial compliance with either of these two voluntary standards, based on the Commission's preliminary testing indicating that there is a high proportion of devices that have no bases or that have bases that detach from the device during handling, storage, or use and the injury data showing the severe injuries that can result when devices tip over or have unexpected flight paths, both of which can result from detached bases.

(C) *Relationship of benefits to costs.* The benefits expected from the rule, including increased public safety, bear a reasonable relationship to its costs, including minimal costs associated with affixing bases to devices and increased shipping costs.

(D) *Least-burdensome requirement.* The Commission considered less burdensome alternatives to the rule, but concluded that none of these alternatives would adequately reduce the risk of injury.

(b) For purposes of this section, the base means the bottom-most part or foundation attached to one or more tubes of a fireworks device that serves as a flat, stabilizing surface from which the device may function.

11. Amend § 1507.6 to number the paragraphs and to add paragraph (b) to read as follows:

**§ 1507.6 Burnout and blowout.**

(a) The pyrotechnic chamber in fireworks devices shall be constructed in a manner to allow functioning in a normal manner without burnout or blowout.

(b) As used in this section, the terms blowout and burnout are as defined in sections 2.3 and 2.4, respectively, of APA Standard 87-1 (incorporated by reference, see § 1507.14).

12. Add § 1507.13 to read as follows:

**§ 1507.13 Fragments.**

(a) Fireworks devices must function in accordance with section 3.7.2 of APA Standard 87-1 (incorporated by reference, see § 1507.14).

(b) *Findings.*

(1) *General.* In order to issue a rule under section 2(q)(1) of the Federal Hazardous Substances Act (FHSA), 15 U.S.C. 1261(q)(1), classifying a substance or article as a banned

hazardous substance, the FHSA requires the Commission to make certain findings and to include these findings in the regulation. These findings are discussed below.

(2) *Voluntary standards.* The Commission believes it is unlikely that there will be substantial compliance with the provisions in APA Standard 87-1, *Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics*, December 1, 2001 edition or the American Fireworks Standards Laboratory's voluntary standard for consumer fireworks that prohibit devices from projecting sharp fragments, based on the Commission's preliminary testing indicating that there are devices on the market that project sharp fragments when functioning and injury data showing the severe injuries that can result when projected fragments strike bystanders.

(3) *Relationship of benefits to costs.* The benefits expected from the rule, including increased public safety, bear a reasonable relationship to its costs, including minimal costs associated redesigning fireworks devices.

(4) *Least-burdensome requirement.* The Commission considered less burdensome alternatives to the rule, but concluded that none of these alternatives would adequately reduce the risk of injury.

13. Add § 1507.14 to read as follows:

**§ 1507.14 Incorporation by reference.**

Certain portions, identified in this part, of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 (APA Standard 87-1) are incorporated by reference into this part with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51 (IBR approved for §§ 1507.1, 1507.6, and 1507.13). You may obtain a copy of the approved material

from American Pyrotechnics Association, 7910 Woodmont Avenue, Suite 1220, Bethesda, MD 20814; telephone 301-907-8181; http://www.americanpyro.com/. You may inspect a copy of the approved material at the U.S. Consumer Product Safety Commission, Office of the Secretary, 4330 East West Highway, Room 820, Bethesda, MD 20814; telephone 301-504-7923; or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030 or go to http://www.archives.gov/federal_register/code_of_federal regulations/ibr_locations.html.

Dated: _____

_____

Todd A. Stevenson,

Secretary, Consumer Product Safety Commission

# Fireworks Notice of Proposed Rulemaking
# Briefing Package

Notice of Proposed Rulemaking to revise current fireworks regulations in 16 C.F.R. §§ 1500.3; 1500.17(a)(3), (8) and (14); 1500.83(a)(27); 1500.85(a)(2); and part 1507

December 14, 2016

---


For Additional Information, Contact

Rodney Valliere, Project Manager
Division of Chemistry
Directorate for Laboratory Sciences
Office of Hazard Identification and Reduction

U.S. Consumer Product Safety Commission
5 Research Place
Rockville, MD 20850
301-987-2526, rvalliere@cpsc.gov

**Table of Contents**

**Executive Summary**

Since 1973, the U.S. Consumer Product Safety Commission (CPSC or Commission) has regulated fireworks devices under the Federal Hazardous Substances Act (FHSA).[1] Under the direction of the Commission in the CPSC Fiscal Year 2015 Operating Plan, staff completed a rule review of the current fireworks regulations. Staff identified problems and burdens and possible solutions. Additionally, staff considered the goals set forth in Executive Orders (E.O.s) 13563 and 13579, and in doing so, sought to improve the current regulations to protect "public health, welfare, safety, and our environment," by identifying more effective and less burdensome ways to ensure public safety.

This briefing package provides support for staff's recommendation that the Commission propose most of the changes discussed in the rule review package.

Commission staff recommends revisions to the current regulations, as summarized in the table below, and explained in more detail in the following discussion. Staff believes that updating the current regulations would enhance safety by clarifying requirements and imposing additional requirements that, in some cases, are more stringent than current CPSC regulations. Furthermore, updating the current regulations would provide the fireworks industry with additional regulatory guidance and would assist in reducing compliance burdens by reducing testing and making administration of the regulations less complicated. Staff recommends that the Commission seek public comments on the safety needs, costs, and benefits of the recommended changes and the alternatives considered, including the voluntary and international standards.

For some of these changes, staff believes there is adequate support to make the required FHSA findings to adopt these changes in a final rule. However, for other changes, the Commission is seeking additional information to support the findings required under the FHSA.. For this reason, the draft NPR requests comments supplying additional information.

| Section | Draft Recommendations | Additional Information Requested |
|---|---|---|
| 1500.3<br>Definitions | • Add APA definitions of relevant terms, including "burst charge," "expelling charge," "break charge," "chemical composition," "pyrotechnic composition," "explosive composition," "lift charge," and "firecracker" (APA 87-1, Sections 2.5, 2.6, 2.6.1, 2.6.2, 2.10, and 3.1.3.1) | |

[1] 15 U.S.C. §§ 1261-1278.

| | | |
|---|---|---|
| | • Define "aerial bomb" | |
| 1500.17(a)(3)<br>Ban on devices intended to produce audible effects with more than 2 grains of pyrotechnic composition | • Adopt a quantifiable method of identifying devices that are limited to 2 grains of pyrotechnic content, namely those that contain a burst charge containing metallic powder less than 100 mesh in particle size<br>• Replace references to "audible effects" with appropriate descriptions<br>• Remove reference to firecrackers<br>• Remove the term "aerial bombs" | The Commission is seeking additional data or other information supporting particular metallic-powder content level . |
| 1500.17(a)(8)<br>Firecrackers | • Replace references to "audible effects" with appropriate descriptions | |
| 1500.17(a)(14)<br>Chemical composition and pyrotechnic weight limits | • Add chemical composition and pyrotechnic weight limits for certain fireworks devices that do not incorporate metallic fuels, less than 100 mesh (149 microns) in particle size. | The Commission is seeking additional data or information regarding incidents or injuries involving ground devices and compliance rates with the voluntary standard limits on ground devices. |
| 1500.83(a)(27)<br>Exemptions for small packages, minor hazards and special circumstances | • Clarify the language to replace "audible effects" with "burst charge"<br>• Replace references to "audible effects" with appropriate descriptions | |
| 1500.85(a)(2)<br>Exemption for firecrackers less than 50 mg | • Replace references to "audible effects" with appropriate descriptions | |
| 1507.1<br>Scope | • Relocate exemption for firecrackers to specific substantive provisions<br>• Add APA definitions of relevant terms, including "pyrotechnic composition," "explosive | |

| | | |
|---|---|---|
| | composition," and "firecracker" (APA 87-1, Sections 2.6.1, 2.6.2, and 3.1.3.1) | |
| 1507.2<br>Prohibited chemicals | • Add lead, lead compounds, and HCB to prohibited chemical list<br>• Set contamination limits of 0.01% for HCB and 0.25% for the remaining prohibited chemicals<br>• Move exemption for firecrackers from 1507.1 to this section | The Commission is seeking additional information about consumers' exposure to these chemicals through consumers' use of fireworks, compliance rates with the voluntary standards, and data or other information supporting the particular allowance level the regulation sets. |
| 1507.3<br>Fuses | • Adopt a test method for measuring side ignition (with a 3 second ignition resistance) (now in the Consumer Fireworks Testing Manual[2])<br>• Move exemption for firecrackers from 1507.1 to this section | The Commission is seeking additional information about the frequency and severity of injuries that are directly-attributable to side ignitions |
| 1507.4<br>Bases | • Require that bases remain attached to devices during handling, storage, and normal operation<br>• Define "base" | |
| 1507.6<br>Burnout and blowout | • Incorporate the APA definitions of "burnout" and "blowout" | |
| 1507.13<br>Fragments | • Incorporate APA requirement (APA 87-1, Section 3.7.2) prohibiting devices from projecting fragments | The Commission is seeking additional information regarding the injuries or incidents that are directly-attributable to projected fragments in consumer fireworks devices |

Staff's recommended changes are consistent with provisions of the American Pyrotechnics Association Standard 87-1: Standard for Construction and Approval for

[2] https://www.cpsc.gov/PageFiles/121068/testfireworks.pdf

Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics (APA 87-1) and the American Fireworks Standards Laboratory's voluntary standards for consumer fireworks (AFSL standard), most of which are already required by DOT regulations. The changes staff recommends to sections 1500.17(a)(3), 1507.2, 1507.3, 1507.4, and 1507.13 could have the effect of prohibiting more fireworks devices than the current CPSC regulations proscribe. Therefore, these changes may have some costs associated with them. A substantial number of firms may need to modify products to bring them into compliance with these provisions. However, staff does not believe these modifications will create a significant burden on those firms because many of the APA 87-1 requirements are already imposed by DOT in their regulation of fireworks transport. Manufacturers currently in compliance with APA 87-1 will incur no burden to comply with those requirements. The remainder of the changes that staff recommends pertain to clarification and alignment of existing requirements, which should not create costs.

**UNITED STATES**
**CONSUMER PRODUCT SAFETY COMMISSION**
**4330 EAST WEST HIGHWAY**
**BETHESDA, MD 20814**

This document has been electronically approved and signed.

**Briefing Memorandum**

Date: December 14, 2016

TO: The Commission

Todd A. Stevenson, Secretary

THROUGH: Mary T. Boyle, General Counsel
Patricia H. Adkins, Executive Director
DeWane Ray, Deputy Executive Director for Safety Operations

FROM: George A. Borlase, Assistant Executive Director,
Office of Hazard Identification and Reduction

Rodney Valliere, Chemist, Project Manager
Division of Chemistry, Directorate for Laboratory Sciences

SUBJECT: Notice of proposed rulemaking to revise current fireworks regulations

The U.S. Consumer Product Safety Commission (CPSC or Commission) regulates fireworks devices as household substances under the Federal Hazardous Substances Act (FHSA)[3] and the Consumer Product Safety Act (CPSA).[4] Under its current regulations, the Commission has declared certain fireworks devices to be "banned hazardous substances."[5] Additionally, there are various requirements that fireworks must meet to avoid being classified as "banned hazardous substances." These regulations prohibit the use of certain chemicals in fireworks devices, as well as specify performance and design requirements for the fuses, bases, pyrotechnic chambers, and handles and spikes.[6] Additional regulations prescribe specific warning labels for a variety of fireworks devices.[7] Finally, the Commission's regulations also provide exemptions from full labeling for special circumstances and minor hazards associated with some fireworks.[8]

[3] 15 U.S.C. §§ 1261-1278.
[4] 15 U.S.C. §§ 2051-2089.
[5] 16 C.F.R. §§ 1500.17(a)(3), (8), (9), (11) and (12).
[6] 16 C.F.R. part 1507.
[7] 16 C.F.R. § 1500.14(b)(7).
[8] 16 C.F.R § 1500.83(a)(27) and 16 C.F.R. § 1500.85(a)(2).

Staff reviewed the existing fireworks regulations, following the directive in the CPSC Fiscal Year 2015-17 Operating Plans. As a result of that review, staff has prepared a draft notice of proposed rulemaking (NPR), proposing to revise the current fireworks regulations issued under the FHSA. Staff considered the goals set forth in Executive Orders (E.O.s) 13563 and 13579, and in doing so, sought to improve the current regulations to protect "public health, welfare, safety, and our environment," by identifying and recommending the "best, most innovative and least burdensome tools" for consumer safety, compliance, and enforcement.

## I. Background

Before the formation of the CPSC, fireworks regulations were administered by the U.S. Food and Drug Administration (FDA). On May 14, 1973, the CPSC assumed responsibility for and administration of the FHSA. On September 27, 1973, the Commission transferred the existing fireworks regulations under the FHSA from 21 C.F.R. parts 191 and 191b to 16 C.F.R. part 1500. Thereafter, the CPSC promulgated additional requirements for fireworks devices, including labeling (§ 1500.14(b)(7)); pyrotechnic limits for firecrackers (§§ 1500.17(a)(8) and 1500.85(a)(2)); and performance requirements for fireworks devices (part 1507); reloadable tube aerial shell devices (§ 1500.17(a)(11)); and large multiple tube devices (§ 1500.17(a)(12)).

Since the promulgation of some of these regulations, new types of devices have been introduced into the market, and different types of explosive powders have replaced traditional black powder (charcoal, sulfur, and saltpeter) and flash powder (aluminum-fueled chlorates or perchlorates).[9] In addition, some new devices contain hybrid powders comprised of various mixtures of black and flash powder.

On July 12, 2006, CPSC issued an advance notice of proposed rulemaking (ANPR), discussing options and requesting comments regarding the fireworks regulations in 16 C.F.R. parts 1500 and 1507.[10] Since then, staff researched methods to improve the fireworks regulations and published several memoranda on the work completed, to date. This work included responding to public comments from the ANPR, evaluating new devices, and conducting specific research focused on the composition and energetics of the break charge of fireworks devices intended to produce audible effects.[11,12, and 13]

On December 30, 2015, staff submitted to the Commission a rule review briefing package in which staff considered CPSC-researched methods, current technology, market information, compliance and injury data, as well as applicable domestic, international and voluntary standards for the possible improvement of existing mandatory fireworks regulations.

---

[9] Christopher Musto & Andrew Lock, Consumer Product Safety Commission, "Fireworks Safety Standards Development Project FY 2013 Status Report" (2013).
[10] 71 Fed. Reg. 39249 (July 12, 2006).
[11] Christopher Musto & Andrew Lock, Consumer Product Safety Commission, "FY 2012 Fireworks Safety Standards Development Status Report" (2013).
[12]Christopher Musto, Consumer Product Safety Commission, "Fireworks Safety Standards Status Report" (2011).
[13] Christopher Musto & Andrew Lock, Consumer Product Safety Commission, "Fireworks Safety Standards Development Project FY 2013 Status Report" (2013).

At the Commission's direction, staff prepared this draft NPR addressing the recommendations in the rule review briefing package.

The two main standards applicable to fireworks are the European Standard, EN 15947-1–15947-5: Pyrotechnic Articles—Fireworks, Categories 1, 2, and 3 (European Standard), and the American Pyrotechnics Association Standard 87-1: Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics (APA 87-1). The U.S. Department of Transportation (DOT) regulates the transportation of fireworks and requires compliance with APA 87-1 to transport in commerce display and consumer fireworks.

The American Fireworks Standards Laboratory (AFSL) developed voluntary standards and a certification for consumer fireworks that incorporate the CPSC and DOT regulations. The AFSL standard has a number of requirements in addition to CPSC and DOT requirements. AFSL is a nonprofit corporation established by members of the fireworks industry to: (1) develop and maintain voluntary safety and quality standards for fireworks, (2) assist manufacturers in improving safety and quality in fireworks, and (3) provide a testing and certification program to determine which fireworks comply with AFSL standards. The AFSL standards committee is appointed by the AFSL board and is comprised of technical experts; representatives that manufacture, import, distribute or retail fireworks; federal and state agencies that regulate the safety of fireworks, the insurance industry; and consumers.[14] Although CPSC staff attends AFSL standards committee meetings and offers input, CPSC staff does not have a vote on the board.

Staff focused on APA 87-1, in particular, because the DOT incorporates by reference APA 87-1 into its regulations, thereby requiring consumer fireworks to comply with the standard concerning transportation in commerce.[15] APA was established in 1948. Currently APA membership includes nearly 85 percent of the fireworks industry, which includes domestic and international importers and distributors of consumer and display fireworks.[16] APA's mission is to "encourage safety in design and use of all types of fireworks, provide industry information and support to its members, and to promote responsible regulation of the fireworks industry."[17] The APA board is elected by the APA members, and APA works with the DOT, its members and code development organizations, such as the National Fire Protection Association, to develop their standard and ensure that "standards are not overly burdensome or restrictive to the fireworks industry."[18] Although CPSC staff attends APA meetings and offers input, CPSC staff does not vote on the board.

This briefing package provides staff's recommendation that the Commission propose to adopt provisions that are consistent with APA 87-1, and in some cases, to incorporate by reference provisions of APA 87-1 into CPSC regulations. It should be noted, however, that APA is currently working to update its standard and anticipates completing that update by 2017.

[14] http://www.afsl.org/content/about-us.
[15] 49 C.F.R. § 173.65.
[16] http://www.americanpyro.com/assets/apamembershippresentationrev1.29.15pptx.pptx.
[17] http://www.americanpyro.com/assets/apamembershippresentationrev1.29.15pptx.pptx.
[18] https://pyro.memberclicks.net/benefits-of-membership.

Should APA update the standard before the Commission adopts a final rule, the Commission could adopt portions of the updated version of APA 87-1 in the final rule stage, provided those revisions are consistent with the provisions proposed in the NPR.

Staff also considered the AFSL and the European Standards because, like APA 87-1, those standards are widely used by the fireworks industry. AFSL estimates AFSL members represent 85 percent to 90 percent of all U.S. fireworks importers,[19] and each AFSL member agrees to test fireworks to the AFSL standard. Thirty-one countries around the world use the European Standard, which industry experts developed.

E.O. 13563 calls for agencies to "identify and use the best, most innovative and least burdensome tools for achieving regulatory ends." Staff believes that aligning the CPSC regulations with the internationally recognized standards, where appropriate, would assist the fireworks industry in clarifying applicable regulations and reduce compliance burdens by making applicable legal requirements more consistent across regulatory agencies.

## II. Incident Data

According to the Fireworks Annual Report[20] (2015 Report), CPSC staff received reports of 11 non-occupational fireworks-related deaths during calendar year 2015. U.S. hospital emergency departments treated an estimated 11,900 fireworks-related injuries during that year.

Staff obtained information on fireworks-related deaths from news clippings and other sources in the CPSC's Injury and Potential Injury Incident (IPII) databases and the CPSC's Death Certificate File. Staff estimated fireworks-related injuries from the CPSC's National Electronic Injury Surveillance System (NEISS). To supplement the information available in these records, every year, during the month surrounding July 4th, staff conducts a special study of fireworks-related injuries. For 2015, staff completed this study between June 19, 2015 and July 19, 2015. This study provides a more detailed analysis of injuries, including the type of injury, the fireworks involved, how the injury occurred, and the medical treatment and prognosis. About 67 percent of the estimated annual fireworks-related injuries treated in emergency departments for 2015 occurred during this 1-month period.

Based on in-depth telephone investigations of some of the more severe fireworks incidents that occurred during the 1-month special study period, over half of the incidents investigated involved the misuse of fireworks devices. The other injuries resulted from malfunctioning devices. This is consistent with previous years' findings.

Additionally, according to the results from the special study of the 2015 incidents, children younger than 15 years of age accounted for approximately 26 percent of the estimated fireworks-related injuries treated in the special study period.[21] The report also states that an estimated 1,900 fireworks-related injuries treated in emergency departments were associated

[19] http://www.afsl.org/content/about-us.
[20] Yongling Tu, Consumer Product Safety Commission, "2015 Fireworks Annual Report" (2016).
[21] Yongling Tu, Consumer Product Safety Commission, "2015 Fireworks Annual Report" (2016).

with sparklers during the special study, consistent with previous years. The report adds that 16 percent of injuries were associated with firecrackers; reloadable shells accounted for 9 percent; Roman Candles accounted for 3 percent; and 10 percent of injuries were associated with bottle rockets. Additionally, similar to previous years, more than half of the estimated fireworks-related injuries, according to the special study, involved burns. Burns constituted the most frequent injury to all parts of the body, except the eyes, where contusions, lacerations, and foreign bodies in the eyes occurred more frequently.[22]

## III. Staff's Recommendations for Proposed Changes to CPSC Fireworks Regulations

The staff's recommended changes to CPSC's fireworks regulations, arranged by the order in which the regulations appear in the Code of Federal Regulations (C.F.R.), follow. The proposed text for the C.F.R. is included after each section's discussion of the regulation and staff's recommendations.

### A. 16 C.F.R. § 1500.3 Definitions

*§ 1500.3*

Staff recommends changes in, and additions to, definitions in this section. The definition changes are needed to be consistent with the changes staff recommends to § 1500.17(a)(3) that would specify a quantifiable method of identifying devices that are limited to 2 grains of pyrotechnic composition and create limits on the chemical composition and pyrotechnic weights of various devices. These recommended changes align with APA 87-1and include the addition of of several terms that are currently not defined in the regulations. Defining common terms would make testing easier and simplify administration of the regulation. Adding the suggested definitions also would clarify the current regulations and improve compliance and safety by providing a uniform understanding of the regulations. Staff recommends defining the following terms in the regulations: "aerial bombs," "pyrotechnic composition," "explosive composition," "chemical composition," "burst charge," and "lift charge." Staff recommends incorporating by reference the definitions of these terms in APA 87-1 for consistency with the industry standard.

In addition, staff recommends adopting a definition for "firecrackers," in section 1500.3 and § 1507.1. The discussion of § 1507.1, below, explains this recommendation.

Commission staff recommends inviting comments on these proposed changes in the NPR.

Draft Proposed Regulatory Text

(a) *Certain terms used in this part.* As used in this part:

(1) *Act* means the Federal Hazardous Substances Act (Pub. L. No. 86-613, 74 Stat. 372-81 (15 U.S.C. 1261-74)), as amended by:

(2) *Aerial bomb* means a tube device that fires an explosive charge into the air without added visual effect.

[22] Yongling Tu, Consumer Product Safety Commission, "2015 Fireworks Annual Report" (2016).

(3) *Burst charge*, also known as *expelling charge* or *break charge*, is as defined in section 2.5 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

(4) *Chemical composition* includes lift charge, burst charge, and visible/audible effect materials and is as defined in section 2.6 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

(5) *Commission* means the Consumer Product Safety Commission established May 14, 1973, pursuant to provisions of the Consumer Product Safety Act (Pub. L. No. 92-573, 86 Stat. 1207-33 (15 U.S.C. 2051-81)).

(6) *Explosive composition* is as defined in section 2.6.1 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

(7) *Firecracker*, is as defined in section 3.1.3.1 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

(8) *Lift charge*, is as defined in section 2.10 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

(9) *Pyrotechnic composition*, is as defined in section 2.6.2 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

(b) *Statutory definitions.*

## B. 16 C.F.R. § 1500.17 Banned hazardous substances

### *1. § 1500.17(a)(3) (Audible effects)*

Section 1500.17(a)(3) bans fireworks devices that are "intended to produce audible effects" if the audible effect is produced by a charge of more than 2 grains (130 milligrams (mg)) of pyrotechnic composition. The Commissioner of the FDA discussed this requirement in the 1970 *Federal Register* notice, which states:

> The intention is not to ban so-called "Class C" common fireworks, but only those designed to produce audible effects caused by a charge of more than 2 grains of pyrotechnic composition. (Propelling and expelling charges consisting of a mixture of sulfur, charcoal, and saltpeter are not considered as designed to produce audible effects.) The Commissioner's primary concern in this matter is to close the loophole through which dangerously

> explosive fireworks, such as cherry bombs, M-80 salutes, and similar items, reach the general public.[23]

As stated in the Division of Chemistry (LSC) memorandum in this briefing package (Tab B), the addition of fine mesh metallic fuels makes an explosive more energetic per volume than one without metallic fuel. A more energetic explosion creates more potential for injury if the firework device functions in close proximity to a person. Fireworks using metallic fuels with metal particles below 100 mesh in size have greater explosive force per volume of pyrotechnic material than fireworks using only black powder. Pyrotechnic materials that contain metallic powders are frequently used by fireworks manufacturers to produce sharp, clear audible effects in aerial devices. Although all devices will produce audible effects, the audible effect may be a byproduct of the explosion of the break charge required to disperse the visual elements of the firework, and not the primary intended effect of the device.

During the 1-month special study period in 2015, multiple-tube and reloadable shell devices were involved in 1,200 estimated injuries (based on a nationwide probability sample), and 100 of these estimated injuries involved children under the age of 5 years.

Reloadable aerial shell devices commonly contain metallic fuel. Nine of 11 deaths related to fireworks in 2015 involved reloadable aerial devices. Of the 11 deaths, 10 victims died from direct impacts of fireworks. Reporting of fireworks-related deaths for 2015 is not complete. Therefore, the number of deaths noted above for 2015 should be considered a minimum.

Therefore, it is extremely important to limit the amount of explosive power of these types of fireworks devices. If the device contained greater than the current 2-grain limit, the injuries resulting from the fireworks could have been more severe.

Commission compliance data show that there is a high level of noncompliance with § 1500.17(a)(3). Between October 2005 and October 2014, Commission staff tested 2,547 fireworks samples and found 495 violations of § 1500.17(a)(3), in which devices "intended to produce audible effects" contained more than 2 grains of pyrotechnic composition.[24]

Although all devices produce an audible effect, not all audible effects are designed specifically with that intent. For example, certain fireworks devices, such as tube mortars and mine shells, may produce visible effects with an audible effect that is a byproduct of the explosion of the break charge required to disperse those visual effect elements. As such, determining whether an aerial device is "intended to produce an audible effect" requires training and expertise.

To determine "intent to produce an audible effect," CPSC staff listens to the device during field testing, and based on the sound, determines whether the applicable "loud report" was detected. If staff hears a "loud report," staff considers the fireworks device "intended to produce

[23] 35 Fed. Reg. 7415 (May 13, 1970).
[24] Data supplied by CPSC Compliance staff.

an audible effect," in which case, the break charge (which causes the audible effect) is limited to 2 grains (130 mg).[25] To clarify, staff does not listen for sound level produced by a device but for a certain type of sound. Specifically, staff listens for a crisp sharpness that is related to the pressure pulse associated with the ignition of flash powder. As noted above, this type of sound is an indication of the energy of the explosion which is the Commission's primary concern. Therefore, a simple sound meter that would measure sound level would be unable to detect this sound differential. Moreoever, fireworks identified as "intended to produce an audible effect" in this screening test are not automatically considered violative. Rather, these fireworks are subjected to additional testing. Specifically, staff examines the shell and weighs the break charge to determine compliance with the regulatory limits. A device found to be intended to produce an audible effect is banned if the pyrotechnic material exceeds 2 grains (130 mg).

Since the promulgation of this rule in 1970, the development of new voluntary standards has provided a more straightforward means of determining "intent to produce an audible effect." For example, APA 87-1 states: "any burst charge containing metallic powder (such as magnalium or aluminum) less than 100 mesh in particle size, is considered to be intended to produce an audible effect, and is limited to 130 mg in 1.4G [consumer] fireworks devices." Additionally the APA standard states: "burst charge consisting of black powder or equivalent non-metallic composition is not considered to be intended to produce an audible effect when it is used to expel and ignite a secondary effect in a fireworks device." The fireworks devices listed as examples in section 1500.17(a)(3) are traditionally made with flash powder, which is a mixture of an oxidizer (typically potassium perchlorate) and a metallic fuel (typically aluminum). The addition of metallic fuels makes an explosive that is more energetic per volume (and therefore more hazardous to health) than one without metallic fuel.

**Table 1**
**Audible Effect Regulations in Voluntary Standards Compared to CPSC Regulations**

| APA 87-1 | AFSL Standard | CPSC Regulation | European Standard |
|---|---|---|---|
| States that "any burst charge containing metallic powder (such as magnalium or aluminum) less than100 mesh in particle size, is considered to be intended to produce an audible effect, and is limited to 130 mg in 1.4G fireworks devices." Additionally states that "burst charge consisting of black powder or equivalent non-metallic composition | Break charge must consist of "black powder or equivalent" (non-metallic fuel or demonstrated by empirical testing data that it is equivalent in performance to black powder.) | Limits fireworks devices intended to produce an audible effect to not more than 130 mg of pyrotechnic composition. Tests for "intent to produce audible effect" during field testing by listening to the device. | For report and/or bursting charges, the net explosive content is limited to the amount of black powder or the amount of nitrate/metal-based report composition or the amount of perchlorate/metal based report composition. These limitations vary based on type of device |

[25] Consumer Product Safety Commission, "Consumer Fireworks Testing Manual" (Aug. 17, 2006).

| | | | |
|---|---|---|---|
| is not considered to be intended to produce an audible effect when it is used to expel and ignite a secondary effect in a fireworks device." | | | |
| Limits on total chemical and pyrotechnic material for all fireworks devices | Limits on total chemical and pyrotechnic material for all fireworks devices | Current CPSC regulations only provide pyrotechnic limits for firecrackers (50 mg) and for "devices intended to produce audible effects" | Limits on total chemical and pyrotechnic material for all fireworks devices (some devices are different than what are used in the United States) |
| Limits the ratio of break charge to effects for mine and shell devices as well as aerial shells at "25% of the total weight of chemical composition in the component/shell" (respectively) | Limits the ratio of break charge to effects for large (greater than 1 inch) mine and shell devices at "25% by weight of the chemical composition of the tube or 10 grams, whichever is less." Small devices (1 inch or less) are limited to "50% by weight of the chemical composition of the tube or 10 grams, whichever is less." Aerial shells are limited to "35% by weight of the chemical composition of the shell or 10 grams, whichever is less" | Current CPSC regulations do not provide a ratio of break charge to effects. | Limits total pyrotechnic weight for report charges containing nitrate at 40% of black powder limit or limits perchlorate based report charges at 20% of black powder limit |

As Table 1 shows, the European Standard, the AFSL standard, and the APA standard all address audible effects (analogous to "reports") through limits in the chemical composition of break charges as well as limits in total pyrotechnic composition. The limits in the standards address both the metallic (flash powder as well as newer hybrid powders) and total mass of the break charge. By limiting the chemical composition in the break charge and the total pyrotechnic material of all devices, as is done in the standards listed, CPSC would capture all fireworks devices that have a break charge, not just those "intended to produce audible effects."

With the exception of the CPSC regulations, all standards consider the use of metallic fuel in the break charge as intended to produce an audible effect. The standards limit the amount of burst charge containing metallic powder under 100 mesh to 130 mg of pyrotechnic composition (however, it should be noted that the European standard limits vary, based on the type of device).

Flash powders, even within intended uses, often release an explosive force of a deadly capacity. Flash powder and flash powder devices pose high risks to children, who typically cannot understand the danger. Nearly all widely used flash powder mixtures are sensitive to shock, friction and electrostatic discharge. Additionally, accidental contaminants such as strong acids or sulphur compounds can sensitize these mixtures even more. In certain mixtures, it is not uncommon for this sensitivity to change spontaneously over time. However, formulations of flash powder differ in their sensitivity and explosive power, depending on different additives, as explained below.

Flash powders—especially those that use chlorate—are often highly sensitive to friction, heat/flame and static electricity. A spark of as little as 0.1–10 millijoules can set off certain mixtures. Formulations containing both sulphur and potassium chlorate are especially shock and friction sensitive and should be considered unpredictable. Modern pyrotechnic practices call for never using sulphur in a mix containing chlorate salts. The Commission's existing fireworks regulations (16 CFR § 1507.2) ban the use of chlorates, with the exception of smoke devices, caps, party poppers, and other small devices that contain extremely limited quantities of material.

Flash powder formulations that use fine mesh aluminum or magnesium powder as their fuel can self-confine and explode in small quantities. This makes this type of flash powder dangerous to handle because it can cause severe damage and amputation injury, even when sitting in the open. For this reason, staff recommends limiting fine mesh metallic fuel in consumer fireworks.

A more energetic explosion creates greater potential for injury if the fireworks device functions in close proximity to a person. Since the promulgation of this rule, the fireworks industry has moved away from black powder as the break charge in some fireworks devices; and instead, the industry sometimes uses hybrid powders (mixtures of other powders). These hybrid powders, depending on the construction of the shell, packing density, and quantity of powder, in some cases, might produce an audible effect; while in other cases, the sound produced is incidental to the necessary function of dispersing the visual effects. In the case of the sound being incidental to the dispersion of visual effects, the limit in § 1500.17(a)(3) does not apply, and no CPSC regulation limits the quantity of explosive composition.

There have been several incidents over the last few years that occurred due to accidental ignition of fireworks. In 2013, a 34-year-old male was seriously injured where he lost an eye and an arm in a fireworks accident that authorities believed involved devices that were accidentally initiated by heat, shock, or friction. Also, in 2013, a 25-year-old male sustained injuries to his left hand and two fingers in addition to lacerations in the thigh, side, and wrist when a "cherry bomb"(typically consisting of flash powder) exploded in his hand allegedly due to the heat of the kitchen at the residence. In 2012, a 16-year-old male was killed when an explosion occurred while he was moving boxes in a fireworks warehouse.[26]

[26] CPSRMS Database

The APA does not allow for trace contamination of metallic fuel less than 100 mesh in particle size in fireworks devices that are not intended to produce an audible effect. The absence of a trace allowance limit would make compliance with the APA requirement difficult, should it be adopted by the Commission because a complete ban of metallic fuel is subject to the limits of detection of the instrumentation involved in the analysis. For example, the CPSC's Inductively Couple Plasma Mass Spectrometer (ICP-MS) has detection limits in the low part per trillion (PPT) range for aluminum; whereas, the X-Ray Fluorescence Spectrometers (XRF) have detection limits of around 0.1 percent for aluminum. This limitation will change as technology evolves and will only become more stringent over time. This flexibility and sensitivity would certainly become increasingly burdensome to industry testing. Commission staff believes that trace amounts of metals (*i.e.*, low levels of contaminants below the amount that would be sufficient to achieve a particular designed effect) would not pose an increased safety risk to consumers because a scarce amount of contaminant would not significantly add to the energy of the explosive. In addition, allowing trace amounts of metal could reduce the burden on industry because very stringent measures and costly testing to ensure no contamination from metallic fuel would not be required. To facilitate reasonable and cost-effective testing, Compliance staff plans to exercise enforcement discretion for contamination up to, but not exceeding, a 1.00 percent level. Staff believes that this trace level of 1.00 percent would not cause a significant increase in the amount of energy per volume, based on the information in Table 2 of Tab B. This would also avoid imposing significant contamination control and testing measures to address a limited amount of metallic powders (and thus, limited energy and risk). Current analytical techniques, such as x-ray fluorescence (XRF), allow for detection at these and lower levels.

CPSC staff believes that, due to advances in technology, the CPSC's method of determining whether a device is "intended to produce an audible effect" should be updated to reflect those advances, which staff believes, will reduce the burden of certain field testing requirements. Additionally, staff recommends removing the clause: "and other fireworks designed to produce audible effects" because this refers to large firecrackers and aerial bombs, and the 2-grain limit does not apply to these devices. This recommendation is discussed further in the discussions of §§ 1500.17(a)(8) and 1500.85(a)(2), below.

To update CPSC's fireworks regulations and to make them more consistent with industry standards, staff recommends replacing the phrase "intent to produce audible effects" with a description of the devices to which the 2-grain limit would apply. Accordingly, the regulation would apply to devices containing metallic fuel less than 100 mesh in particle size (149 microns) with Compliance enforcement discretion for contamination up to, but not exceeding, a 1.00 percent level.

Finally, staff recommends defining the term "aerial bomb" that appears in this section and in § 1500.3 Definitions to clarify the meaning of the term and the types of devices that are subject to the limits specified in this section. Staff recommends defining "aerial bombs" as "a tube device that fires an explosive charge into the air without added visual effect."

Staff recommends inviting comments on these proposed changes in the NPR.

Draft Proposed Regulatory Text

(a) Under the authority of section 2(q)(1)(B) of the act, the Commission declares as banned hazardous substances the following articles because they possess such a degree or nature of hazard that adequate cautionary labeling cannot be written and the public health and safety can be served only by keeping such articles out of interstate commerce:

…

(3) Fireworks devices that contain a burst charge containing metallic powder less than 100 mesh in particle size (including but not limited to cherry bombs, M-80 salutes, silver salutes, and kits and components intended to produce such fireworks) if the burst charge is produced by a charge of more than 2 grains (~ 130 mg) of pyrotechnic composition; except that this provision shall not apply to such fireworks devices if all of the following conditions are met:

## *2. § 1500.17(a)(8)*

This section of the C.F.R. applies a limit of 50 mg (.772 grains) of pyrotechnic composition to firecrackers that are "designed to produce audible effects." The language used in this regulation differs slightly, but significantly, from the language in § 1500.17(a)(3). Because firecrackers do not have any pyrotechnic effects and only produce an audible effect while functioning, all firecrackers are "designed to produce audible effects," and therefore, they are limited to 50 mg of pyrotechnic composition.

Because the phrase "designed to produce audible effects" is redundant with the term "firecracker" and may be confusing because of its similarity to the phrase "intended to produce audible effects," staff recommends removing the phrase "designed to produce audible effects" from the regulations, and instead, simply refer to "firecrackers." Similarly, to provide consistency throughout the regulation, Commission staff recommends using the term "explosive composition" to describe the function of the device and as used in other sections of the C.F.R.

In addition, the language in § 1500.17(a)(3), is unclear because this section mentions "aerial bombs." The term "aerial bomb" is not defined by the CPSC, the AFSL, the APA, or the European Standard. Moreover, using the term "aerial bombs" in both §§ 1500.17(a)(3) and (a)(8) is inconsistent because the former limits devices to 2 grains of pyrotechnic content, and the latter prohibits aerial bombs entirely. To clarify the requirements, Commission staff recommends removing the term "aerial bomb" from § 1500.17(a)(3). Staff believes that § 1500.17(a)(8) is the appropriate section to address limits on aerial bombs.

Commission staff recommends inviting comments on these proposed changes in the NPR.

Draft Proposed Regulatory Text

(a) Under the authority of section 2(q)(1)(B) of the act, the Commission declares as banned hazardous substances the following articles because they possess such a degree or nature of

hazard that adequate cautionary labeling cannot be written and the public health and safety can be served only by keeping such articles out of interstate commerce:
…
(8)
Firecrackers, if the explosive composition is produced by more than 50 mg (.772 grains) of pyrotechnic composition, (not including firecrackers included as components of a rocket), aerial bombs, and devices that may be confused with candy or other foods, such as "dragon eggs," and "cracker balls" (also known as "ball-type caps"), and including kits and components intended to produce such fireworks, except such devices that meet all of the following conditions:
(i) …

### *3. § 1500.17(a)(14) (Pyrotechnic weight limits)*

The European Standard, the AFSL Standard, and APA 87-1 each limits the total pyrotechnic weight of all fireworks devices, regardless of whether the device is intended to produce an audible effect, and each limits the chemical composition of various devices. This is important because the energetic power of the device is directly related to the amount of pyrotechnic material in the device. Depending on the type of device, a different limit applies. Staff believes that a limit on the total pyrotechnic weight in certain devices (not only those intended to produce an audible effect) is an important component missing in the CPSC regulations because all fireworks have the potential to cause an injury, not just those intended to produce an audible effect, and because the pyrotechnic content in a device affects its energetic power, and consequently, the severity of injuries it can cause.

Because companies must adhere to the DOT limits on pyrotechnic composition and weights to transport fireworks in the Unites States, and because staff believes that the limits in APA 87-1 are appropriate in light of current fireworks designs and consumer safety hazards, staff recommends adopting limits consistent with the APA 87-1. Moreover, adopting provisions that are consistent with APA 87-1 would impose minimal economic burdens on industry. Currently, industry must comply with the CPSC regulation and APA 87-1. Under APA 87-1, each type of device has its own pyrotechnic and chemical limit. Staff recommends adding into the CPSC regulations the specific limits delineated in APA 87-1 for certain devices.

Commission staff conducted research to determine whether the fireworks industry is complying with the pyrotechnic limits APA 87-1 imposes. The results of this research are included in more detail in the LSC memorandum of this briefing package (Tab B). We provide a summary below. It is important to note that because the sample size staff used was limited, definitive conclusions on overall industry compliance cannot be made at this time. Nevertheless, the results give some indication of the compliance of devices on the market.

Specifically, staff tested 42 fireworks samples that the Office of Compliance and Field Operations obtained during Fiscal Year (FY) 2014 and FY 2015. Of the 42 devices tested, 30 were mine and shell, and 12 were reloadable tube mortar devices. The 42 devices were selected at random from previously collected samples. Of the 30 multiple-tube and mine and shell devices, six contained a total pyrotechnic composition limit greater than the allowed 200 grams

or 500 grams (APA 87-1 section 3.1.2.5), depending on the base construction. Three of these violations were only by a small margin. Eight of the 30 mine and shell devices had a break charge-to-effect ratio of greater than the 25 percent limit imposed by APA 87-1. No reloadable-tube aerial device contained more than the 20-gram limit of lift charge or the 60-gram limit of total pyrotechnic composition allowed by APA 87-1. Two reloadable tube aerial devices had a break charge-to-effect ratio greater than the 25 percent allowed by APA 87-1.

To address ground devices, Commission staff also recommends adopting the pyrotechnic weight limits for ground devices stated in APA Standard 87-1, by incorporating those provisions by reference. Commission staff believes that because devices containing a large amount of black powder can pose a safety hazard to consumers as well, it is necessary to limit the power of devices that contain only black powder, in addition to devices containing metallic powder.

Commission staff recommends inviting comments on these proposed changes in the NPR, which align with APA 87-1.

Draft Proposed Regulatory Text

(a) Under the authority of section 2(q)(1)(B) of the act, the Commission declares as banned hazardous substances the following articles because they possess such a degree or nature of hazard that adequate cautionary labeling cannot be written and the public health and safety can be served only by keeping such articles out of interstate commerce:

…

(14)(i) Fireworks devices that do not conform to the following chemical composition and pyrotechnic weight limits:

(A) *Sky Rockets, Bottle Rockets, Missile-Type Rockets, Helicopters (Aerial Spinners), and Roman Candles.* Each of these devices shall not contain more than 20 grams of chemical composition.

(B) *Mine and Shell Devices*. Devices shall conform to section 3.1.2.5 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here, except that:

(1) The lift charge of each shell is limited to black powder (potassium nitrate, sulfur, and charcoal) or similar pyrotechnic composition without metallic fuel.

(C) *Aerial Shells with Reloadable Tubes*. Devices shall conform to section 3.1.2.6 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here, except that the lift charge of each shell is limited to black powder (potassium nitrate, sulfur, and charcoal) or similar pyrotechnic composition without metallic fuel.

(D) *Cylindrical Fountains.* Devices shall conform to section 3.1.1.1 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

(E) *Cone Fountains.* Devices shall conform to section 3.1.1.2 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

(F) *Illuminating Torches.* Devices shall conform to section 3.1.1.3 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

(G) *Wheels.* Devices shall conform to section 3.1.1.4 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

(H) *Chasers.* Devices shall conform to section 3.1.3.2 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

## C. 16 C.F.R. § 1500.83 Exemptions for small packages, minor hazards, and special circumstances

### *§ 1500.83(a)(27)*

This section of the fireworks regulations was transferred to the CPSC from the FDA.[27] Ordinarily, hazardous substances must meet the labeling requirements of section 2(p) of the FHSA. Section 1500.83(a)(27) provides an exemption from full labeling for the outer packaging of fireworks assortments, which generally include different types of devices, such as sparklers, fountains, firecrackers, and aerial shells. This section in the regulation has not been updated to include the sections added to the C.F.R. after 1973, including the stricter limit for firecracker devices.

As mentioned above in the discussion of § 1500.17(a)(8), staff recommends removing the phrase "designed to produce audible effects" throughout the regulations, and instead, simply refer to "firecrackers." Similarly, to provide consistency throughout the regulations, staff recommends using the terms, "explosive composition" and "burst charge," rather than "audible effect," to describe the function of the device as described in this section and as used in other sections of the C.F.R.

Commission staff recommends inviting comments on this proposed change in the NPR.

Draft Proposed Regulatory Text

(a) The following exemptions are granted for the labeling of hazardous substances under the provisions of §1500.82:

…

(27) Packaged fireworks assortments intended for retail distribution are exempt from section 2(p)(1) of the act (repeated in §1500.3(b)(14)(i)), if:

(i) The package contains only fireworks devices suitable for use by the public and designed primarily to produce visible effects by combustion, except that small devices with an explosive composition that includes metallic fuel at less than 100 mesh in particle size may also be

[27] 38 Fed. Reg 27012 (Sept. 27, 1973).

included if the burst charge or explosive composition is produced by not more than 2 grains of pyrotechnic composition; (ii) …

## D. 16 C.F.R. § 1500.85 Exemptions from classification as banned hazardous substances

### *§ 1500.85(a)(2)*

This section of the regulation provides an exemption from the hazardous substance ban for firecrackers containing less than 50 mg of pyrotechnic composition. As discussed above, to provide consistency throughout the regulations, Commission staff recommends removing the phrase "designed to produce audible effects" and replacing the reference to "audible effects" with the words "explosive composition."

Staff recommends inviting comments on these proposed changes in the NPR.

Draft Proposed Regulatory Text
(a) The term *banned hazardous substances,* as used in section 2(q)(1)(A) of the act, shall not apply to the following articles, provided that these articles bear labeling giving adequate directions and warnings for safe use:
…
(2)
Firecrackers, if the explosive composition is produced by no more than 50 milligrams (.772 grains) of pyrotechnic composition (See also § 1500.14(b)(7); § 1500.17(a)(8) and (9); and part 1507).

## E. 16 C.F.R. part 1507 (Fireworks Devices)

### *1. § 1507.1 (Scope and Definitions)*

Section 1507.1 details the scope of the fireworks regulations in part 1507. This section expressly states that firecrackers are exempt from part 1507. The Commission concluded in 1976 that it was appropriate to allow flash powder firecrackers, which generally contain a composition of chlorates and perchlorates, sulfur, and aluminum powder, which would be prohibited under § 1507.2.[28] In that same rulemaking, the Commission explained that the fuses that the Commission aimed to address in § 1507.3 were not being used in firecrackers, and there was conflicting information about whether they could be used in firecrackers; accordingly, the Commission concluded that the fuse requirements in § 1507.3 need not apply to firecrackers.[29]

To clarify the statutory language and organize the regulations, staff recommends moving the exemption for firecrackers in its entirety to the parts of 1507 where it is relevant, namely, to § 1507.2 (Prohibited Chemicals) and § 1507.3 (Fuse Requirements), as opposed to part 1507.

[28] 41 Fed. Reg. 9512, 9519 (note 36) (Mar. 4, 1976).
[29] 41 Fed. Reg 9512, 9520 (note 43) (Mar. 4, 1976).

The remaining sections in part 1507 are not relevant to firecrackers; thus, there is no need to wholly exempt them from that part. This clarification of the requirements for firecrackers would not add any additional requirements for firecrackers.

Staff also recommends adding a definition for "firecrackers," as used in this section and throughout the regulations. Staff recommends incorporating by reference the definition of "firecrackers" in APA 87-1 because staff believes that APA 87-1's definition accurately and clearly describes those devices. This definition is similar to the AFSL standard, as well. Staff believes that providing a definition for "firecrackers" would give the fireworks industry a consistent understanding of the devices for which certain regulations apply, thereby improving compliance and consumer safety.

Finally, as discussed previously, staff recommends adding definitions for terms used in the regulations that are not currently defined and terms in new provisions recommended by staff in the draft NPR. For terms that appear in both part 1500 and part 1507, which staff recommended defining in the discussion of § 1500.3, staff recommends also including them in § 1507.1.

Commission staff recommends inviting comments on these proposed changes in the NPR.

Draft Proposed Regulatory Text

(a) *Scope*. This part 1507 prescribes requirements for fireworks devices not otherwise banned under the act. Any fireworks device that fails to conform to applicable requirements is a banned hazardous substance and is prohibited from the channels of interstate commerce. Any fireworks device not otherwise banned under the act, shall not be a banned hazardous substance by virtue of the fact that there are no applicable requirements prescribed here.

(b) *Definitions*. As used in this part:

(1) *Explosive composition* is as defined in section 2.6.1 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

(2) *Firecracker*, is as defined in section 3.1.3.1 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

(3) *Pyrotechnic composition* is as defined in section 2.6.2 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

## *2. § 1507.2 (Prohibited Chemicals)*

### *2.1 Trace allowance*

Section 1507.2 contains a list of chemicals prohibited in fireworks devices. Certain chemicals in the regulation, such as arsenates and mercury salts, are classified as human

carcinogens.[30] The other prohibited chemicals—boron, chlorates, gallates, magnesium, white phosphorus, magnesium, picric acid, titanium, and zirconium—were likely banned for manufacturing safety reasons, due to spontaneous combustion and/or the occupational hazards associated with manufacturing and storage.[31] This list has not been updated since 1976, when the Commission adopted it.[32]

As currently written, the regulation prohibits even trace amounts of the chemicals listed, making the testing and manufacturing of devices that comply with this requirement difficult and expensive. Instrumentation used to test for the presence of chemicals has improved greatly since 1974, when the CPSC issued the rule. For this reason, trace amounts may not have been an issue in 1974. Trace amounts of chemicals that previously went undetected are now identified in tested samples. Furthermore, quantifying trace amounts of these chemicals involves substantial time and ample resources. For further explanation, see Tab B. Disproving even trace amounts of a chemical in a product becomes almost impossible because instrumentation can only quantify to parts per billion (ppb) and even parts per trillion (ppt), but never prove zero.

These chemicals are not intentionally introduced into the products through production methods, but are present in background levels in the environment. Complete removal of the chemicals from the end product would necessitate ensuring that they are not present in the environment during production. Staff recommends allowing a reasonable amount of these chemicals as impurities to facilitate reasonable and cost-effective testing without posing any increase in risk.

APA 87-1 sets the allowance for trace levels of prohibited chemicals at 0.25 percent, unless otherwise noted in the standard. Current analytical techniques, such as XRF, allow for detection at significantly lower levels.

To evaluate the prevalence of trace amounts of prohibited chemicals currently in fireworks devices, CPSC staff used x-ray fluoresce spectroscopy to evaluate 32 devices for trace amounts of prohibited chemicals. While nearly every device contained detectable quantities of titanium, only three out of the 32 devices evaluated (9 percent) contained titanium at greater than 2,500 ppm (0.25 percent). Most titanium levels were below 0.05 percent. The trace quantity in a vast majority of samples was likely due to contamination, rather than the intentional use of titanium as a fuel because the quantity involved does not add substantially to energy, and thus, effect. Currently, quantifying titanium is conducted via inductively coupled plasma optical emission spectroscopy (ICP-OES) and confirmed by a scanning electron microscope (SEM). This confirmation takes a significant amount of time and resources. With a trace limit allowance, staff would begin looking into quantifying results based on the XRF screening, allowing for much faster determination. A trace limit allowance would save time and resources because XRF does not require significant sample preparation or digestion. Although the testing burden and

[30] US EPA. 2000. Integrated Risk Information System (IRIS). Summary on Arsenic, Inorganic (7440-38-2). Available at: http://www.epa.gov/iris/.
[31] The FDA prohibited of these chemicals before the CPSC assumed responsibility for these regulations; the FDA's rationale for including these specific chemicals is not clear. *See* 39 Fed. Reg. 17435 (May 16, 1974).
[32] 39 Fed. Reg. 17435 (May 16, 1974); 41 Fed. Reg. 9512 (Mar. 4, 1976).

cost may be significant to establish amounts below the trace levels proposed, the likelihood that the trace amount of prohibited chemicals would cause a significant increase in injury potential is believed to be low.

To establish a threshold for trace contamination of prohibited chemicals, the Commission could choose one of several options. The Commission could adopt an overarching allowance for all prohibited chemicals (like APA 87-1) or different allowances for different chemicals (like the AFSL standard). The Commission also could choose from various threshold levels. Because staff does not have specific data establishing an appropriate threshold for consumer safety, staff recommends soliciting comments and relevant data in the NPR. Staff has identified the following options:

- Allowing trace amounts less than 0.25% by weight (consistent with the general limit in APA Standard 87-1),
- Allowing trace amounts less than 0.01% by weight (consistent with CPSIA lead limits),
- Allowing trace amounts less than 0.05% by weight (because CPSC's initial testing indicates that most devices comply with this level),
- Allowing trace amounts less than 0.01% by weight (consistent with the most stringent allowance in the voluntary standards),
- Allowing trace amounts less than 0.009% by weight (consistent with the CPSIA limit on lead compounds in certain consumer materials), or
- Adopt no allowance for certain chemicals.

The Commission does not have exposure data regarding the relative safety of the various trace contamination levels identified; however, the staff recommendation is to use 0.25% which is consistent with the limits in APA Standard 87-1.

### *2.2 Addition of HCB and Lead and Lead Compounds*

The Directorate for Health Sciences evaluated the current list of prohibited chemicals and found no reason to remove any of the substances in the regulation. The substances have been prohibited for several decades, have safety implications, and the bans are consistent with industry standards. Health Sciences staff, however, did see merit in adding chemicals banned in the voluntary standards that are not currently prohibited in CPSC's fireworks regulations—lead, lead compounds and hexachlorobenzene (HCB).

Lead and lead compounds are prohibited in both the internationally recognized standards (APA 87-1 and the European Standard) and AFSL's voluntary standard. Currently, lead and lead compounds are not mentioned in CPSC's fireworks regulations. Lead tetroxide and other lead compounds can be absorbed by the oral and inhalation routes, and they exert a variety of toxicological effects. Children are more sensitive to lead toxicity than adults, and the adverse effect of most concern is neurological development in children. Several agencies have also determined that lead and lead compounds, including lead tetroxide, are probably carcinogenic to humans.

The AFSL standard and the European Standard also include HCB on their prohibited chemicals list. AFSL has a stricter limit (0.01 percent by weight) than the APA's general allowance for trace contamination of prohibited chemicals (0.25 percent by weight); and currently, APA does not ban HCB. HCB is a persistent organic pollutant that has been banned in many countries. Exposure to HCB can lead to developmental and reproductive effects, liver toxicity, and cancer. Oral inhalation or dermal exposures can lead to systemic absorption with distribution to diverse tissues, and elimination from the body is slow.[33]

If present in fireworks, lead, lead compounds, and HCB can be released into the environment, upon explosion, where these substances can be inhaled as particles. Lead and HCB particles may also settle onto surfaces where oral exposures could occur. Because of the human health hazards, the Directorate for Health Sciences recommends limiting lead tetroxide and other lead compounds, as well as HCB, in consumer fireworks.

CPSC staff conducted preliminary testing of FY 2014 and FY 2015 fireworks samples and found that 12 out of 32 samples (38 percent) contained lead at detectable levels. Of the 12 samples containing lead, only one sample contained lead greater than the APA 87-1 limit for trace contamination of 0.25 percent. Eleven out of the 12 samples contained lead at less than 0.05 percent. As the Directorate for Health Sciences memorandum indicates, summarizing AFSL and CPSC test results, lead compounds have been found in 9 percent to 38 percent of fireworks samples, depending on the study, and in concentrations up to more than 0.25 percent.

In addition, studies have found HCB to be present in fireworks devices. As the Directorate for Health Sciences memorandum explains, studies have found HCB in 25 percent to 53 percent of fireworks samples, depending on the study and in concentrations up to 4.4 percent. As an example, in 2014, Schwarz et al., examined 220 fireworks devices for HCB.[34] Of those devices, only three would not meet the general trace contamination allowance of 0.01 percent in the AFSL standard, indicating 98.6 percent compliance. Thus, there would be very little burden on industry if the Commission prohibited the use of HCB in fireworks devices.

The Directorate for Health Sciences has not performed detailed toxicological reviews or risk assessments of HCB or lead compounds in fireworks. No quantitative models for estimating human exposure to fireworks ingredients are known to staff, but the actual exposure to HCB, lead, or lead compounds from consumer fireworks is expected to be low. Nevertheless, the toxicological hazards of these currently unregulated substances in fireworks devices suggest that a limit on their content in consumer fireworks is reasonable.

Staff recommends adding lead compounds and HCB to the list of prohibited chemicals. Additionally, LSC staff recommends setting the trace contamination limit at 0.25 percent, consistent with the APA 87-1 limit, for all of the chemicals, except HCB, and staff also

[33] ATSDR. 2013. Draft Toxicological Profile of Hexachlorobenzene. US DHHS. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp90.pdf.

[34] Schwarz S. (2014). Screening of hexachlorobenzene (HCB) contents in fireworks.

recommends adopting the AFSL limit of 0.01 percent for HCB. Currently, there is a complete ban on the prohibited chemicals, which are subject to the limits of detection of the instrumentation involved in the analysis. This limitation will change as technology evolves and will only become more stringent over time. This variance and sensitivity would certainly become increasingly burdensome to industry testing.

The Commission has several choices. It could choose from various threshold levels. Because staff does not have specific data establishing an appropriate threshold for consumer safety, staff recommends soliciting comments and relevant data in the NPR. Staff has identified the following options:

- Allowing trace amounts less than 0.25 percent by weight (consistent with the general limit in APA Standard 87-1);
- Allowing trace amounts less than 0.01 percent by weight (consistent with CPSIA lead limits);
- Allowing trace amounts less than 0.05 percent by weight (since CPSC's initial testing indicates that most devices comply with this level);
- Allowing trace amounts less than 0.01 percent by weight (consistent with the most stringent allowance in the voluntary standards);
- Allowing trace amounts less than 0.009 percent by weight (consistent with the CPSIA limit on lead compounds in certain consumer materials); or
- Adopting no allowance for these chemicals.

As mentioned, the Commission does not have exposure data regarding the relative safety of the various trace contamination levels identified; however, the staff recommendation is to use 0.25% which is consistent with the limits in APA Standard 87-1.

### *2.3 Firecracker Exemption*

Staff recommends moving the exemption for firecrackers from § 1507.1 to § 1507.2, where the exemption specifically applies.

Staff recommends inviting comments on these proposed changes in the NPR.

Draft Proposed Regulatory Text

Fireworks devices, other than firecrackers, shall not contain any of the following chemicals:

(a) Arsenic sulfide, arsenates, or arsenites, except in trace amounts less than 0.25% by weight.

(b) Boron, except in trace amounts less than 0.25% by weight.

(c) Chlorates, except in trace amounts less than 0.25% by weight and:

(1) In colored smoke mixtures in which an equal or greater amount of sodium bicarbonate is included.

(2) In caps and party poppers.

(3) In those small items (such as ground spinners) where the total powder content does not exceed 4 grams of which not greater than 15 percent (or 600 milligrams) is potassium, sodium, or barium chlorate.

(d) Gallates or gallic acid, except in trace amounts less than 0.25% by weight.

(e) Hexachlorobenzene, except in trace amounts less than 0.01% by weight.

(f) Lead and lead compounds, except in trace amounts less than 0.25% by weight.

(g) Magnesium, except in trace amounts less than 0.25% by weight (magnesium/aluminum alloys, called magnalium, are permitted).

(h) Mercury salts, except in trace amounts less than 0.25% by weight.

(i) Phosphorus (red or white), except in trace amounts less than 0.25% by weight. Except that red phosphorus is permissible in caps and party poppers.

(j) Picrates or picric acid, except in trace amounts less than 0.25% by weight.

(k) Thiocyanates, except in trace amounts less than 0.25% by weight.

(l) Titanium, except in particle size greater than 100-mesh or in trace amounts less than 0.25% by weight.

(m) Zirconium, except in trace amounts less than 0.25% by weight.

### *3. § 1507.3 (Fuses)*

Section 1507.3 details fusing requirements for fireworks. The first requirement aims to reduce the possibility of side ignition of the fuse. However, the regulation does not provide a test method or evaluation criteria for the fuse. Instead, this criterion is found in the CPSC Consumer Fireworks Testing Manual.[35] The Testing Manual indicates that testing should measure how long the side of the fuse that protrudes from the device (including any tape or paper attached to the fuse) resists ignition from a cigarette. Although the manual states that the test should be carried out for a maximum of 5 seconds, CPSC staff currently enforces to a 3 second time for ignition resistance. Including the 3 second threshold in the regulation would reduce confusion and, additionally, would align with industry standards. The AFSL and APA 87-1 test methods are similar, requiring that the fuse resists ignition for at least 3 seconds.

Between October 2005 and February 2015, CPSC staff tested 2,835 fireworks samples and identified 28 violations of the CPSC standard. This accounts for less than 2.5 percent of all CPSC staff-determined fireworks violations during this same period.[36] Although this rate indicates a high level of compliance with this provision staff recommends specifying the current test method, stated in the CPSC Consumer Fireworks Testing Manual, in the regulations because of the severity of potential injuries.

The potential for injury when a fireworks device ignites inadvertently is serious and could severely injure or kill a person attempting to light the fireworks device or kill or injure bystanders. If a device lights quickly without the user deliberately lighting it, the user could be holding the device or be close to it when it explodes. Although incident and injury reports listed in the 2015 Report do not specifically reference side ignition of fireworks devices (which may be difficult to identify), the 2015 Report includes numerous incidents in which users or bystanders died or sustained serious injuries when a fireworks device exploded while the user was holding it or when the device was lit too close to bystanders or other fireworks or explosives. Injuries resulting from these incidents included severe burns, bone fractures, and lacerations.

[35] Consumer Product Safety Commission, "Consumer Fireworks Testing Manual" (Aug. 17, 2006). https://www.cpsc.gov/PageFiles/121068/testfireworks.pdf.

[36] Data supplied by CPSC Compliance staff.

Therefore, to clarify the regulation, set specific criteria for devices that would promote consumer safety, and require producers to test their products' fuses, staff recommends adding a requirement that fuses meet the side ignition resistance test currently stated in the CPSC Consumer Fireworks Testing Manual.

According to the CPSC Consumer Fireworks Testing Manual, currently, an unfiltered Pall Mall cigarette is used to test side ignition. To avoid any potential future marketplace uncertainty in the tobacco industry, staff recommends replacing the Pall Mall cigarette with the standard NIST cigarette (SRM 1196) used for testing in several of the Commission's flammability standards.

In addition, as discussed, staff recommends moving the exemption for firecrackers from § 1507.1 to § 1507.3, where the exemption specifically applies. Staff also recommends correcting an editorial error in the existing regulation, which states: "whether," where it should state "whichever," under fuse attachment at 1507.3(b).

Commission staff recommends inviting comments on these proposed changes in the NPR.

Draft Proposed Regulatory Text

(a) Fireworks devices, other than firecrackers, that require a fuse shall use a fuse that has been treated or coated in such manner as to reduce the possibility of side ignition.

(1) The following test must be conducted to evaluate whether a fuse has been treated or coated in such a manner as to reduce the possibility of side ignition:

(i) Cut the fuse at the point where the fuse enters the fireworks device. If the fuse is wrapped in paper, plastic, or taped to the device, remove the fuse with the paper, plastic, and/or tape intact.

(ii) Place the glowing tip of a lit standard NIST (SRM 1196) cigarette directly on the side of the fuse (or the paper, plastic, or tape attached to the fuse) and time, in seconds, how long it takes for the fuse to ignite.

(2) The fuse must not ignite within 3 seconds.

(3) The following devices are exempted from § 1507.3(a)(1) and (2):

(i) Devices such as ground spinners that require a restricted orifice for proper thrust and contain less than 6 grams of pyrotechnic composition.

(ii) Devices with fuses that protrude less than ½ inch from the device, because the end of the fuse may ignite during testing.

(b) Fireworks devices, other than firecrackers, that require a fuse shall use a fuse that will burn at least 3 seconds but not more than 9 seconds before ignition of the device.

(c) For fireworks devices, other than firecrackers, that require a fuse, the fuse shall be securely attached so that it will support either the weight of the fireworks device plus 8 ounces of dead weight or double the weight of the device, whichever is less, without separation from the fireworks device.

### *4. § 1507.4 (Bases)*

Currently, the regulation does not define the term "base." Although CPSC staff believes that the term "base" is well understood by the fireworks industry, staff recommends defining the term to provide clarity. APA 87-1 does not define a "base"; however, the AFSL standard sets forth the following definition:

> Base - The platform to which one or more tubes of a fireworks device are attached to provide a stable platform for the functioning of the item.

Staff believes that this definition of a "base," as set forth in the AFSL standard, accurately expresses CPSC's and industry's understanding of the term. As such, staff recommends that the Commission adopt a definition consistent with the AFSL definition, but with more detail.

Currently, the regulation requires that the minimum horizontal dimension or the diameter of the base of a fireworks device must be at least one-third of the height of the device. This is a non-dynamic stability test. That is, the purpose of the required ratio is to ensure that the device does not tip over. However, it is a static test and does not measure the stability of a device while it is being fired.[37] If the base is not attached properly, injuries could occur because the device might be unstable. Although the 2015 Report does not specifically track incidents or injuries that involve bases detaching, the 2015 Report does indicate that during the 1-month special study period in 2015, of the incidents selected and completed during the special study, 6 percent of incidents involved devices tipping over, and 13 percent of incidents involved errant flight paths (including devices firing at bystanders, rather than directly upward), which resulted in severe burns. Although these incidents are not attributed to base attachments, specifically, tip-overs and errant flight paths are the types of incidents that can occur when a base detaches from a device, causing the device to tip over or fire in a direction other than upward. To address safety concerns, staff believes that an additional performance requirement for bases should be added.

Staff recommends amending § 1507.4 to reduce the risk of injury associated with base detachment and to harmonize the regulation with DOT and industry standards. Staff found that both the APA 87-1 and AFSL standards require that the base of a fireworks device remain attached during transportation, handling, and normal operation of the device, as shown in Table 2.

**Table 2**
**Base Regulations in Voluntary Standards Compared to CPSC Regulations**

| APA 87-1 | AFSL Standard | CPSC Regulation |
|---|---|---|
| States: "bases shall remain firmly attached to the item during transportation, handling and normal operation" | States: "bases must remain firmly attached to the item during transportation, handling and normal operation" | Current CPSC regulations do not state a requirement for base attachment. |

[37] 59 Fed. Reg. 33928, 33931 (July 1, 1994).

CPSC cannot regulate transportation which falls under the jurisdiction of the U.S. Department of Transportation (DOT). However, CPSC can require that the base of a fireworks device remain attached during storage, handling, and normal operation. Based on staff's observations, as indicated in fireworks testing reports, bases become detached during storage, handling, and operation. Therefore, it is appropriate to include these three phases in the recommended requirement. Staff has observed that several devices on the market do not have bases, or they have bases that become detached before or during use. Because CPSC currently does not have a requirement for base attachment, CPSC staff does not test for base attachment when testing samples of fireworks. However, when samples are examined, and the bases are not attached, staff typically makes note of this in the testing record. Between FY 1999 and FY 2016, staff reports indicate that 88 devices had no base, or the base detached before or during operation, and 32 devices tipped over during testing. In some of these cases, staff noted that the base was detached or was broken when received; in others, staff noted, the base detached during handling; and in others, the base detached or cracked when the device fired. Staff has identified more than 4,500 devices that have, or could have, bases, which indicates that there is a large number of devices on the market that potentially pose a safety hazard if a device tips over.

In addition to providing consumer safety, the recommended revision would align with DOT regulations and industry standards.

Staff recommends that the Commission invite comments on the proposed change—namely, on the question of whether the proposed definition and performance requirement would be sufficient to reduce injuries and promote clarity.

Draft Proposed Regulatory Text

(a) For purposes of this section, the base means the bottommost part or foundation to which one or more tubes of a fireworks device that serves as a flat, stabilizing surface from which the device may function.

(b) The base of fireworks devices that are operated in a standing upright position shall:

(1) Have the minimum horizontal dimensions or the diameter of the base equal to at least one-third of the height of the device, including any base or cap affixed thereto; and

(2) Remain securely attached to the device during handling, storage, and normal operation.

## *5. § 1507.6 (Burnout and Blowout)*

According to § 1507.6, fireworks devices must be constructed to allow functioning in a normal manner without blowout or burnout. This is an important safety consideration. Blowouts often create a large explosion low to the ground, where debris can injure spectators. Burnouts can cause fires, leading to property damage and injury. A similar provision exists in APA 87-1 section 3.6.2.5, with definitions for the terms "blowout" and "burnout" in sections 2.3 and 2.4, respectively.

Although Commission staff believes the terms "burnout" and "blowout" are well understood by the fireworks industry, staff recommends defining the terms in the regulations. Staff believes that the APA definitions accurately express the CPSC's and industry's understanding of these terms. Additionally, because the DOT incorporates APA 87-1 by

reference, by extension, the DOT also incorporates APA 87-1's definitions. The addition of definitions may clarify and streamline the regulation and would align CPSC regulations with the DOT regulations.

Commission staff recommends inviting comments on this proposed change in the NPR.

Draft Proposed Regulatory Text

(a) The pyrotechnic chamber in fireworks devices shall be constructed in a manner to allow functioning in a normal manner without burnout or blowout.

(b) As used in this section, the terms *blowout* and *burnout* are as defined in sections 2.3 and 2.4, respectively, of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

### *6. § 1507.13 (Fragments)*

Based on the reports of fireworks-related incidents that CPSC received and the in-depth investigations of fireworks incidents that CPSC conducted, eight possible injury cases between 2005 and 2015 involved projected fragments from fireworks. These incidents included bystanders getting fragments or debris in their eyes; a bystander being struck by a piece of metal that lodged in the bystander's ankle after a fireworks device fired sideways; a bystander suffering a first-degree burn and corneal abrasion when a piece of metal struck the bystander's eye; and a bystander sustaining third-degree burns from debris. Staff could not determine whether these injuries resulted from a fragment inside a consumer fireworks device, or whether the sharp fragments resulted from debris in the surrounding area of the explosion. Regardless, the incident data demonstrate the possibility of injury due to projectile fragments.

APA 87-1 addresses this risk, stating: "no component of any consumer fireworks device or novelty may upon functioning, project or disperse any metal, glass, or brittle plastic fragments." To align CPSC standards with the internationally recognized standards and address this safety issue, staff recommends adding this requirement. However, staff also recommends soliciting comments on whether the Commission should only limit such fragments to a particular size or amount.

Staff recommends inviting comments on this proposed change in the NPR.

Draft Proposed Regulatory Text

Fireworks devices must function in accordance with section 3.7.2 of APA Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics, December 1, 2001 version, which is incorporated by reference here.

## IV. Summary of Revisions Staff Recommends for Proposed Rule

A summary of staff's recommendations for changes that are included in the draft NPR follows. Staff lists the recommendations in three categories. The first category includes recommendations that do not create a new hazardous substance ban under the FHSA and are not expected to have any net effect on the fireworks industry; these recommendations simply aim to

streamline or clarify the existing regulations. The second category sets forth the recommendations that aim to reduce burdens on the fireworks industry by easing an existing regulation. The third category lists recommendations that would create a new hazardous substance ban under the FHSA, by establishing a new requirement, or expanding the scope of an existing requirement, by adopting a specific test method. Staff believes that changes in this third category, which require the requisite findings under the FHSA, could provide greater safety to the public, and would align with voluntary standards.

**Recommendations intended to clarify and streamline the regulations that create no new requirements:**

- Define "aerial bomb," "lift charge," "burst, expelling, or break charge," "chemical composition," "pyrotechnic composition," and "explosive composition" in §§ 1500.3 and 1507.1, as applicable;

- Define "firecracker" in §§ 1500.3 and 1507.1;
- Remove the references to "aerial bombs" and "firecrackers" in § 1500.17(a)(3);
- Replace references to "firecrackers designed to produce audible effects" to simply reference "firecrackers" in §§ 1500.17(a)(8), and 1500.85(a)(2);
- Specify the sections (fusing requirements and prohibited chemicals) from which firecrackers are exempt, rather than exempt firecrackers from all of part 1507, in §§ 1507.2 and 1507.3;
- Define "burnout" and "blowout" in § 1507.6;
- Define "bases" in § 1507.4; and
- Revise § 1500.83(a)(27) to clarify language using "burst charge."

**Recommendation intended to ease existing requirements:**

- Amend § 1507.2 to allow a contamination level of 0.25 percent for prohibited chemicals.

**Recommendations that would create new hazardous substance bans under the FHSA:**

- Replace the phrase "devices intended to produce audible effects," in § 1500.17(a)(3), with a quantifiable method of identifying these devices that specifically states that devices that contain a burst charge containing metallic fuels less than 100-mesh in particle size are limited to 2 grains;
- Adopt limits on chemical composition, pyrotechnic weight, and the ratio of break charge-to-effects for specific types of fireworks devices, in § 1500.17(a)(14);
- Add lead, lead compounds, and HCB to the list of prohibited chemicals in § 1507.2;
- Adopt the test method in the CPSC Fireworks Testing Manual for identifying whether devices have been treated to "reduce the possibility of side ignition," in § 1507.3;
- Require that the base of a fireworks device is to remain attached during storage, handling, and normal operation in § 1507.4; and
- Prohibit fireworks devices from projecting fragments upon functioning, in § 1507.13.

## V. Conclusions

In this briefing package, staff highlights provisions in CPSC's regulations that staff recommends the Commission update. The recommended changes are meant to achieve greater clarity, consistency, and reflect the current fireworks market and technology, and provide increased consumer safety. Many of staff's recommendations align with the voluntary standards, where they reduce consumer safety risks and provide performance-based standards. Staff believes that this consistency provides the least-burdensome tool to protect the public.

Commission staff's recommended changes would have a limited economic impact because, where changes are needed to comply, the costs of compliance are expected to be low (*i.e.*, for example, replace flash powder with black, one-time changes to measuring devices, and allowances are made for trace contamination); and some requirements only clarify existing requirements. Moreover, the fireworks industry already must comply with APA 87-1's requirements that are relevant to transportation safety. Staff believes that the changes that go beyond clarifications of existing requirements likely meet the requirements for rulemaking under the FHSA. However, additional information or data may be needed to issue a final rule regarding some provisions. In the proposed changes to sections 1500.17(a)(3), 1507.2, 1507.3, 1507.4, and 1507.13, new bans would be created that may have some associated costs. A number of firms may need to modify products to bring them into compliance with these provisions. However, staff does not believe these modifications will create a significant burden on those firms. The remainder of the proposed changes involve clarifications and alignment of existing requirements that should not create costs.

Section 553(d) of the Administrative Procedure Act requires the effective date of a rule to be at least 30 days after publication of the final rule. To establish clear and consistent requirements that promote consumer safety, and because industry already must comply with APA 87-1's requirements relevant to transportation safety, staff believes a short effective date is appropriate and therefore staff recommends that the Commission propose that the rule, if adopted, take effect 30 days after the Commission publishes the final rule in the *Federal Register*. The draft NPR requests comments on whether a longer effective date is necessary for industry compliance or would significantly mitigate costs.

**Tab A – Health Sciences Memorandum**

**UNITED STATES**
**CONSUMER PRODUCT SAFETY COMMISSION**
**4330 EAST WEST HIGHWAY**
**BETHESDA, MD 20814**

Memorandum

Date: December 14, 2016

TO : Rodney Valliere, Project Manager for Fireworks, Division of Chemistry, Directorate for Laboratory Sciences

THROUGH: Alice M. Thaler, DVM, Associate Executive Director for Health Sciences
Michael A. Babich, Ph.D., Director, Division of Toxicology & Risk Assessment

FROM : Eric Hooker, M.S., D.A.B.T., Toxicologist, Division of Toxicology & Risk Assessment

SUBJECT : Toxicology of Hexachlorobenzene, Lead, and Lead Compounds in Fireworks

**Health Sciences Memorandum**

## I. Introduction

The U.S. Consumer Product Safety Commission (CPSC or the Commission) regulates fireworks devices under the Federal Hazardous Substances Act (FHSA; 15 U.S.C. §§ 1261-1278). Under the direction of the Commission, staff has completed a rule review of the current fireworks regulations.

## II. International and Voluntary Standards Regarding Prohibited Chemicals

In particular, the Directorate for Health Sciences reviewed the regulations on prohibited chemicals in 16 C.F.R. § 1507.2 and considered applicable international and voluntary standards possibly to improve the regulations. The two main international standards are the European Standard EN 15947-1–15947-5: Pyrotechnic Articles—Fireworks, Categories 1, 2, and 3 (European Standard), and the American Pyrotechnics Association Standard 87-1: Standard for Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics (APA 87-1). The U.S. Department of Transportation (DOT) regulates the transportation of fireworks and requires compliance with APA 87-1 when approving the transportation of display and consumer fireworks. The American Fireworks Standards Laboratory (AFSL) has developed voluntary standards that incorporate both the CPSC and DOT regulations, as well as a number of standards developed by AFSL that are in addition to federal requirements. The European Standard is used by 31 countries around the world and was developed by industry experts.

## III. Analysis of Prohibited Chemicals and Staff Recommendations

### A. Chemicals Prohibited Under the Present Requirements of 16 C.F.R. § 1507.2

The Directorate for Health Sciences supports the continued prohibition of the chemicals currently listed in 16 C.F.R. § 1507.2. Certain chemicals listed in the regulation, such as arsenates and mercury salts, are classified as human carcinogens (EPA, 2000). The other prohibited chemicals, namely boron, chlorates, gallates, magnesium, white phosphorus, magnesium, picric acid, titanium, and zirconium, were likely banned for manufacturing safety reasons, due to spontaneous combustion and/or the occupational hazards associated with manufacturing and storage. These chemicals have been banned from consumer fireworks since June 8, 1976 (41 Fed. Reg. 22931 (June 8, 1976)) and are consistent with the chemicals banned in both of the international standards (APA 87-1 and European Standard) and the AFSL voluntary standard.

### B. Lead, Lead Compounds, and Hexachlorobenzene

Currently, the Commission's fireworks regulations do not limit the presence of lead, lead compounds, or hexachlorobenzene (HCB).

Lead and lead compounds are prohibited in the internationally recognized standards (APA 87-1 and the European Standard), as well as in AFSL's voluntary standard. APA 87-1 bans lead and other lead compounds at a level of 0.25 percent by weight; the AFSL voluntary standard and the European Standard generally prohibit lead without providing a minimal allowance. Currently, lead is not mentioned in CPSC's fireworks regulations.

APA 87-1 and the CPSC regulations do not mention HCB. The AFSL voluntary standard and the European Standard list HCB as a prohibited chemical. AFSL limits HCB to 0.01 percent by weight, while the European Standard generally prohibits HCB.

The following provides CPSC's Directorate for Health Sciences staff's review of the potential health effects of HCB, lead tetroxide, and other lead compounds in consumer fireworks. This memorandum presents summaries of the known toxicological issues regarding these substances and supports prohibiting or limiting HCB (at 0.01%) and lead tetroxide and other lead compounds (at 0.25%) in consumer fireworks.

The Directorate for Health Sciences has not performed detailed toxicological reviews or risk assessments of HCB or lead compounds in fireworks. Information discussed below indicates that these chemicals are present in consumer fireworks. However, CPSC does not have specific information on the extent to which they are present. No quantitative models for estimating human exposure to fireworks ingredients are known to staff; but the actual exposure to HCB or lead from consumer fireworks is expected to be low. There is no indication of any incidents in which children have put consumer fireworks in their mouths. Therefore, the concern with human exposure stems from residue dispersed during explosion of the fireworks. Residue from fireworks may be inhaled or may settle onto surfaces that humans contact and may lead to potential hand-to-mouth transfer. It may be possible to model or estimate these exposures, but additional information would be needed regarding the devices containing the contaminants and descriptions of the typical use patterns of consumer fireworks (*e.g.*, number of devices of each type used in a session; distance of the spectators from the activation/explosion of the device; frequency of use). There is lack of exposure data, which hampers the ability to confirm what specific limits on HCB, lead, and lead compounds in consumer fireworks would be safe or pose

no human health risk. The toxicological hazards of these substances suggest that a limit on their content in consumer fireworks is reasonable to minimize the health risk to consumers. It is perhaps for these reasons that these compounds have been restricted or banned by existing voluntary standards in the United States and internationally. The Directorate for Health Sciences concurs that including these compounds in the CPSC regulations is appropriate and consistent with recognized best practices.

### 1. Hexachlorobenzene

HCB was formerly used as a fungicide and in the manufacture of fireworks, ammunition, and synthetic rubber. Its function in fireworks is to improve illumination effects (Schmid et al., 2014). Use of HCB as a pesticide ended in the United States in 1965. Aside from its detection in fireworks samples, there are no known current commercial uses of HCB in the United States. There are no known natural occurrences of HCB, but it can be created as a byproduct in the manufacture of other chemicals and by burning of municipal waste. Katz et al. (1980) reported that HCB was a combustion product of hexachloroethane-based smoke generators (smoke bombs) used by the United States Army. Production and use of HCB have been prohibited globally under the Stockholm Convention on Persistent Organic Pollutants (http://chm.pops.int/), adopted in 2001, and effective in 2004. However, the United States did not ratify the Stockholm Convention.

The limit of 0.01 percent HCB in consumer fireworks is the industry standard limit for consumer fireworks, as provided in the AFSL 2014. No explanation is available for how this value was derived. The European Standard also prohibits HCB in consumer fireworks. Limited information is available on the levels of potential human exposure to HCB from consumer use of fireworks. However, recent testing reports the presence of HCB above this level in commercial and professional fireworks in the United States and Europe.

The AFSL (2011) reported that eight of 15 randomly sampled mine and shell pyrotechnic devices manufactured in China contained detectable HCB at concentrations of 0.00014 to 0.27 percent by weight, with three (20 percent) of the samples exceeding the 0.01 percent limit. Fleischer et al. (1999) reported that remains of fireworks contained HCB up to 0.14 percent. A program named Chemical Legislation European Enforcement Network (CLEEN) tested the HCB content of samples of fireworks in several European countries, where HCB is prohibited under the Stockholm Convention. Of 439 samples tested, 317 had an HCB content below the quantification limit of 0.00005 percent; 77 samples showed a content between the quantification limit and 0.0005 percent; and 45 samples (~10%) showed HCB content of more than 0.0005 percent. The highest HCB content tested was 27,000 mg/kg (2.7%). Before the CLEEN project, samples of fireworks imported from China into Denmark (2008-2010) and Austria (2009-2010) were tested for HCB content. In total, 82 samples were analyzed, and 25 percent of the products tested contained HCB at concentrations of 0.005 percent to 4.4 percent (CLEEN 2012).

A study by Schmid et al. (2014) reported that 297 $pg/m^3$ HCB was detected in air samples 3 hours after numerous small-scale fireworks were used by inhabitants of Zurich, Switzerland, during a Swiss National Day celebration on August 1, 2011. This concentration was approximately 10 times higher than ambient HCB levels measured 1 week before and 2 weeks after the event. The report clarified that the fireworks were not large-scale public displays by municipalities. Thus, presumably the fireworks that were used were consumer grade and not

professional. A total emission of 23 g HCB was released into the environment from the single night of fireworks throughout Zurich. Human exposure to HCB was not measured in this study. It is not known what proportions of the HCB released were added firework ingredients, versus a product of combustion of other chlorinated hydrocarbons (Schmid et al., 2014).

The adverse human health effects of HCB exposure have been described recently by the U.S. Environmental Protection Agency (US EPA 2013) and the Agency for Toxic Substances and Disease Registry (ATSDR 2013). HCB is readily absorbed into the human body by oral ingestion; and although there are no specific data, presumably HCB is readily absorbed into systemic circulation with inhalation exposure. HCB may also be absorbed with contact to the skin, mucous membranes, and the eyes. HCB accumulates in lipid-rich tissues, such as adipose tissue, adrenal cortex, bone marrow, skin, and some endocrine tissues. Additionally, HCB can be transferred to offspring across the placenta and via mother's milk. HCB undergoes limited metabolism, yielding pentachlorophenol, tetrachlorohydroquinone, and pentachlorothiophenol as the major metabolites excreted in urine. However, HCB is excreted primarily unchanged in feces. There are no data describing the timing of excretion in humans, but the elimination half-lives for HCB range from approximately 1 month in rats and rabbits, to 2 to 3 years in monkeys (ATSDR 2013).

Acute and intermediate oral exposures to HCB have been associated with developmental and reproductive toxicity in laboratory animals. Chronic oral exposures have produced liver toxicity, including cancer (hepatocellular carcinoma) in laboratory animals (ATSDR 2013; US EPA 2013). There are no data describing toxicological effects of inhalation or dermal exposure to HCB. A summary of the toxicological reference values by ATSDR and US EPA are provided below in Table 1.

As noted, exposure to HCB has been shown to cause liver cancer in laboratory animals. The US EPA (1996) describes HCB as a *probable human carcinogen* (Classification B2). The International Agency for Research on Cancer (IARC) determined that HCB is *possibly carcinogenic to humans* (Group 2B). The National Toxicology Program (NTP) describes that HCB is *reasonably anticipated to be a human carcinogen* in its 13$^{th}$ Report on Carcinogens (NTP 2014). The California Environmental Protection Agency (Cal EPA 2015) includes HCB in its current Proposition 65 list of "chemicals known to the state to cause cancer or reproductive toxicity." The American Conference of Governmental Industrial Hygienists (ACGIH 2012) has listed HCB as a confirmed animal carcinogen with unknown relevance to humans (A3 Classification).

**Table 1. Summary of Toxicological Reference Values for Hexachlorobenzene**

| Reviewing Agency (year of Review) | Toxicological Reference Value Type | Value | Critical Toxicity Endpoint |
|---|---|---|---|
| ***Non-Cancer*** | | | |
| ATSDR (2013) | Acute oral Minimal Risk Level (MRL) | 0.008 mg/kg-d | Developmental (hyperactivity in offspring, rats) |
| | Intermediate oral MRL | 0.0001 mg/kg-d | Reproductive (degenerative lesions in ovarian follicles) |
| | Chronic oral MRL | 0.00007 mg/kg-d | Liver toxicity |
| US EPA (1991) | Chronic oral Reference Dose (RfD) | 0.0008 mg/kg-d | Liver toxicity |

| | | | |
|---|---|---|---|
| ***Cancer*** | | | |
| US EPA (1996) | Oral Cancer Slope factor (CSF) | 1.6 $(mg/kg\text{-}d)^{-1}$ | Hepatocellular carcinoma |
| | Drinking Water Unit Risk | 0.000046 $(mg/kg\text{-}d)^{-1}$ | Hepatocellular carcinoma |
| | Inhalation Unit Risk (IUR) | 0.00046 $(\mu g/m^3)^{-1}$ | Hepatocellular carcinoma (based on oral exposure data) |

In summary, HCB is a persistent organic pollutant that has been banned globally but has recently been detected in fireworks. HCB can be released into the environment upon explosion of fireworks, whereupon it may be inhaled as a vapor or adsorbed to inhalable particles. Particles containing HCB may also settle onto surfaces where dermal or oral exposures could occur. Oral, inhalation or dermal exposures can lead to systemic absorption with distribution to diverse tissues and slow elimination from the body. Exposure to HCB can lead to developmental and reproductive effects and liver toxicity, including cancer. Because of the human health hazards and the environmental concerns (persistence and bioaccumulation), the Directorate for Health Sciences supports limiting HCB in consumer fireworks. While the staff cannot currently comment on how protective of human health the proposed limit value of 0.01 percent would be, staff believes that setting a maximum level consistent with other standards is prudent.

### 2. Lead Tetroxide

Lead tetroxide (Chemical Abstract Service Number 1314-41-6) is an inorganic lead compound. It is also known as minium, red lead, and triplumbic tetroxide. Lead tetroxide has the chemical symbol $Pb_3O_4$. It is described as a red or orange crystalline solid or powder that is not water soluble. There is limited information on lead tetroxide, but the toxicological information available for other lead compounds is generally expected to be relevant to lead tetroxide.

Lead tetroxide is reportedly used as a delay charge in commercial fireworks to make "crackling microstars" (PyroData). Use of lead tetroxide as a paint pigment is limited under prohibitions of lead-containing paints. There might be uses of lead tetroxide in the manufacture of stained glass windows.

The limit of 0.25 percent (2,500 ppm) lead in consumer fireworks is the industry standard limit of prohibited chemicals for consumer fireworks in APA 87-1; no explanation is available for how this value was determined. The AFSL standard (2014) and European Standard also prohibit lead and lead compounds in consumer fireworks, but neither recommends an acceptable concentration. Section 101 of the Consumer Product Safety Improvement Act of 2008 (CPSIA; Pub. L. No. 110-314 (Aug. 14, 2008)) limits the lead content of most component parts of most children's products, including toys, to 100 ppm by weight, except for inaccessible component parts, certain electronic devices, and certain other products or component parts. The lead content is limited to 90 ppm in paint and similar surface coatings of children's products and some furniture. These limits are based on the oral route of exposure to children by mouthing objects.

Exposure to lead and lead compounds from consumer fireworks is likely to be low compared to children's products or exposure to household paints that contain lead. A literature search revealed very little information on which to base an exposure model for lead compounds from consumer fireworks. The AFSL (2008) reported that 9 percent of 400 fireworks samples tested in 2007 contained excess lead (*i.e.*, more than 0.06% concentration); and 11 percent of 200 samples

tested in 2006 contained excess lead. The report did not state how many samples exceeded the APA 87-1 limit of 0.25 percent.

When released into the environment, lead tetroxide binds to organic materials in soil and precipitates in water. In the air, as when exploded in fireworks, particulate matter containing lead tetroxide is subject to gravitational settling, creating the potential of inhalation, oral exposure, and dermal contact.

Inhalation or oral ingestion of lead compounds results in high systemic absorption. However, absorption through intact skin is low. Once absorbed, lead is distributed to several tissues but is primarily stored in bones and teeth, where it can remain for decades. Systemically absorbed lead can be passed from mother to offspring via the placenta and in milk. The elimination kinetics of lead in blood is slow, and most lead is eliminated from the body in urine and feces (ATSDR 2007a).

Exposure to lead and lead compounds can affect many systems and tissues in the human body, in particular, the nervous system. Children are more sensitive to lead toxicity than adults. For this reason, most lead regulations are based on effects in children. Lead toxicity occurs by multiple mechanisms, including binding to sulfhydryl groups, which can affect the structure and function of various enzymes, receptors, and other proteins. Lead may also compete with other ions, such as calcium, iron, and zinc, which have important metabolic and homeostatic functions.

The US EPA (2004) and ATSDR (2007a) have not derived any toxicological reference values (*e.g.*, RfD, RfC, MRL) for inorganic lead compounds because a clear exposure threshold for the more sensitive effects in humans has not been identified. The total body burden of lead depends on the individual's history of exposure; so a metric of external exposure is not a reliable predictor of absorbed dose. Instead of an MRL approach, ATSDR (2007 a,b) recommends a hazard dose-response approach, based on internal doses, as measured by blood lead levels. Table 2 summarizes the ranges of blood lead levels at which specific health effects have been reported. ATSDR (2007b) recently revised its reference level of 10 µg/dL to 5 µg/dL of lead in blood for children and recommends chelation therapy if a child's blood lead level is ≥ 45 µg/dL.

**Table 2. Summary of Health Effects Associated with Blood Lead Levels (ATSDR 2007)**

| System | Health Effect | Blood Lead Level Range |
|---|---|---|
| Hematological | Decreased activity of several heme biosynthesis enzymes | <10 µg/dL |
| Gastrointestinal | Colic in children | 60–100 µg/dL |
| Cardiovascular | Elevated blood pressure | <10 µg/dL |
| Renal | Decreased glomerular filtration rate | <20 µg/dL |
| Neurological | Encephalopathy | 100–120 µg/dL (adults)<br>70–100 µg/dL (children) |
| | Peripheral neuropathy | 40 µg/dL |
| | Neurobehavioral and neuropsychological effects in adults | 40–80 µg/dL |
| | Cognitive and neurobehavioral effects in children | <10 µg/dL |
| Reproductive | Reduced fertility | >40 µg/dL |

NTP, in its 13th Report on Carcinogens (NTP 2014), determined that lead and lead compounds are "reasonably anticipated to be a human carcinogen." The US EPA (1993) has determined that inorganic lead is a "probable human carcinogen" (Classification B2). IARC has determined that

inorganic lead (including lead tetroxide) is "probably carcinogenic to humans" (Group 2A). The ACGIH (2008) has listed inorganic lead as a confirmed animal carcinogen with unknown relevance to humans (A3 Classification). Cal EPA (2015) includes lead and lead compounds in its current Proposition 65 list of "chemicals known to the state to cause cancer or reproductive toxicity." The US EPA (1993) has not derived a quantitative cancer potency value for lead compounds. However, Cal EPA (2009) reports an oral cancer slope factor of 0.0085 (mg/kg-day),$^{-1}$ an inhalation slope factor of 0.042 (mg/kg-day),$^{-1}$ and an inhalation unit risk of 0.000012 $\mu g/m^3$ (staff could not locate a technical document describing the derivation of these values).

In summary, as an ingredient in fireworks, lead and lead compounds can be released into the environment upon explosion, where they may be inhaled as particles. Lead particles may also settle onto surfaces where oral exposures could occur. Lead tetroxide and other lead compounds can be absorbed by the oral and inhalation routes and exert a variety of toxicological effects. Children are more sensitive to lead toxicity than adults, and the effect of most concern is neurological development in children. The guidance values for preventing lead toxicity are based on body burden (*i.e.*, children's blood lead levels), rather than on typical toxicological reference values (*e.g.*, RfD, MRL). Several agencies have determined that lead and lead compounds (including lead tetroxide) are probably carcinogenic to humans. Because of the human health hazards, the Directorate for Health Sciences supports limiting lead and lead compounds in consumer fireworks. While the staff cannot currently comment on how protective of human health the limit value of 0.25 percent would be, setting a maximum level limit consistent with other standards is prudent.

## IV. Conclusion

To summarize, data indicate that HCB, lead, and lead compounds have been found in consumer fireworks devices in recent years. Consumers who come in contact with the HCB, lead, and lead compounds in fireworks devices can absorb these chemicals. The Directorate for Health Sciences finds that HCB, lead, and lead compounds, including lead tetroxide, meet the definition of "toxic" under the FHSA, meaning these substances have "the capacity to produce personal injury or illness to man through ingestion, inhalation, or absorption through any body surface" [16 C.F.R. § 1500.3 (b)(5)]. Although staff did not perform risk assessments for lead, lead compounds, and HCB in fireworks, we recommend that any unnecessary use and exposure should be avoided. Consequently, staff recommends limiting HCB, lead and lead compounds in consumer fireworks by adding them to the list of substances prohibited under 16 C.F.R. § 1507.2.

The European standard prohibits the use of HCB in consumer fireworks and the AFSL standard prohibits it at the level of 0.01 percent by weight. The European standard and AFSL standard prohibit the use of lead and lead compounds in consumer fireworks and APA 87-1 limits it to less than 0.25 percent by weight. The Directorate for Health Sciences supports aligning CPSC requirements with these established standards to ensure a consistent approach to addressing these health hazards.

**References Cited**

Agency for Toxic Substances and Disease Registry (ATSDR). 2007a. Toxicological Profile for Lead. United States Department for Health and Human Services (US DHHS). Available at: http://www.atsdr.cdc.gov/toxprofiles/tp13.pdf.

ATSDR. 2007b. ToxGuideTM for Lead, Pb, CAS# 7439-92-1. US DHHS. Available at: http://www.atsdr.cdc.gov/toxguides/toxguide-13.pdf.

ATSDR. 2013. Draft Toxicological Profile of Hexachlorobenzene. US DHHS. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp90.pdf.

American Conference of Governmental Industrial Hygienists (ACGIH). 2008. Lead and inorganic compounds, as Pb. Threshold limit values for chemical substances and physical agents and biological exposure indices. Cincinnati, OH: ACGIH.

ACGIH. 2012. Hexachlorobenzene. Threshold limit values for chemical substances and physical agents and biological exposure indices. Cincinnati, OH: ACGIH.

American Fireworks Standards Laboratory (AFSL). 2008. Lead in fireworks targeted by testing program. AFSL News. 42: 6.

AFSL. 2011. Suggest perchlorobenzene screen test in QIP. Internal AFSL Memo, dated July 13 2011, from William Zhou to Executive Director John D. Rogers.

AFSL. 2014. AFSL Standards. Appendix A: Prohibited and Permitted Chemicals.

American Pyrotechnics Association (APA). 2001. APA Standard 87-1. 3.7 Prohibited Chemicals and Components.

California Environmental Protection Agency (Cal EPA). 2009. OEHHA Cancer Potency Values as of July 21, 2009. Available at: http://oehha.ca.gov/risk/pdf/tcdb072109alpha.pdf.

Cal EPA. 2015. Chemicals Known to the State to Cause Cancer or Reproductive Toxicity, March 27, 2015. Office of Environmental Health Hazard Assessment. Available at: http://oehha.ca.gov/prop65/prop65_list/files/P65single03272015.pdf.

Chemical Legislation European Enforcement Network (CLEEN). 2012. EUROPOP Final report. CLEEN Secretariat and EUROPOP Working Group. Report Available at: http://www.cleen-europe.eu/projects/europop.html.

Fleischer O, Wichmann H, Lorenz W. 1999. Release of polychlorinated dibenzo-p-dioxins and dibenzofurans by setting off fireworks. *Chemosphere*. 39(6): 925–932.

Katz S, Snelson A, Farlow R, Welker R, Mainer S. 1980. Physical and Chemical Characterization of Fog Oil Smoke and Hexachloroethane Smoke. Final Report – January 1980. Part 1 of 2. U.S. Army Medical Research and Development Command. NTIS Report No. ADA080936. Available at http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA080936.

National Toxicology Program (NTP). 2014. *13th Report on Carcinogens. US DHHS. Available at:* http://ntp.niehs.nih.gov/pubhealth/roc/roc13/index.html.

PyroData. (no date). Lead Tetroxide. Available at: http://www.pyrodata.com/chemicals/Lead-tetroxide.

Schmid P, Bogdal C, Wang Z, et al. 2014. Releases of chlorobenzenes, chlorophenols and dioxins during fireworks. *Chemosphere*. 114: 158-164.

United States Environmental Protection Agency (US EPA). 1991. Hexachlorobenzene; CASRN 118-74-1. I. Chronic Health Hazard Assessments for Noncarcinogenic Effects. Integrated Risk Information System (IRIS). Available at: http://www.epa.gov/iris/subst/0374.htm.

US EPA. 1993. Lead and compounds (inorganic) (CASRN 7439-92-1). II. Carcinogenicity Assessment for Lifetime Exposure. IRIS. Available at: http://www.epa.gov/iris/subst/0277.htm.

US EPA. 1996. Hexachlorobenzene; CASRN 118-74-1. II. Carcinogenicity Assessment for Lifetime Exposure. IRIS. Available at: http://www.epa.gov/iris/subst/0374.htm.

US EPA. 2000. Integrated Risk Information System (IRIS). Summary on Arsenic, Inorganic (7440-38-2). Available at: http://www.epa.gov/iris/.

US EPA. 2004. Lead and compounds (inorganic) (CASRN 7439-92-1). 1. I. Chronic Health Hazard Assessments for Noncarcinogenic Effects. IRIS. Available at: http://www.epa.gov/iris/subst/0277.htm.

US EPA. 2013. Hexachlorobenzene. Technology Transfer Network – Air Toxics Web Site. Available at: http://www.epa.gov/ttn/atw/hlthef/hexa-ben.html.

**Tab B – LSC Memorandum**

**UNITED STATES**
**CONSUMER PRODUCT SAFETY COMMISSION**
**4330 EAST WEST HIGHWAY**
**BETHESDA, MD 20814**

**Memorandum**

Date:December 14, 2016

TO : Rodney Valliere, Project Manager

THROUGH: Andrew G. Stadnik, Associate Executive Director for Laboratory Sciences
Aaron Orland, Division Director, Laboratory Sciences – Chemistry

FROM : Matthew Roemer, Chemist
Priscilla Verdino, Chemist

SUBJECT : Fireworks NPR Preliminary Regulatory Analysis

## Laboratory Sciences Memorandum

### Introduction

The U.S. Consumer Product Safety Commission (CPSC or Commission) regulates fireworks devices under the Federal Hazardous Substances Act (FHSA).[38] The division of Laboratory Sciences-Chemistry (LSC) tests consumer fireworks under CPSC's compliance testing program. CPSC staff has developed a testing manual to facilitate industry compliance with the various fireworks regulations.[39] The CPSC is considering a draft proposed rule to revise the regulations concerning fireworks in 16 C.F.R. parts 1500 and 1507. The requirements in the draft proposed rule are based on the recommendations that CPSC staff developed during a review of all regulations pertaining to fireworks.

In particular, LSC staff focused on the requirements in the draft proposed rule that pertain to the testing, design, and chemical composition of fireworks. These rules include the requirements and changes to § 1500.17(a)(3) and (8), which limit the pyrotechnic material in aerial devices and in firecrackers, and additions and edits to part 1507, which currently specifies certain prohibited chemicals in fireworks devices, and performance and design requirements for the fuses, bases, pyrotechnic chambers, handles, spikes, wheel devices, toy smoke devices, flitter devices, stick rockets, party poppers, and multiple-tube fireworks devices.

### Revisions to 16 C.F.R. § 1500.17(a)(3)

Section 1500.17(a)(3) bans a fireworks device that is "intended to produce audible effects" if the audible effect is produced by a charge of more than 2 grains (130 milligrams (mg)) of

[38] 15 U.S.C. §§ 1261-1278.
[39] CPSC Fireworks Testing Manual.

pyrotechnic composition. This is essentially a two-part test. First, a fireworks device must be one "intended to produce audible effects." In this step, CPSC staff determines whether a device is subject to a 2 grain limit of pyrotechnic content by evaluating the type of sound the device makes. Second, if staff determines the device is intended to produce an audible effect, then the amount of pyrotechnic content in the device is measured to determine if it exceeds the permissible limit.

Fireworks devices are field tested in accordance with the "Consumer Fireworks Testing Manual."[40] Fireworks devices that are determined by CPSC staff as "not intended to produce an audible effect" have no restriction on pyrotechnic composition. Although all devices potentially produce an audible effect, not all audible effects are the designed intent. For example, fireworks devices such as tube mortars and mine shells may produce visual effects and the audible effect heard is a byproduct of the break charge, burst charge, or expelling charge, required to disperse those visual effect elements. As such, determining whether an aerial device is "intended to produce an audible effect" requires training and expertise.

To determine "intent to produce an audible effect," CPSC staff listens to the device during field testing, and based on the sound, determines whether the applicable "loud report" was detected. If staff hears a "loud report," staff considers the fireworks device "intended to produce an audible effect" and the break charge (which causes the audible effect) less than 100-mesh in particle size is limited to 2 grains (130 mg).[41] Staff examines the shell of a similar sample and weighs the break charge to determine compliance with the regulatory limit. A device found to be intended to produce an audible effect is banned if the pyrotechnic material exceeds 2 grains (130 mg).

Over the years, CPSC staff has extensively trained the fireworks industry to help improve the consistency of this testing protocol.[42] However, because all fireworks devices produce an audible effect, the tester must determine if the sound is an audible effect or necessary for the functioning of the device (*e.g.*, break charge). Further complicating matters, fireworks devices tend to be handmade, so devices that are intended to be identical often are not, and thus, do not produce the same audible effect. The amount of powder, effects, shell width and height, often vary greatly within devices from the same manufacturer and lot.

CPSC has not updated § 1500.17(a)(3) since its adoption many decades ago. The FDA's and subsequently, the Commission's primary intention with this regulation was to prohibit the sale to the general public of dangerous devices, such as M-80s, Silver Salutes, aerial bombs, and Cherry bombs.[43] The intention was not to ban devices that use black powder (a mixture of charcoal, sulfur, and saltpeter) as the break charge, but rather, to ban devices using large quantities of flash powder (a metallic fuel containing a mixture of perchlorate and aluminum). Limiting the total flash powder content of devices "intended to produce audible effects" was not intended to protect consumers from loud sounds; rather, it was intended to limit the total powder content of the more powerful devices (ones with flash powder). The addition of fine mesh metallic fuels, such as that added in flash powder, creates an explosive that is more energetic per volume, and more dangerous, than the

[40] Consumer Product Safety Commission, "Consumer Fireworks Testing Manual" (Aug. 17, 2006). https://www.cpsc.gov/PageFiles/121068/testfireworks.pdf.
[41] Consumer Product Safety Commission, "Consumer Fireworks Testing Manual" (Aug. 17, 2006).
[42] Christopher Musto & Andrew Lock, Consumer Product Safety Commission, "FY 2012 Fireworks Safety Standards Development Status Report" (2013).
[43] 35 Fed. Reg. 7115 (May 13, 1970).

explosive without metallic fuel. [44] Fireworks using metallic fuels with metal particles below 100 mesh in size have greater explosive force per volume of pyrotechnic material than fireworks using only black powder. Pyrotechnic materials that contain metallic powders are frequently used by fireworks manufacturers to produce sharp, clear audible effects in aerial devices. Although all devices will produce audible effects, the audible effect may be a byproduct of the explosion of the break charge required to disperse the visual elements of the firework, and is not the primary intended effect of the device.

A more energetic explosion creates greater potential for injury if the fireworks device functions in close proximity to a person. Since the promulgation of this rule, the fireworks industry has moved away from black powder as the break charge in some fireworks devices; and instead, the industry sometimes uses hybrid powders (mixtures of other powders). These hybrid powders, depending on the construction of the shell, packing density, and quantity of powder, in some cases, might produce an audible effect; while in other cases, the sound produced is incidental to the necessary function of dispersing the visual effects. In the case of the sound being incidental to the dispersion of visual effects, the limit in § 1500.17(a)(3) does not apply, and no CPSC regulation limits the quantity of explosive composition.

Staff believes that the language this regulation uses, in particular "intent to produce audible effects," should be updated to reflect the current design and composition of fireworks devices. Likewise, the regulation should use a quantifiable method, rather than a method relying on the experience and training of test personnel to identify a particular sound. This would eliminate the initial screening test to determine if the device was intended to produce an audible effect, and would focus instead on the determination of whether the device falls within the limits of the regulation. Staff believes that such an update would support the purpose of this regulation, which is to keep powerful explosives out of the consumer market because of the serious injuries they can pose to users.

In considering an alternative test method for fireworks devices and not simply for devices "intended to produce an audible effect," staff reviewed available fireworks standards, such as APA 87-1 and the European Standard, as well as the AFSL voluntary standard. Significantly, like the current CPSC standard, all of these standards refer to "audible effects." Table 1 summarizes the major differences between these standards and the CPSC regulation.

[44] Akhavan, J. (2011). The Chemistry of Explosives. Cambridge, UK: The Royal Society of Chemistry.

**Table 1**
**Audible Effect Regulations in Voluntary Standards Compared to CPSC Regulations**

| APA 87-1 | AFSL Standard | CPSC Regulation | European Standard |
|---|---|---|---|
| States that "any burst charge containing metallic powder (such as magnalium or aluminum) less than100 mesh in particle size, is considered to be intended to produce an audible effect, and is limited to 130 mg in 1.4G fireworks devices." Additionally states that "burst charge consisting of black powder or equivalent non-metallic composition is not considered to be intended to produce an audible effect when it is used to expel and ignite a secondary effect in a fireworks device." | Break charge must consist of "black powder or equivalent" (non-metallic fuel or demonstrated by empirical testing data that it is equivalent in performance to black powder.) | Limits fireworks devices intended to produce an audible effect to not more than 130 mg of pyrotechnic composition. Tests for "intent to produce audible effect" during field testing by listening to the device. | For report and/or bursting charges, the net explosive content is limited to the amount of black powder or the amount of nitrate/metal-based report composition or the amount of perchlorate/metal based report composition. These limitations vary based on type of device |
| Limits on total chemical and pyrotechnic material for all fireworks devices | Limits on total chemical and pyrotechnic material for all fireworks devices | Current CPSC regulations only provide pyrotechnic limits for firecrackers (50 mg) and for "devices intended to produce audible effects" | Limits on total chemical and pyrotechnic material for all fireworks devices (some devices are different than what are used in the United States) |
| Limits the ratio of break charge to effects for mine and shell devices as well as aerial shells at "25% of the total weight of chemical composition in the component/shell" (respectively) | Limits the ratio of break charge to effects for large (greater than 1 inch) mine and shell devices at "25% by weight of the chemical composition of the tube or 10 grams, whichever is less." Small devices (1 inch or less) are limited to "50% by weight of the chemical composition of the tube or 10 grams, whichever is less." Aerial shells are limited to "35% by weight of the chemical composition of the shell or 10 grams, whichever is less" | Current CPSC regulations do not provide a ratio of break charge to effects. | Limits total pyrotechnic weight for report charges containing nitrate at 40% of black powder limit or limits perchlorate based report charges at 20% of black powder limit |

As Table 1 shows, the European Standard, the AFSL standard, and the APA standard all address audible effects (analogous to "reports") through limits in the chemical composition of break charges as well as limits in total pyrotechnic composition. The limits in the standards address both the metallic (flash powder as well as newer hybrid powders) and total mass of the break charge. By limiting the chemical composition in the break charge and the total pyrotechnic material of all devices, as is done in the standards listed, CPSC would capture all fireworks devices that have a break charge, not just those "intended to produce audible effects."

With the exception of the CPSC regulations, all standards consider the use of metallic fuel in the break charge as intended to produce an audible effect. The standards limit the amount of burst charge containing metallic powder under 100 mesh to 130 mg of pyrotechnic composition (however, it should be noted that the European standard limits vary, based on the type of device).

Aluminum is the most common metallic fuel used in fireworks. It is typically used because it increases the heat and energy produced, and makes for more geometrically symmetrical detonations. It can be demonstrated, through a quadratic fit of the data in Table 2, that a 1 percent addition of aluminum will increase the energy by a noticeable amount of 3 percent.[45] Chart 1 displays the quadratic fit of energy versus percent aluminum data found in Table 2. Table 2 demonstrates that as aluminum is increased, so is the amount of explosive power, where it reaches a maximum of 18 percent aluminum content. At an aluminum content of 25 percent, the explosive power begins to diminish as the explosive becomes too fuel-rich and thus, quenching the reaction. This can be seen in Chart 2.

In addition to an increase to explosive power, the addition of aluminum to an energetic material also increases the sensitivity to impact, spark, and friction. This increase in sensitivity could result in accidental ignition, which could likely lead to injury or death. In 2013, a 34-year-old male was seriously injured where he lost an eye and an arm in a fireworks accident that authorities believed involved devices that were accidentally initiated by heat, shock, or friction. Also, in 2013, a 25-year-old male sustained injuries to his left hand and two fingers in addition to lacerations in the thigh, side, and wrist when a "cherry bomb"(typically consisting of flash powder) exploded in his hand allegedly due to the heat of the kitchen at the residence. In 2012, a 16-year-old male was killed when an explosion occurred while he was moving boxes in a fireworks warehouse.[46]

A large piece (greater than 100 mesh) of metal would not necessarily increase the explosive power of the device because the surface area is greater. A greater surface area produces a slower rate of reaction. However, small pieces (under 100 mesh) would burn at an increased rate of reaction, thus increasing the explosive power and injury potential at a close proximity.

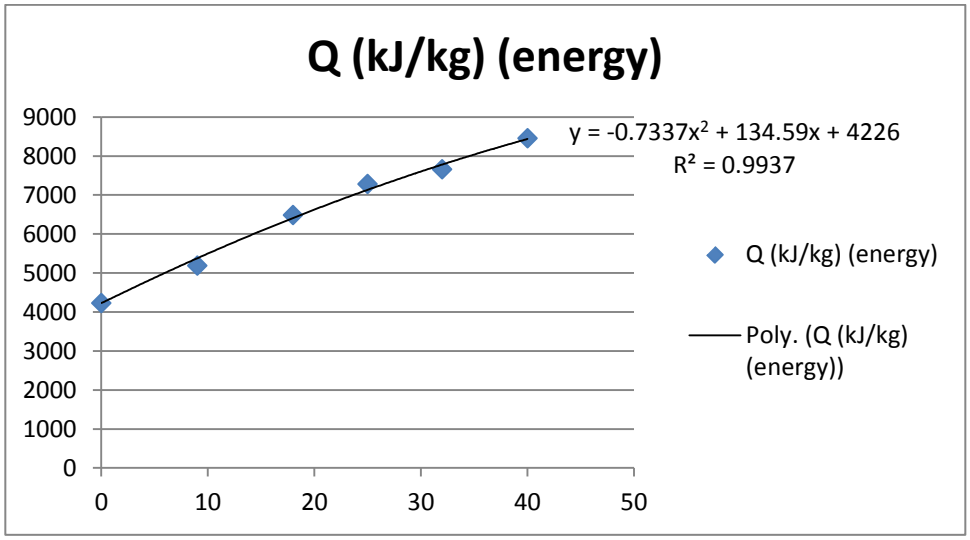
Additionally, the AFSL and APA 87-1 standards limit the ratio of break charge to effects. This is important because if a shell consists of too much break charge relative to effects, the effects could potentially disperse farther and cause flaming debris.

[45] In an explosive reaction, heat and gases are liberated. The volume of the gas (third column in Table 2) and the heat of explosion (second column in Table 2) can both be calculated independently, but these values can be combined to give the value for the explosive power. The term "TNT equivalence" is a normalization technique for equating properties of an explosive to TNT, the standard.
[46] Data supplied by Epidemiology staff

**Table 2**
**Effect of the addition of aluminum on the heat of explosion and volume of gaseous products for TNT/Al[47]**

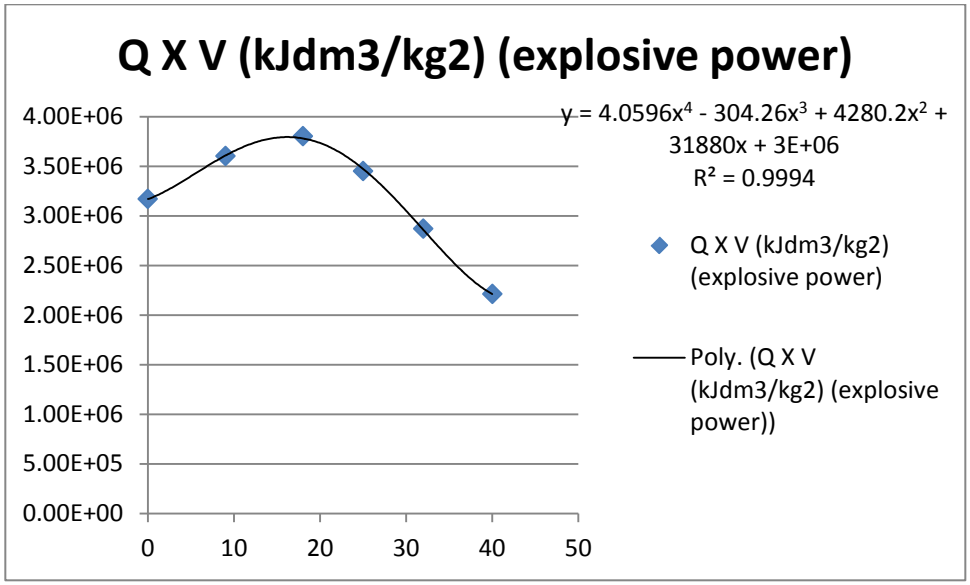
| *Al % weight* | *Q (kJ/kg) (energy)* | *V ($dm^3$/kg) (volume)* | *Q X V ($kJdm^3/kg^2$) (explosive power)* |
|---|---|---|---|
| 0 | 4226 | 750 | 3170000 |
| 9 | 5188 | 693 | 3600000 |
| 18 | 6485 | 586 | 3800000 |
| 25 | 7280 | 474 | 3450000 |
| 32 | 7657 | 375 | 2870000 |
| 40 | 8452 | 261 | 2210000 |

**Chart 1: Energy vs Percent Aluminum**




[47] Akhavan, J. (2011). The Chemistry of Explosives. Cambridge, UK: The Royal Society of Chemistry.

**Chart 2: Explosive Power vs Percent Aluminum**




Because the U.S. Department of Transportation (DOT) has incorporated APA-87-1 by reference into its regulations, companies currently must adhere to APA 87-1 to transport display and consumer fireworks in the United States. Although the AFSL standard is similar, adopting the particular language in APA 87-1 would be more appropriate because this would provide a more harmonized regulatory environment for the fireworks industry and would specifically address the chemical compositions regarding energetic fine mesh metallic fuels. The European Standard language is difficult to incorporate because the European Standard places fireworks devices into different categories than the United States, and the types of devices are unique to Europe.

To reiterate, APA 87-1 states: "any burst charge containing metallic powder (such as magnalium or aluminum) less than 100 mesh in particle size, is considered to be intended to produce an audible effect, and is limited to 130 mg in 1.4G [consumer] fireworks devices." It should be noted that the 130 mg limit (2 grains) is the same as the current CPSC limit. The difference is that the language in APA 87-1 specifically addresses the fact that some chemical compositions of explosives (those containing metallic fuel) are more energetic per volume than those that do not contain metallic fuel. Additionally, APA 87-1 states: "burst charge consisting of black powder or equivalent non-metallic composition is not considered to be intended to produce an audible effect when it is used to expel and ignite a secondary effect in a fireworks device." APA 87-1 also limits the total pyrotechnic and chemical composition, as well as the ratio of effects to break charge to 25 percent and provides quantifiable limits for all devices, not solely those intended to produce audible effects.

Revising § 1500.17(a)(3) to identify all devices and provide a limit based on their explosive power, rather than "intent to produce audible effect," would provide a straightforward and quantitative method for determining whether a device is subject to the 2-grain limit. The devices listed in § 1500.17(a)(3) used flash powder, which is a mixture of an oxidizer (typically potassium perchlorate) and a metallic fuel (typically aluminum) and caused significant injuries and death at the

time the rule was written.[48] Incorporating a methodology that uses modern methods to evaluate the metallic content of a fuel would be consistent with the original intent of the rule.

The European Standard, the AFSL Standard, and APA 87-1 all limit the total pyrotechnic weight of all fireworks devices, not just devices that produce a report. This is important because the energetic power of the device is directly related to the amount of pyrotechnic material in the device. Depending on the type of device, a different limit applies. Staff believes that a limit on the total pyrotechnic weight in all devices is an important component missing in the CPSC regulation because all fireworks have the potential of creating an injury, not just fireworks intended to produce an audible effect.

Because companies must adhere to the DOT limits of pyrotechnic composition and weights to transport fireworks in the United States, staff believes that adopting the APA 87-1 provisions would create a minimal economic burden on the fireworks industry. Currently, the fireworks industry must comply with both the CPSC regulations and APA 87-1. Revising the current FHSA regulation would make testing quantifiable and repeatable, while potentially reducing the economic burden on the fireworks industry (see Tab C for further analysis). Under APA 87-1, each type of device has its own pyrotechnic and chemical limit. Staff recommends the addition of these specific limits into the CPSC regulation.

The APA 87-1 limits for aerial devices are listed below:[49]

A) *Sky Rockets, Bottle rockets, Missile-type rockets, Helicopter (aerial spinners), Roman Candles*: Limited to no more than 20 grams of chemical composition.

B) *Mine and Shell devices*: Total chemical composition is limited to no more than 60 grams per shell. Total chemical composition of multiple-tube devices must not exceed 200 grams unless the tubes are securely attached to a wood or plastic base and the tubes are separated from each other on the base by a distance of at least 0.50 inches (12.7mm) in which case no more than 500 grams of total chemical composition is allowed. Lift charge is limited to a maximum allowance of 20 grams per shell. Lift charge is limited to black powder (potassium nitrate, sulfur, and charcoal) or similar pyrotechnic composition without metallic fuel. The maximum amount of burst charge should not exceed 25% of the total weight of chemical composition in the component. Although not explicitly clear in the APA standard, CPSC staff considers that the 25 percent limit excludes the lift charge because it is not part of "the component" that subsequently bursts in the air.

C) *Aerial Shell with reloadable tube*: Limited to no more than 60 grams per shell. Lift charge is limited to a maximum allowance of 20 grams per shell. Lift charge is limited to black powder (potassium nitrate, sulfur, and charcoal) or similar pyrotechnic composition without metallic fuel. The maximum amount of burst charge should not exceed 25 percent of the total weight of chemical composition in the component. (Although not explicitly clear in the APA standard, CPSC staff considers that the 25 percent limit excludes the lift charge because it is not part of "the component" that subsequently bursts in the air.) The total chemical composition of all the shells in the kit must not exceed 400 grams.

[48] 38 Fed. Reg. 4666 (Feb. 20, 1973); 35 Fed. Reg. 7415 (May 13, 1970).
[49] Definitions of relevant terms are included in section III. F. in this briefing package.

To summarize, staff recommends replacing "intent to produce audible effect" with a quantifiable method of identifying devices, consistent with APA 87-1, such that any burst charge containing metallic powder (such as magnalium or aluminum) less than 100 mesh in particle size is limited to 130 mg; this effectively removes the sound screening test and instead focuses directly on the composition tests. Staff also recommends adopting pyrotechnic and chemical composition limits, consistent with APA 87-1, for all fireworks devices, since all devices cause injuries, not solely those intended to produce audible effects. Additionally, staff plans to exercise enforcement discretion to allow a contamination level of 1.00 percent for metal powder presence in break charges exceeding 2 grains (130 mg). Staff believes that a minimal allowance for trace contamination may reduce the burden on the fireworks industry and the Commission because it will not be necessary to use test methods capable of detecting very low levels of metals, which would require more costly equipment and test methods that have more stringent quality control to prevent contamination at very low levels. Staff believes that trace amounts of metal would not pose an additional safety risk to consumers compared to the same powder without the trace amounts of metal. This is because at trace amounts, the rate of reaction, and thus, the explosive power, would not be affected.

Staff believes that the presence of metal at the level of 1.00 % is minimal enough that it would not significantly increase the amount of energy, as compared to the same powder without trace amounts. At this very low level, the presence of metallic fuel will not have a measureable energetic effect. Staff believes that this allowance would facilitate reasonable testing and production, while still ensuring the same safety as fuel without trace amounts of metals.

There are several other options that the Commission may adopt as a trace allowance of metallic fuels. These options include: allowing trace amounts less than 0.25 percent by weight (consistent with the general limit in APA Standard 87-1); less than 0.01 percent by weight (consistent with CPSIA lead limits); less than 0.05 percent by weight (because CPSC's initial testing indicates that most devices comply with this level); less than 0.01 percent by weight (consistent with the most stringent allowance in the voluntary standards); less than 0.009 percent by weight (consistent with the CPSIA limit on lead compounds in certain consumer materials); or adopt no allowance. Staff is not aware of exposure data regarding the relative safety of the various trace contamination levels identified.

In conclusion, currently, the CPSC regulations only limit the total pyrotechnic composition for devices intended to produce an audible effect (§ 1500.17(a)(3)) and firecrackers (§ 1500.17(a)(8)). The limits are in place to protect consumers from powerful devices. However, all firework devices have a potential for injury, and staff recommends the addition of APA 87-1 limits for the total pyrotechnic composition of all fireworks devices, the total lift charge a device or part of a device may contain, and the mass distribution of break charge to effects. Staff also recommends removing the phrasing "intended to produce audible effects" and instead using a more quantifiable and repeatable determination of devices that should be limited to 2 grains, when a device contains fine mesh metallic fuel under a particle size of 100 mesh.

**Analyses of proposed test method and pyrotechnic limits**

To assess current industry compliance with the APA 87-1 requirement for the total pyrotechnic weight in devices, LSC performed random testing of fiscal year (FY) 2014, FY 2015,

and FY 2016 fireworks samples collected by the Office of Compliance. The process and test results are described below.

### a. Description of Samples

Staff chose fireworks samples of various sizes and types from several manufacturers, based on availability from existing CPSC compliance samples. The two types of devices staff chose for evaluation were reloadable tube mortar devices (Figure 1) and multiple-tube mine and shell devices (Figure 2). These two types of products represent the majority of fireworks devices sampled for compliance evaluation. Staff analyzed the individual devices for powder weights and saved the break charge chemical composition for subsequent elemental analysis.

**Figure 1: Example of a Reloadable Tube Mortar Device**

**Figure 2: Example of a Mine Shell Device**

### b. Analysis of Pyrotechnic Composition Mass for Individual Components

APA 87-1 section 3.1.2.5 states that if the break charge is composed of black powder or equivalent non-metallic composition, consumer fireworks may have a maximum break charge of 25 percent by weight of the device's total pyrotechnic composition in each component. If the break charge contains a fine particulate metal fuel (for example, aluminum or the aluminum-magnesium

alloy called magnalium), the charge is, by definition, "intended to produce an audible effect" and the limit for the break charge is 130 mg.

APA 87-1 limits the mass of the lift charge to a maximum allowance of 20 grams per shell in both reloadable aerial shells (APA 87-1 section 3.1.2.5) and multiple-tube mine and shell devices (APA 87-1 section 3.1.2.6). For reloadable aerial shell devices, the maximum amount of pyrotechnic composition allowed in a single shell is 60 grams. For multiple-tube mine or shell devices, the maximum amount of pyrotechnic material is 200 grams total, unless the tubes are securely attached to a wood or plastic base and the tubes are separated from each other on the base by a distance of at least 0.50 inches (12.7 mm). In this case, no more than 500 grams of total chemical composition is allowed.

Staff carefully dissected and subsequently analyzed 42 (12 reloadable aerial shell devices and 30 multiple-tube mine or shell devices) uniquely labeled "sample devices" to obtain the lift charge, break charge, and effect weights. Following CPSC's staff's testing protocol,[50] staff separated the break charge from the effects by passing the pyrotechnic contents of the shell through a 100-mesh sieve. Tables 3 and 4 show the results of the pyrotechnic components analysis.

**Table 3: Mass of Pyrotechnic Composition for Reloadable Aerial Shells**

| Sample Number | Lift Charge (g) | Break Charge (g) | Effect Mass (g) | Total Pyrotechnic Composition (g) | Ratio[51] | CPSC Field Test Pass/Fail (Report weight only)* | Pass/Fail under proposed requirements (mass and ratio only)** |
|---|---|---|---|---|---|---|---|
| 30 | 4.881 | 2.995 | 19.26 | 27.132 | 13.50% | Pass | Pass |
| 31A | 5.437 | 2.626 | 17.52 | 25.583 | 13.00% | Pass | Pass |
| 31B | 5.691 | 4.823 | 30.24 | 40.751 | 13.80% | Pass | Pass |
| 32 | 3.826 | 8.222 | 24.83 | 36.877 | 24.90% | Pass | Pass |
| 33 | 4.226 | 1.951 | 19.88 | 26.061 | 8.90% | Pass | Pass |
| 34 | 7.826 | 6.38 | 18.21 | 32.417 | 26.00% | Fail | Fail |
| 35 | 6.437 | 10.23 | 34.55 | 51.214 | 22.80% | Fail | Pass |
| 36 | 8.721 | 9.369 | 29.4 | 47.486 | 24.20% | Fail | Pass |
| 37 | 8.78 | 11.59 | 26.37 | 46.744 | 30.50% | Fail | Fail |
| 38 | 6.47 | 9.477 | 33.11 | 49.057 | 22.30% | Pass | Pass |
| 39 | 8.159 | 6.428 | 28.34 | 42.927 | 18.50% | Fail | Pass |
| 40 | 7.641 | 7.732 | 29 | 44.368 | 21.10% | Fail | Pass |

[50] Consumer Product Safety Commission, "Consumer Fireworks Testing Manual" (Aug. 17, 2006).
[51] Ratio of burst charge mass to total pyrotechnic composition excluding lift charge mass

* Staff determined a report weight only if they found an audible effect in even one trial for a particular sample during field testing. Staff deemed a pyrotechnic composition mass for material passing through a 100-mesh sieve greater than 130 mg (2 grains) a failure for that sample.
** Although these samples passed or failed for mass and ratio under the proposed requirements, they may have failed for other proposed changes, such as metallic fuel content greater than 2 grains (see Table 5)

**Table 4: Mass of Pyrotechnic Composition for Mine Shell Devices***

| Sample Number | Max Pyro Comp (g) | Number of Tubes per device | Lift Charge Average (g) | Break Charge Average (g) | Effect Mass Average (g) | Total Pyro Comp (g)** | Ratio | CPSC Pass/Fail (Report weight only)*** | Pass/Fail under proposed requirements (mass and ratio only) **** |
|---|---|---|---|---|---|---|---|---|---|
| 41 | 200 | 10 | 2.938 | 3.348 | 8.009 | 142.953 | 29.50% | Pass | Fail |
| 42 | 500 | 28 | 3.494 | 2.576 | 11.341 | 487.508 | 18.50% | Pass | Pass |
| 43 | 500 | 36 | 1.613 | 1.754 | 7.606 | 395.028 | 18.70% | Pass | Pass |
| 44 | 500 | 15 | 3.394 | 3.341 | 12.467 | 288.02 | 21.10% | Pass | Pass |
| 45 | 500 | 9 | 8.159 | 1.271 | 30.769 | 361.788 | 4.00% | Pass | Pass |
| 46 | 500 | 30 | 3.189 | 3.684 | 8.948 | 474.66 | 29.20% | Pass | Fail |
| 47 | 200 | 19 | 2.157 | 2.298 | 6.979 | 217.24 | 24.80% | Pass | Fail |
| 48 | 500 | 25 | 3.337 | 1.881 | 11.605 | 420.567 | 13.90% | Pass | Pass |
| 49 | 200 | 16 | 2.312 | 2.042 | 6.948 | 180.843 | 22.70% | Pass | Pass |
| 50 | 200 | 25 | 2.692 | 2.732 | 4.097 | 238.025 | 40.00% | Pass | Fail |
| 51 | 500 | 18 | 5.009 | 3.525 | 17.293 | 464.892 | 16.90% | Pass | Pass |
| 52 | 500 | 16 | 3.859 | 2.228 | 12.267 | 293.669 | 15.40% | Pass | Pass |
| 53 | 500 | 24 | 3.844 | 3.103 | 2.905 | 236.448 | 51.60% | Pass | Fail |
| 54 | 200 | 9 | 3.334 | 3.54 | 13.39 | 182.376 | 20.90% | Pass | Pass |
| 55 | 500 | 30 | 3.841 | 3.631 | 9.42 | 506.76 | 27.80% | Pass | Fail |
| 56 | 500 | 16 | 10.472 | 3.031 | 20.522 | 544.395 | 12.90% | Pass | Fail |
| 57 | 200 | 20 | 2.168 | 0 | 5.093 | 145.22 | 0.00% | Pass | Pass |
| 58 | 200 | 24 | 2.161 | 2.835 | 6.709 | 280.912 | 29.70% | Pass | Fail |
| 59 | 500 | 47 | 2.643 | 0 | 6.233 | 417.156 | 0.00% | Pass | Pass |
| 60 | 500 | 30 | 3.34 | 2.741 | 8.509 | 437.7 | 24.40% | Pass | Pass |
| 61 | 500 | 30 | 3.465 | 3.846 | 8.547 | 475.76 | 31.00% | Pass | Fail |
| 62 | 200 | 25 | 2.071 | 2.407 | 5.851 | 258.225 | 29.10% | Pass | Fail |
| 63 | 500 | 30 | 3.835 | 0.906 | 8.821 | 406.85 | 9.30% | Pass | Pass |
| 64 | 500 | 10 | 7.081 | 2.335 | 31.234 | 406.493 | 7.00% | Fail | Pass |
| 65 | 500 | 9 | 7.32 | 0.744 | 29.646 | 339.384 | 2.40% | Pass | Pass |
| 66 | 500 | 12 | 3.224 | 3.232 | 10.47 | 203.112 | 23.60% | Pass | Pass |
| 67A | | 110 | 0.78 | 0 | 2.363 | | 0.00% | Pass | Pass |
| 67B | 500 | 5 | 3.191 | 1.965 | 7.544 | 409.175 | 20.70% | Pass | Pass |
| 68A | | 12 | 4.375 | 1.762 | 19.826 | | 8.20% | Pass | Pass |
| 68B | 500 | 3 | 7.299 | 1.612 | 41.241 | 461.994 | 3.80% | Pass | Pass |

* Staff obtained averages from three random shells per sample sub. Individual weights of shells (lift, break, and effects) are listed in Appendix 1.
** Staff determined total pyrotechnic weight by multiplying the sum of the average lift, break, and effect masses by the respective total number of tubes in the shell. The letter designations "A" and "B" indicate the presence of different diameter tubes in a single device. Staff took three measurements of each diameter and calculated the total pyrotechnic composition as one device.
*** Staff determined a report weight only if they observed an audible effect in even one trial for a particular sample during field testing. Staff deemed a pyrotechnic composition mass for material passing through a 100-mesh sieve greater than 130 mg (2 grains) a failure for that sample.

**** Although these samples passed or failed for mass and ratio under the proposed requirements, they may have failed for other proposed changes, such as metallic fuel content greater than 2 grains (see Table 5)

### c. Break Charge Chemical Analysis

Staff used X-Ray Fluorescence spectroscopy (XRF) to analyze the break charge for elemental analysis and tested several samples using Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES) to quantify the aluminum content (Table 5). This was done to verify if any of the break charge masses contained metallic fuel with a particle size under 100 mesh, and thus, according to APA 87-1, were "intended to produce an audible effect" (report) and are limited to 130 mg (2 grains). Violations are discussed below. Staff also tested the effects for potential contamination sources to the break charge (Tables 6-9).

**Table 5: Elemental Composition of Break Charge via X-Ray Fluorescence (XRF) and Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES)**

| Sample number | Aluminum content XRF (ppm Al) | Aluminum content ICP (% Al ) | CPSC Pass/Fail (Report weight only)* |
|---|---|---|---|
| 1 | 3883 | Not Tested | Pass |
| 2 | ND | Not Tested | Pass |
| 3 | 31300 | Not Tested | Pass |
| 4 | 29300 | Not Tested | Pass |
| 5 | 2052 | Not Tested | Pass |
| 6 | 6766 | Not Tested | Pass |
| 7 | 19800 | Not Tested | Pass |
| 8 | ND | Not Tested | Pass |
| 9 | 17500 | Not Tested | Pass |
| 10 | 34600 | Not Tested | Pass |
| 29 | 5654 | Not Tested | Pass |
| 11 | 6905 | Not Tested | Pass |
| 12 | ND | Not Tested | Pass |
| 13 | 6089 | Not Tested | Pass |
| 14 | 27800 | Not Tested | Pass |
| 30 | ND | Not Tested | Pass |
| 31A | 5339 | Not Tested | Pass |
| 31B | 5165 | Not Tested | Pass |
| 32 | ND | Not Tested | Pass |
| 33 | 41600 | Not Tested | Pass |
| 22 | ND | Not Tested | Pass |
| 23 | 12400 | Not Tested | Pass |
| 24 | 17100 | Not Tested | Pass |

| | | | |
|---|---|---|---|
| 25 | ND | Not Tested | Pass |
| 26 | 17600 | Not Tested | Pass |
| 34 | 51600 | Not Tested | Pass |
| 18 | 26800 | Not Tested | Pass |
| 20 | 16000 | Not Tested | Pass |
| 21 | 23000 | Not Tested | Pass |
| 15 | 28500 | Not Tested | Pass |
| 16 | 29000 | Not Tested | Pass |
| 28B | 1808 | Not Tested | Pass |
| 69 | 9,516 | Not Tested | Pass |
| 70 | 33,900 | Not Tested | Pass |
| 71 | 62,000 | Not Tested | Fail |
| 72 | 10,900 | Not Tested | Pass |
| 73 | ND | Not Tested | Fail |
| 74 | 98,300 | Not Tested | Fail |
| 75 | 97,740 | Not Tested | Fail |
| 76 | ND | Not Tested | Fail |
| 77 | 8,812 | Not Tested | Fail |
| 78 | ND | Not Tested | Fail |
| 79 | 75,400 | Not Tested | Pass |
| 80 | 81,000 | Not Tested | Pass |
| 81 | 23,400 | Not Tested | Pass |
| 82 | 3,596 | Not Tested | Pass |
| 83 | 9,458 | Not Tested | Pass |
| 84 | 2,766 | Not Tested | Pass |
| 85 | 20,600 | Not Tested | Pass |
| 86 | 2,766 | Not Tested | Pass |
| 87 | 110,000 | 12.7 | Pass |
| 88 | 109,000 | 10.7 | Pass |
| 89 | 94,400 | 10.1 | Pass |
| 90 | 169,000 | 13.0 | Pass |
| 91 | 144,000 | 14.1 | Pass |
| 92 | 139,000 | 11.1 | Pass |
| 93 | 129,000 | 12.9 | Pass |
| 94 | 104,000 | 10.4 | Fail |
| 95 | 93,300 | 8.8 | Fail |
| 96 | 124,000 | 8.4 | Fail |
| 97 | 119,000 | 10.2 | Fail |
| 98 | 81,100 | 9.7 | Fail |
| 99 | 238,000 | 18.4 | Fail |

| | | | |
|---|---|---|---|
| 100 | 159,000 | 20.4 | Fail |

ND indicates None Detected.

* Staff determined a report weight only if they found an audible effect in even one trial for a particular sample during field testing. Staff deemed a pyrotechnic composition mass for material passing through a 100-mesh sieve greater than 130 mg (2 grains) a failure for that sample.

**Table 6: Analysis of Aluminum Content in Break Charges Using ICP-OES and XRF**

| Sample Number | ICP-OES Analysis: %Al | XRF Analysis: %Al |
|---|---|---|
| 1 | 2.05 | 3.04 |
| 2 | 2.00 | 2.84 |
| 3 | 2.27 | 2.92 |
| 4 | 2.98 | 3.84 |
| 5 | 3.55 | 3.32 |
| 6 | 1.89 | 3.06 |
| 7 | 1.49 | 3.84 |
| 8 | 1.68 | 2.35 |
| 9 | 15.23 | 14.52 |
| 10 | 15.25 | 15.70 |
| 11 | 15.09 | 13.58 |
| 12 | 15.70 | 13.95 |
| 13 | 15.38 | 15.33 |
| 14 | 14.20 | 17.43 |
| 15 | 7.42 | 7.98 |
| 16 | 7.38 | 8.71 |
| 17 | 7.20 | 8.28 |
| 18 | 8.01 | 8.07 |
| 19 | 13.33 | 16.99 |
| 20 | 14.77 | 17.93 |
| 21 | 13.65 | 17.16 |
| 22 | 12.58 | 16.88 |
| 23 | 14.74 | 17.29 |
| 24 | 15.55 | 17.33 |
| 25 | 14.50 | 19.40 |
| 26 | 14.77 | 18.86 |
| 27 | 14.45 | 19.60 |
| 28 | 15.48 | 13.05 |
| 29 | 14.97 | 13.88 |
| 30 | 13.81 | 12.92 |
| 31 | 16.81 | 15.18 |
| 32 | 15.69 | 17.79 |
| 33 | 14.11 | 18.57 |
| 34 | 16.28 | 12.91 |
| 35 | 15.74 | 15.85 |
| 36 | 15.80 | 14.45 |

**Table 7: ICP-OES Analysis of Strontium in Break Charge and Effects**

| Sample Number | Effects: %Sr | Break Charge: %Sr |
|---|---|---|
| 1 | 2.21 | 0.31 |
| 2 | 5.73 | 0.30 |
| 3 | 4.67 | 0.28 |
| 4 | 9.60 | 0.25 |
| 5 | 9.97 | 0.34 |
| 6 | 4.39 | 0.31 |

**Table 8: ICP-OES Analysis of Copper in Break Charge and Effects**

| Sample Number | Effects: %Cu | Break Charge: %Cu |
|---|---|---|
| 1 | 6.94 | 0.25 |
| 2 | 3.32 | 0.28 |
| 3 | 9.72 | 0.25 |
| 4 | 14.47 | 0.23 |
| 5 | 13.59 | 0.38 |
| 6 | 12.57 | 0.29 |
| 7 | 7.97 | 0.18 |

**Table 9: ICP-OES Analysis of Barium in Break Charge and Effects**

| Sample Number | Break Charge: %Ba | Small Effects: %Ba | Large Effects: %Ba |
|---|---|---|---|
| 1 | 9.18 | 4.07 | 6.95 |
| 2 | 8.76 | 2.22 | 13.78 |
| 3 | 9.43 | 3.52 | 9.25 |
| 4 | 9.65 | 2.73 | 7.70 |

**d. Discussion of Results**

Two (17%) reloadable aerial shell devices that staff analyzed (Table 3) had a break charge-to-effect ratio above the 25 percent mass ratio allowed under APA 87-1. None of the analyzed reloadable aerial shells contained more than the allowable 20 grams of lift charge or 60 grams of total pyrotechnic composition.

Eight out of the 30 (27%) analyzed multiple-tube mine and shell devices (Table 4) had a break charge-to-effects ratio above the 25 percent mass ratio allowed under APA 87-1. None of the 30 analyzed multiple-tube mine and shell devices had a lift charge in excess of the allowed 20 grams. Six of the 30 (20%) analyzed multiple-tube mine and shell devices had a total pyrotechnic composition greater than the allowed 200 grams or 500 grams (APA 87-1 section 3.1.2.5), depending on the base construction. Four of these six failures also failed the 25 percent mass-ratio requirement.

According to APA 87-1 section 2.5, any break charge containing metallic powder (such as aluminum) less than 100-mesh in particle size is considered to be "intended to produce an audible effect." Of the 64 break charge pyrotechnic materials available and further examined by XRF and ICP (Table 5), 54 contained detectable quantities of aluminum. All aluminum-containing break charges exceeded the 130 mg limit specified in APA 87-1.

Additional testing of reloadable aerial shell devices utilizing ICP-OES and XRF for detection of aluminum content was completed to address the validity of XRF as a viable screening technique. Table 6 illustrates a close correlation between the data obtained via ICP-OES and the data obtained via XRF. Therefore, LSC staff believes that screening for aluminum in fireworks devices through XRF is a viable method of detection.

Strontium is metal that is often used in the visual effects of fireworks because when it burns, it provides a red color. Similarly, copper can be used to produce a blue color and barium can be used to produce a green color. Several samples of reloadable aerial shell devices were analyzed by ICP-OES to address the potential of contamination of the break charge from the effects, where a 100 mesh sieve was used to separate the two components. Table 7 displays the amount of strontium found in both the break charge and the effects. Although, strontium appears to be present in both components, it is significantly lower in the break charge where it was found to be no greater than 0.34 percent. Table 8 shows similar results for copper. This strontium and copper analysis demonstates the unlikeliness of the effects to contaminate the break charge. Table 9 displays the amount of barium in the effects and the break charge. It should be noted here, however, that the samples used for this analysis had two different sizes of effects and they were analyzed separately. Here, it can be seen that both the effects along with the break charge had noticeable amounts of barium. The potential source of barium in the break charge of these samples could be attributed to barium nitrate, a potential oxidizer in the explosive reaction of the break charge. Additionally, staff found no measurable amount of residue after vigorous agitation of the effects isolated by themselves.

To understand if the manufacturing environment could be a potential source of aluminum contamination, staff analyzed the lift charges of 16 devices using ICP-OES. Staff found that none of the lift charges in the devices contained more than 0.02% aluminum.

Both the CPSC regulation and APA 87-1 are intended to address the same hazard regarding devices, “intended to produce an audible effect.” Only seven devices failed the CPSC test method for determining whether a device is “intended to produce an audible effect,” while 54 failed the APA method. Both APA 87-1 and the CPSC test method would keep M-80s and silver salutes out of the public’s hands; however, the standards do so through different means. Devices that staff determined were “intended to produce an audible effect” during field trials and that exceeded the 2-grains (130 mg) limit, also contained metallic fuel, thus failing the APA 87-1 requirement. Although the methods of identifying these devices are different, both protect against the hazards from fireworks devices with high explosive content.

CPSC staff believes that adopting a repeatable and quantifiable identification method, consistent with APA 87-1, would help the fireworks industry to attain a higher rate of compliance and improve safety through greater consistency in results by providing a clearer, more uniform, and more quantifiable identification method. The recommended test method, which relies on precise and quantifiable measurements rather than experienced observation and subsequent quantifiable measurements, greatly reduces variation.

**e. Conclusion**

The APA standard sets requirements for fireworks devices that can be evaluated using analytical laboratory methods that are reliable and repeatable. There is less room for variability with a method

that relies purely on identifying the presence of a material of a particular size in an identifiable weight. The CPSC regulation bans devices that are "intended to produce audible effects" that have a charge of more than 2 grains, but the requirement does not provide objective criteria to identify the devices that are subject to this limit. CPSC staff believes that due to the changing fireworks industry and advances in pyrotechnic materials technology, the recommended test method is a reliable way to identify these more powerful devices. CPSC staff recommends removing the language "intended to produce audible effects," and incorporating language that specifies a quantifiable analytic method. By doing so, CPSC would be aligning with the DOT's regulations for consumer fireworks, which incorporate by reference the comparable method in APA 87-1. This would provide the fireworks industry with a uniform regulatory framework and reduce the burden on industry of having to comply with two different tests. Staff also recognizes that all devices have a potential for injury, not just devices with metallic fuel; as such all devices should have a specified pyrotechnic limit.

**16 C.F.R. Part 1507**

Part 1507 specifies certain prohibited chemicals in fireworks devices and sets forth performance and design requirements for the fuses, bases, and pyrotechnic chambers. CPSC staff recommends the following additions:

**§ 1507.2 (Prohibited Chemicals)**

**1. Addition of HCB and Lead**

Section 1507.2 lists various chemicals that are prohibited in fireworks devices. Health Sciences reviewed the merits of these chemicals and recommended adding to the prohibited chemicals list lead, lead compounds, and hexachlorobenzene (HCB) (see HS memorandum provided in this briefing package). Adding these chemicals would not place a large burden on CPSC. Lead can be quickly detected via XRF, and HCB would require detection by Gas Chromatography – Mass Spectroscopy (GC-MS), which the CPSC already maintains and operates.

Staff tested some current compliance samples for presence of lead (table 6) and found that only one sample contained lead at greater than 0.25 percent.

A study by Schwarz et al. (2014)[52] screened 220 samples for HCB content in fireworks. The vast majority of samples showed concentrations below 5 mg HCB/kg. Three samples out of the 220 tested gave a value above 0.01 percent (1.36%). This means that 98.6 percent of samples tested for HCB would be compliant, if the Commission allowed for trace contamination up to 0.01 percent.

**2. Allowance of Trace Amounts**

As currently written, the regulation prohibits any amount of the chemicals listed, making the testing and manufacturing of devices that comply with this requirement difficult and expensive. Instrumentation used in chemical analysis has improved greatly since the rule was enacted. As a result, trace amounts of chemicals that previously went undetected are now identified in tested samples at very low levels (*e.g.*, parts per million or parts per billion). For this reason, staff recommends allowing for a reasonable amount of prohibited chemicals as impurities.

[52] Schwarz S. (2014). Screening of hexachlorobenzene (HCB) contents in fireworks.

CPSC staff believes that trace amounts of the prohibited chemicals currently in the CFR as well as lead and HCB being recommended for addition, may not pose a safety risk to consumers and will allow for less costly production and quality control methods. When in trace amounts, these chemicals are not intentionally added into the products, but are present in background levels in the environment and as contaminants in manufacturing. Complete removal of the chemicals from the end product would necessitate ensuring that they are not present in the environment during production. Staff believes that this recommended allowance would not change any current practice, but would preclude adoption of hazardous practices in the future, while facilitating reasonable and cost-effective testing. Many of the prohibited chemicals are listed in the regulation due to their instability in the manufacturing process and storage. Therefore, it is in the fireworks industry's best interest to avoid the use of the listed chemicals.

There are several other options for adopting as a general allowance for all prohibited chemicals or as trace allowances for particular chemicals, such as HCB and lead tetroxide and other lead compounds. These options include allowing trace amounts less than 0.25 percent by weight (consistent with the general limit in APA Standard 87-1 and LSC recommendation); less than 0.01 percent by weight (consistent with CPSIA lead limits); less than 0.05% by weight (since CPSC's initial testing indicates that most devices comply with this level); less than 0.01 percent by weight (consistent with the most stringent allowance in the voluntary standards); less than 0.009 percent by weight (consistent with the CPSIA limit on lead compounds in certain consumer materials); or adopt no allowance for certain chemicals. The Commission does not have exposure data regarding the relative safety of the various trace contamination levels identified.

With additional information and public input, staff believes that setting an appropriate limit on trace amount would simultaneously protect consumers and account for the advances in detection technology. Accordingly, staff recommends allowing a reasonable amount of the chemicals as impurities to facilitate reasonable and cost-effective testing without posing any increase in risk.

To evaluate how prevalent trace amounts of prohibited chemicals are present in fireworks devices, CPSC investigated the presence of titanium (Ti) content in some FY 2014 and FY 2015 compliance fireworks samples. Titanium that is 100-mesh or less in particle size is currently prohibited in § 1507.2, APA 87-1 and the AFSL voluntary standard. Staff tested lead simultaneously, due to the nature of the instrumentation and the ease in doing so.

### a. Test Method

After staff removed the break charge pyrotechnic composition from the device and passed it through a No. 100-mesh sieve, they used XRF to test the break charge for elemental composition. The benefits of XRF testing include a lack of further sample preparation and simultaneous testing of all elements of the periodic table above magnesium in atomic number. This means that the XRF testing is very cost effective for routine elemental analysis screening.

### b. Results

Table 8 lists the quantity of lead and titanium detected in the samples.

**Table 8: Elemental Composition of Break Charge via X-Ray Fluorescence (XRF)**

| Sample | Titanium Content (ppm Ti) | Lead (ppm Pb) |
|---|---|---|
| 1 | 170 ± 38 | ND |
| 2 | 258 ± 34 | ND |
| 3 | 293 ± 36 | ND |
| 4 | 148 ± 50 | ND |
| 5 | 157 ± 39 | 27 ± 3 |
| 6 | 231 ± 62 | 7369 ± 59 |
| 7 | ND | ND |
| 8 | 298 ± 38 | ND |
| 9 | ND | ND |
| 10 | 244 ± 44 | 452 ± 11 |
| 29 | 133 ± 39 | ND |
| 11 | 222 ± 19 | 38 ± 2 |
| 12 | 292 ± 19 | ND |
| 13 | 123 ± 41 | ND |
| 14 | 175 ± 40 | ND |
| 30 | 89 ± 33 | ND |
| 31A | 92200 ± 600 | 66 ± 5 |
| 31B | 89400 ± 600 | 72 ± 5 |
| 32 | 441 ± 35 | ND |
| 33 | 7108 ± 78 | ND |
| 22 | 276 ± 54 | 276 ± 6 |
| 23 | 248 ± 39 | ND |
| 24 | 121 ± 58 | ND |
| 25 | 121 ± 37 | ND |
| 26 | 481 ± 40 | ND |
| 34 | 536 ± 48 | 30 ± 4 |
| 18 | ND | 32 ± 5 |
| 20 | 155 ± 50 | ND |
| 21 | 315 ± 56 | 417 ± 10 |
| 15 | 191 ± 53 | 432 ± 11 |
| 16 | 274 ± 49 | 427 ± 11 |
| 28A | 119 ± 41 | ND |

Note: "ND" indicates "None Detected"

**c. Discussion of Results**

Although almost every device CPSC staff evaluated contained detectable quantities of titanium, only three (highlighted) out of the 32 devices (9%) contained greater than 2,500 ppm (0.25%), which is the current APA 87-1 allowance for trace amounts. Additionally, 12 out of 32 samples (38%) contained lead at detectable levels, but only one contained it at levels greater than 0.25 percent. The trace quantity in a vast majority of samples was likely due to incidental contamination.

Without a recognized allowable trace contamination limit, chemical composition testing may involve Inductively Coupled Plasma (ICP) for parts per million (ppm) or parts per billion (ppb) elemental analysis, Scanning Electron Microscopy – Energy Dispersive X-Ray Spectroscopy (SEM-EDS) for particle size and elemental identity confirmation, Gas- Chromatography-Mass Spectroscopy (GC-MS) for organic compound identification and quantification, or Ion

Chromatography (IC) for ionic species recognition and quantification. There is often significant sample preparation required for each of these techniques. Allowing trace contamination leaves room for a screening tool, such as XRF, that requires minimal sample preparation, which represents significant time and cost savings to confirm compliance.

Although APA 87-1 currently allows for trace amounts at 0.25 percent, the majority of the samples staff tested contained amounts much lower than 0.25 percent. Staff recognizes that a risk assessment of all chemicals currently prohibited by the fireworks regulations., as well as chemicals staff recommends prohibiting to align with the international standards would be costly and time consuming. Although this would be helpful in identifying whether a lower trace allowance limit is appropriate, staff recommends adopting the current DOT and APA 87-1 standard and conducting additional research on whether a higher trace allowance limit would be appropriate.

### d. Conclusions

LSC recognizes that trace quantities of some chemicals may be present, due to contamination or impurities. Although a risk assessment has not been performed and would be difficult and costly to complete, it is reasonable to assume that there is a trace amount that would not increase safety risk for the consumer and facilitate reasonable and cost-effective testing. These chemical elements and compounds are regulated in § 1507.2 for various valid and important reasons. Often pyrotechnic composition involving these regulated materials is more energetic or easy to initiate accidentally. Additionally, some of these chemicals are known carcinogens and environmental contaminants. However, there are significant additional burdens placed on the fireworks industry and the CPSC by the absence of a trace allowance limit that would not impact safety. Staff recommends considering the industry interpretation of trace amounts (0.25%). Nearly all of the devices tested contained less than 0.05 percent of titanium or lead. Staff recommends working with the public to determine whether alternative limits on these chemicals are warranted for reasons currently unknown to CPSC.

## § 1507.3 (Fuses)

Section 1507.3 details fusing requirements for fireworks. The first requirement aims to reduce the possibility of side ignition of the fuse. However, the regulation does not specifically articulate a test method to explain to what extent the fuse needs to reduce side ignition, nor does the regulation specifically articulate a test method for measuring side ignition. Instead, this information is found in the CPSC Consumer Fireworks Testing Manual (Test Manual). The Test Manual indicates how the side of the fuse that protrudes from the device (including any tape or paper attached to the fuse) must be tested to evaluate how long it resists ignition from a cigarette. The Test Manual specifies testing for up to 5 seconds, but CPSC considers fuses that resist ignition for 3 seconds to be compliant. The AFSL and APA 87-1 test methods and 3 second resistance times are similar.

Between October 2005 and February 2015, CPSC staff tested 2,835 fireworks samples, where there have been 28 violations of the CPSC standard. This accounts for less than 2.5 percent of all fireworks violations during this same period.[53] This indicates significant compliance with this

[53] Data supplied by CPSC Compliance staff.

provision, but there are still some violations. In FY 2015, 211 samples were tested for side ignition. One sample had a side-ignition time of less than 3 seconds; 12 samples had a side-ignition time between 3 and 5 seconds; and 198 samples had a side-ignition time of 5 seconds or more. These data indicate that the CPSC compliance threshold of 3 seconds is reasonable. To clarify the regulation, staff recommends adding the current CPSC test method, and compliance guidance of 3 seconds of resistance to side fuse ignition to the C.F.R.

Although staff found in their testing that a large number of products are in compliance, staff recognizes that the potential for injury or death from noncompliance could be very high. Fireworks that function inadvertently because of side-fuse ignition present a significant hazard to a person lighting the firework and to any bystanders. As such, staff recommends codifying the current test requirement.

**§ 1507.4 (Bases)**

Section 1507.4 describes the performance requirement for the base of a fireworks device—specifically, the allowable relative dimensions of the base and the height of the device. Both APA 87-1 and the AFSL standard require that the base remain attached during transportation, handling, and normal operation of the device. If the base is not attached properly, injuries can result from unstable devices. Evaluation of anecdotal data indicates that from FY 2000 to FY 2016, at least 2 percent of samples tested had base separation.[50] However, more than 50 percent of incidents involving devices with base separation occurred between FY 2010 to FY 2016, indicating a decrease in compliance in the latter portion of this period.

Based on Human Factors staff's assessment, attaching the base to a fireworks device is a critical task to setting up fireworks for safe use. There are various reasons why the base may not be attached to the device or may be attached inadequately. For example, consumers may commit a skill-based error, such as slips, which are errors that are caused by lack of attention, where a simple, frequently performed physical action goes wrong, or short-term memory lapses lead to omitting a required action. Consumers may also commit a rule-based mistake, where they inadequately attach the base to the device. Requiring fireworks devices to come attached to the base would minimize the likelihood of user errors. In addition, having a base may signal to consumers that the fireworks device needs to be placed on a flat surface, rather than hold it in their hands or on an unstable surface.

During routine field testing of fireworks samples, LSC staff observed multiple "tip overs" of reloadable tubes. These tubes are designed to launch single-shot mortars multiple times. These tubes are not attached to a base, but rather, they are placed in a cardboard box. Lacking any stability, the tubes fall or tip-over when the mortar is launching. This can lead to serious injury or death. LSC staff recommends adding a requirement that the base must remain attached to the device during storage, handling, and normal operation, which is consistent with APA 87-1 and the AFSL standard.

**§ 1507.6 Addition of definitions (Burnout and Blowout)**

[50] Because CPSC does not currently have a requirement for base attachment, CPSC staff does not test for base attachment when testing samples of fireworks. However, when samples are examined and the bases are not attached, a note is typically made in the testing record.

According to § 1507.6, fireworks devices must be constructed to allow functioning in a normal manner without blowout or burnout. This is an important safety consideration. Blowouts often create a large explosion, low to the ground, where debris can injure spectators. Burnouts can cause fires, leading to property damage and injury.

Although CPSC staff believes the terms "burnout" and "blowout" are well understood by the fireworks industry, staff recommends defining the terms in the regulation to ensure a consistent and clear understanding of the terms. Staff recommends adding the APA 87-1 definitions of these terms. Staff believes the APA definitions accurately express the CPSC's and industry's understanding of these terms. Additionally, because the DOT incorporates APA 87-1 by reference, by extension, the DOT also incorporates APA 87-1 definitions. The addition of definitions may clarify and streamline the regulation and would align CPSC regulations with the DOT.

**Additional Recommendations**

1. ***Fragments***

Based on the reports of fireworks-related incidents that the CPSC received and the in-depth investigations of fireworks incidents that CPSC staff conducted, eight possible injury cases between 2005 and 2015 were found that involved projected fragments from fireworks. Staff could not determine whether these injuries resulted from a fragment from inside the fireworks device, or whether the sharp fragments resulted from debris in the surrounding area of the explosion. Regardless, the possibility of injury due to projected fragments certainly exists. In addition, during testing of fireworks devices, staff has often observed hard plastic, metal, or other fragments expelled from fireworks. This information is not regularly noted in the test reports because it is not one of the required tests. However, staff believes that these hard fragments present an unreasonable risk of injury to consumers.

APA 87-1 addresses this risk by prohibiting devices from projecting fragments when firing. To align CPSC standards with the internationally recognized standard and to address this safety issue, staff recommends that the Commission consider adding this requirement.

2. ***Definitions***

Staff recommends expanding the definitions section in 16 C.F.R. § 1500.3 to provide clarity and consistency in interpreting and applying regulatory requirements. In particular, the clarifications and changes that staff is recommending involve specific terms that require precise definitions to be clear about the requirements. These terms include "aerial bombs," "lift charge," "burst charge," "expelling charge," "break charge," chemical composition," "pyrotechnic composition," "explosive composition," and "firecracker." Staff recommends adding the APA 87-1 definitions of relevant terms. Staff believes that the APA definitions accurately express CPSC and industry understanding of these terms. Additionally, because the DOT incorporates by reference APA 87-1, by extension, the DOT also incorporates APA 87-1 definitions. Adding the definitions would clarify the regulation and harmonize with the DOT.

*Lift charge*: pyrotechnic composition used to propel a component of a mine or shell device into the air. Lift charge is limited to black powder (potassium nitrate, sulfur, and charcoal) or similar pyrotechnic composition without metallic fuel.

*Burst charge, Expelling charge or Break charge*: Chemical composition used to break open a device after it has been propelled into the air, producing a secondary effect, such as a shower of stars. Burst charge containing metallic powder, such as aluminum or magnalium, is limited to 2 grains.

*Chemical composition*: All pyrotechnic and explosive material contained in a fireworks device. Inert materials, such as clay used for plugs, or organic matter, such as rice hulls used for density control, are not considered to be chemical composition. This includes lift charge, burst charge, and visible/audible effect materials.

*Pyrotechnic composition*: A chemical mixture, which upon burning, and without explosion, produces visible or brilliant displays or bright lights, or whistles, or motions.

*Explosive Composition*: Any chemical compound or mixture, the primary purpose of which is to function by explosion, producing an audible effect (report) in a fireworks device.

*Firecracker:* Small, paper-wrapped or cardboard tube containing not more than 50 mg of explosive composition, those used in aerial devices may contain not more than 130 mg of explosive composition per report. Upon ignition, noise and a flash of light are produced.

**Appendix 1: Pyrotechnic weights**

| Sample | Lift Charge 1 (g) | Lift Charge 2 (g) | Lift Charge 3 (g) | Break Charge 1 (g) | Break Charge 2 (g) | Break Charge 3 (g) | Effect Mass 1 (g) | Effect Mass 2 (g) | Effect Mass 3 (g) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.005 | 2.892 | 2.917 | 3.120 | 2.922 | 4.002 | 6.776 | 7.465 | 9.787 |
| 2 | 3.390 | 3.454 | 3.637 | 2.653 | 2.656 | 2.420 | 10.702 | 10.519 | 12.802 |
| 3 | 1.258 | 1.825 | 1.756 | 1.715 | 1.732 | 1.816 | 7.487 | 7.764 | 7.566 |
| 4 | 3.476 | 3.544 | 3.161 | 3.206 | 3.242 | 3.574 | 12.266 | 12.673 | 12.462 |
| 5 | 8.745 | 8.453 | 7.278 | 1.021 | 1.057 | 1.736 | 30.845 | 31.785 | 29.676 |
| 6 | 3.434 | 3.131 | 3.003 | 3.915 | 3.331 | 3.807 | 10.467 | 10.051 | 6.327 |
| 7 | 1.981 | 2.153 | 2.338 | 2.310 | 2.276 | 2.307 | 5.055 | 7.825 | 8.056 |
| 8 | 3.140 | 3.673 | 3.197 | 1.942 | 2.017 | 1.683 | 11.593 | 12.518 | 10.705 |
| 9 | 2.372 | 2.322 | 2.242 | 2.052 | 2.012 | 2.063 | 6.956 | 6.566 | 7.323 |
| 10 | 2.124 | 2.954 | 2.999 | 2.651 | 2.724 | 2.820 | 4.189 | 4.044 | 4.058 |
| 11 | 5.055 | 5.198 | 4.775 | 2.379 | 4.073 | 4.123 | 15.747 | 17.577 | 18.555 |
| 12 | 3.752 | 3.848 | 3.978 | 2.374 | 1.953 | 2.357 | 12.619 | 12.232 | 11.950 |
| 13 | 3.957 | 4.056 | 3.519 | 3.451 | 2.464 | 3.395 | 0.000 | 0.000 | 8.714 |
| 14 | 3.735 | 3.473 | 2.795 | 3.589 | 3.530 | 3.501 | 13.290 | 13.425 | 13.454 |
| 15 | 3.879 | 3.874 | 3.771 | 3.596 | 3.690 | 3.606 | 9.792 | 8.739 | 9.729 |
| 16 | 10.495 | 10.463 | 10.457 | 2.556 | 3.196 | 3.342 | 20.257 | 20.437 | 20.871 |
| 17 | 2.093 | 2.483 | 1.927 | 0.000 | 0.000 | 0.000 | 5.758 | 5.130 | 4.392 |
| 18 | 2.215 | 2.226 | 2.041 | 2.839 | 2.807 | 2.859 | 6.890 | 6.546 | 6.691 |
| 19 | 2.442 | 2.758 | 2.728 | 0.000 | 0.000 | 0.000 | 5.934 | 6.189 | 6.576 |
| 20 | 3.449 | 3.114 | 3.456 | 3.505 | 2.380 | 2.338 | 7.303 | 9.793 | 8.432 |
| 21 | 3.835 | 3.251 | 3.309 | 3.753 | 3.809 | 3.977 | 8.954 | 7.809 | 8.879 |
| 22 | 2.017 | 2.164 | 2.033 | 2.161 | 2.769 | 2.291 | 5.925 | 5.789 | 5.838 |
| 23 | 3.966 | 3.966 | 3.573 | 0.000 | 0.000 | 2.718 | 10.319 | 7.644 | 8.499 |
| 24 | 6.674 | 7.439 | 7.130 | 2.950 | 2.722 | 1.332 | 29.441 | 30.315 | 33.945 |
| 25 | 7.111 | 7.451 | 7.398 | 0.546 | 0.744 | 0.941 | 28.349 | 28.043 | 32.545 |
| 26 | 3.156 | 3.067 | 3.448 | 3.495 | 2.532 | 3.670 | 8.779 | 10.100 | 12.531 |
| 27A | 0.749 | 0.81 | | 0 | 0 | | 2.308 | 2.418 | |
| 27B | 3.191 | | | 1.965 | | | 7.544 | | |
| 28A | 4.651 | 4.098 | | 2.336 | 1.187 | | 20.25 | 19.401 | |
| 28B | 7.299 | | | 1.612 | | | 41.241 | | |

*Sample contained 110 small tubes and 5 larger tubes.
**Sample contained 12 small tubes and 3 larger tubes.

**UNITED STATES**
**CONSUMER PRODUCT SAFETY COMMISSION**
**4330 EAST WEST HIGHWAY**
**BETHESDA, MD 20814**

Memorandum

Date: December 14, 2016

TO : Rodney Valliere, Project Manager, Lab Sciences

THROUGH : Gregory B. Rodgers, Ph.D., Associate Executive Director,
Directorate for Economic Analysis
Robert Franklin, Senior Staff Coordinator,
Directorate for Economic Analysis

FROM : Robert Squibb, Directorate for Economic Analysis

SUBJECT : Fireworks Notice of Proposed Rulemaking: Preliminary Regulatory Analysis

## Preliminary Regulatory Analysis Memorandum

### Background

The Consumer Product Safety Commission (CPSC or the Commission) is considering a draft proposed rule to revise the regulations concerning fireworks in 16 C.F.R. parts 1500 and 1507. The requirements in the draft proposed rule are based on the recommendations that the CPSC staff developed during a review of all regulations pertaining to fireworks and are generally intended to harmonize the existing CPSC regulations with the voluntary standard established by the American Pyrotechnic Association (APA 87-1).[54] This memorandum provides a preliminary regulatory analysis of the draft proposed rule.

### The Product

Consumer fireworks are fireworks intended to be used by consumers and are distinct from display fireworks, which are intended to be used by professionals at public fireworks displays. According to the APA, an industry trade group, consumer fireworks are distinct from display fireworks based on intended use and amount of chemical composition. The import, sale, and manufacturing of display fireworks are under the jurisdiction of the Bureau of Alcohol, Tobacco, Firearms, and Explosives and the U.S. Department of Transportation (DOT). Consumer fireworks have many different varieties, including firecrackers, bottle rockets, sparklers, fountains, Roman Candles, wheels, and several others.

[54] CPSC Staff, Fireworks Rule Review Briefing Package (December 30, 2015)

## The Market for Consumer Fireworks

According to data from the APA, sales of consumer fireworks have grown relatively steadily from 1998 to 2014.[55] In real terms, sales of consumer fireworks have increased from roughly $412 million in 1998, to roughly $695 million in 2014, or about 69 percent.[56] A substantial majority of consumer fireworks sales are of imported fireworks. The U.S. International Trade Commission (ITC) reported total imports for 2014 and 2015 for all consumer fireworks were $215 million and $279 million, respectively.[57]

The American Fireworks Standards Laboratory (AFSL), which conducts testing and certification for a substantial portion of the industry, maintains a public list of U.S. importers and Chinese manufacturers that participate in its programs. AFSL's list includes 165 importers, of which six are large, 121 are small, and the remaining 38 are of unknown size, although likely small.[58] AFSL claims its members represent 85 percent to 90 percent of U.S. importers, estimating a total market size of 183 to 194 importers.

## Other Federal Regulations and Voluntary Standards for Fireworks

Staff considered three standards for fireworks in drafting the proposed rule: APA voluntary standard 87-1 (APA 87-1), the AFSL standard, and EN 15947-1–15947-5: Pyrotechnic Articles-Fireworks, Categories 1, 2, and 3 (European Standard). Additionally, DOT incorporates by reference APA 87-1 into its regulations, which apply to fireworks when transported in commerce. Because all fireworks sold to consumers are, at some point, transported in commerce, all consumer fireworks fall under the jurisdiction of DOT and are subject to the requirements of APA 87-1. However, DOT's jurisdiction only extends to issues related to transportation safety, and DOT's compliance enforcement program is limited by that scope. Theoretically, the proposed adoption of a regulation with which industry is already required to comply (by DOT) should incur little to no cost, but evidence suggests less than full compliance with the non-transportation requirements of the standard by industry. As such, estimates of current compliance with DOT/APA 87-1 are used to generate estimates of the noncompliance burden to manufacturers imposed by the draft proposal.

## Regulatory Analysis of the Draft Proposed Rule

[55] APA Facts and Figures. *American Pyrotechnics Association.* Accessed April 12, 2016. http://www.americanpyro.com/assets/docs/FactsandFigures/fireworks%20revenue%20by%20industry%20segment%201998-14.pdf.

[56] In real terms, sales of display fireworks increased from $204 million in 1998 to $332 million in 2014, or about 63 percent. In both cases, the reported sales revenues for 1998 were inflated to 2014 dollars using the consumer price index.

[57] The ITC data report import value as "value of first sale" and are not comparable to APA sales data. The concept of "value of first sale" allows importers to report the value of goods as the first sale price recorded for those goods in a series of sales from manufacturer to middleman to importer.

[58] According to criteria established by the Small Business Administration, fireworks manufacturers (NAICS code 325998) are considered to be small if they have fewer than 500 employees. Importers (NAICS code 423920, if a wholesale distributor, or 453998, if a retailer) are considered to be small if they have fewer than 100 employees (wholesalers) or less than $7.5 million in sales (retailers). CPSC staff made these determinations using information from Dun & Bradstreet and ReferenceUSA, as well as firm websites.

The draft proposed rule includes provisions that are intended to limit the explosive force of consumer fireworks. The draft proposed rule also contains provisions to add hexochlorobenzene, lead, and other lead compounds to the list of chemicals banned in fireworks; require testing for side ignition of fuses; require bases for fireworks be attached to the device, and remain attached through storage, handling, and operation; prohibit consumer fireworks from containing fragments of glass or hard plastic; and amend the existing regulations to allow for trace contaminants of the banned chemicals. These provisions are explained in greater detail below.

Finally, the draft proposed rule includes several provisions that do not materially affect the requirements, but clarify the existing requirements. For example, the draft proposal includes several new definitions for terms based on industry understanding and their use in the voluntary standards.

**Requirements Intended to Limit the Explosive Force of Consumer Fireworks**

The draft proposed rule includes two sets of requirements intended to limit the explosive force of consumer fireworks, by limiting the composition or size of the burst charge in aerial fireworks, and by limiting the total pyrotechnic material allowable in certain firework types. The draft proposal would amend § 1500.17(a)(3) to replace the current portion of the regulation, which limits the total pyrotechnic material in fireworks "intended to produce an audible effect" to 2 grains (130 mg), with a requirement consistent with the AFSL and the APA requirements that limit the total pyrotechnic material to 2 grains if metallic powders are present. Both the existing CPSC standard and the APA standard are intended to address hazards that might be associated with higher explosive force per volume in fireworks. Fireworks using metallic fuels with metal particles below 100 mesh in size have greater explosive force per volume of pyrotechnic material than fireworks using only black powder. Pyrotechnic materials that contain metallic powders are frequently used by fireworks manufacturers to produce sharp, clear audible effects in aerial devices. Although all devices will produce audible effects, the audible effect may be a byproduct of the explosion of the break charge required to disperse the visual elements of the firework, and is not the primary intended effect of the device.

To identify whether a device is subject to the current requirements, CPSC staff applies an initial filter, where staff listens to the device during field testing and if a loud report is heard, the device is considered to be "intended to produce an audible effect." The draft proposed rule would adopt the method used in APA 87-1, which considers any burst charge that contains metallic powder, less than 100 mesh in particle size, to be subject to composition limits that align with APA 87-1. Therefore, the draft proposed requirement would be enforced by testing pyrotechnic material for the presence of metal powders, less than 100 mesh in particle size, which can be accomplished using various techniques, including x-ray fluorescence spectroscopy (XRF). This method of enforcement is more easily repeatable with identical results by industry than the current CPSC test method.

The draft proposed rule would not change the amount of material considered to be a pyrotechnic overload. Both the existing regulation (§ 1500.17(a)(3)) and the draft proposed CPSC regulations limit the total amount of pyrotechnic material in fireworks designed to produce an audible effect, less than 100 mesh in particle size, or that contain metallic powder, to 2 grains (130 milligrams).

CPSC's current regulations and testing rely on a method of detonating the devices, listening for an audible effect, and then measuring the pyrotechnic contents to determine if there is pyrotechnic overload. It requires substantial training of the technicians performing the tests to distinguish the difference between the quality of sound or "loud report" made by a firework device intended to produce an audible effect from the quality of the sound produced simply as a byproduct of the explosion of the break charge intended only to disperse the visual effects. Because AFSL and APA make the determination of whether a device is intended to produce audible effects solely by the presence of metallic powder in the burst charge, the test is more objective and the results more repeatable.

Testing by CPSC suggests that adopting the draft proposed standard will result in a somewhat more stringent rule. Of 32 samples staff tested from one manufacturer, two failed using the current CPSC test method, and 25 failed the method associated with the draft proposed standard, due to detection of metallic powder less than 100 mesh in particle size. The two samples failing the current CPSC test method also failed when screened for metallic powder, less than 100 mesh in particle size.[59] In many instances, the technicians did not detect a loud report during testing and "passed" the device. However, due to the presence of metallic powders, the burst charge would be subject to the 2-grain limit, and in fact, would have more explosive force per volume of pyrotechnic material. Therefore, this could result in a stronger explosion than expected by the consumer.

Although the APA standard has been adopted and mandated by DOT, CPSC Laboratory Sciences testing of compliance samples revealed a greater than 85 percent noncompliance rate with the draft proposed standard (54 samples out of 64 tested failed, using the APA 87-1 standard proposed for adoption.)

To comply with the draft proposed requirements, staff expects fireworks producers to use only black powder formulations. Per CPSC Laboratory Sciences staff, the amount of explosive power necessary to produce an effect in aerial fireworks is higher than the explosive power derived from 2 grains (130 mg) of metallic or hybrid powder, the limit on pyrotechnic load, if metallic powders are present. Therefore, staff expects industry to comply with the regulation by eliminating metallic powder from the formulations used in fireworks, rather than comply through a reduction in the total amount of pyrotechnic material in the device.

The estimated rate of compliance with the draft proposed regulation implies that fireworks producers will incur some costs to comply with the new regulation. Per CPSC laboratory sciences staff, one of the reasons fireworks producers do not currently exclusively use black powder formulations is they believe that consumers prefer the more concentrated explosion of metallic and hybrid fuels. However, if CPSC's current test method of listening for a difference in report is difficult for producers to repeat, the ability of untrained consumers to differentiate between the effects of a metallic or hybrid powder formulation and a black powder formulation is doubtful.

The costs of switching from metallic and hybrid powders to black powder should not create a significant impact for firms that have to change formulations. Staff examined retail prices of

[59] CPSC Memorandum from Jason E. Howe to Priscilla M. Verdino, "APA 87-1 Harmonization Investigation," U.S. Consumer Product Safety Commission, Bethesda, MD (April 17, 2015).

aluminum and other popular powders, along with black powder kits.[60] Retail prices for aluminum powder typically used ranged from $18.35 per pound to $38.67 per pound. Black powder kits sold for approximately $5.20 per pound. The maximum cost for switching would be a firework switched from the maximum allowable metallic powder (130 mg) to the maximum allowable black powder burst charge in the draft proposed rule (15 g).[61] A firework producer switching from 130 mg of aluminum powder purchased for $18.35 per pound to 15 g of black powder purchased for $5.20 per pound would incur a materials cost increase of $0.17 per shell.[62] Because these mine/shell devices typically sell for $4 to $5 per shell, the difference in fuel costs could represent up to 4 percent of retail revenues. As fireworks manufacturers are unlikely to pay retail prices for fuels, this is probably a high estimate of the cost of bringing noncompliant devices into compliance.

Another provision of the draft proposed rule that is intended to limit the explosive force of consumer fireworks further would amend § 1500.17 to limit the total amount of pyrotechnic material in consumer fireworks, not only those that are "intended to produce an audible effect." Under the draft proposed rule, sky rockets, bottle rockets, missile-type rockets, helicopters (aerial spinners), and Roman Candles would be limited to 20 grams of chemical composition. Mine and shell devices would be limited to 60 grams of total pyrotechnic chemical composition in any shell, and the lift charge could not contain more than 20 grams of black powder. The lift charge must contain only black powder. Multiple-tube devices could contain up to 200. The burst charge of any component would not be allowed to exceed 25 percent of the total pyrotechnic material weight of the component. Aerial shells with reloadable tubes would be limited to 60 grams of pyrotechnic material per shell, 20 grams of black powder in the lift charge, and 400 grams per device total, with the burst charge limited to 25 percent of the total pyrotechnic material weight. The limits specified align with APA 87-1, and are high enough to allow sufficient explosive force for a viable fireworks device, even accounting for switching from flash powder and hybrid formulations to black powder exclusively. The limits would not preclude the existence of any device types based on an inability to function with the limited amount of pyrotechnic material, and only represent a limit on the size.

Compliance samples from FY 2003 to FY 2015 revealed that only 1 percent of fireworks are potentially noncompliant with the draft proposed burst charge provisions in the limits on pyrotechnic weight. This represents a low-end estimate for noncompliance. However, the Laboratory Sciences memorandum in this package describes testing by CPSC staff, which found two of 12 sample reloadable shell devices did not comply with the draft proposed burst charge limits, and eight of 30 sample multiple-tube mine and shell devices did not comply with the draft proposed burst charge limits. Although this testing cannot be generalized to the fireworks industry as a whole, it suggests that a significant number of firms may be noncompliant with the draft proposed regulations. To comply with the additional regulations, currently noncompliant fireworks producers likely would be forced to implement some quality control to their production to limit devices to the proscribed amount of pyrotechnic material. The limits do not preclude the existence of any device types based on an inability to function with the limited amount of pyrotechnic material, and only represent a limit on the size. Given the handmade production methods, a quality control system to comply with the draft proposed regulations could consist of changes such as a one-time adoption of smaller measuring devices for filling fireworks with pyrotechnic material.

---

[60] Skylighter Fireworks and Pyrotechnic Chemicals. Accessed 8/3/2016. http://www.skylighter.com/mall/chemicals.asp.
[61] The draft proposed rule would limit the total pyrotechnic material in mine and shell devices to 60 grams and the burst charge would be limited to no more than 25 percent of the total.
[62] 15 grams is approximately 0.0331 pounds.

In summary, the two draft provisions intended to limit the explosive force of fireworks limit the explosive force of any fireworks device to the force produced by either 130 mg of flash powder or the specific amount of black powder allowed for the device. The benefits of this provision cannot be quantified because CPSC Health Sciences staff cannot determine the degree to which injuries and deaths increase in occurrence or severity due to pyrotechnic overload, as opposed to the limited loading in the draft proposed rule. In cases of intentional misuse, accidents, or malfunctions, in which the device could explode in close proximity to people, the draft proposed requirements could somewhat limit, but not prevent, the potential damage. While CPSC testing indicates a significant portion of firms will need to modify their production to comply with the draft proposed regulation, the cost of modifying devices that do not now comply with these draft proposed provisions would be restricted to limiting the use of flash powder, increasing the amount of black powder, and low-cost changes to the manufacturing processes, such as using smaller measuring devices.

**Add Hexachlorobenzene, Lead, and Lead Compounds to Banned Chemicals in Fireworks**

The draft proposal would add hexochlorobenzene (HCB), lead, and lead compounds to the list of chemicals prohibited in consumer fireworks. The toxicity of both HCB and lead compounds is well documented.[63] Both chemicals were once prominent in fireworks formulations, but have since largely fallen out of use, although there are indications that HCB is still present in trace amounts in fireworks.[64] APA 87-1 prohibits the use of lead tetroxide and other lead compounds, while the AFSL standard prohibits the use of HCB, lead, and lead compounds. Testing by AFSL indicates there is already widespread compliance with these prohibitions. Both additional chemicals would be banned under the proposed rule, although trace amounts would be permitted.

Lead was traditionally used in creating "crackle" effects, but bismuth trioxide has largely replaced lead in fireworks as the chemical used to create crackle effects.[65] Bismuth trioxide is less expensive and a more effective legal substitute. HCB was typically used in fireworks as a color enhancer. However, because HCB has been banned by AFSL and by the European Standard, fireworks manufacturers apparently have stopped using HCB in fireworks. According to a study in the Journal of Pyrotechnics, when a sample of 220 fireworks was tested for HCB, only four of the 220 samples (1.8%) tested positive at a concentration higher than 50 mg per kilogram.[66] This study was an update of the 2012 Chemical Legislation European Enforcement Network (CLEEN) testing cited in the toxicology memorandum in this briefing package.[67] These analyses are consistent with CPSC scientific staff estimates of high compliance with the existing voluntary standards. Because of the high rates of compliance, staff expects the addition of lead and HCB to the list of prohibited

---

[63] CPSC Memorandum from Eric Hooker to Priscilla Verdino, "Toxicology of Hexachlorobenzene and Lead Compounds in Fireworks," U.S. Consumer Product Safety Commission, Bethesda, Maryland (May 13, 2015).
[64] Schwarz S. (2014). Screening of hexachlorobenzene (HCB) contents in fireworks.

[65] Dejka, Joe. June 30, 2008. Lead-tainted Fireworks Rarely Reach Store Shelves. "Omaha World-Herald," pg. 01. Retrieved from Lexis Nexis Academic 4/11/2015.
[66] Schwarz, Silke, et. al. Screening of Hexachlorobenzene (HCB) Contents in Fireworks. *Journal of Pyrotechnics*. Issue 33, 2014, pp3-8.
[67] CPSC Memorandum from Eric Hooker to Rodney Valliere, "Toxicology of Hexachlorobenzene and Lead Compounds in Fireworks," U.S. Consumer Product Safety Commission, Bethesda, Maryland (August 8, 2016).

chemicals to pose minimal burden to industry and have little effect on the societal costs associated with fireworks devices.

**Require Testing for Side Ignition of Fuses**

The draft proposal includes altering the regulatory language in § 1507.3 to include a test for side ignition of fuses. The test to be required is the test currently specified in the CPSC Consumer Fireworks Testing Manual. The test requires placing the lit end of a cigarette directly against the side of a fuse and observing how much time elapses before it ignites.

CPSC testing has indicated that 99.5 percent of fireworks pass the test for side ignition. The remaining 0.5 percent of fireworks may fail the test because they have not been treated to prevent side ignition or have not been sufficiently treated or coated to prevent side ignition within 3 seconds. Without specifying a test method, CPSC's current regulations leave open to interpretation what constitutes an effective treatment of a fuse for side ignition.

The addition of the test method to the regulation would make it necessary for fireworks manufacturers and importers to actually conduct the test to issue a certificate of compliance with their products. It is unknown at this time what proportion of fireworks currently are tested for side ignition of fuses. However, a reasonable testing program associated with this requirement is unlikely to create a significant impact on fireworks producers. Conceivably, a producer could test its treatment or coating on a sample of fuses, conclude the treatment or coating is effective, and simply use these test results to certify all fireworks in which the fuses are used. Thus, a producer could amortize the costs of fuse testing across all fireworks sold with fuses, and still be compliant with the draft proposed requirement.

Because CPSC testing for side ignition of fuses is currently done in accordance with the draft proposed regulation, staff expects to see little change in societal costs from the addition to the regulation. CPSC testing and enforcement of the side ignition regulation, as currently written, has not been challenged by industry, despite the increased stringency relative to the voluntary standard. By incorporating the method of testing from the CPSC Testing Manual into the regulation and mandating testing, staff hopes to eliminate any confusion between the voluntary and mandatory standard requirements for side ignition of fuses.

**Require Bases to Remain Attached During Storage, Handling, and Operation**

The draft proposed rule includes a requirement for bases to remain attached to fireworks during storage, handling, and operation. Currently, the regulations only specify the required size of base attachments. Staff expects minimal impact to manufacturers from the draft proposed requirements for base attachments. CPSC does not test for base attachment when testing samples of fireworks, but on occasions where bases were not attached or detached, staff may note this in the testing record. In fireworks tested from fiscal year 1999 to the present, out of 4,554 relevant samples, 111 samples (2.4%) contained notes indicating that bases were either missing or functioned improperly during operation.

For devices not currently meeting the requirements, staff expects firms to comply by either adapting the firework design so the device and base are all one piece, or securing the base to the rest of the device with an adhesive. The potential costs of complying with this aspect of the draft proposed regulation include additional time in affixing the base to the firework (seconds per device);

acquiring materials for affixing the base to the device; and paying potential shipping costs associated with higher volume per device, when the base is attached rather than separate. For devices that are initially produced with bases attached, but the bases detach during storage, handling, and operation, some measure of quality control may be necessary to ensure that detachment does not occur.

Improper attachment of the base or base detachment often leads to devices tipping over upon use. Fireworks not launched at the intended launch angle pose a hazard to consumers by exploding too low, or even launching horizontally, directly at consumers. The granularity of CPSC epidemiological data does not allow for identifying which incidents fitting the hazard pattern are associated with base detachment, as opposed to more general tipovers. However, staff believes that there could be some reduction in societal costs associated with the draft proposed requirements for bases.

**Prohibit Fragments in Fireworks**

The draft proposed rule includes an additional ban on fireworks expelling or dispersing fragments of metal, glass, or brittle plastic upon operation. This ban is also in APA 87-1 and the AFSL voluntary standard. CPSC does not have information on compliance rates with the draft proposed ban, and does not keep testing data related to fragments because there is no provision in the C.F.R. currently banning them. However, CPSC Laboratory Sciences staff has observed fragments falling from detonated fireworks during testing. Incident data from 2005 to 2015 reveals eight potential incidents associated with fragments in fireworks. CPSC staff believes the fragments expelled and dispersed from fireworks are typically due to manufacturers' intentional use of metal, glass, or brittle plastic components. These components are not part of the effects associated with the device, but may play a role in the functioning of the device. To comply with the draft proposed rule, fireworks producers would have to redesign their products to not require the use of these components or use greater quality control to ensure that these components, when used, are not expelled or dispersed by the device. CPSC staff has little information on what the expected costs of these changes would be for firms. Anecdotally, the proportion of tested fireworks expelling or dispersing fireworks may likely be less than 10 percent of devices, but without collecting data on fireworks fragments, staff cannot verify this estimate.

**Allow for Trace Contaminants of Prohibited Chemicals**

The draft proposed rule would amend § 1507.2 to allow for trace amounts of up to 0.25 percent of the chemicals prohibited in fireworks, including lead. The limit for HCB content would be .01 percent to match the allowance for trace contamination in the AFSL standard. At these levels, there is no practical purpose to add these chemicals to fireworks; their presence at this level would be due to trace contamination only. This provision would harmonize the CPSC regulations with the allowance in APA 87-1. In the time since this section of the CPSC regulations was developed, testing equipment has become much more advanced and capable of detecting increasingly lower concentrations of banned chemicals in fireworks. Because of these advancements, banned chemicals are being detected and samples destroyed in cases where the concentration of the chemicals pose little to no hazard to consumers. From fiscal year 2000 to 2015, CPSC compliance officers reported 41 violations of § 1507.2. Of these violations, four came from samples that contained banned chemicals in concentrations below the draft proposed allowances. The total lot value of the four lots is $7,109. Over 15 years, this comes to less than $500 per year, which represents the theoretical

reduction in cost to industry should this provision be adopted. Additional burden reduction may be realized because fireworks manufacturers would no longer incur the costs of reducing concentrations of banned chemicals from the trace allowance level to zero, although quality control programs in place will be likely to remain in place to prevent contamination from banned chemicals above the allowance.

**Summary**

The draft proposed provisions to revise the regulations governing consumer fireworks represent CPSC staff's recommendations to enhance consumer safety and minimize the burden on the fireworks industry to comply. CPSC staff cannot quantify the societal benefits expected from adoption of the draft proposed regulations because injury and mortality data do not specify the required cause. Fireworks are an inherently dangerous product; staff's recommendations are designed to reduce, not eliminate the hazards associated with consumer fireworks.

CPSC staff believes the draft proposed provisions are unlikely to result in significant burdens imposed on industry. CPSC staff has identified the likely modifications to products and production methods needed where products must be brought into compliance. Where possible, staff has estimated these costs. However, in many instances, data on specific costs for modifications are unavailable. CPSC staff welcomes comment on the modifications and estimated costs presented in the regulatory analysis.

**Provisions Intended to Clarify Existing Requirements**

The draft proposed rule includes several provisions that are not intended to change the existing regulations substantively. Rather, the changes are intended to clarify the meaning or scope of the requirements. Staff does not believe there will be costs or benefits associated with these draft changes, beyond the benefits created by clarifying and improving the understanding of the regulated community about the requirements. These changes are discussed below:

**Define "Aerial Bomb" and Clarify the Regulations Using the Term:** Currently, the regulations mention the term "aerial bomb" as both subject to the limits described in § 1500.17(a)(3) and subject to the ban described in § 1500.17(a)(8). The draft proposed rule would remove the term from § 1500.17(a)(3) to clarify that the only applicable regulation for such devices is § 1500.17(a)(8).

**Modify the Exemption for Firecrackers from 16 C.F.R. Part 1507:** The draft proposed rule would define the term "firecracker" and would replace the current global exemption for firecrackers in § 1507.1 (Scope) with exemptions for firecrackers in §§ 1507.2 (Banned Chemicals) and 1507.3 (Fuses). The remaining subsections of part 1507 do not apply to firecrackers.

**Define Several Terms in the C.F.R.:** The draft proposed rule would add several definitions for terms used, but not defined, in the regulations. CPSC staff believes that the draft proposed definitions are consistent with industry use and understanding of these terms; and staff also believes that for certain terms there is consistency with the definitions used in the CPSC Test Manual. The terms that the draft proposed rule would define are "aerial bomb," "blowout," "burnout," "chemical composition," "base," "lift charge," "burst charge," "explosive composition," "firecracker," and "pyrotechnic composition."

## Alternatives to the Draft Proposed Regulations

Staff considered alternatives to provisions of the draft proposed rule that would impose new requirements for consumer fireworks. In all cases, one of the alternatives is for the Commission not to adopt the proposed rule, and instead, take no action. Some of the other proposed provisions have additional alternatives considered by Commission staff. These alternatives are discussed below.

### Alternatives to the Provisions Related to "Explosive Force"

If the Commission chose not to adopt the draft proposed provision (which would replace the current regulations regarding devices "intended to produce an audible effect" with the APA limitations on burst charges containing metallic powder, less than 100 mesh in particle size), the cost to industry could be somewhat less. This is because industry would not have to bring the devices that currently do not comply (estimated to be about 30 percent of the devices on the market), into compliance. However, APA and AFSL have supported the Commission adopting the draft proposed provision because they claim industry finds the current CPSC test method more difficult to duplicate, creating regulatory uncertainty.[68]

An additional consideration is that both the existing requirement on fireworks intended to produce audible effects and the APA 87-1 limitations on break charges containing metallic powderless than 100 mesh in particle size, are intended to limit the use of flash powder in consumer fireworks. Flash powder has up to five times the explosive force as a similar volume of black powder. In addition, simply adding aluminum powder to black powder also increases the explosive force by up to two times the explosive force of black powder alone. If the provisions limiting the use of metallic powders less than 100 mesh in particle size were not adopted, then even if the limits on total pyrotechnic material were established, consumer fireworks could have substantially more explosive force, which could potentially lead to an increase in injuries. Accordingly, staff recommends adopting the draft proposed regulations.

Staff considered recommending taking no action regarding the draft regulations limiting total pyrotechnic weight and chemical composition. Staff also considered recommending a test to measure the explosive force of a firework. Staff recommends the draft proposed regulation to close the compliance gap existing with the voluntary standard that creates a significant, if not directly quantifiable, potential hazard for consumers. Staff recommends the draft proposed regulation to minimize the burden on industry through aligning with the voluntary standard. Other potential tests for explosive force proved more costly to both industry and CPSC to use. One other such test involves a chamber for detonating a firework and measuring the explosive force. Therefore, staff recommends adopting the draft proposed requirements on the total pyrotechnic content of fireworks devices.

### Alternative of No Action Regarding Hexachlorobenzene, Lead, and Lead Compounds

For the additions of lead, lead compounds, and HCB to the banned chemicals list, the alternative of no action would likely have little reduction in costs to manufacturers because

[68] Correspondence letter from AFSL to CPSC.

compliance with the draft proposed provision is already high. Staff also considered recommending the addition of only HCB or lead and lead compounds to the list of prohibited chemicals and allow various levels of contamination for each chemical. Staff recommends including HCB, lead, and lead compounds to the list of chemicals prohibited from consumer fireworks because these chemicals are toxic and provisions regarding these chemicals are already included in the voluntary standards. Moreover, there is some benefit to harmonizing the requirements across agencies and voluntary standards.

**Alternative of No Action Regarding Base Attachment**

Staff considered the alternative of taking no action concerning base attachment. However, if the base became detached and the consumer still attempted to use the firework, perhaps by propping the firework up, holding it, or attempting to reattach the base, the risk of the device toppling during use and firing the aerial device or shells directly at consumers or in another unsafe direction could result in serious injuries or property damage. Therefore, even though compliance with the similar provision in APA 87-1 is thought to be high, staff recommends including this provision to reduce the risk to consumers and to harmonize the CPSC regulations with the voluntary standard.

**Alternative of No Action Regarding Fragments in Fireworks**

Staff considered the alternative of taking no action to ban fragments in fireworks. APA 87-1 already includes this provision, and compliance with the provision is high. Therefore, if the Commission did not adopt this provision, there would likely be little observable impact on societal injuries associated with fragments in fireworks devices or the societal cost of complying with the fireworks regulations. However, CPSC staff recommends adopting this regulation to ensure a low risk to consumers from fragments dispersed by fireworks and to harmonize the CPSC regulations with the voluntary standard.

**UNITED STATES**
**CONSUMER PRODUCT SAFETY COMMISSION**
**4330 EAST WEST HIGHWAY**
**BETHESDA, MD 20814**

Date: December 14, 2016

TO : Rodney Valliere, Project Manager, Lab Sciences

THROUGH : Gregory B. Rodgers, Ph.D., Associate Executive Director, Directorate for Economic Analysis
Robert Franklin, Senior Staff Coordinator, Directorate for Economic Analysis

FROM : Robert Squibb, Directorate for Economic Analysis

SUBJECT : Fireworks NPR Initial Regulatory Flexibility Analysis

## Regulatory Flexibility Analysis Memorandum

## Background

The U.S. Consumer Product Safety Commission (CPSC or the Commission) is considering a draft proposed rule to amend the regulations concerning fireworks (16 C.F.R. parts 1500 and 1507). The draft proposed rule would make changes to federal regulations to bring the Code of Federal Regulations (C.F.R.) in line with existing U.S. Department of Transportation (DOT) regulations and voluntary standards and to improve consumer safety. Staff provided the Commission with an informational briefing package on December 30, 2015, following staff's review of all regulations pertaining to consumer fireworks. After publishing this package, the Commission approved the FY 2016 Operating Plan, directing staff to draft a notice of proposed rulemaking (NPR) regarding the fireworks regulations.

Whenever an agency is required to publish an NPR, section 603 of the Regulatory Flexibility Act (5 U.S.C. 601-612) requires that the agency prepare an initial regulatory flexibility analysis (IRFA) that describes the impact that the rule would have on small businesses and other entities. An IRFA is not required if an agency certifies that the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities. 5 U.S.C. 605. The IRFA must contain –

1. a description of why action by the agency is being considered;
2. a succinct statement of the objectives of, and legal basis for, the proposed rule;
3. a description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply;
4. a description of the projected reporting, recordkeeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record; and
5. an identification to the extent practicable, of all relevant federal rules which may duplicate, overlap or conflict with the proposed rule.

In addition, the IRFA must describe any significant alternatives to the proposed rule that accomplish the stated objectives and minimize any significant economic impact of the proposed rule on small entities.

This memorandum provides the IRFA of the draft proposed rule.

**Why the Agency Is Considering this Action**

The Commission is considering the draft proposed rule to increase the safety of consumers using fireworks, reduce the burden on industry of complying with the existing fireworks regulations, clarify and streamline the C.F.R., and harmonize CPSC regulations with the other federal and voluntary standards for consumer fireworks.

**Objectives and Legal Basis for the Rule**

The objectives of the draft proposed rule are to reduce injuries and deaths associated with highly explosive fireworks and other fireworks devices and to harmonize with the other federal and voluntary standards to reduce regulatory uncertainty. The legal basis for the rule is the Federal Hazardous Substances Act, which provides the Commission the authority to adopt regulations regarding hazardous substances and regulatory provisions necessary to enforce those requirements.

**The Product**

Consumer fireworks are fireworks intended to be used by consumers, distinct from display fireworks. According to the American Pyrotechnics Association (APA), an industry trade group, consumer fireworks are distinct from display fireworks based on intended use and amount of chemical composition. The import, sale, and manufacturing of display fireworks are under the jurisdiction of the Bureau of Alcohol, Tobacco, Firearms, and Explosives and the U.S. Department of Transportation. Consumer fireworks have many different varieties, including firecrackers, bottle rockets, sparklers, fountains, Roman Candles, wheels, and several others.

**Small Entities to Which the Draft Proposed Rule Will Apply**

Domestic fireworks manufacturing is covered under North American Industry Classification System (NAICS) code 325998, "All Other Miscellaneous Chemical Product and Preparation Manufacturing." Importers and retail sales firms are counted under NAICS codes 423920 and 453998, "Toy and Hobby Goods and Supplies Merchant Wholesalers" and "All Other Miscellaneous Store Retailers," respectively. The U.S. Small Business Administration (SBA) size guidelines define manufacturers categorized under this code as "small" if they have fewer than 500 employees. The SBA defines importers as small if they have fewer than 100 employees (wholesalers) or less than $7.5 million sales (retailers). The American Fireworks Standards Laboratory (AFSL), which conducts testing and certification for a substantial portion of the industry, maintains a public list of U.S. importers and Chinese manufacturers that participate in its programs. Its list includes 165 importers, of which 121 are small, six are large, and the remaining 38 are of unknown size, although likely small.[69] AFSL claims its members represent 85 percent to 90 percent of U.S. importers, estimating a total market size of 183 to 194 importers. Although some

[69] CPSC staff made these determinations using information from Dun & Bradstreet and ReferenceUSA, as well as firm websites.

U.S.-based firms continue to manufacture fireworks, the vast majority of the market is represented by imported products.

**Requirements of the Draft Proposed Rule and Potential Impact on Small Entities**

The draft proposed rule includes the following provisions, which may impact small entities:

- provisions banning fireworks with greater than 2 grains (130 mg) of pyrotechnic material when metallic powder, less than 100 mesh in particle size, is used as fuel;
- limits on total pyrotechnic weight and chemical composition, by firework type;
- adding hexachlorobenzene, lead, and lead compounds to the list of chemicals banned in fireworks;
- requiring the testing of fuses for side ignition;
- requiring bases for fireworks be attached to the device, and remain attached through storage, handling; and use, and
- banning fireworks expelling or dispersing fragments of metal, glass, or hard plastic.

These provisions are explained in greater detail below.

The draft proposed rule also includes provisions intended to reduce burden on industry by establishing allowances for trace contaminants of banned chemicals.

Fireworks are typically manufactured overseas and imported into the United States. Most of the potential impact will be felt by small domestic importers, rather than small domestic manufacturers. Because the draft proposed rule includes changes intended to harmonize federal regulations with voluntary standards, many foreign manufacturers already comply with the draft proposed regulations. Because of this, for many importers, finding a new supplier may be the lowest burden option for complying with the new requirements. Staff's estimates of impact on small businesses include estimates for importers that do not switch suppliers and incur the full cost of the regulation, in comparison to the burden potentially faced by small, domestic manufacturers.

CPSC staff does not believe that, collectively, the following provisions will create a significant impact on a substantial number of small firms. Individually, some of the provisions may impact a substantial number of small firms, but none of the identified likely modifications necessary for compliance is likely to represent an impact greater than 1 percent of firm revenues for a substantial number of firms. CPSC staff welcomes comment from the public addressing the likely modifications firms will make and assessing the accuracy of staff's estimates that costs will not be significant.

*Provisions Banning Fireworks with Greater Than Two Grains (130 mg) of Pyrotechnic Material When Metallic Powder, Less Than 100 Mesh in Particle Size, Is Used as Fuel*

The draft proposal would amend § 1500.17(a)(3) to replace the portion of the current regulation, which limits the total pyrotechnic material in fireworks "intended to produce an audible effect" to 2 grains (130 milligrams), with a requirement consistent with the AFSL and the APA requirements that limit the total pyrotechnic material to 2 grains if metallic powders, less than 100 mesh in particle size, allowing for trace amounts. CPSC testing of fireworks samples revealed that

greater than 85 percent of the samples tested did not comply with the draft proposed standard (54 samples out of 64 tested failed the draft proposed test method). Although this testing cannot be generalized to the fireworks industry as a whole, it suggests that a significant number of firms may not comply with the draft proposed regulation.

To comply with the draft proposed requirements, staff expects fireworks producers to use only black powder formulations. Per CPSC Laboratory Sciences (LSC) staff, the amount of explosive power necessary to produce an effect in aerial fireworks is higher than the explosive power derived from 2 grains (130 mg) of metallic or hybrid powder, the limit on pyrotechnic load. Therefore, staff expects industry to comply with the regulation by eliminating metallic powder from the formulations used in fireworks, rather than complying via a reduction in the total amount of pyrotechnic material in the device.

The estimated rate of compliance with the draft proposed regulation implies that fireworks producers will incur some costs to comply with the new regulation. Per CPSC LSC staff, one of the reasons fireworks producers do not currently exclusively use black powder formulations in fireworks is because they believe that consumers desire the more concentrated explosion of metallic and hybrid fuels. However, if CPSC's current test method of listening for a difference in report is difficult for producers to repeat, the ability of untrained consumers to differentiate between the audible effects of a metallic or hybrid powder formulation and the audible effects of a black powder only formulation is doubtful.

The costs of switching to black powder should not create a significant impact for firms that have to change formulations. Staff examined retail prices of aluminum and other popular powders, along with black powder kits.[70] Retail prices for aluminum powder typically used in fireworks (per CPSC LSC staff) ranged from $18.35 per pound to $38.67 per pound. Black powder kits sold for approximately $5.20 per pound. Therefore, the maximum cost for switching would be a firework switched from the maximum allowable metallic powder (130 mg) to the maximum allowable black powder burst charge in the limits by firework type (15 g). A firework producer switching from 130 mg of aluminum powder purchased for $18.35 per pound to 15 g of black powder purchased for $5.20 per pound would incur a materials cost increase of $0.17 per shell. Because these mine/shell devices typically sell for $4 to $5 per shell, the difference in fuel costs could represent up to 4 percent of retail revenues. However, because fireworks manufacturers are unlikely to pay retail prices for fuels and the applicable devices represent only a portion of fireworks manufacturers' product lines, the impact of this draft provision on the total revenue of any manufacturer or importer could actually be less than 1 percent and may not be to be significant for the affected small firms.

*Limit Total Pyrotechnic Weight and Chemical Composition by Firework Type*

The draft proposed rule includes a provision to amend § 1500.17(a)(3) to limit the total amount of pyrotechnic material in consumer fireworks, not just fireworks devices that are "intended to produce an audible effect." Under the draft proposed rule, sky rockets, bottle rockets, missile-type rockets, helicopters (aerial spinners), and Roman Candles would be limited to 20 grams of total pyrotechnic material. Mine and shell devices would be limited to 60 grams of chemical composition in any shell, and the lift charge could not contain more than 20 grams of black powder. The lift charge must contain only black powder. Multiple-tube devices could contain up to 200 grams total, depending on the base structure. The burst charge of any component could not exceed 25 percent of

[70]Skylighter Fireworks and Pyrotechnic Chemicals. Accessed 8/3/2016. http://www.skylighter.com/mall/chemicals.asp.

the total pyrotechnic material weight of the component. Aerial shells with reloadable tubes would be limited to 60 grams of pyrotechnic material per shell, 20 grams of black powder in the lift charge, and 400 grams per device total, with the burst charge limited to 25 percent of the total pyrotechnic material weight.

This provision would align the CPSC requirements with the limits imposed by APA 87-1. The limits specified in APA 87-1 are high enough to allow sufficient explosive force for a viable fireworks device, even accounting for switching from flash powder and hybrid formulations to black powder exclusively. Compliance samples from FY 2003 to FY 2015 revealed that only 1 percent of fireworks are potentially noncompliant with the burst charge provisions in the limits on pyrotechnic weight. This represents a low-end estimate for noncompliance. The Laboratory Sciences memorandum in this package describes testing by CPSC staff, which found two of 12 sample reloadable shell devices to be noncompliant with the burst charge limits, and eight of 30 sample multiple-tube mine and shell devices to be noncompliant with the burst charge limits. Although this testing cannot be generalized to the fireworks industry as a whole, it suggests that a significant number of firms may be noncompliant with the draft proposed regulation. To comply with the additional regulations, currently noncompliant fireworks producers would likely be forced to implement some quality control measures to their production, to limit devices to the proscribed amount of pyrotechnic material. The limits do not preclude the existence of any devices based on their inability to function with the limited amount of pyrotechnic material; and the restriction only represents a limit on the size. Given the handmade production methods, a quality control system to comply with the regulations could consist of changes such as a one-time adoption of smaller measuring devices for filling fireworks with pyrotechnic material. Thus, this regulation probably will not produce a significant impact on affected small firms. CPSC staff seeks comments on the assessed burden on small entities to comply with the pyrotechnic weight limits.

*Add Hexachlorobenzene, Lead, and Lead Compounds to Banned Chemicals in Fireworks*

The draft proposal would ban lead, lead compounds, and hexachlorobenzene (HCB) in concentrations above 0.25 percent and 0.01 percent, respectively. Such chemicals were once prominent in fireworks formulations, but have since fallen out of use. Lead and lead compounds are banned by DOT/APA 87-1, and testing by AFSL indicates the bans on their use have high compliance rates. These chemicals would be banned with allowances for trace amounts present in fireworks of each.

Lead was traditionally used in creating "crackle" effects, but bismuth trioxide has largely replaced lead in fireworks as the chemical used to create crackle effects.[71] Bismuth trioxide is a cheaper and more effective legal substitute. HCB was typically prevalent in fireworks as a color enhancer. Because HCB has been banned by the AFSL and European Standards, fireworks manufacturers have moved on from using it in fireworks, as well. According to a study in the Journal of Pyrotechnics, when a sample of 220 fireworks was tested for HCB, four of the 220 samples (1.8%) tested positive at a concentration higher than the draft proposed trace allowances amount.[72] These analyses are consistent with CPSC Engineering Staff's estimates of high

[71] Dejka, Joe. June 30, 2008. Lead-tainted Fireworks Rarely Reach Store Shelves. "Omaha World-Herald," pg. 01. Retrieved from Lexis Nexis Academic 4/11/2015.
[72] Schwarz, Silke, et. al. Screening of Hexachlorobenzene (HCB) Contents in Fireworks. *Journal of Pyrotechnics*. Issue 33, 2014, pp3-8.

compliance with APA 87-1. Because of the high rates of compliance, staff expects the addition of lead and HCB would pose minimal burden to small businesses.

*Require Testing for Side Ignition of Fuses*

The draft proposal would amend the regulatory language in § 1507.2 to include a test for side ignition of fuses. The test proposed is the test currently specified in the CPSC testing manual. The test requires placing the lit end of a cigarette directly against the side of a fuse and observing how much time elapses before it ignites. A device would fail if it ignites within 3 seconds.

CPSC testing has indicated that 99.5 percent of fireworks pass the test for side ignition. The remaining 0.5 percent of fireworks may fail the test because they have not been treated to prevent side ignition or have not been sufficiently treated or coated to prevent side ignition within three seconds. Without specifying a test method, CPSC's current regulations leave open to interpretation what constitutes an effective treatment of a fuse for side ignition.

The addition of the test method to the regulation would make it necessary for fireworks manufacturers and importers to actually conduct the test to issue a certificate of compliance with their products. It is unknown at this time what proportion of fireworks is currently tested for side ignition of fuses. However, a reasonable testing program associated with this requirement is unlikely to create a significant impact on fireworks producers. Conceivably, a producer could test its treatment or coating on a sample of fuses, conclude the treatment or coating is effective, and simply use the same test results for all fireworks that use the same type of fuse. Thus, a producer could amortize the costs of fuse testing across all fireworks sold with the fuses.

*Require Bases to Be Attached, and Remain Attached During Storage, Handling, and Operation*

The draft proposed rule includes a requirement for bases to remain attached to fireworks during storage, handling, and operation. Currently, the regulations only specify the required size of base attachments. Staff expects minimal impact to manufacturers from the draft proposed requirements. CPSC does not test for base attachment when testing samples of fireworks, but on occasions where bases were not attached or detached, staff may note this in the testing record. In fireworks tested from fiscal year 1999 to the present, out of 4,554 relevant samples, 111 samples (2.4%) contained notes that bases were either missing or functioned improperly during operation.

For devices not currently meeting the requirements, staff expects firms to comply by either adapting the firework design so the device and base are all one piece, or securing the base to the rest of the device with an adhesive. The potential costs of complying with the draft proposed regulation include additional time in affixing the base to the firework (seconds per device), materials for affixing the base to the device, and potential shipping costs associated with higher volume per device when the base is attached rather than separate. Potentially, some additional quality control effort might be required to ensure that the bases are attached correctly so that they do no detach during storage, handling, and operation. Because only a small proportion of products do not meet the draft proposed requirements, and the potential activities necessary for compliance are not costly, staff does not expect this provision to cause a significant impact on a substantial number of small firms.

*Ban Fireworks Expelling or Dispersing Fragments of Metal, Glass, or Brittle Plastic*

The draft proposed rule includes an additional ban on fireworks expelling or dispersing fragments of metal, glass, or brittle plastic upon operation. This ban is also in APA 87-1 and the

AFSL voluntary standard. CPSC does not have information on compliance rates with the draft proposed ban, and does not keep testing data related to fragments, as there is no provision in the C.F.R. currently banning them. However, CPSC Laboratory Sciences staff has observed fragments falling from detonated fireworks during testing. Anecdotally, the frequency of these occurrences is less than 10 percent of samples tested. CPSC Epidemiological Incident data from 2005-2015 reveals eight potential incidents associated with fragments in fireworks. CPSC staff believes the fragments expelled and dispersed from fireworks are typically due to manufacturers' intentional use of metal, glass, or brittle plastic parts. These components are not part of the effects associated with the device, but may play a role in the functioning of the device. To comply with the draft proposed rule, fireworks producers would have to either redesign their products to not require the use of these components or use greater quality control to ensure these components, when used, are not expelled or dispersed by the device. CPSC staff has little information on what the expected costs of these changes will be for firms. Anecdotally, the proportion of tested fireworks expelling or dispersing fireworks may be less than ten percent of devices, but without collecting data on fireworks fragments, staff cannot verify such an estimate.

*Allow for Trace Contaminants of Banned Chemicals*

The draft proposal would amend § 1507.2 to allow for trace amounts of the banned chemicals in fireworks up to concentrations of 0.25 percent. This level was chosen to harmonize with the allowance in APA 87-1. In the time since this provision was first developed, testing equipment has become much more advanced and capable of detecting increasingly lower concentrations of banned chemicals in fireworks. Because of these advancements, banned chemicals are being detected and samples destroyed in cases where the concentration of the chemicals pose little to no hazard to consumers. From FY 2000 to FY 2015, CPSC compliance officers reported 41 violations of § 1507.2. Of these violations, four came from samples which contained banned chemicals in concentrations below the draft proposed allowances. The total lot value of the four lots is $7,109, which represents the theoretical reduction in burden on industry from compliance activities had trace allowances for banned chemicals existed over the past 15 years. Additional burden reduction may be realized as fireworks manufacturers will no longer incur the marginal costs of reducing concentrations of banned chemicals from the trace allowance level to zero, though quality control programs in place will be likely to remain in place to prevent contamination from banned chemicals above the allowance. Therefore, this requirement should not have a significant impact to a substantial number of firms.

**Other Provisions in the Draft Proposed Standard**

The draft proposed rule would add definitions for "aerial bomb," "blowout," "burnout," "chemical composition," "base," "lift charge," "burst charge," "explosive composition," "firecracker," and "pyrotechnic composition." These definitions are based on what staff believes is industry's understanding of the terms and their use in the voluntary standards. Therefore, adding these definitions should have no impact on small firms. The draft proposed rule would also clarify the exemptions that apply to firecrackers, but would not substantively change the requirements for firecrackers.

**Alternatives to the Draft Proposed Regulations**

Staff considered alternatives to the draft proposed requirements that would minimize any significant economic impact on small business while accomplishing the objectives of the rulemaking. In all cases, one of the alternatives considered is for the Commission to not adopt the

proposed rule and take no action. Some of the other provisions have additional alternatives considered by the staff.

*Alternatives to Provisions Banning Fireworks with Greater Than Two Grains (130 mg) Pyrotechnic Material When Metallic Powder, Less Than 100 Mesh in Particle Size, is Used as Fuel*

For the change in audible effects requirements, the Commission taking no action might be less burdensome than the draft proposal, as compliance with the current regulation is higher than with the draft proposed regulation. However, APA and AFSL have supported the Commission adopting the draft proposed provision, as they claim industry finds the current CPSC test method more difficult for them to duplicate, leaving them in a place of regulatory uncertainty.[73] Additionally, as discussed above, CPSC staff believes that the cost of meeting the draft proposed requirement would be low and would improve consumer safety by providing a uniform and repeatable method of identifying devices with greater explosive power that present a greater risk to consumers.

An additional alternative staff considered is eliminating the requirement, as written, without adopting the APA limits on pyrotechnic material containing metallic fuels, less than 100 mesh in particle size. However, absent a provision in the regulations to eliminate the use of metallic fuels, less than 100 mesh in particle size, in break charges over 130 mg, manufacturers would not be limited in the explosive power of their fireworks to the same degree as they would be by the requirements in the draft proposed rule. Even if the draft provision limiting total pyrotechnic weight were adopted, omitting the provision regarding fireworks intended to produce audible effects or without the draft proposed regulation limiting the use of metallic fuels less than 100 mesh in particle size, the explosive power would be substantially higher when metallic or hybrid powders are used. The elimination of this provision would undercut the societal benefit associated with placing limits on the total pyrotechnic weight by de facto increasing the allowable explosive power of fireworks.

*Alternatives to Limiting the Total Pyrotechnic Weight and Chemical Composition by Firework Type*

Staff considered recommending taking no action regarding additional regulations limiting total pyrotechnic weight and chemical composition. To the extent industry is already complying with the draft proposed rule, the burden of the draft proposed rule would be low. Moreover, CPSC staff believes that there is some benefit in harmonizing the requirements between the C.F.R. and voluntary standards absent other costs and benefits, which the draft proposal seeks to do. This rule also serves to limit the total power in fireworks, potentially limiting the hazard associated with such devices.

*Alternatives to Requiring Testing for Side Ignition of Fuses*

Staff considered taking no action regarding requiring specific testing of fuses. Current compliance with the 3 second limit is 99.5%. The alternative of doing nothing would not significantly reduce the impact on firms because CPSC already uses the specified test method to determine whether fuses meet the existing regulation and the burden of requiring testing of fuses is minimal when amortized across all fireworks sold with fuses meeting the specification.

*Alternative to Adding Hexachlorobenzene, Lead, and Lead Compounds to Banned Chemicals in Fireworks*

[73] Correspondence letter from AFSL to CPSC.

For the additions of lead, lead compounds, and HCB to the banned chemicals list, the alternative of no action would likely have little reduction in burden on industry, as compliance with the draft proposed provision is already high. Staff also considered recommending the addition of only HCB or lead and lead compounds to the list of banned chemicals and various levels of contamination for each chemical. Contaminants beyond the draft proposed limits for trace allowances theoretically could be less burdensome on industry. However, compliance with the draft proposed requirements is already high, therefore, any reduction in burden from a higher allowable contamination allowance would be low. The allowable level in the draft proposed rule was chosen to harmonize with the voluntary standards.

*Alternatives to Requiring Bases to Remain Attached During Storage, Handling, and Operation*

Staff considered the alternative of taking no action concerning base attachment. However, the draft proposed requirement is intended to address a specific hazard. Therefore, staff felt the potential benefit of the draft proposed requirement outweighed the potential costs to industry to comply, which staff concluded are unlikely to be significant for a substantial number of firms.

*Alternatives to Banning Fireworks Which Expel or Disperse Fragments of Metal, Glass, or Brittle Plastic*

Staff considered the alternative of taking no action to ban fireworks that dispel fragments of glass, metal, or brittle plastic. However, the potential for severe injury exists in those rare cases where fragments are dispelled from fireworks, and staff considered the alternative of no action insufficient in addressing the potential injuries.

**Federal Rules That Duplicate, Overlap, or Conflict with the Draft Proposed Rule**

The Department of Transportation (DOT) incorporates by reference APA 87-1 in its regulations, which apply to fireworks when transported in commerce. Because all fireworks sold to consumers are, at some point, transported in commerce, all consumer fireworks fall under the jurisdiction of DOT and are subject to the requirements of APA 87-1. However, DOT's jurisdiction only extends to issues related to transportation safety and DOT's compliance enforcement program is limited by that scope. Where staff's draft proposal includes changes to CPSC regulations to bring them in line with DOT/APA 87-1, estimates of current compliance with DOT/APA 87-1 are used to generate estimates of the burden to manufacturers imposed by the draft proposal. The provisions of the draft proposed rule are designed to eliminate conflict where it exists between DOT regulations and CPSC regulations for fireworks.

**Summary and Conclusion**

The draft proposed rule is intended primarily to harmonize several CPSC regulations concerning fireworks and firecrackers with the voluntary standards established by AFSL and APA and to improve consumer safety. In most cases where some firms may not be in current compliance, CPSC staff does not believe that bringing their products into compliance will impose significant costs on firms. Moreover, given that most fireworks are imported, any small importer that finds that its foreign supplier is not in compliance with the draft proposed requirements may be able to switch to complying suppliers, if that is the less costly option. For these reasons, CPSC staff believes that the draft proposed rule probably would not have a significant impact on a substantial number of small entities. However, the staff welcomes comments on the burden to small entities that might be associated with any of the requirements in the draft proposed rule, particularly for the pyrotechnic composition and total pyrotechnic weight provisions, which may affect a substantial number of

firms. CPSC is also particularly interested in comments from small firms that believe that they would be significantly impacted by the draft proposed rule.