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<AGENCY TYPE='S'>DEPARTMENT OF TRANSPORTATION

<SUBAGY>Federal Aviation Administration

<CFR>14 CFR Part 420

<DEPDOC>[Docket No. FAA-2011-0105; Amdt. No. 420-6]

<RIN>RIN 2120–AJ73

<SUBJECT>Explosive Siting Requirements

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This rule amends the requirements for siting explosives under a license to operate a launch site. It increases flexibility for launch site operators in site planning for the storage and handling of energetic liquids and explosives.

DATES: Effective November 6, 2012.

ADDRESSES: For information on where to obtain copies of rulemaking documents and other information related to this final rule, see “How To Obtain Additional Information” in the <E T='02'>SUPPLEMENTARY INFORMATION</E> section of this document.

FOR FURTHER INFORMATION CONTACT: For technical questions concerning this final rule contact Yvonne Tran, Commercial Space Transportation, Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC 20591; telephone (202) 267-7908; facsimile (202) 267-5463, e-mail yvonne.tran@faa.gov. For legal questions concerning this final rule contact Laura Montgomery, AGC 200, Senior Attorney for Commercial Space Transportation, Office of the Chief Counsel, Federal

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SUPPLEMENTARY INFORMATION:

<HD1>Authority for this Rulemaking

The Commercial Space Launch Act of 1984, as amended and re-codified at 51 United States Code (U.S.C.) Subtitle V—Commercial Space Transportation, ch.509, Commercial Space Launch Activities, 51 U.S.C. 50901-50923 (the Act), authorizes the Department of Transportation (DOT) and thus the FAA, through delegations, to oversee, license, and regulate commercial launch and reentry activities, and the operation of launch and reentry sites as carried out by U.S. citizens or within the United States. 51 U.S.C. 50904, 50905. Authority for this particular rulemaking is derived from 51 U.S.C. 50905, which requires that the FAA issue a license to operate a launch site consistent with public health and safety. See also 49 U.S.C. 322(a), 51 U.S.C. 50901(a)(7). Section 50901(a)(7) directs the FAA to regulate only to the extent necessary to, in relevant part, protect the public health and safety and safety of property.

<HD2>I. Overview of Final Rule

This final rule amends part 420 of Title 14 of the Code of Federal Regulations (14 CFR) Chapter III, updating the FAA's requirements for how to site explosives under a license to operate a launch site.[1] Part 420 establishes criteria for siting facilities at a launch site where solid propellants, energetic liquids, or other explosives are located to prepare launch vehicles and payloads for flight. These criteria are commonly referred to as quantity-distance (Q-D) requirements because they provide minimum separation

[1] The FAA published a notice of proposed rulemaking (NPRM) that proposed the changes to part 420 that the FAA is now adopting. Explosive Siting Requirements, 76 FR 8923 (Feb. 16, 2011).

distances between explosive hazard facilities, surrounding facilities and locations where the public may be present on the basis of the type and quantity of solid propellants, energetic liquids, and other explosives located within the area. Minimum separation distances are necessary to protect the public from explosive hazards.

The FAA is making a number of changes consistent with the goals of Executive Order 13610, Identifying and Reducing Regulatory Burdens, 77 FR 28469 (May 14, 2012). First, the FAA is dispensing with its separation distance requirements at launch sites for storing liquid oxygen, nitrogen tetroxide, hydrogen peroxide in concentrations equal to or below 91 percent, and refined petroleum-1 (RP-1). If these energetic liquids are not within an intraline distance of an incompatible energetic liquid or co-located on a launch vehicle, the FAA is no longer imposing public area separation distances because the current separation requirements for storing these energetic liquids unnecessarily duplicate the requirements of the Occupational Safety and Health Administration. Second, the FAA is decreasing the separation distances required for division 1.1 explosives and liquid propellants with trinitrotoluene (TNT) equivalents of less than or equal to 450 pounds. Although decreased, the revised separation requirements will continue to protect against hazardous fragments, which are defined as having a kinetic energy of 58 foot-pounds, which is a level of kinetic energy capable of causing a fatality. The probability of a person six feet tall and one foot wide being struck by a hazardous fragment at a given separation from a given net explosive weight (NEW) is one percent, which is an equivalent level of safety to today's separation distances. Third, the FAA is reducing the separation distances for the storage and handling of division 1.3 explosives, while maintaining a level of safety equivalent to current requirements. Fourth, the FAA

is eliminating its own separation distance requirements for storing liquid oxidizers and Class I, II and III flammable and combustible liquids because they duplicate the requirements of other regulatory regimes. Consistent with the current Department of Defense (DOD) Explosive Siting Board's (DDESB) and National Fire Protection Association (NFPA) practice, the FAA is dispensing with the hazard groups of tables E-3 through E-6 of appendix E of part 420 as a means of classification. This revision will conform the FAA's classification to the NFPA classification system, which is more commonly used to reflect chemical hazards of energetic liquids used at commercial launch sites. Finally, a site map must now be at a sufficient scale to determine compliance with part 420.

<HD2>II. Background

In 2000, the FAA issued rules governing the storage and handling of explosives as part of its regulations governing the licensing and operation of a launch site. Licensing and Safety Requirements for Operation of a Launch Site; Final Rule, 65 FR 62812 (Oct. 19, 2000) (Launch Site Rule). The FAA has requirements for obtaining a license to operate a launch site in part 420. Part of the application for a license requires an applicant to provide the FAA with an explosive site plan that complies with the explosive siting requirements of part 420. The plan must show how a launch site operator will separate explosive hazard facilities from the public. It must identify the location of the explosives and how the public is safeguarded. The explosive siting requirements of part 420 mandate how far apart a launch site operator should site its explosive hazard facilities based on the quantities of energetic materials housed in each facility. Distances vary based on the quantities at issue, whether the energetic materials at a given facility are

being handled or stored, and whether or not the distance being calculated is a distance to a public area or public traffic route.

Since the original rulemaking, the FAA's experience with the requirements has led it to the current changes. At the time it promulgated the original requirements, the FAA anticipated that any new launch sites would have similar siting issues as launch sites devoted to expendable launch vehicles, and, therefore, relied on the siting requirements of the DDESB DOD Ammunition and Explosive Safety Standard, 6055.9-STD (1997) (1997 DOD Standard).[2] Instead, for the most part, the FAA has issued a number of licenses for the operation of launch sites at existing airports, such as Mojave Air and Space Port in California. At these airports, the presence of jet fuels regulated under existing FAA space transportation requirements created conditions requiring the FAA to reconcile and clarify its separation requirements for launch vehicle liquid propellant requirements with the presence of other industrial chemicals, such as aircraft fuels. Based on experience with these launch sites and on research on other regimes that address explosive materials, the FAA amends its own requirements as described above.

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III. Discussion of Public Comments and Final Rule

The comment period for the NPRM closed on May 17, 2011. The FAA received comments from XCOR Aerospace (XCOR). XCOR's comments support the FAA's

[2] The DDESB updated the DOD Standard in 2004. Notice of Revision of Department of Defense 6055.9-STD Department of Defense Ammunition and Explosives Safety Standards, 70 FR 24771 (May 11, 2005) (2004 DOD Standard). DOD released a new edition in 2008, but the 2004 changes are the ones relevant to this rulemaking. The 2004 DOD standard bases its separation distances for storage on Occupational Safety and Health Administration (OSHA) and NFPA standards for classes I through III flammable and combustible liquids and liquid oxygen, and on NFPA standards for classes 2 and 3 liquid oxidizers. The 2004 DOD Standard contains less restrictive requirements for explosive division 1.1 solid explosives with a net explosive weight of less than or equal to 450 pounds, and for energetic liquids with a TNT equivalence of less than or equal to 450 pounds. The FAA is mirroring these requirements now.

acceptance of a separation distance different from the one required by §§ 420.63 through 420.69 if an operator demonstrates an equivalent level of safety. XCOR also supports the FAA's proposal to abandon storage requirements for the types of liquid fuels and oxidizers that are already regulated by OSHA. The FAA also received a number of opposing comments from XCOR. They are discussed below and address the FAA's jurisdiction over explosive hazards, the nature of explosive hazards and whether energetic liquids are all explosives, the interplay between the definition of liquid propellants and aviation fuels, the appropriate license for dealing with explosive hazards and, lastly, stoichiometric ratios, the theoretical ratio of fuel and oxidizer at which the fuel is burned completely.

As an initial matter, the FAA must address XCOR's objection to the FAA's jurisdiction over treating a location where static engine firing takes place as an explosive hazard facility. XCOR at 12.[3] Congress charged the FAA with licensing and regulating the operation of launch sites as well as launches. 51 U.S.C. 50904. Explosive hazards are present at launch sites and may threaten members of the public who are also present at the site, as well as persons outside of the launch site. Because static firing of an engine involves the handling of energetic liquids or explosives and all the hazards associated with their mixing, the FAA finds it necessary to require separation distances between the location and the public. At commercial launch sites, locations where static firing occurs are considered explosive hazard facilities under § 420.5.

As it proposed in the NPRM, the FAA is adopting and defining the term "energetic liquids" to mean a liquid, slurry, or gel, consisting of, or containing an

[3] XCOR Aerospace, Comments to NPRM (FAA-2011-0105), Online posting, http://www.regulations.gov/#!searchResults;rpp=10;po=0;s=faa-2011-0105, (May 18, 2011) (referred to as XCOR).

explosive, oxidizer, fuel, or combination of the above, that may undergo, contribute to, or cause rapid exothermic decomposition. XCOR opposes the FAA's proposed definition of "energetic liquids" on the grounds that there is no need for the FAA to regulate fuels and oxidizers, as explosives, because, according to XCOR, energetic liquids are not explosives. XCOR at 6.

In 2000, the FAA found it necessary to regulate both explosives and liquid propellants, but did not define the latter. The FAA's use of both terms apparently created the erroneous impression that the FAA only regulated materials that do not require mixing to explode, notwithstanding the FAA's inclusion of liquid propellants in its part 420 requirements. As should be evident from the FAA's requirements for materials other than division 1.1 explosives, the FAA has not so limited itself. "Explosive" is a broad term, and the FAA is using it throughout part 420 as such. Because of past confusion, the FAA is now defining "energetic liquids" to encompass liquid fuels, oxidizers, and liquid propellants.

XCOR believes that if a fuel and oxidizer are not mixed, the FAA's separation requirements for energetic liquids are not necessary. The FAA's requirements, however, are designed to mitigate harm caused by ***inadvertent*** mixing. Energetic liquids such as fuels and oxidizers may, when mixed, produce the reactions of and share characteristics with materials that are explosives in the truest technical sense. Explosions are due to the sudden release of energy over a short period of time and may or may not involve chemical reactions.[4] Three basic characteristics of an explosion are: a sudden energy release, a rapidly moving blast or shock wave, and a blast of a magnitude large enough to be potentially hazardous. Additionally, explosions may be purely a physical event

[4] Crowl, D.A., Understanding Explosions, AIAA Center for Chemical Process Safety (CCPS), 2, (2003).

involving a sudden release of mechanical energy, or a chemical explosion requiring a chemical reaction. Furthermore, an accident may happen without mixing. For example, liquid oxygen is an oxidizer and is usually stored in its liquid state at a very low temperature. Because liquid oxygen has a very large liquid-to-gas-expansion ratio, 1 to 860 at 68º F, it can undergo an explosion known as a boiling liquid expanding vapor explosion, commonly referred to as a BLEVE. The FAA recognizes that no one intends inadvertent mixing, but because it can happen and because not all accidents are the result of mixing, separation distances are necessary for energetic liquids.

As proposed, the FAA now defines "liquid propellant" to mean a monopropellant or incompatible energetic liquids co-located for purposes of serving as propellants on a launch vehicle or a related device. In response to XCOR's comment that unmixed fuels and oxidizers do not explode, the FAA is clarifying that the co-location of incompatible energetic liquids makes something a liquid propellant only where the incompatible energetic liquids are housed in tanks connected by piping for purposes of mixing. The stored energy present when incompatible energetic liquids are connected by piping poses a hazard requiring separation distances because, under feasible conditions, the system may fail and cause fire, blast, and flying fragment hazards. It is because of these hazards that organizations such as the NFPA require a minimum separation distance of 20 feet between a liquid fuel and an oxidizer. Obviously, for launch, this is not possible, but the NFPA requirement underscores the importance of separating a fueled launch vehicle from the public. For most liquid fueled launch vehicles, incompatible energetic liquids such as fuels and oxidizers are housed in separate tanks on the vehicle. Pipes lead from each tank to a combustion chamber where combustion takes place to generate thrust. The

presence of the piping is designed to ensure mixing in the combustion chamber in order to achieve propulsion. Accordingly, the FAA is revising its definition of liquid propellants from what it proposed to the following: a monopropellant or an incompatible energetic liquid co-located for purposes of serving as propellants on a launch vehicle or a related device where the incompatible energetic liquids are housed in tanks connected by piping for purposes of mixing. This new reference to "connecting piping" should alleviate concerns that the FAA intends the definition of liquid propellants to apply to aircraft or tanker trucks. See XCOR at 6, 7.

XCOR claims that because a launch license will govern incompatible energetic liquids co-located on a launch vehicle, these issues should not be addressed through a site license. XCOR at 3, 8. The FAA does not dispute that the launch license will govern launch. That being said, the launch operator will also have to operate with separation distances in effect. This means the site operator's advance planning attendant to explosive siting will not go to waste. For example, § 417.411, which applies to launch operators, requires safety clear zones that would keep the hazards associated with a launch operator's vehicle from the public during launch processing.[5] Accordingly, a site operator must be able to provide appropriately sited facilities that permit a launch operator to comply with its requirements.[6] Similarly, XCOR maintains that, in the context of the definition of liquid propellants, energetic liquids are better addressed in the launch license where an appropriate hazard assessment will be conducted. The FAA

[5] Section 417.411(a)(1) requires a launch operator to establish a safety clear zone able to confine an adverse explosive event, based on a worst-case event, regardless of the fault tolerance of the system.
[6] On a related note, XCOR raises the possibility of having to evacuate the public as a result of the FAA's regulations. XCOR at 7. As is the case under the current requirements, the better solution than evacuation would be to relocate a hazardous operation. If a site operator addresses the necessary separation distances, neither relocation nor evacuation should be necessary.

agrees, but there still needs to be enough room to encompass the results of that assessment. For example, if a launch operator performs its hazard assessment and it, or the FAA, determines that it needs a great deal of room to encompass its hazards, the launch site operator's preliminary explosive siting should already have made sure that the necessary separation distances are in place at the launch site. Different launch vehicles may have different levels of quality, safety, and reliability, depending on the maturity of the technology and the organization, which means that the site operator's separation distances must account for a worst-case launch vehicle.

XCOR suggests the FAA take into account launch vehicle design and construction when determining separation distances at a launch site where the launch vehicles may vary in reliability. XCOR at 3, 8. XCOR brings to light an issue that requires clarification. Part 420 addresses a different issue than a launch operator's safety clear zone. Under parts 417 and 437, a launch operator must establish a safety clear zone during pre- and post-flight operations. Part 420 requires there be room for such safety clear zones in the first place. Otherwise, when constructing or establishing a launch site, a site operator may fail to plan for the safety needs and regulatory requirements of its customers. The philosophy underlying the necessity for separation distance requirements is that there must be room for hazardous operations, even those covered by other licenses. Accordingly, the separation distances for the site operator must account for vehicles of varying quality and reliability.

The FAA is amending its definition of "explosive hazard facility" to clarify that it includes locations and facilities at a launch site where solid propellants, liquid propellants or other explosives are stored or handled. XCOR objected to the proposed definition of

an "explosive hazard facility" because it includes facilities containing energetic liquids, including liquid oxygen. XCOR at 4. XCOR maintains this conflicts with the FAA proposal that it would no longer require separation distances around liquid oxygen. Although the FAA will no longer require separation distances for many energetic liquids, a site operator must still, in its explosive site plan, identify all explosive hazard facilities where all energetic liquids will be located. The FAA has been regulating liquid oxygen as part of an explosive hazard facility since 2000, characterizing liquid oxygen as a liquid propellant, and will continue to do so under the new rule, while characterizing it as an energetic liquid. However, because the FAA has been attempting to reduce duplicative requirements, the FAA will rely on OSHA's regulations. Therefore, while the FAA will no longer require separation distances around liquid oxygen, OSHA will continue to do so, and for the FAA to fail to recognize that liquid oxygen is an energetic liquid would only create confusion. As discussed in the NPRM, OSHA's requirements are extensive and serve to protect the safety of the public as an ancillary benefit to OSHA's protection of worker safety.

Lastly, XCOR comments that the net explosive weight (NEW) of liquid propellant should not be based on the total quantity of liquid fuel and oxidizer available on a launch vehicle, but only on the portion where the liquid fuel and oxidizer are at a stoichiometric ratio. XCOR at 10. For example, XCOR postulated a horizontal vehicle dumping unused oxidizer so that it returns to the runway with only 100 pounds of liquid oxygen and 1000 pounds of kerosene aboard. XCOR maintains that part 420 would require it to treat the amount of kerosene in excess of that which would react explosively as, in fact, exploding. Therefore, any excess should be ignored. XCOR's comments

relate to existing requirements that the FAA did not propose to change. Therefore, its comments are outside the scope of this rulemaking. Additionally, part 420 addresses a site operator's location of its facilities, and XCOR raises an operational issue addressed not through a launch site operator license, but through a launch license. The FAA would assess NEW for scenarios hypothesized by XCOR under a launch license or permit.

<HD3>Differences Between the NPRM and the Final Rule

This final rule is adopted for the reasons discussed in the NPRM, but with minor changes from what the FAA proposed. The FAA is defining "explosive hazard facility" to mean a facility or location at a launch site where solid propellants, energetic liquids, or other explosives are stored or handled. In the NPRM, the FAA proposed to define this facility as one where, in relevant part, solid explosives were stored or handled. However, this would have created redundancies with the references to "solid explosives" and "other explosives" being references to the same thing; the FAA is accordingly keeping the original reference to solid propellants.

The FAA requires a launch site operator to submit a scaled map that shows the location of all explosive hazard facilities at the launch site, the actual and minimal allowable distances between each explosive hazard facility and all other explosive hazard facilities, each public traffic route, and each public area, including the launch site boundary. The NPRM incorrectly identified the public traffic route as a public area. This is relevant for division 1.1 explosives because the separation distances between an explosive hazard facility and a public traffic route are less than those between an explosive hazard facility and a public area. Likewise, § 420.63(d), which permits a site

operator to demonstrate an equivalent level of safety now clarifies that this form of relief applies to separation distances to public traffic routes as well as to public areas. See also § 420.67(a) (separating incompatible energetic liquids from public traffic routes); § 420.69 (separating division 1.1 and 1.3 explosives co-located with liquid propellants from public traffic routes).

The FAA is clarifying its requirement that a launch site operator must separate each explosive hazard facility where the NEW is greater than 450 pounds and less than 501,500 pounds from each public area containing any member of the public in the open by a distance equal to -1133.9 + [389 *ln(NEW)].[7] Accordingly, the final rule contains this requirement not only in section 420.65(c)(3), where it appeared in the NPRM, but also in sections 420.67(d)(3) and 420.69(b)(4), (c) and (d)(5), where it was inadvertently omitted. The FAA discussed the reasons for this provision in its original discussion. NPRM at 8928.

The final rule, § 420.65(c)(3), which governs the handling of division 1.1 and 1.3 explosives, now requires each public area containing any member of the public in the open to be separated from an explosive hazard facility by a distance equal to -1133.9 + [389 *ln(NEW)] where the NEW is greater than 450 pounds and less than 501,500 pounds. The NPRM incorrectly[8] identified the range of NEW as less than 600,000 pounds, rather than 501,500 pounds. Above 501,500 pounds the NEW formulas for blast and fragments show that blast hazards, rather than fragment hazards, determine the separation distance. This means that an operator must use a blast formula rather than

[7] Although the NPRM characterized this as affecting operations rather than the siting of buildings, the FAA must note that it could apply to a site operator's initial planning because a site operator would be well advised to consider this formula when siting any bleachers for members of the public to view a launch.
[8] When the FAA reviewed these numbers using a more refined analysis, it found that the separation distance increments could be expressed with greater precision.

a fragment formula for quantities above 501,500 pounds. Table E-2 contains the formulas.

In the NPRM, the FAA stated, in proposed footnote 3 of Table E-3 that a net explosive weight of greater than 500,000 pounds was not allowed for division 1.1 explosives because it was implied in the 2004 DOD Standard. Further investigation has disclosed, however, that the FAA misread the DDESB limitation. The FAA now understands that the limitation meant only that the table's intraline distances could not be used for division 1.1 explosives.

In the interest of greater clarity, the FAA is modifying § 420.65(d)(2), from what it proposed in the NPRM to clarify that when a site operator has quantities of explosives that fall between table entries, the site operator may use a formula provided by the tables to find a separation distance different than the one listed for the specified quantity. For example, if a site operator has 17 pounds of division 1.1 explosives, table E-1 would require a separation distance for a public area of either 506 or 529 feet. However, the site operator may calculate a distance using footnote 1 that falls between these two distances. The FAA's change clarifies that the site operator must use the equation from the same table as the distance the site operator seeks to determine. In other words, the site operator may not use an equation from table 2 to calculate a distance for table 1. Similarly, for paragraph (e)(3), a site operator with existing structures who wants to calculate the maximum quantity of explosives permitted in those structures may not use an equation from another table to calculate for a quantity being calculated.

Section 420.69 now clarifies that a launch site operator may, when determining separation distances for co-location of division 1.1 and 1.3 explosives with liquid

propellants, employ a maximum credible event (MCE) assessment under paragraph (e) rather than using the separation distances prescribed by paragraphs (b), (c) and (d). The NPRM incorrectly described the MCE assessment as a requirement rather than an option. An MCE assessment is one way of demonstrating an equivalent level of safety.

Finally, in table E-7 of Appendix E of part 420, the FAA inadvertently transcribed a footnote from the DDESB requirements that the FAA had not intended to propose. Specifically, footnote 3 of table E-7 in the NPRM, would have required sprinklers for Class 4 oxidizers inside a building. This final rule does not incorporate that requirement.

<HD1>Regulatory Notices and Analyses

Changes to Federal regulations must undergo several analyses. First, Executive Order 12866 and Executive Order 13563 direct that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 (Pub. L. 96-354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96-39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, the Trade Act requires agencies to consider international standards and, where appropriate, that they be the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104-4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the

private sector, of $100 million or more annually (adjusted for inflation with base year of 1995). This portion of the preamble summarizes the FAA's analysis of the economic impacts of this final rule.

Department of Transportation Order DOT 2100.5 prescribes policies and procedures for simplification, analysis, and review of regulations. If the expected cost impact is so minimal that a proposed or final rule does not warrant a full evaluation, this order permits that a statement to that effect and the basis for it be included in the preamble if a full regulatory evaluation of the cost and benefits is not prepared. Such a determination has been made for this final rule. The reasoning for this determination follows:

In this final rule, the FAA is amending its explosive siting separation requirements. First, the FAA will dispense with separation distances for liquid oxygen, nitrogen tetroxide, and hydrogen peroxide in concentrations equal to or below 91 percent, if not stored within an intraline distance of another incompatible energetic liquid, and if not co-located on a launch vehicle. These are unnecessary because they duplicate the requirements of other regulatory regimes. Second, the FAA is decreasing required separation distances for division 1.1 explosives and liquid propellants with TNT equivalents that are less than or equal to 450 pounds, while maintaining a level of safety equivalent to current requirements. Third, the FAA is reducing separation distances for the storage and handling of division 1.3 explosives, while maintaining an equivalent level of safety to current requirements. Fourth, the FAA is dispensing with the separation distance requirements for storing liquid oxidizers and Class I, II and III flammable and combustible liquids because they duplicate the requirements of other regulatory regimes.

The outcome of these changes is expected to be cost relieving. These amendments will allow the launch operator increased flexibility in site planning for the storage and handling of explosives. By encouraging existing launch sites to more effectively use their infrastructure, which could result in the additional co-location of launch sites with existing airports, the rule provides benefits (such as encouraging the development of more launch sites) and is cost relieving. By removing duplications, the amendments make the regulations less burdensome. There may be additional cost savings if the FAA issues fewer waivers as a result of this rule.

Under current part 420, the FAA does not distinguish between public areas that are buildings, where people are sheltered, and those where people are out in the open. This final rule will result in greater distances for some public areas than are required under current rules, but should not result in increased distances for siting buildings. The operational constraints themselves should not increase costs because a launch site operator currently must ensure under § 420.55 that its customers schedule their hazardous operations so as not to harm members of the public. A site operator may incur minimal costs in performing these new calculations and updating its procedures to reflect any changes in distances.

Other provisions will add clarity to the regulations and result in reduced ambiguity and confusion. Included are: dispensing with the hazard groups of tables E-3 through E-6 of appendix E of part 420 as a means of classification; changing the definition of explosive hazard facility, and adding definitions for energetic liquid, liquid propellant and maximum credible event. These provisions are cost neutral. The requirement that the explosive site map be at a scale sufficient to determine compliance

with part 420 can be cost relieving because it can avoid time spent reviewing maps that are difficult to read or requesting that an applicant create and submit another map.

The FAA has, therefore, determined this final rule provides cost saving opportunities, is not a "significant regulatory action" as defined in section 3(f) of Executive Order 12866, and is not "significant" as defined in DOT's Regulatory Policies and Procedures.

<HD1>Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (Pub. L. 96-354) (RFA) establishes "as a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration." The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a rule will have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA.

However, if an agency determines that a rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify and a regulatory flexibility analysis is

not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

The final rule will not increase and will likely reduce costs to industry because it provides options to launch sites with regards to explosive siting. It does not require launch site operators to increase the distances between where they have sited explosives and buildings. We did not receive comments regarding the initial regulatory flexibility analysis.

Therefore, as the acting FAA Administrator, I certify that this rule will not have a significant economic impact on a substantial number of small entities.

<HD1>International Trade Impact Assessment

The Trade Agreements Act of 1979 (Pub. L. 96-39), as amended by the Uruguay Round Agreements Act (Pub. L. 103-465), prohibits Federal agencies from establishing standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Pursuant to these Acts, the establishment of standards is not considered an unnecessary obstacle to the foreign commerce of the United States, so long as the standard has a legitimate domestic objective, such the protection of safety, and does not operate in a manner that excludes imports that meet this objective. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. The FAA has assessed the potential effect of this final rule and determined that it will have only a domestic impact.

<HD1>Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104-4) requires each Federal agency to prepare a written statement assessing the effects of any Federal

mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (in 1995 dollars) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a "significant regulatory action." The FAA currently uses an inflation-adjusted value of $143.1 million in lieu of $100 million. This final rule does not contain such a mandate; therefore, the requirements of Title II of the Act do not apply.

<HD1>Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. The map requirement is not an increased burden in collecting information because the FAA already required a map. The FAA has determined that there is no new requirement for information collection associated with this final rule.

<HD1>International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to conform to International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has determined that there are no ICAO Standards and Recommended Practices that correspond to these regulations.

<HD1>Environmental Analysis

FAA Order 1050.1E identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The

FAA has determined this rulemaking action qualifies for the categorical exclusion identified in paragraph 310f and involves no extraordinary circumstances.

<HD1>Executive Order Determinations

<HD2>Executive Order 13132, Federalism

The FAA has analyzed this final rule under the principles and criteria of Executive Order 13132, Federalism. The agency determined that this action will not have a substantial direct effect on the States, or the relationship between the Federal Government and the States, or on the distribution of power and responsibilities among the various levels of government, and, therefore, does not have Federalism implications.

<HD2>Executive Order 13211, Regulations that Significantly Affect Energy Supply, Distribution, or Use

The FAA analyzed this final rule under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). The agency has determined that it is not a "significant energy action" under the executive order and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

<HD1>How To Obtain Additional Information

<HD2>Rulemaking Documents

An electronic copy of a rulemaking document my be obtained by using the Internet—

1. Search the Federal eRulemaking Portal (http://www.regulations.gov);
2. Visit the FAA's Regulations and Policies Web page at http://www.faa.gov/regulations_policies/ or

3. Access the Government Printing Office's Web page at http://www.gpo.gov/fdsys/.

Copies may also be obtained by sending a request (identified by notice, amendment, or docket number of this rulemaking) to the Federal Aviation Administration, Office of Rulemaking, ARM-1, 800 Independence Avenue SW., Washington, DC 20591, or by calling (202) 267-9680.

<HD2>Comments Submitted to the Docket

Comments received may be viewed by going to http://www.regulations.gov and following the online instructions to search the docket number for this action. Anyone is able to search the electronic form of all comments received into any of the FAA's dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.).

<HD2>Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. A small entity with questions regarding this document, may contact its local FAA official, or the person listed under the <E T='02'>FOR FURTHER INFORMATION CONTACT</E> heading at the beginning of the preamble. To find out more about SBREFA on the Internet, visit http://www.faa.gov/regulations_policies/rulemaking/sbre_act/.

<LSTSUB><HED>List of Subjects in 14 CFR Part 420

Launch sites, Reporting and recordkeeping requirements, Space transportation and exploration.</LSTSUB>

<HD1>The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends Chapter III of Title 14, Code of Federal Regulations as follows:<REGTEXT TITLE='14 ' PART=' 420 '>

<PART><HED>PART 420—LICENSE TO OPERATE A LAUNCH SITE

1. The authority citation for part 420 continues to read as follows:

   <AUTH><HED>Authority: <P>51 U.S.C. 50901-50923

2. Amend § 420.5 by revising the definition of Explosive hazard facility and by adding the definitions of Energetic liquid, Liquid propellant, Maximum credible event, and Public traffic route, in alphabetical order to read as follows:

§ 420.5 Definitions.

*****

Energetic liquid means a liquid, slurry, or gel, consisting of, or containing an explosive, oxidizer, fuel, or combination of the above, that may undergo, contribute to, or cause rapid exothermic decomposition, deflagration, or detonation.

*****

Explosive hazard facility means a facility or location at a launch site where solid propellants, energetic liquids, or other explosives are stored or handled.

*****

Liquid propellant means:

(1) A monopropellant on a launch vehicle or related device; or

(2) Incompatible energetic liquids co-located for purposes of serving as propellants on a launch vehicle or a related device where the incompatible energetic liquids are housed in tanks connected by piping for purposes of mixing.

Maximum credible event means a hypothesized worst-case accidental explosion, fire, or agent release that is likely to occur from a given quantity and disposition of explosives, chemical agents, or reactive material.

*****

Public traffic route means any highway or railroad that the general public may use.

*****

3. Revise §420.63 to read as follows:

§ 420.63 Explosive siting.

(a) Except as otherwise provided by paragraph (b) of this section, a licensee must ensure the configuration of the launch site follows its explosive site plan, and the licensee's explosive site plan complies with the requirements of §§ 420.65 through 420.70. The explosive site plan must include:

(1) A scaled map that shows the location of all explosive hazard facilities at the launch site and that shows actual and minimal allowable distances between each explosive hazard facility and all other explosive hazard facilities, each public traffic route, and each public area, including the launch site boundary;

(2) A list of the maximum quantity of energetic liquids, solid propellants and other explosives to be located at each explosive hazard facility, including explosive class and division;

(3) A description of each activity to be conducted at each explosive hazard facility; and

(4) An explosive site map using a scale sufficient to show whether distances and structural relationships satisfy the requirements of this part.

(b) A licensee operating a launch site located on a federal launch range does not have to comply with the requirements in §§ 420.65 through 420.70 if the licensee complies with the federal launch range's explosive safety requirements.

(c) For explosive siting issues not addressed by the requirements of §§ 420.65 through 420.70, a launch site operator must clearly and convincingly demonstrate a level of safety equivalent to that otherwise required by this part.

(d) A launch site operator may separate an explosive hazard facility from another explosive hazard facility, public area, or public traffic route by a distance different from one required by this part only if the launch site operator clearly and convincingly demonstrates a level of safety equivalent to that required by this part.

4. Revise § 420.65 to read as follows:

§ 420.65 Separation distance requirements for handling division 1.1 and 1.3 explosives.

(a) Quantity. For each explosive hazard facility, a launch site operator must determine the total quantity of division 1.1 and 1.3 explosives as follows:

(1) A launch site operator must determine the maximum total quantity of division 1.1 and 1.3 explosives by class and division, in accordance with 49 CFR part 173, Subpart C, to be located in each explosive hazard facility where division 1.1 and 1.3 explosives will be handled.

(2) When division 1.1 and 1.3 explosives are located in the same explosive hazard facility, the total quantity of explosive must be treated as division 1.1 for determining

separation distances; or, a launch site operator may add the net explosive weight of the division 1.3 items to the net explosive weight of division 1.1 items to determine the total quantity of explosives.

(b) Separation of division 1.1 and 1.3 explosives and determination of distances. A launch site operator must separate each explosive hazard facility where division 1.1 and 1.3 explosives are handled from all other explosive hazard facilities, all public traffic routes, and each public area, including the launch site boundary, by a distance no less than that provided for each quantity and explosive division in appendix E of this part as follows:

(1) For division 1.1 explosives, the launch site operator must use tables E-1, E-2, and E-3 of appendix E of this part to determine the distance to each public area and public traffic route, and to determine each intraline distance.

(2) For division 1.3 explosives, the launch site operator must use table E-4 of appendix E of this part to determine the distance to each public area and public traffic route, and to determine each intraline distance.

(c) Separation distance by weight and table. A launch site operator must:

(1) Employ no less than the public area distance, calculated under paragraph (b) of this section, to separate an explosive hazard facility from each public area, including the launch site boundary.

(2) Employ no less than an intraline distance to separate an explosive hazard facility from all other explosive hazard facilities used by a single customer. For explosive hazard facilities used by different customers a launch site operator must use the greater public area distance to separate the facilities from each other.

(3) Separate each public area containing any member of the public in the open by a distance equal to -1133.9 + [389 *ln(NEW)], where the NEW is greater than 450 pounds and less than 501,500 pounds.

(d) NEW Quantities that Fall between Table Entries. A launch site operator must, when determining a separation distance for NEW quantities that fall between table entries ,use the equation provided by tables E-1, E-3, or E-4 of appendix E of this part.

(e) Calculating Maximum Permissible NEW Given a Distance. A launch site operator must, when determining a permissible quantity of explosives, calculate maximum permissible NEW using the equation of tables E-1, E-3, or E-4 of appendix E of this part.

5. Add § 420.66 to read as follows:

§ 420.66 Separation distance requirements for storage of hydrogen peroxide, hydrazine, and liquid hydrogen and any incompatible energetic liquids stored within an intraline distance.

(a) Separation of energetic liquids and determination of distances. A launch site operator must separate each explosive hazard facility from each other explosive hazard facility, each public area, and each public traffic route in accordance with the minimum separation distance determined under this section for each explosive hazard facility storing:

(1) Hydrogen peroxide in concentrations of greater than 91 percent;

(2) Hydrazine;

(3) Liquid hydrogen; or

(4) Any energetic liquid that is:

(i) Incompatible with any of the energetic liquids of paragraph (a)(1) through (3) of this section; and

(ii) Stored within an intraline distance of any of them.

(b) Quantity. For each explosive hazard facility, a launch site operator must determine the total quantity of all energetic liquids in paragraph (a)(1) through (4) of this section as follows:

(1) The quantity of energetic liquid in a tank, drum, cylinder, or other container is the net weight in pounds of the energetic liquid in the container. The determination of quantity must include any energetic liquid in associated piping to any point where positive means exist for:

(i) Interrupting the flow through the pipe, or

(ii) Interrupting a reaction in the pipe in the event of a mishap.

(2) A launch site operator must convert the quantity of each energetic liquid from gallons to pounds using the conversion factors provided in table E–6 of appendix E of this part and the following equation:

Pounds of energetic liquid = gallons × density of energetic liquid (pounds per gallon).

(3) Where two or more containers of compatible energetic liquids are stored in the same explosive hazard facility, the total quantity of energetic liquids is the total quantity of energetic liquids in all containers, unless:

(i) The containers are each separated from each other by the distance required by paragraph (c) of this section; or

(ii) The containers are subdivided by intervening barriers that prevent mixing, such as diking.

(4) Where two or more containers of incompatible energetic liquids are stored within an intraline distance of each other, paragraph (d) of this section applies.

(c) Determination of separation distances for compatible energetic liquids. A launch site operator must determine separation distances for compatible energetic liquids as follows:

(1) To determine each intraline, public area, and public traffic route distance, a launch site operator must use the following tables in appendix E of this part:

(i) Table E-7 for hydrogen peroxide in concentrations of greater than 91 percent; and

(ii) Table E-8 for hydrazine and liquid hydrogen.

(2) For liquid hydrogen and hydrazine, a launch site operator must use the "intraline distance to compatible energetic liquids" for the energetic liquid that requires the greater distance under table E-8 of appendix E of this part as the minimum separation distance between compatible energetic liquids.

(d) Determination of separation distances for incompatible energetic liquids. If incompatible energetic liquids are stored within an intraline distance of each other, a launch site operator must determine the explosive equivalent in pounds of the combined liquids as provided by paragraph (d)(2) of this section unless intervening barriers prevent mixing.

(1) If intervening barriers prevent mixing, a launch site operator must separate the incompatible energetic liquids by no less than the intraline distance that tables E-7 and E-8 of appendix E of this part apply to compatible energetic liquids using the quantity or energetic liquid requiring the greater separation distance.

(2) A launch site operator must use the formulas provided in table E–5 of appendix E of this part, to determine the explosive equivalent in pounds of the combined incompatible

energetic liquids. A launch site operator must then use the explosive equivalent in pounds requiring the greatest separation distance to determine the minimum separation distance between each explosive hazard facility and all other explosive hazard facilities and each public area and public traffic route as required by tables E-1, E-2 and E-3 of appendix E of this part.

6. Revise § 420.67 to read as follows:

§ 420.67 Separation distance requirements for handling incompatible energetic liquids that are co-located.

(a) Separation of energetic liquids and determination of distances. Where incompatible energetic liquids are co-located in a launch or reentry vehicle tank or other vessel**,** a launch site operator must separate each explosive hazard facility from each other explosive hazard facility, each public area, and each public traffic route in accordance with the minimum separation distance determined under this section for each explosive hazard facility.

(b) Quantity. For each explosive hazard facility, a launch site operator must determine the total quantity of all energetic liquids as follows:

(1) The quantity of energetic liquid in a launch or reentry vehicle tank is the net weight in pounds of the energetic liquid. The determination of quantity must include any energetic liquid in associated piping to any point where positive means exist for:

(i) Interrupting the flow through the pipe; or

(ii) Interrupting a reaction in the pipe in the event of a mishap.

(2) A launch site operator must convert each energetic liquid's quantity from gallons to pounds using the conversion factors provided by table E–6 of appendix E of this part and the following equation:

Pounds of energetic liquid = gallons × density of energetic liquid (pounds per gallon).

(c) Determination of separation distances for incompatible energetic liquids. A launch site operator must determine separation distances for incompatible energetic liquids as follows:

(1) A launch site operator must use the formulas provided in table E-5 of appendix E of this part, to determine the explosive equivalent in pounds of the combined incompatible energetic liquids; and

(2) A launch site operator must then use the explosive equivalent in pounds to determine the minimum separation distance between each explosive hazard facility and all other explosive hazard facilities and each public area and public traffic route as required by tables E-1, E-2 and E-3 of appendix E of this part. Where two explosive hazard facilities contain different quantities, the launch site operator must use the quantity of liquid propellant requiring the greatest separation distance to determine the minimum separation distance between the two explosive hazard facilities.

(d) Separation distance by weight and table. For each explosive hazard facility, a launch site operator must:

(1) For an explosive equivalent weight from one pound through and including 450 pounds, determine the distance to any public area and public traffic route following table E-1 of appendix E of this part;

(2) For explosive equivalent weight greater than 450 pounds, determine the distance to any public area and public traffic route following table E-2 of appendix E of this part;

(3) Separate each public area containing any member of the public in the open by a distance equal to -1133.9 + [389 *ln(NEW)], where the NEW is greater than 450 pounds and less than 501,500 pounds;

(4) Separate each explosive hazard facility from all other explosive hazard facilities of a single customer using the intraline distance provided by table E–3 of appendix E of this part; and

(5) For explosive hazard facilities used by different customers, use the greater public area distance to separate the facilities from each other.

7. Revise § 420.69 to read as follows:

§ 420.69 Separation distance requirements for co-location of division 1.1 and 1.3 explosives with liquid propellants.

(a) Separation of energetic liquids and explosives and determination of distances. A launch site operator must separate each explosive hazard facility from each other explosive hazard facility, each public traffic route, and each public area in accordance with the minimum separation distance determined under this section for each explosive hazard facility where division 1.1 and 1.3 explosives are co-located with liquid propellants. A launch site operator must determine each minimum separation distance from an explosive hazard facility where division 1.1 and 1.3 explosives and liquid propellants are to be located together, to each other explosive hazard facility, public traffic route, and public area as described in paragaphs (b) through (e) of this section.

(b) Liquid propellants and division 1.1 explosives located together. For liquid propellants and division 1.1 explosives located together, a launch site operator must:

(1) Determine the explosive equivalent weight of the liquid propellants by following § 420.67(c);

(2) Add the explosive equivalent weight of the liquid propellants and the net explosive weight of division 1.1 explosives to determine the combined net explosive weight;

(3) Use the combined net explosive weight to determine the distance to each public area, public traffic route, and each other explosive hazard facility by following tables E-1, E-2, and E-3 of appendix E of this part; and

(4) Separate each public area containing any member of the public in the open by a distance equal to -1133.9 + [389 *ln(NEW)], where the net explosive weight is greater than 450 pounds and less than 501,500 pounds.

(c) Liquid propellants and division 1.3 explosives located together. For liquid propellants and division 1.3 explosives located together, a launch site operator must separate each explosive hazard facility from each other explosive hazard facility, public area, and public traffic route using either of the following two methods:

(1) Method 1. (i) Determine the explosive equivalent weight of the liquid propellants by following § 420.67(c);

(ii) Add to the explosive equivalent weight of the liquid propellants, the net explosive weight of each division 1.3 explosive, treating division 1.3 explosives as division 1.1 explosives;

(iii) Use the combined net explosive weight to determine the minimum separation distance to each public area, public traffic route, and each other explosive hazard facility by following tables E-1, E-2, and E-3 of appendix E of this part; and

(iv) Separate each public area containing any member of the public in the open by a distance equal to -1133.9 + [389 *ln(NEW)], where the net explosive weight is greater than 450 pounds and less than 501,500 pounds.

(2) Method 2. (i) Determine the explosive equivalent weight of each liquid propellant by following § 420.67(c);

(ii) Add to the explosive equivalent weight of the liquid propellants, the net explosive weight of each division 1.3 explosive to determine the combined net explosive weight;

(iii) Use the combined net explosive weight to determine the minimum separation distance to each public area, public traffic route, and each other explosive hazard facility by following tables E-1, E-2, and E-3 of appendix E of this part; and

(iv) Separate each public area containing any member of the public in the open by a distance equal to -1133.9 + [389 *ln(NEW)], where the net explosive weight is greater than 450 pounds and less than 501,500 pounds.

(d) Liquid propellants and division 1.1 and 1.3 explosives located together. For liquid propellants and division 1.1 and 1.3 explosives located together, a launch site operator must:

(1) Determine the explosive equivalent weight of the liquid propellants by following § 420.67(c);

(2) Determine the total explosive quantity of each division 1.1 and 1.3 explosive by following § 420.65(a)(2);

(3) Add the explosive equivalent weight of the liquid propellants to the total explosive quantity of division 1.1 and 1.3 explosives together to determine the combined net explosive weight;

(4) Use the combined net explosive weight to determine the distance to each public area, public traffic route, and each other explosive hazard facility by following tables E-1, E-2, and E-3 of appendix E of this part; and

(5) Separate each public area containing any member of the public in the open by a distance equal to -1133.9 + [389 *ln(NEW)], where the net explosive weight is greater than 450 pounds and less than 501,500 pounds

(e) Use of maximum credible event analysis. If a launch site operator does not want to employ paragraphs (b), (c), or (d) of this section, the launch site operator must analyze the maximum credible event (MCE) or the worst case explosion expected to occur. If the MCE shows there will be no simultaneous explosion reaction of the liquid propellant tanks and the solid propellant motors, the minimum distance between the explosive hazard facility and all other explosive hazard facilities and public areas must be based on the MCE.

8. Add § 420.70 to read as follows:

§ 420.70 Separation distance measurement requirements.

(a) This section applies to all measurements of distances performed under §§ 420.63 through 420.69.

(b) A launch site operator must measure each separation distance along straight lines. For large intervening topographical features such as hills, the launch site operator must measure over or around the feature, whichever is the shorter.

(c) A launch site operator must measure each minimum separation distance from the closest hazard source, such as a container, building, segment, or positive cut-off point in piping, in an explosive hazard facility. When measuring, a launch site operator must:

(1) For a public traffic route distance, measure from the nearest side of the public traffic route to the closest point of the hazard source; and

(2) For an intraline distance, measure from the nearest point of one hazard source to the nearest point of the next hazard source. The minimum separation distance must be the distance for the quantity of energetic liquids or net explosive weight that requires the greater distance.

9. Revise Appendix E to part 420 to read as follows:

<HD1>Appendix E to Part 420 - Tables for Explosive Site Plan

Table E-1 - Division 1.1 Distances to a Public Area or Public Traffic Route for NEW≤ 450 lbs

NEW (lbs.)	Distance to Public Area (ft) [1,2]	Distance to Public Traffic Route Distance (ft) [2]
≤0.5	236	142
0.7	263	158
1	291	175
2	346	208
3	378	227
5	419	251
7	445	267
10	474	284
15	506	304
20	529	317
30	561	337
31	563	338
50	601	361
70	628	377
100	658	395
150	815	489
200	927	556
300	1085	651

450	1243	746

[1] To calculate distance d to a public area from NEW:

NEW ≤ 0.5 lbs: d = 236

0.5 lbs<NEW < 100 lbs: d = 291.3 + [79.2 *ln(NEW)]

100 lbs ≤ NEW ≤ 450 lbs: d = -1133.9 + [389 *ln(NEW)]

NEW is in lbs; d is in ft; ln is natural logarithm.

To calculate maximum NEW given distance d (noting that d can never be less than 236 ft):

0 ≤ d < 236 ft: Not allowed (d cannot be less than 236 ft)

236 ft ≤d < 658 ft: NEW = exp [(d/79.2)-3.678]

658 ft ≤ d < 1250 ft: NEW = exp [(d/389) +2.914]

NEW is in lbs; d is in ft; exp[x] is e^x.

[2] The public traffic route distance is 60 percent of the distance to a public area.

Table E-2. Division 1.1 Distance to Public Area and Public Traffic Route for NEW > 450 lbs

NEW (lbs)	Distance to Public Area (ft)[1]	Distance to Public Traffic Route (ft)
450 lbs< NEW ≤ 30,000 lbs	1,250	750
30,000 lbs< NEW ≤ 100,000 lbs	$40*NEW^{1/3}$	0.60*(Distance to Public Area)
100,000 lbs< NEW ≤250,000lbs	$2.42*NEW^{0.577}$	0.60*(Distance to Public Area)
250,000 lbs< NEW	$50*NEW^{1/3}$	0.60*(Distance to Public Area)

[1] To calculate NEW from distance d to a public area:

1, 243 ft< d ≤ 1,857 ft: $NEW = d^3 / 64{,}000$

1, 857 ft< d ≤ 3,150 ft: $NEW = 0.2162 * d^{1.7331}$

3,150 ft< d: $NEW = d^3 / 125{,}000$

NEW is in lbs; d is in ft.

Table E-3. Division 1.1 Intraline Distances[1,2,3]

NEW (lbs)	Intraline Distance (ft)
50	66
70	74
100	84
150	96
200	105
300	120
500	143
700	160
1,000	180
1,500	206
2,000	227
3,000	260
5,000	308
7,000	344
10,000	388
15,000	444
20,000	489
30,000	559
50,000	663
70,000	742
100,000	835
150,000	956
200,000	1,053
300,000	1,205
500,000 [3]	1,429
700,000	1,598
1,000,000	1,800
1,500,000	2,060
2,000,000	2,268
3,000,000	2,596
5,000,000	3,078

[1] To calculate intraline distance d from NEW:

$d = 18*NEW^{1/3}$

NEW is in pounds; d is in feet

[2] To calculate maximum NEW from given intraline distance d:

$NEW = d^3/5,832$

NEW is in pounds; d is in feet.

[3] NEW values of more than 500,000 lbs only apply to liquid propellants with TNT equivalents equal to those NEW values. The intraline distances for NEW greater than 500,000 pounds do not apply to division 1.1 explosives.

Table E-4. Division 1.3 Separation Distances

NEW (lbs)	Distance to Public Area or Public Traffic Route (ft) [1]	Intraline distance (ft) [2]
≤1000	75	50
1,500	82	56
2,000	89	61
3,000	101	68
5,000	117	80
7,000	130	88
10,000	145	98
15,000	164	112
20,000	180	122
30,000	204	138
50,000	240	163
70,000	268	181
100,000	300	204
150,000	346	234
200,000	385	260
300,000	454	303
500,000	569	372
700,000	668	428
1,000,000	800	500
1,500,000	936	577
2,000,000	1,008	630

[1] To calculate distance d to a public area or traffic route from NEW:

NEW ≤1,000lbs

$$d = 75 \text{ ft}$$

1,000 lbs< NEW ≤ 96,000 lbs

$$d = \exp[2.47 + 0.2368*(\ln(NEW)) + 0.00384*(\ln(NEW))^2]$$

96,000 lbs< NEW ≤1,000,000lbs

$$d = \exp[7.2297 - 0.5984*(\ln(NEW)) + 0.04046*(\ln(NEW))^2]$$

NEW > 1,000,000 lbs

$$d = 8*NEW^{1/3}$$

NEW is in pounds; d is in feet; exp[x] is e^x; ln is natural logarithm.

To calculate NEW from distance d to a public area or traffic route (noting that d cannot be less than 75 ft):

$0 \leq d < 75$ ft:

Not allowed (d cannot be less than 75 ft) for NEW ≤ 1000 lbs

75 ft ≤ d≤ 296 ft

$$NEW = \exp[-30.833 + (307.465 + 260.417*(\ln(d)))^{1/2}]$$

296 ft< d≤ 800 ft

$$NEW = \exp[7.395 + (-124.002 + 24.716*(\ln(d)))^{1/2}]$$

800 ft< d

$$NEW = d^3/ 512$$

NEW is in lbs; d is in ft; exp[x] is e^x; ln is natural logarithm

[2] To calculate intraline distance d from NEW:

NEW ≤ 1,000 lbs

d = 50 ft

1,000 lbs< NEW ≤ 84,000 lbs

$$d=\exp[2.0325 + 0.2488*(\ln(NEW)) + 0.00313* (\ln(NEW))^2]$$

84,000 lbs< NEW ≤ 1,000,000 lbs

$$d= \exp[4.338 \pm 0.1695*(\ln(NEW)) + 0.0221*(\ln(NEW))^2]$$

1,000,000 lbs< NEW

$$d =5*NEW^{1/3}$$

NEW is in pounds; d is in feet; exp[x] is e^x; ln is natural logarithm

To calculate NEW from an intraline distance d:

$0 \leq d < 50$ ft:

Not allowed (d cannot be less than 50 ft) for NEW ≤ 1000 lbs

50 ft ≤ d≤ 192 ft

$$NEW = \exp[-39.744 + (930.257 + 319.49*(\ln(d)))^{1/2}]$$

192 ft<d≤ 500 ft

$$NEW = \exp[3.834 + (-181.58 + 45.249*(\ln(d)))^{1/2}]$$

500 ft<d

$$NEW = d^3/125$$

NEW is in pounds; d is in feet; exp[x] is e^x; ln is natural logarithm

Table E-5. Energetic Liquid Explosive Equivalents[1,2,3]

Energetic Liquids	TNT Equivalence	TNT Equivalence
	Static Test Stands	Launch Pads
LO_2/LH_2	See Note 3	See Note 3
$LO_2/LH_2 + LO_2/RP\text{-}1$	Sum of (see Note 3 for LO_2/LH_2) + (10% for $LO_2/RP1$)	Sum of (see Note 3 for LO_2/LH_2) + (20% for $LO_2/RP1$)
$LO_2/RP\text{-}1$	10%	20% up to 500,000 lbs Plus 10% over 500,000 lbs
IRFNA/UDMH	10%	10%
$N_20_4/UDMH + N_2H_4$	5%	10%

[1] A launch site operator must use the percentage factors of table E-5 to determine TNT equivalencies of incompatible energetic liquids that are within an intraline distance of each other.

[2] A launch site operator may substitute the following energetic liquids to determine TNT equivalency under this table as follows:

Alcohols or other hydrocarbon for RP-1

H_2O_2 for LO_2 (only when H_2O_2 is in combination with RP-1 or equivalent hydrocarbon fuel)

MMH for N_2H_4, UDMH, or combinations of the two.

[3]TNT equivalency for LO_2/LH_2 is the larger of:

(a) TNT equivalency of $8*W^{2/3}$, where W is the weight of LO_2/LH_2 in lbs; or

(b) 14 percent of the LO_2/LH_2 weight.

Table E-6. Factors to Use When Converting Energetic Liquid Densities

Item	Density (lb/gal)	Temperature (°F)
Ethyl alcohol	6.6	68
Hydrazine	8.4	68
Hydrogen peroxide (90 percent)	11.6	68
Liquid hydrogen	0.59	-423
Liquid oxygen	9.5	-297
Red fuming nitric acid (IRFNA)	12.9	77
RP-1	6.8	68
UDMH	6.6	68
UDMH/Hydrazine	7.5	68

Table E-7. Separation Distance Criteria for Storage of Hydrogen Peroxide in Concentrations of More than 91 Percent[1,2]

Quantity (lbs)	Intraline Distance or Distance to Public Area or Distance to Public Traffic Route (ft)
10,000	510
15,000	592
20,000	651
30,000	746
50,000	884
70,000	989
100,000	1114
150,000	1275
200,000	1404
300,000	1607
500,000	1905

[1] Multiple tanks containing hydrogen peroxide in concentrations of greater than 91 percent may be located at distances less than those required by table E-7; however, if the

tanks are not separated from each other by 10 percent of the distance specified for the largest tank, then the launch site operator must use the total contents of all tanks to calculate each intraline distance and the distance to each public area and each public traffic route.

[2] A launch site operator may use the equations below to determine permissible distance or quantity between the entries of table E-7:

W > 10,000 lbs Distance = $24 * W^{1/3}$

Where Distance is in ft and W is in lbs.

To calculate weight of hydrogen peroxide from a distance d:

d > 75 ft

$W = \exp[-134.286 + 71.998*(\ln(d)) - 12.363*(\ln(d))^2 + 0.7229*(\ln(d))^3]$

Table E-8: Separation Distance Criteria for Storage of Liquid Hydrogen and Bulk Quantities of Hydrazine

Pounds of energetic liquid	Pounds of energetic liquid	Public area and intraline distance to incompatible energetic liquids	Intraline distance to compatible energetic liquids	Pounds of energetic liquid	Pounds of energetic liquid	Public area and intraline distance to incompatible energetic liquids	Intraline distance to compatible energetic liquids
Over	Not Over	Distance in feet	Distance in feet	Over	Not Over	Distance in feet	Distance in feet
				60,000	70,000	1,200	130
100	200	600	35	70,000	80,000	1,200	130
200	300	600	40	80,000	90,000	1,200	135
300	400	600	45	90,000	100,000	1,200	135
400	500	600	50	100,000	125,000	1,800	140
500	600	600	50	125,000	150,000	1,800	145
600	700	600	55	150,000	175,000	1,800	150
700	800	600	55	175,000	200,000	1,800	155
800	900	600	60	200,000	250,000	1,800	160
900	1,000	600	60	250,000	300,000	1,800	165
1,000	2,000	600	65	300,000	350,000	1,800	170
2,000	3,000	600	70	350,000	400,000	1,800	175

3,000	4,000	600	75	400,000	450,000	1,800	180
4,000	5,000	600	80	450,000	500,000	1,800	180
5,000	6,000	600	80	500,000	600,000	1,800	185
6,000	7,000	600	85	600,000	700,000	1,800	190
7,000	8,000	600	85	700,000	800,000	1,800	195
8,000	9,000	600	90	800,000	900,000	1,800	200
9,000	10,000	600	90	900,000	1,000,000	1,800	205
10,000	15,000	1,200	95	1,000,000	2,000,000	1,800	235
15,000	20,000	1,200	100	2,000,000	3,000,000	1,800	255
20,000	25,000	1,200	105	3,000,000	4,000,000	1,800	265
25,000	30,000	1,200	110	4,000,000	5,000,000	1,800	275
30,000	35,000	1,200	110	5,000,000	6,000,000	1,800	285
35,000	40,000	1,200	115	6,000,000	7,000,000	1,800	295
40,000	45,000	1,200	120	7,000,000	8,000,000	1,800	300
45,000	50,000	1,200	120	8,000,000	9,000,000	1,800	305
50,000	60,000	1,200	125	9,000,000	10,000,000	1,800	310

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<NAME>Michael P. Huerta,
<TITLE>Acting Administrator.</SIG>

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