(2) When applying the 1.0 psi threshold to determine potential casualties due to blast overpressure effects, the analysis must:

(i) Incorporate a probabilistic model that accounts for the probability of casualty due to any blast overpressures of 1.0 psi or greater and satisfy paragraph (d) of this section; or

(ii) Count each person within the 1.0 psi overpressure radius of the source explosion as a casualty. When using this approach, the analysis must compute the peak incident overpressure using the Kingery-Bulmash relationship and may not take into account sheltering, reflections, or atmospheric effects. For persons located in buildings, the analysis must compute the peak incident overpressure for the shortest distance between the building and the blast source. The analysis must count each person located anywhere in a building subjected to peak incident overpressure equal to or greater than 1.0 psi as a casualty.

(d) *Casualty modeling.* A probabilistic casualty model must be based on accurate data and scientific principles and must be statistically valid. A launch operator must obtain FAA approval of any probabilistic casualty model that is used in the flight safety analysis. If the launch takes place from a Federal launch range, the analysis may employ any probabilistic casualty model that the FAA accepts as part of the FAA's launch site safety assessment of the Federal launch range's safety process.

(e) *Collision avoidance.* (1) A launch operator must ensure that a launch vehicle, any jettisoned components, and its payload do not pass closer than 200 kilometers to a manned or mannable orbital object—

(i) Throughout a sub-orbital launch; or

(ii) For an orbital launch:

(A) During ascent to initial orbital insertion and through at least one complete orbit; and

(B) During each subsequent orbital maneuver or burn from initial park orbit, or direct ascent to a higher or interplanetary orbit or until clear of all manned or mannable objects, whichever occurs first.

(2) A launch operator must obtain a collision avoidance analysis for each launch from United States Strategic Command or from a Federal range having an approved launch site safety assessment. United States Strategic Command calls this analysis a conjunction on launch assessment. Sections 417.231 and A417.31 of appendix A of this part contain the requirements for obtaining a collision avoidance analysis. A launch operator must use the results of the collision avoidance analysis to develop flight commit criteria for collision avoidance as required by § 417.113(b).

(f) *Flight safety analysis.* A launch operator must perform and document a flight safety analysis as required by subpart C of this part. A launch operator must not initiate flight unless the flight safety analysis demonstrates that any risk to the public satisfies the public risk criteria of paragraph (b) of this section. For a licensed launch that involves a Federal launch range, the FAA will treat an analysis performed and documented by the Federal range, and which has an FAA approved launch site safety assessment, as that of the launch operator as provided in § 417.203(d) of subpart C of this part. A launch operator must use the flight safety analysis products to develop flight safety rules that govern a launch. Section 417.113 contains the requirements for flight safety rules.

§ 417.109 Ground safety.

(a) Ground safety requirements apply to launch processing and post-launch operations at a launch site in the United States.

(b) A launch operator must protect the public from adverse effects of hazardous operations and systems associated with preparing a launch vehicle for flight at a launch site.

(c) §§ 417.111(c), 417.113(b), and 417.115(c), and subpart E of this part provide launch operator ground safety requirements.

§ 417.111 Launch plans.

(a) *General.* A launch operator must implement written launch plans that define how launch processing and flight of a launch vehicle will be conducted without adversely affecting public safety and how to respond to a launch mishap. A launch operator's launch plans

must include those required by this section. A launch operator's launch plans do not have to be separate documents, and may be part of other applicant documentation. A launch operator must incorporate each launch safety rule established under §417.113 into a related launch safety plan. The launch operator must follow each launch plan.

(b) *Flight Safety Plan.* A launch operator must implement a plan that includes the following:

(1) *Flight safety personnel.* Identification of personnel by position who:

(i) Approve and implement each part of the flight safety plan and any modifications to the plan; and

(ii) Perform the flight safety analysis and ensure that the results, including the flight safety rules and establishment of flight hazard areas, are incorporated into the flight safety plan.

(2) *Flight safety rules.* All flight safety rules required by §417.113.

(3) *Flight safety system.* A description of any flight safety system and its operation, including any preflight safety tests that a launch operator will perform.

(4) *Trajectory and debris dispersion data.* A description of the launch trajectory. For an orbital expendable launch vehicle, the description must include each planned orbital parameter, stage burnout time and state vector, and all planned stage impact times, locations, and downrange and crossrange dispersions. For a guided or unguided suborbital launch vehicle, the description must include each planned stage impact time, location, and downrange and crossrange dispersion.

(5) *Flight hazard areas.* Identification and location of each flight hazard area established for each launch as required by §417.223, and identification of procedures for surveillance and clearance of these areas and zones as required by paragraph (j) of this section.

(6) *Support systems and services.* Identification of any support systems and services that are part of ensuring flight safety, including any aircraft or ship that a launch operator will use during flight.

(7) *Flight safety operations.* A description of the flight safety related tests, reviews, rehearsals, and other flight safety operations that a launch operator will conduct under §§417.115 through 417.121. A flight safety plan must contain or incorporate by reference written procedures for accomplishing all flight safety operations.

(8) *Unguided suborbital launch vehicles.* A launch operator's flight safety plan for the launch of an unguided suborbital rocket must meet the requirements of paragraph (b) of this section and provide the following data:

(i) Launch angle limits, as required by §417.125(c)(3); and

(ii) All procedures for measurement of launch day winds and for performing wind weighting as required by §§417.125 and 417.233.

(c) *Ground safety plan.* A launch operator must implement a ground safety plan that describes implementation of the hazard controls identified by a launch operator's ground safety analysis and implementation of the ground safety requirements of subpart E of this part. A ground safety plan must address all public safety related issues and may include other ground safety issues if a launch operator intends it to have a broader scope. A ground safety plan must include the following:

(1) A description of the launch vehicle and any payload, or class of payload, identifying each hazard, including explosives, propellants, toxics and other hazardous materials, radiation sources, and pressurized systems. A ground safety plan must include figures that show the location of each hazard on the launch vehicle, and indicate where at the launch site a launch operator performs hazardous operations during launch processing.

(2) Propellant and explosive information including:

(i) Total net explosive weight of each of the launch operator's liquid and solid propellants and other explosives for each explosive hazard facility as defined by part 420 of this chapter.

(ii) For each toxic propellant, any hazard controls and process constraints determined under the launch operator's toxic release hazard analysis for launch processing performed as required by §417.229 and appendix I of this part.

(iii) The explosive and occupancy limits for each explosive hazard facility.

(iv) Individual explosive item information, including configuration (such as, solid motor, motor segment, or liquid propellant container), explosive material, net explosive weight, storage hazard classification and compatibility group as defined by part 420 of this chapter.

(3) A graphic depiction of the layout of a launch operator's launch complex and other launch processing facilities at the launch site. The depiction must show separation distances and any intervening barriers between explosive items that affect the total net explosive weight that each facility is sited to accommodate. A launch operator must identify any proposed facility modifications or operational changes that may affect a launch site operator's explosive site plan.

(4) A description of the process for ensuring that the person designated under §417.103(b)(2) reviews and approves any procedures and procedure changes for safety implications.

(5) Procedures that launch personnel will follow when reporting a hazard or mishap to a launch operator's safety organization.

(6) Procedures for ensuring that personnel have the qualifications and certifications needed to perform a task involving a hazard that could affect public safety.

(7) A flow chart of launch processing activities, including a list of all major tasks. The flow chart must include all hazardous tasks and identify where and when, with respect to liftoff, each hazardous task will take place.

(8) Identification of each safety clear zone and hazard area established as required by §§417.411 and 417.413, respectively.

(9) A summary of the means for announcing when any hazardous operation is taking place, the means for making emergency announcements and alarms, and identification of the recipients of each type of announcement.

(10) A summary of the means of prohibiting access to each safety clear zone, and implementing access control to each hazard area, including any procedures for prohibiting or allowing public access to such areas.

(11) A description of the process for ensuring that all safety precautions and verifications are in place before, during, and after hazardous operations. This includes the process for verification that an area can be returned to a non-hazardous work status.

(12) Description of each hazard control required by the ground safety analysis for each task that creates a public or launch location hazard. The hazard control must satisfy §417.407(b).

(13) A procedure for the use of any safety equipment that protects the public, for each task that creates a public hazard or a launch location hazard.

(14) The requirement and procedure for coordinating with any launch site operator and local authorities, for each task creating a public or launch location hazard.

(15) Generic emergency procedures that apply to all emergencies and the emergency procedures that apply to each specific task that may create a public hazard, including any task that involves hazardous material, as required by §417.407.

(16) A listing of the ground safety plan references, by title and date, such as the ground safety analysis report, explosive quantity-distance site plan and other ground safety related documentation.

(d) *Launch support equipment and instrumentation plan.* A launch operator must implement a plan that ensures the reliability of the equipment and instrumentation involved in protecting public safety during launch processing and flight. A launch support equipment and instrumentation plan must:

(1) List and describe support equipment and instrumentation;

(2) Identify all certified personnel, by position, as required by §417.105, who operate and maintain the support equipment and instrumentation;

(3) Contain, or incorporate by reference, written procedures for support equipment and instrumentation operation, test, and maintenance that will be implemented for each launch;

(4) Identify equipment and instrumentation reliability; and

(5) Identify any contingencies that protect the public in the event of a malfunction.

(e) *Configuration management and control plan.* A launch operator must implement a plan that:

(1) Defines the launch operator's process for managing and controlling any change to a safety critical system to ensure its reliability;

(2) Identifies, for each system, each person by position who has authority to approve design changes and the personnel, by position, who maintain documentation of the most current approved design; and

(3) Contains, or incorporates by reference, all configuration management and control procedures that apply to the launch vehicle and each support system.

(f) *Frequency management plan.* A launch operator must implement a plan that:

(1) Identifies each frequency, all allowable frequency tolerances, and each frequency's intended use, operating power, and source;

(2) Provides for the monitoring of frequency usage and enforcement of frequency allocations; and

(3) Identifies agreements and procedures for coordinating use of radio frequencies with any launch site operator and any local and Federal authorities, including the Federal Communications Commission.

(g) *Flight termination system electronic piece parts program plan.* A launch operator must implement a plan that describes the launch operator's program for selecting and testing all electronic piece parts used in any flight termination system to ensure their reliability. This plan must—

(1) Demonstrate compliance with the requirements of §417.309(b)(2);

(2) Describe the program for selecting piece parts for use in a flight termination system;

(3) Identify performance of any derating, qualification, screening, lot acceptance testing, and lot destructive physical analysis for electronic piece parts;

(4) Identify all personnel, by position, who conduct the piece part tests;

(5) Identify the pass/fail criteria for each test for each piece part;

(6) Identify the levels to which each piece part specification will be derated; and

(7) Contain, or incorporate by reference, test procedures for each piece part.

(h) *Accident investigation plan (AIP).* A launch operator must implement a plan containing the launch operator's procedures for reporting and responding to launch accidents, launch incidents, or other mishaps, as defined by §401.5 of this chapter. An individual, authorized to sign and certify the application as required by §413.7(c) of this chapter, and the person designated under §417.103(b)(2) must sign the AIP.

(1) *Reporting requirements.* An AIP must provide for—

(i) Immediate notification to the Federal Aviation Administration (FAA) Washington Operations Center in case of a launch accident, a launch incident or a mishap that involves a fatality or serious injury (as defined by 49 CFR 830.2).

(ii) Notification within 24 hours to the Associate Administrator for Commercial Space Transportation or the Federal Aviation Administration (FAA) Washington Operations Center in the event of a mishap, other than those in §415.41 (b) (1) of this chapter, that does not involve a fatality or serious injury (as defined in 49 CFR 830.2).

(iii) Submission of a written preliminary report to the FAA, Associate Administrator for Commercial Space Transportation, in the event of a launch accident or launch incident, as defined by §401.5 of this chapter, within five days of the event. The report must identify the event as either a launch accident or launch incident, and must include the following information:

(A) Date and time of occurrence;

(B) Description of event;

(C) Location of launch;

(D) Launch vehicle;

(E) Any payload;

(F) Vehicle impact points outside designated impact lines, if applicable;

(G) Number and general description of any injuries;

(H) Property damage, if any, and an estimate of its value;

(I) Identification of hazardous materials, as defined by §401.5 of this chapter, involved in the event, whether on the launch vehicle, payload, or on the ground;

(J) Action taken by any person to contain the consequences of the event; and

(K) Weather conditions at the time of the event.

(2) *Response plan.* An AIP must—

(i) Contain procedures that ensure the containment and minimization of the consequences of a launch accident, launch incident or other mishap;

(ii) Contain procedures that ensure the preservation of the data and physical evidence;

(3) *Investigation plan.* An AIP must contain—

(i) Procedures for investigating the cause of a launch accident, launch incident or other mishap;

(ii) Procedures for reporting investigation results to the FAA; and

(iii) Delineated responsibilities, including reporting responsibilities for personnel assigned to conduct investigations and for any one retained by the licensee to conduct or participate in investigations.

(4) *Cooperation with FAA and NTSB.* An AIP must contain procedures that require the licensee to report to and cooperate with FAA and National Transportation Safety Board (NTSB) investigations and designate one or more points of contact for the FAA and NTSB.

(5) *Preventive measure.* An AIP must contain procedures that require the licensee to identify and adopt preventive measures for avoiding recurrence of the event.

(i) *Local agreements and public coordination plans.* (1) Where there is a licensed launch site operator, a launch operator must implement and satisfy the launch site operator's local agreements and plans with local authorities at or near a launch site whose support is needed to ensure public safety during all launch processing and flight, as required by part 420 of this chapter.

(2) For a launch from an exclusive-use site, where there is no licensed launch site operator, a launch operator must develop and implement any agreements and plans with local authorities at or near the launch site whose support is needed to ensure public safety during all launch processing and flight, as required by part 420 of this chapter.

(3) A launch operator must implement a schedule and procedures for the release of launch information before flight, after flight, and in the event of an mishap.

(4) A launch operator must develop and implement procedures for public access to any launch viewing areas that are under a launch operator's control.

(5) A launch operator must describe its procedures for and accomplish the following for each launch—

(i) Inform local authorities of each designated hazard areas near the launch site associated with a launch vehicle's planned trajectory and any planned impacts of launch vehicle components and debris as defined by the flight safety analysis required by subpart C of this part;

(ii) Provide any hazard area information prepared as required by § 417.225 or § 417.235 to the local United States Coast Guard or equivalent local authority for issuance of the notices to mariners;

(iii) Provide hazard area information prepared as required by § 417.223 or § 417.233 for each aircraft hazard area within a flight corridor to the FAA Air Traffic Control (ATC) office or equivalent local authority having jurisdiction over the airspace through which the launch will take place for the issuance of notices to airmen;

(iv) Communicate with the local Coast Guard and the FAA ATC office or equivalent local authorities, either directly or through any launch site operator, to ensure that notices to airmen and mariners are issued and in effect at the time of flight; and

(v) Coordinate with any other local agency that supports the launch, such as local law enforcement agencies, emergency response agencies, fire departments, National Park Service, and Mineral Management Service.

(j) *Hazard area surveillance and clearance plan.* A launch operator must implement a plan that defines the process for ensuring that any unauthorized persons, ships, trains, aircraft or other vehicles are not within any hazard areas identified by the flight safety analysis or the ground safety analysis. In the plan, the launch operator must—

(1) List each hazard area that requires surveillance under §§417.107 and 417.223;

(2) Describe how the launch operator will provide for day-of-flight surveillance of the flight hazard area to ensure that the presence of any member of the public in or near a flight hazard area is consistent with flight commit criteria developed for each launch as required by §417.113;

(3) Verify the accuracy of any radar or other equipment used for hazard area surveillance and account for any inaccuracies in the surveillance system when enforcing the flight commit criteria;

(4) Identify the number of security and surveillance personnel employed for each launch and the qualifications and training each must have;

(5) Identify the location of roadblocks and other security checkpoints, the times that each station must be manned, and any surveillance equipment used; and

(6) Contain, or incorporate by reference, all procedures for launch personnel control, handling of intruders, communications and coordination with launch personnel and other launch support entities, and implementation of any agreements with local authorities and any launch site operator.

(k) *Communications plan.* A launch operator must implement a plan providing licensee personnel and Federal launch range personnel, if applicable, communications procedures during countdown and flight. Effective issuance and communication of safety-critical information during countdown must include hold/resume, go/no go, and abort commands by licensee personnel and any Federal launch range personnel, during countdown. For all launches from Federal launch ranges, the Federal launch range must concur with the communications plan. The communications plan must:

(1) Describe the authority of licensee personnel and any Federal launch range personnel by individual or position title, to issue these commands;

(2) Ensure the assignment of communication networks, so that personnel identified under this paragraph have direct access to real-time safety-critical information required for issuing hold/resume, go/no go, and abort decisions and commands;

(3) Ensure personnel, identified under this paragraph, monitor each common intercom channel during countdown and flight; and

(4) Ensure the implementation of a protocol for using defined radio telephone communications terminology.

(l) *Countdown plan.* A launch operator must develop and implement a countdown plan that verifies that each launch safety rule and launch commit criterion is satisfied, verifies that personnel can communicate during the countdown and that the communication is available after the flight; and verifies that a launch operator will be able to recover from a launch abort or delay. A countdown plan must:

(1) Cover the period of time when any launch support personnel are to be at their designated stations through initiation of flight.

(2) Include procedures for handling anomalies that occur during a countdown and events and conditions that may result in a constraint to initiation of flight.

(3) Include procedures for delaying or holding a launch when necessary to allow for corrective actions, to await improved conditions, or to accommodate a launch wait.

(4) Describe a process for resolving issues that arise during a countdown and identify each person, by position, who approves corrective actions.

(5) Include a written countdown checklist that provides a formal decision process leading to flight initiation. A countdown checklist must include the flight day preflight tests of a flight safety system required by subpart D of this part and must contain:

(i) Identification of operations and specific actions completed, verification that there are no constraints to flight, and verification that a launch operator satisfied all launch safety rules and launch commit criteria;

(ii) Time of each event;

(iii) Identification of personnel, by position, who perform each operation or specific action, including reporting to the person designated under §417.103(b)(3);

(iv) Identification of each communication channel that a launch operator uses for reporting each event;

(v) Identification of all communication and event reporting protocols;

(vi) Polling of personnel, by position, who oversee all safety critical systems and operations, to verify that the systems and the operations are ready to proceed with the launch; and

(vii) Record of all critical communications network channels that are used for voice, video, or data transmission that support the flight safety system, during each countdown.

(6) In case of a launch abort or delay:

(i) Identify each condition that must exist in order to make another launch attempt;

(ii) Include a schedule depicting the flow of tasks and events in relation to when the abort or delay occurred and the new planned launch time; and

(iii) Identify each interface and supporting entity needed to support recovery operations.

§ 417.113 Launch safety rules.

(a) *General.* For each launch, a launch operator must satisfy written launch safety rules that govern the conduct of the launch.

(1) The launch safety rules must identify the meteorological conditions and the status of the launch vehicle, launch support equipment, and personnel under which launch processing and flight may be conducted without adversely affecting public safety.

(2) The launch safety rules must satisfy the requirements of this section.

(3) A launch operator must follow all the launch safety rules.

(b) *Ground safety rules.* The launch safety rules must include ground safety rules that govern each preflight ground operation at a launch site that has the potential to adversely affect public safety. The ground safety rules must implement the ground safety analysis of subpart E of this part.

(c) *Flight-commit criteria.* The launch safety rules must include flight-commit criteria that identify each condition that must be met in order to initiate flight.

(1) The flight-commit criteria must implement the flight safety analysis of subpart C of this part. These must include criteria for:

(i) Surveillance of any region of land, sea, or air necessary to ensure the number and location of members of the public are consistent with the inputs used for the flight safety analysis of subpart C of this part;

(ii) Monitoring of any meteorological condition and implementing any flight constraint developed using appendix G of this part. The launch operator must have clear and convincing evidence that the lightning flight commit criteria of appendix G, which apply to the conditions present at the time of lift-off, are not violated. If any other hazardous conditions exist, other than those identified by appendix G, the launch weather team will report the hazardous condition to the official designated under § 417.103(b)(1), who will determine whether initiating flight would expose the launch vehicle to a lightning hazard and not initiate flight in the presence of the hazard; and

(iii) Implementation of any launch wait in the launch window for the purpose of collision avoidance.

(2) For a launch that uses a flight safety system, the flight-commit criteria must ensure that the flight safety system is ready for flight. This must include criteria for ensuring that:

(i) The flight safety system is operating to ensure the launch vehicle will launch within all flight safety limits;

(ii) Any command transmitter system required by section D417.9 has sufficient coverage from lift-off to the point in flight where the flight safety system is no longer required by § 417.107(a);

(iii) The launch vehicle tracking system has no less than two tracking sources prior to lift-off. The launch vehicle tracking system has no less than one verified tracking source at all times from lift-off to orbit insertion for an orbital launch, to the end of powered flight for a suborbital launch; and

(iv) The launch operator will employ its flight safety system as designed in accordance with this part.

(3) For each launch, a launch operator must document the actual conditions used for the flight-commit criteria at the time of lift-off and verify