Environmental Impact Control Methods: Primary Site Rules and Constraints

SS2S Technical Document

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Table of Contents

General information

This document outlines environmental impact control methods for the primary operations site. The primary operations site is the location where propellant is mixed and cast, the launch vehicle is assembled and tested, range activities are conducted, and the rocket is launched. These rules and constraints must be complied with and implemented during all activities at the primary site. All procedures, processes and other documents must account for rules and constraints set forth in this document. While these controls are intended for use at the primary site, they may be implemented at alternate locations.

Since the primary site location is still to be determined, these guidelines are general in nature, yet comprehensive. This document must be revised and updated with site-specific information once the location is selected.

1. Operations.

1.1 Wildlife. Wildlife habitats, migration routes, and nesting areas must not be disturbed. Activities at the operations site must not interfere with local wildlife activities. Every effort must be made to not attract wildlife to the operations site, not startle wildlife due to noise or activity level, not harm wildlife, or otherwise upset the natural balance of the area. Should wildlife become obviously upset or intrigued by activities, the operation must cease to assess the situation. Care must be taken to protect threatened or endangered species. Contact the local BLM office for region-specific details.

1.2 Vegetation. Vegetation damage must be limited. Trampling, cutting, mowing, or otherwise eliminating standing vegetation is prohibited. Firewood collection is prohibited. Every effort must be made to place the operations site in a relatively vegetation-free area (dirt, sand, gravel, dry lakebed, etc.). Operating equipment must be situated so it does not damage vegetation due to footprint, heat output, or possible spills. Care must be taken to protect threatened or endangered species. Contact the local BLM office for region-specific details.

1.3 Noise. Noise from primary and secondary operations must be limited, so as not to disturb local wildlife or unaffiliated people in the vicinity. Noise may upset wildlife, or draw them to the site. Noise is also a primary attractant for people in the region, who may be drawn to the activities and enter a hazardous area. Should wildlife or unaffiliated people approach the operation, activities must cease to assess the situation. Noise complaints to law enforcement may require terminating operations.

1.4 Chemical Pollutants. All combustion system exhaust, including vehicles, generators, stoves, or campfires, must comply with local EPA regulations. The introduction of chemical pollutants into the local atmosphere must be monitored and limited. Any solid propellant combustion by-products must be characterized as environmentally friendly in expected quantities. The maximum expected

quantity includes a catastrophic fire during manufacture or standard output during full-scale motor burn, in both cases consuming all of the liquid or solid propellant.

2. Equipment and Infrastructure.

2.1 Permanent Structures. No permanent structures are allowed. A permanent structure is any physical object or alteration to the local environment that cannot be removed quickly and without a trace. As substantial setup and even construction of equipment may be necessary at the site, the most fitting definition of a permanent structure is any object that is fixed to the ground with *no intention of removal*. Additionally, no earth may be moved, including for burms, barriers, catch basins, ditches, roadways, buried cables, reinforcements, ramps, or other uses. Note: some of these restrictions may be lifted if the site is located on private property and the owner permits such construction. In this case, a local building permit may be required.

2.2 Roadways. Only pre-existing roadways may be utilized. All motorized vehicles must remain on the roadways while in operation, or parked just off the side of the roadway when not in use. New roadways may not be constructed.

2.3 Operations Equipment. Operations equipment is that which is necessary to conduct the operations (mixing/casting propellant, testing motors, conducting launches, etc). Commercially-obtained equipment (rented, purchased, or borrowed) must be current on applicable environmental inspections, ratings, and other testing. Team-developed equipment must be designed to comply with all local and federal environmental regulations. The primary environmental concern for operations equipment is propellant chemical contamination/spillage or propellant combustion products.

2.4 Support Equipment. Support equipment is that which provides necessary commodities (electrical power), shelter, and workspaces. Commercially-obtained equipment (rented, purchased, or borrowed) must be current on applicable environmental inspections, ratings, and other testing. Team-developed equipment must be designed to comply with all local and federal environmental regulations. The primary environmental concern for support equipment is human waste control and mechanical system fuel, lubricants and exhaust.

2.5 Safety Equipment. Safety equipment is that which aids in safe primary and secondary operations. Environmental impact of safety equipment *may* be waived based on the criticality of the safety feature. For example, a water deluge system may (after appropriate analysis) be permitted to drench a burning propellant batch with subsequent absorption of contaminated water into the soil. All safety equipment must be evaluated to ensure the environmental repercussions of its use are commensurate with the level of associated risk. Preferably, all safety equipment will comply with local and federal environmental regulations.

3. Waste Management.

3.1 General Waste. All general waste (rubbish, scrap) must be collected and removed from the site. On-site disposal (incineration, burial, etc.) is not permitted. Large (30 gallon or greater) plastic or metal trash receptacles lined with a heavy plastic bag must be available at the site. At a minimum, one receptacle will be located near the support equipment and the other near the operations equipment. Hazardous materials, including paint, electronics waste, acids, batteries, etc., must be removed from site and delivered to the appropriate hazardous material disposal center.

3.2 Human Waste. Portable toilet systems with a sanitary hand-washing station must be available on site. The system may be a Port-o-John type toilet or camper/RV type toilet, and must be available at the rate of at least one per ten personnel, or in accordance with local health codes, if more restrictive.

3.3 Primary Operations Waste.

3.3.1 Sorbitol Powder. The fuel powder is non-harmful to people or wildlife. However, the chemical is still an environmental consideration. Efforts must be made to contain spills and prevent dust formation, as the introduction of sugar to the environment will attract insects and other animals and alter the local food chain. Spills should be sprayed with water to prevent dust formation and for ease of cleanup.

3.3.2 Potassium Nitrate Powder. The oxidizer powder is harmful to people and wildlife when exposed to skin, eyes, or if ingested. The oxidizer is also a fertilizer; introduction to the soil (especially in large quantities) can alter the local vegetation, encourage overgrowth, and generate harmful nitrates. Formation of dust must be prevented. Spills should be sprayed with water to prevent dust formation and for ease of cleanup.

3.3.3 Solid Propellant (liquid phase). Molten solid propellant is more hazardous than solid phase propellant since it is closer to combustion. Liquid spills must be collected in a basin, possibly with the assistance of a water deluge to cool and solidify the propellant. The deluge water should be filtered and the solid propellants skimmed out to be handled in accordance with para 3.3.4..

3.3.4 Solid Propellant (solid phase – grains or debris). Solid propellants pose less environmental threat as they are more stable and do not leave behind chemicals. Operations creating them, however, may generate debris (from cast removal, mandrel removal, trimming, etc.). This debris must be collected, along with any solidified waste from a liquid-phase spill. The debris should be contained in a bucket and either burned on-site

in a Safety Team-approved burn can or transported off site. It can then be completely dissolved in water and washed into a standard sewer system.

3.4 Secondary Operations Waste.

3.4.1 Lubricants, gasoline, coolants. These fluids are necessary for the operation of primary and secondary operations equipment and vehicles. Systems must be monitored for leaks. When refilling fuel tanks and other reservoirs, every effort must be made to not spill fluids. Each system utilizing these fluids must have a catch basin located beneath them to collect any slow drips, re-fill spillage, or full spills. These waste products must be collected and sealed in a transportation vessel. The only disposal is at an appropriate and licensed collection/disposal site.

3.4.2 Contaminated Water. There are two primary sources of contaminated water: deluge water and gray water. Deluge water, resultant of spraying down a fire or other spill, or used during static fire and launch operations, is contaminated with combustion chemicals, raw propellants, or other possibly hazardous chemicals. Deluge water must be collected and either transported away from the operations site or filtered on-site. If a water reclamation system is to be used, it must comply with local, state, and federal standards. Gray water, resultant from cleaning operations, is generally not hazardous, yet contains chemicals and detergents that make it non-potable. This water must also be collected and transported off site or reclaimed on site. The same water reclamation system may be used for the deluge and gray water.

4. Spills.

4.1 Prevention. Spills are the most likely violator of environmental protection. Typically, noise and gaseous exhaust wastes meet federal and local standards, especially in commercially-obtained systems. However, spills have the potential for causing widespread damage and due to the large amount of chemical and fluid transfer, have a greater possibility for occurring during operations. Overflow basins should be available and placed under chemical containers and mixing areas. Ideally, a sump pump with return line should be placed in the overflow basin to allow quick cleanup of liquids and mitigate a halt to operations. Overflow reservoirs should be designed into fluid lines, in case of a line blockage or excessive flow rate. Quick-drain systems, including remotely operated drain valves, should be included in the operations equipment to allow for a controlled drain into an overflow basin rather than uncontrolled overflow or spill. Protective coverings, such as tarps, plastic sheeting, grills, or blankets should be placed on the ground over the entire operations area, where applicable, to allow easier cleanup in case of a leak or spill. Coverings must not damage vegetation below. During all operations, an Environmental Observer (EO) will be in place to monitor the operations and any environmental impact. The EO will likely be a member from the Environmental Impact Team, but this is not a strict requirement.

Similar to a Safety Observer (SO), this individual reports directly to the Operations Director (OD) and has the authority to place the operations on hold at any point. The EO's main concern is protecting the environment and ensuring no environmental citations which may shut down the operation or project. All operators and other personnel are responsible for reporting possible environmental impacts or violations to the EO; reports may remain anonymous.

4.2 Clean-up. Detection of a significant and uncontrolled spill or leak involving the operations equipment (i.e. molten propellant escaping through a damaged feed line onto un-protected earth) requires an immediate halt of operations and elimination of all ignition sources. An investigation into environmental impact, cleanup, necessary repairs, and re-inspection are required prior to recommencing operations. The EO will give the final go-ahead. Spills or leaks involving support equipment will be analyzed in real time without immediate shut-down of operations. If necessary, operations may be ceased, at the discretion of the EO and OD, to conduct necessary investigation, cleanup, repairs and inspections. All efforts will be made to continue operations during a support system leak or spill. Appropriate containment and cleanup supplies must be readily available. Absorptive blankets and sawdust are required to clean liquid spills. A water truck, water trailer, or other large water tank is required for safety, deluge, and clean-up purposes. Other necessary equipment and materials include mops, brooms, shovels, a wet-dry vacuum, buckets, garbage cans with secure lids, large plastic waste bags, dust masks, and rubber gloves.

4.3 Reporting. All operators are responsible for reporting possible environmental impacts or violations to the EO. The EO is required to report directly to the OD. If an environmental regulation violation occurred, the EO has the obligation to notify the appropriate local authorities. If the spill was excessive, the local fire department or EPA office should be contacted for assistance.