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Chapter I – Introduction to the Interagency Aerial Ignition Guide

I. Objectives

The objectives of the *Interagency Aerial Ignition Guide* (IAIG) are:

- A. **Define and standardize procedures and equipment for approved aerial ignition operations for use by all cooperating natural resource agencies.**
- B. **Ensure that all aerial ignition operations are performed in a safe and efficient manner.**
- C. **Provide a framework within which Areas, Regions, States, and local units can provide supplemental, site-specific guidance.**
- D. **Establish a method to evaluate and approve aerial ignition systems not currently approved and outlined in this guide.**

II. Scope

The *Interagency Aerial Ignition Guide* (IAIG) contains procedures that are specific to aerial ignition operations. The procedures and equipment outlined in this guide address both incident and project aerial ignition operations.

III. Authority

Participating agency aviation manuals contain the authority for implementing this guide.

IV. Participating Agencies

The *Interagency Aerial Ignition Guide* (IAIG) is published with the concurrence and cooperation of the United States Department of Agriculture Forest Service (USDA-FS), certain Bureaus and Offices within the United States Department of Interior (USDI), and various state and local agencies.

V. Approved Aerial Ignition Systems

All aerial ignition systems must meet OSHA, DOT requirements, and NFPA standards. Contact your agency aviation specialist for an updated list of approved devices. The only aerial ignition systems currently approved are:

- A. **Premo Mark III Aerial Ignition Device**
- B. **Simplex Helitorch Model 5400 (With approved retrofit)**
- C. **Western Heli-Craft Helitorch, USDI–Alaska only**
- D. **Fire-Spec Helitorch-US Forest Service**
- E. **The following aerial ignition devices approved for specific bureaus/agencies (non-interagency) must meet the provisions outlined in Chapter I, VI, Non-Standard Aerial Ignition Systems.**
 - 1. **Isolair Fire Fly Application System**
 - 2. **Fusee Dispenser-National Park Service**

VI. Non-Standard Aerial Ignition Systems

An agency may wish to use an aerial ignition system not covered in the *Interagency Aerial Ignition Guide* (IAIG). While all natural resource agencies are strongly encouraged to use the systems and procedures prescribed in this guide the following guidelines should be used for a nonstandard system approval.

- A. **The user must request, in writing, permission to use the non-standard system. The written request shall be submitted through appropriate channels to top level aviation managers for the agency.**
- B. **The written request must include a project proposal, which describes the user needs, and justification of a nonstandard system.**
- C. **A written operating plan must be submitted with the request package, describing operating procedures, training plan and a job hazard analysis.**
- D. **All users of the non-standard system must possess aerial ignition qualifications listed in Chapter II, Page 1 (Table 1).**
- E. **If permission is granted to use a nonstandard system, the system may only be used on the unit for which it was approved.**

VII. Contracted Aerial Ignition Systems

Some geographic areas have private vendors who own and operate aerial ignition systems. When an agency opts to use contract aerial ignition, the following guidelines will be observed.

- A. **The user unit must submit a written Project Aviation Safety Plan (PASP)/Special Use Mission Plan as outlined in the IHOG, (3-25) to appropriate Region, State, or Agency Aviation Managers.**
- B. **Review the training and qualifications of the contractor personnel.**
- C. **Any deviation from established standard operating procedures or policy requires authorization by the Regional Aviation Officer or State Aviation Manager.**

VIII. Organization

The chapters of the *Interagency Aerial Ignition Guide* (IAIG) are to identify the approved aerial ignition systems. The appendices provide the user with operational and administrative forms, checklists, and job aids.

IX. Publication

The United States Department of Agriculture-Forest Service and the Bureau of Land Management, United States Department of the Interior, jointly sponsor publication of the *Interagency Aerial Ignition Guide* (IAIG).

X. Review and Revision

Users are encouraged to send recommended changes for the *Interagency Aerial Ignition Guide* (IAIG) to their aviation program managers at NIFC. This guide will be reviewed every two years.

XI. Ordering and Distribution

Additional copies of this publication may be ordered by mail/fax from: National Interagency Fire Center, ATTN: Great Basin Cache Supply Office, 3833 S. Development Avenue, Boise, Idaho 83705. Order NFES #1080.

Chapter II – Aerial Ignition Positions

I. Introduction

This chapter identifies the positions, duties, responsibilities, and certifications for individuals involved in aerial ignition operations. To meet minimum qualifications, individuals must be trained, experienced, certified, and current with that aerial ignition system. Position requirements apply to both incident and prescribed fire operations.

II. Qualifications

To be qualified in an aerial ignition position, individuals must meet all prerequisite training and experience standards listed in IHOG chart 2-5 on page 2-7.

Aerial Ignition Training, Qualifications, And Experience Requirements

Code	Position	Prerequisites	IHOG Training Requirements	Job Aids/ Currency Requirements
HTMG	Helitorch Manager	Helicopter Manager (Fire Exclusive, or Fire CWN or Project) Helibase Manager Type II	See Charts 2-1 through 2-3 for training requirements for Helicopter Manager; See Chart 2-4 for training requirements for Helibase Manager; Specific helitorch manager training and certification requirements are contained in the text of this chapter.	Performance in the position once within the last three years.
HTMM	Helitorch Mixmaster	Helicopter Crewmember (Fire Exclusive, or Fire CWN or Project)	See Charts 2-1 through 2-3 for training requirements for Helicopter Crewmember; Specific helitorch mixmaster and parking tender training and certification requirements are contained in the text of this chapter.	
HTPT	Helitorch Parking Tender	Helicopter Crewmember (Fire Exclusive, or Fire CWN or Project)		
PLDO	Plastic Sphere Dispenser (PSD) Operator	Project Helicopter Crewmember	See Chart 2-3 for training requirements for the Project Helicopter Crewmember. Specific operator training and certification requirements are contained in that part of the chapter.	

Table 1

III. Instructor Qualifications

- A. **Qualified and current as a Helitorch Manager (HTMG) or Plastic Sphere Dispenser Operator (PSDO) and Helicopter Manager (HEMG).**
- B. **Approval of Regional Helicopter Operations Specialist or State Aviation Manager.**

IV. Certification

In the USDA Forest Service, certification is the responsibility of the applicable Regional Helicopter Operations Specialist, or designee. For DOI Bureaus, certification is accomplished through Bureau/Agency authority at the State or Area office level or as otherwise established by individual Bureau/Agency.

A. Initial Certification and Training

Certification and training for helitorch module members (Helitorch Manager, Mixmaster, and Parking Tender), other helitorch support crew (mixing crew, fire protection, and radio operator), and Plastic Sphere Dispenser Operators shall consist, at a minimum, of a one-day session on each type of equipment utilizing national approved/available lesson plans. Training will cover:

1. Organization and communication requirements:
2. Special safety procedures and concerns, including emergencies.
3. Hazardous materials shipping, storing, and handling procedures and requirements.
4. Equipment testing, troubleshooting, and maintenance.
5. Briefing and checklist requirements.
6. Operational procedures and requirements.
7. A “live-run” exercise. For the helitorch, the live run shall consist of a briefing by the Burn Boss and all personnel, mixing, torch test procedures, pilot briefing and dropping of gel. For the PSD operator, the live run shall consist of briefing the Pilot and Burn Boss, installing and testing the PSD in the helicopter, and dropping plastic spheres.
8. The dropping of gel or plastic spheres may be accomplished either as a training exercise or as part of an actual burn project.
9. Helitorch support personnel must complete the basic helicopter safety course, as well as any additional requirements for helibase positions as outlined in IHOG Chart 2-4, page 2-7.

B. Annual Approval and Re-certification

1. Annual re-certification is required. Once a helitorch module or PSD Operator has been trained and certified, the required annual re-certification shall consist of the following:
 - a. Each helitorch module member or PSD Operator shall review the applicable sections of this guide, as well as agency-specific guidance and direction.
 - b. A certification training session consisting of lesson plans available from State, Area, or Regional aviation management.
 - c. A system for documenting and tracking annual re-certification shall be maintained by responsible Agency/Bureau managers.
2. Aerial ignition personnel who transfer from one Region, State, or Area within an agency or who transfer from one agency to another shall show documentation that they have successfully completed the requirements outlined above for certification and training

C. Currency Requirements

In addition to initial and annual certification/re-certification training, a member of a helitorch module or PSD operator must perform in the position *at least once every three years* to maintain currency and remain eligible for re-certification training. If an individual does not meet the currency requirement, he or she must complete the initial certification and training.

V. Prescribed Fire Positions in Aerial Ignition

A. Prescribed Burn Boss (RXB 1 or 2) /Ignition Specialist (RXI 1 or 2)

PLDO or Helitorch Manager works directly for these positions.

1. Prerequisites – See Wildland Fire Qualifications Subsystem Guide 310-1 (Part 2) for specific requirements.
 - a. Duties and responsibilities – Has complete authority for and directs the firing operation, develops firing plan(s), performs the initial briefing from the firing plan, covers the assignments of each boss/supervisor and pilot. Instructs the pilot as to the plan, firing sequences, and keeps the pilot informed throughout entire operation. For Plastic Sphere Dispenser operations, may be physically located in a helicopter with the dispenser operator, in another aircraft, or at some other vantage point. For helitorch operations, may be in another aircraft, or at some other vantage point.

Note: The Prescribed Burn Boss/Ignition Specialist, and PSD Operator/Helitorch personnel shall not have any collateral duties for the duration of the shift that the ignition operation is conducted. The PSD Operator/Helitorch Manager may have collateral duties as helicopter manager, and the Prescribed Burn Boss/Ignition Specialist may be one in the same.

B. Pilot

1. Prerequisites – See agency requirements.
 - a. Duties and responsibilities – Both pilot and aircraft must be carded for aerial ignition operation. The pilot shall have received a briefing on the mission objectives and flight procedures. Before operations commence the pilot should be familiar with terminology to be used during burning mission.

VI. Wildland Fire Positions in Aerial Ignition

A. Firing Boss

Reports to the Branch Director, or Operations Section Chief and the PLDO or Helitorch Manager works directly for this position.

1. Qualifications – Has received training in helicopter aerial ignition operations and is knowledgeable of ICS organization and concepts.
2. Duties and responsibilities – Has authority for, and directs the firing operation, develops firing plan(s), and performs the initial briefing from the firing plan, covers the assignments of each boss/supervisor and pilot. Instructs the pilot as to the plan, firing sequence, and keeps the pilot informed throughout entire operation. For PLDO operations, may be physically located in a helicopter with the dispenser operator, in another aircraft, or at some other vantage point. For helitorch operations, shall be in another aircraft, or at a vantage point.

Note: The Burn Boss, Firing Boss and PLDO and Helitorch personnel shall not have any collateral duties for the duration of the shift that the ignition operation is conducted. The PLDO/Helitorch Manager may have collateral duties as helicopter manager.

VII. Aerial Ignition Positions

A. Plastic Sphere Dispenser Operator (PLDO)

1. Prerequisites – Helicopter Crewmember (Exclusive-use Fire, CWN, Project).
2. Duties and responsibilities – PLDO provides technical assistance to the Burn Boss/Firing Boss. If assigned concurrent duties as Helibase Manager, supervises helispot/helibase operations; briefs pilot; identifies safety and hazardous material requirements at the operations briefing; monitors overall operation; and provides information on aerial safety procedures. The operator reports to the Burn Boss or an ICS position and is responsible for preparation, installation, operation, maintenance, and care of the dispenser. The operator must;
 - a. Determine if any malfunction occurs and act accordingly;
 - b. If an on-board fire occurs, determine if fire can be extinguished or if unit will have to be jettisoned;
 - c. Be able to communicate with pilot and ground personnel on all procedures associated with operation and emergencies occurring during burn mission.

B. Helitorch Manager (HTMG) (Simplex Helitorch and Western Heli-craft)

1. Prerequisites – Helibase Manager Type 2(HEB2), and Helitorch Mixmaster (HTMM). As per IHOG Chart 2-5, page 2-7.)
2. Duties and responsibilities – Helitorch Manager supervises the mixing operation and provides technical assistance to the Operations Section Chief/Burn Boss. Supervises helibase operations, briefs pilots, identifies hazards/hazardous materials requirements and outlines safety requirements at the operations briefing. Will monitor overall helitorch operation, provide technical direction on the helibase location and operation; ensures safety precautions have been completed prior to mixing; assures Helitorch Operations Checklist is followed.

C. Helitorch Mixmaster (HTMM)

1. Prerequisites – Helicopter Crewmember (Exclusive-use Fire, CWN, Project)
2. Duties and responsibilities – The Mixmaster reports to the Helitorch Manager and is responsible for supervising mixing crew activities. The Helitorch Manager (HTMG) may be used as the Mixmaster on single helicopter operations.

D. Helitorch Parking Tender (HTPT)

1. Prerequisites – Helicopter Crewmember (Exclusive-use Fire, CWN, Project).
2. Duties and responsibilities – Parking Tender reports to the Helitorch Manager and directs the helicopter during take-off and landings, and directs all movements of personnel around the helicopter. The Parking Tender must use a radio with a boom microphone and headset with a remote key switch for all helitorch operations. In addition, has fire protection responsibility for the primary helitorch helipad, with, at a minimum, a 20# dry-chemical fire extinguisher.

Note: It is highly recommended to have a fire protection crew and engine on site, with Class B Foam extinguishing capability on site.

E. Optional Aerial Ignition Positions

1. Plastic Sphere Dispenser Operations
 - a. Helibase/Helispot Manager – Depending on operational complexity, a HEBM may be advisable in addition to the required PSD Operator.
 - b. Additional Operator – Based on complexity, size of burn, and weather factors, an additional PSD Operators may be advisable.
2. Helitorch Operations
 - a. Helitorch Support Personnel – Performs miscellaneous tasks during the helitorch operation under the direction of the helitorch manager or mixmaster.
 - b. Radio Operator – An experienced aircraft radio operator should be used on complex burns or at complex helibases.
 - c. Fire Protection Group – It is highly recommended to have a fire protection crew and engine, or adequate portable foam extinguishing system, with Class B Foam extinguishing capability on site.

Chapter III – Plastic Sphere Dispenser Operations

The *Premo Mark III Aerial Ignition Device* is the only Plastic Sphere Dispenser authorized and is distributed by Aerostat, Inc., Leesburg, Florida.

I. Introduction

The Plastic Sphere Dispenser (PSD) machine was developed to provide a method of igniting ground fuels, in a short time, on large acreage without causing undue damage to the overstory. This method had to be cost-effective, environmentally acceptable, and readily available.

During the early 1960s, Australian foresters developed a spot-firing technique whereby ignition devices were dropped from aircraft onto 5,000 to 10,000 acre blocks of eucalyptus forests to consume the litter and reduce the fire hazard. This early system consisted of a small plastic capsule containing potassium permanganate. A syringe was used to inject ethylene glycol into the plastic capsule, then the charged device was dropped from an aircraft. The exothermic reaction resulted in spot fires where the device landed. The pharmaceutical vials used by the Australians to contain the potassium permanganate were satisfactory for manual dispensers, but their irregular shape caused malfunctions when used in faster machines. The Alberta Department of Land Management and Forest, Equipment Development Section introduced a spherical container. This container was modified for use in the Pacific Forest Research Center (PFRC) dispenser. The Aerial Ignition Device (AID) has proved to be an effective aerial ignition system ignite fuels.

II. Description

The sphere is made of high impact polystyrene, 32-mm (1.25 inches) in diameter and contains approximately 3.0 grams of potassium permanganate. The rate of chemical reaction is dependent on the particle size and concentration of the chemicals involved. An undiluted, glycol-based antifreeze is required. It provides a reliable ignition and a time delay of at least 20 seconds.

III. Dispenser Function

The PSD injects glycol into the plastic sphere, initiating an exothermic reaction and then to expel the primed sphere from the aircraft. Incorporated in the mainframe are the power train, water and glycol reservoirs (with separate pumps), slipper blocks, and injection mechanism. The PSD contains four slipper blocks and feed chutes. Feed chutes can alternate patterns to regulate the number of spheres being dispensed, establishing ignition patterns on the ground. Power to the PSD is supplied by the aircraft's electrical system. The PSD may be ordered for use with either 12 to 24-volt DC electrical systems.

IV. Safety Precautions

- A. The PSD will not be permanently affixed to the helicopter. It will be mounted with straps that can be cut to jettison the PSD in case of malfunction.**
- B. Glycol tank must be filled and tightly capped at least 25 feet away from the aircraft.**
- C. Lead acid batteries will not be carried in the cabin to power the PSD. The PSD must be powered through the aircraft's electrical system.**
- D. A 20 B/C fire extinguisher will be available on site.**
- E. Operator shall wear a restraining harness as per agency requirement**
- F. Extra supplies of glycol will not be carried in the cabin during burning operations.**
- G. A metal container will be available during testing for containment of plastic spheres.**
- H. Ignition time should not be less than 20 seconds.**
- I. Helicopter speed should not exceed 50 mph during ignition operations.**
- J. Do not remove feed chute while in operation.**
- K. Potassium permanganate is a strong oxidizer; it should be stored in a cool, dry place and must be kept completely separate from glycol.**
- L. The area to be burned must be clear of people and equipment.**
- M. At least 5 gallons of water will be available on-site**

CAUTION: An inadequate quantity of glycol injected into the plastic sphere can induce a violent reaction that can cause the sphere to spin or roll and spray a hot, mixture of potassium permanganate and glycol a considerable distance.

Advantages and Disadvantages Compared with the Helitorch	
ADVANTAGES	DISADVANTAGES
<p>Logistically less complicated--plastic spheres can be safely and easily transported in bulk quantity to the burn site. Separate helibase is not required for PSD set-up and operation.</p> <p>Essentially a self-contained operation. PSD Operator and possibly one assistant are the only personnel required.</p> <p>Safety procedures are less complicated than those for the helitorch.</p> <p>Requires little set-up time apart from installation of PSD machine in helicopter.</p> <p>Operator in a hands-on position, able to immediately assess and/or address minor problems without returning to helipad.</p> <p>Equipment costs less than helitorch unit.</p> <p>Operator can see how many plastic spheres are left in hopper, and can approximate how much ignition time is left before having to return to helipad.</p> <p>Possible to lay very long ignition lines, if necessary.</p> <p>Less cost in support staff, set-up, and demobilization time than helitorches.</p> <p>Minimum damage to tree canopy resulting from ignition procedures.</p> <p>Narrow burning windows can be better utilized due to shorter set-up time.</p> <p>Burn Boss can be on board during ignition sequences. Command and control can more easily be maintained.</p>	<p>The Premo Mark III Aerial Ignition Device poses several disadvantages compared with the helitorch.</p> <p>Plastic spheres burn for a shorter time on the ground than do gelled fuels.</p> <p>Even a dense drop pattern of plastic spheres cannot duplicate the characteristics of the helitorch drop pattern.</p> <p>Firelines take longer to form and interact with each other.</p> <p>The pilot cannot jettison the PSD. Operator must manually jettison the PSD in the event of an emergency.</p> <p>PSD requires continuous attention of operator to watch for proper operation and keep balls in the hopper.</p> <p>Possibility of fires developing in the PSD.</p>

Table 2

V. Situations Favorable for Plastic Sphere Ignition

General guidelines are offered here for the plastic sphere system that might be preferable to the helitorch. This is by no means an exhaustive list. The fire manager must select the tool to meet the mission objectives under existing and/or forecasted burning conditions.

- A. **Understory Burning – Plastic Sphere ignition may be used in any stand that can be burned by conventional methods. The plastic sphere ignition system is an excellent tool for hazard fuel reduction in pine plantations. This system is safe, efficient and economical, and users can burn with less risk to the plantation than by using the helitorch.**
- B. **Burns where a long line of fire must be laid down in a short period of time. Because a large number of plastic spheres can be carried on board the helicopter, a longer line can be laid without having to return to the helibase. Set-up and support is simpler and faster.**
- C. **Burns where, due to size, poor access, etc., fixed costs of helitorch operations (mixing crew, fuel, and fuel delivery) may result in a higher cost per acre.**

VI. PSD System Organization

See Charts in Appendix A

A. PSD Operator

Position Responsibilities—Serves as PSD Operator to the Burn Boss/Firing Boss. The Operator briefs pilot, (including the use of the shelter) identifies safety requirements at the operations briefing, and monitors overall operation. May serve as Helibase/Helispot Manager. Provides information on aerial safety procedures to be used by the Burn Boss/Firing Boss. The Operator is responsible for the preparation, installation, operation, maintenance, and care of the PSD. The operator verifies for Burn Boss/Firing Boss that prescribed spacing of ignition is occurring and makes necessary adjustments. Determines if malfunction occurs and acts accordingly. If an onboard fire takes place, it must be determined if fire can be extinguished, or if unit must be jettisoned. The Operator will communicate with the pilot and Burn Boss/Firing Boss on all procedures associated with operation and/or emergencies occurring during operation.

Note: *The following agencies require the operator to wear a restraining harness during operation: USDA Forest Service, Bureau of Land Management, National Park Service, US Fish and Wildlife Service, and Bureau Of Indian Affairs. If your agency is not identified, refer to approving Agency official for Agency/Bureau-specific direction. Seat belts must be worn during take off and landing.*

Harness information: The rappel/smokejumper spotter harness is recommended, model # B49001 & the tether, # MSTC-946. Contact MTDC for current information regarding harness and hard point connections.

Source: Missoula Technology and Development Center (MTDC)

Contact: George Jackson, 406-329-3967

- B. **Pilot Position Responsibility** – The pilot will follow lighting plan, under the direction of Burn Boss/Firing Boss. Pilot-in-command is responsible for all matters related to aircraft operations and safety, and PSD installation oversight and helicopter load calculation.
- C. **Helibase/Helispot Support (as needed)**
 - 1. Helibase/Helispot Fire Protection
 - a. At a minimum, one 20 B/C rated fire extinguisher and five gallons of water will be positioned at the helibase/helispot.
 - b. Provide crash rescue equipment at helibase/helispot.
 - 2. Radio Operator
 - a. Will be positioned at the helibase/helispot.
 - b. Will initiate radio communications with Burn Boss and Dispatch.

VII. Communication

A. Prescribed Fire Communication Plan

A discrete channel should be assigned for communication with the Burn Boss and helibase. A frequency is required for helicopter aerial ignition operations that will be free from other traffic. A separate channel is recommended for ground operations. The amount of coverage is dependent on organization and layout of the project area. The following depicts a PSD prescribed fire communication flow plan.

Plastic Sphere Dispenser Communication Plan

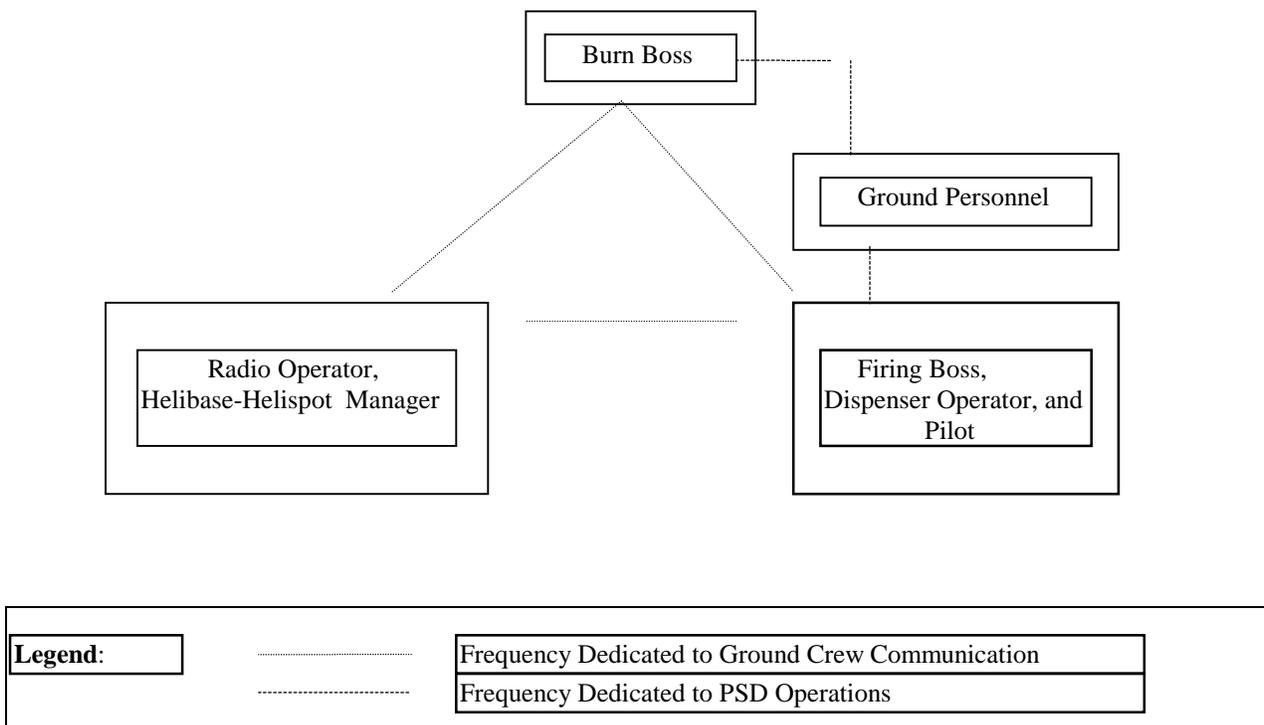


Figure 1

B. Wildland Fire Communication Plan

Aerial ignition missions for wildland fire requires additional communication links. Because of the need for a discrete frequency between the Firing Boss and the aerial ignition helicopter, the discrete air to ground channel need not be published in the Incident Action Plan (IAP). All other frequencies must be included in the IAP Complex Burn Plan and their use covered during briefings. Listed below are the minimum frequencies required:

1. A discrete frequency is required between the aircraft and Firing Boss.
2. Separate command and tactical channels will be used for ground operations.
3. A frequency will be assigned for Flight Following.
4. Air to air frequency is required between the ignition helicopter and other aircraft, it may be the same frequency for Flight Following.

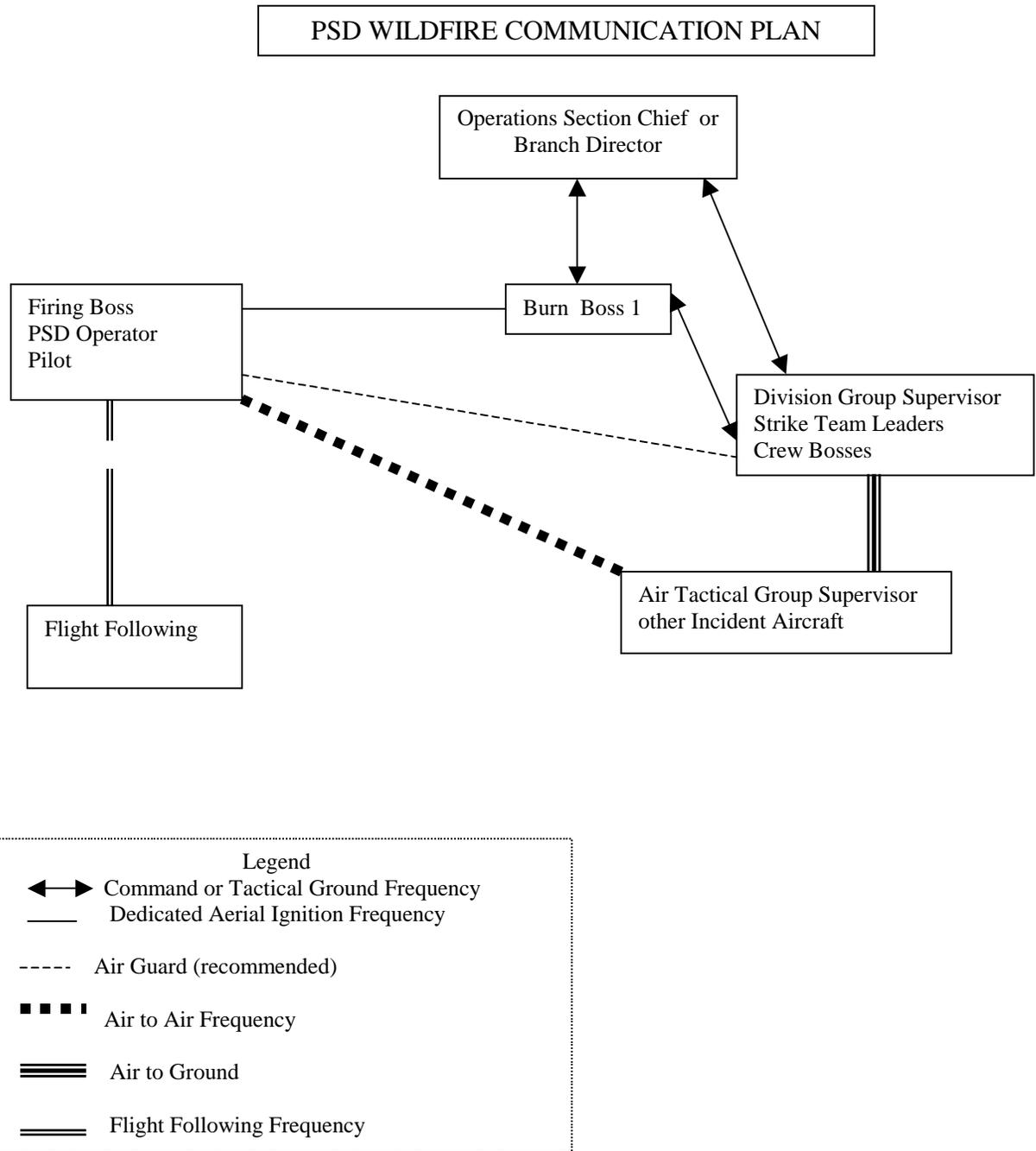


Figure 2

VIII. Bench Testing and Cleaning

Bench tests should be performed prior to actual burn. The following outlines the steps to be performed during a bench test.

A. Review applicable portion of operations checklist.

1. Fill PSD with ethylene glycol and water.
2. Mount the PSD securely on a suitable table or bench approximately 30 inches high.
3. Connect the power cord to power supply. Two 12-volt batteries wired in series or a 24-volt power converter are the most common bench test sources.
4. Prime both pumps and plungers.

CAUTION: *Ensure Potassium Permanganate Does Not Come In Contact With Battery Acid.*

5. Place metal bucket under chute.

CAUTION: *Do Not Put Water In Bucket.*

6. Insert an “EMPTY” plastic sphere in one slipper block. Rotate the sphere through machine with pump operating. Sphere should be ¼- to ½-full of ethylene glycol for proper ignition. Repeat for other slipper blocks.
7. Injector controls are preset by the factory and should not need to be adjusted. If adjustments are needed, adjust injector control valves by loosening lock nut and rotating valve screw. Increase amount of glycol by turning valve to left until desired volume is obtained. Turn off PSD for adjustments and insert a sphere in each of the other blocks. About 1/4 to 1/3 full of glycol will give a 20-second delay.
8. After adjustment has been made, using spheres with potassium-permanganate, turn on the glycol pump and drive, and rotate spheres through a cycle until the spheres drop out of the chute into the bucket. A stopwatch should be used to time injection to ignition. Ignition delay should be at least 20 seconds.

Note: Temperature and humidity may affect ignition delay, causing delays to be greater than 20 seconds. Colder temperatures will cause longer ignitions, often as long as 40 to 60 seconds. This is OK if all spheres are igniting. Very small amounts of ethylene glycol (¼ cc) will give erratic ignition. Excessive amounts of ethylene glycol (2 cc or more) will not give adequate ignition.

Note: Calibration instructions are contained in manufacturer’s manual.

Note: During machine start up, it is normal for two of the first four spheres that pass through the machine to not be injected.

B. Cleaning should follow the bench test. Clean with water and compressed air. Lubricate moving components with Triflow, Never Seize or equivalent. WD-40 should not be used for this purpose.

IX. Preparation for Aerial Ignition

A. Preparation of Helicopter

1. Remove appropriate door/doors.
2. Remove all loose cushions and other loose materials.
3. Locate and assure proper electrical connections.

Note: Only PSD Operator will have control (electrical or manual) of the machine.

B. Preparation of Premo Mark III Aerial Ignition Device (PSD)

1. Fill glycol tank at least 25 feet from aircraft.
2. Fill water storage tank.
3. Assure adequate supply of plastic spheres are available to complete project.
4. Ensure one-gallon container of water is on board, secured, and is readily accessible.
5. Fire shelters for all occupants must be on board and accessible, and one or more hand tools are recommended.

C. Installation

The PSD is designed to be operated from the right rear of a Bell 206 series Jet/Long Ranger helicopter. Other types of helicopters may require an auxiliary support bracket so the exit chute clears the aircraft fuselage. Installation instructions for various helicopters are included at the end of this unit.

1. Install in doorway with exit chute attached and overhanging.
2. Attach tie-down strap:
 - a. Y-end attached to PSD beside exit chute, fasten from the inside-out.
 - b. Pass strap under the fuselage, making sure it clears all wiring and accessories attached to the bottom of the aircraft.
 - c. Return through the opposite door.
 - d. Fasten to buckle attached to machine.
 - e. Cinch tight and secure loose ends.
3. Connect power supply cord.
4. Perform electrical power check by turning on drive switch and hopper feed switch. Manual assist must rotate counter-clockwise (direction of arrow).
5. Recheck the installation.
6. Ensure a sharp knife is available to cut holding strap in case it is necessary to jettison the PSD.

X. Preflight Test Procedures

A. Sphere ignition delay time need not be checked in the Preflight Test if Bench Test has been performed.

CAUTION: *Do not conduct this test near refueling area or in flashy ground fuels.*

B. Test procedures are as follows.

1. Place metal container under the exit chute.
2. Start up the PSD (hopper off) as follows:
 - a. Power on.
 - b. Hopper feed on.
 - c. Glycol pump on.
3. Drive motor on.
4. Lift chute feed levers.
5. Deposit 1 sphere in a slipper block to track calibration. Repeat for each remaining slipper block.
6. Once the sphere has dropped into the metal container, remove it from the vicinity of the aircraft.
7. Time ignition delay by measuring time of injection to ignition.
8. Shut down machine as follows:
 - a. Drive motor off.
 - b. Glycol pump off.
9. Repeat for other three slipper blocks.
10. Check system for leaks.
11. Test the on-board fire extinguisher system by pushing red water button on control panel.
12. Check intercom communications and air-to-ground communications.

XI. In-flight Operations

A. Dry Run over Burn Area Procedures

1. Check burn area is clear of personnel.
2. Identify burn area boundaries.
3. Ensure communication with ground personnel.
4. Make practice run of the first firing sequence.
5. Coordinate machine speed, sphere spacing, and number of chutes to be used on first run with Burn Boss/Ignition Specialist.
6. Identify helispots and emergency landing areas.
7. After a dry run and prior to installation of aerial firing, the Burn Boss/Firing Boss will confirm that all ground personnel are clear of the area and that firing may commence.

XII. In-Flight Procedures

A. Burn Boss/Ignition Specialist communicates to PSD Operator, “Prepare to fire.”

1. Operator actions:
 - a. Hopper feed on.
 - b. Glycol pump on.
 - c. Drive motor on.
 - d. PSD Operator communicates to Burn Boss/Ignition Specialist, “Ready to fire.”
2. Burn Boss/Ignition Specialist communicates to PLDO to “Start firing/Number of chutes”
3. PSD Operator replies, “Firing x chutes”
4. Operator monitors machine operation and refills hopper as needed.
5. When appropriate, Burn Boss/Ignition Specialist communicates, “Prepare to stop firing.”
6. PSD Operator places hand on chute handles and communicates, “Ready to stop.”
7. Burn Boss/Ignition Specialist gives the order “Stop firing.”
8. Operator closes chute handles and responds, “Chutes closed, firing stopped.”
9. Operator observes last sphere clear of the PSD and relays, “Machine cleared.”

XIII. Emergency Procedures

A. Operator notifies pilot of problem and gives brief description.

B. Operator closes chute feed handles.

1. If necessary, operator turns on or off drive motor.
2. If problem is a jammed machine, operator pulls manual assist wheel outward and rotates forward then backward. If obstruction clears, turn on drive motor, check circuit breaker, and notify flight crew before resuming operations.
3. If fire starts, operator pushes red button (emergency water) and holds button depressed for up to 30 seconds. If necessary, uses additional container of water to extinguish fire by pouring down feed chutes in hopper. If problem persists, land if possible.
4. If fire proves uncontrollable during flight, the PSD must be jettisoned, unless the emergency occurs over a congested or developed area. The pilot must be made aware that a fire exists and must direct that the PSD be jettisoned.
5. To jettison a PSD, the following procedures must be performed:
 - a. Cut the restraining strap between the buckle and aircraft door with knife.
 - b. Grasp dispenser, lift and jettison clear of aircraft.

Note: In addition, specific crash procedures and crash seating positions should be discussed for aircraft being used.

XIV. Ignition Operations

- A. The Burn Boss/Ignition Specialist gives the directions as to where he/she wants the spheres to be placed in the burn area. This should be made clear during the dry run before any firing begins. It is important that all parties (Burn Boss/ Ignition Specialist, Pilot, and PSD Operator) all understand where the firing is to be done. This includes starting points, ending points, and desired placement and spacing.
- B. The Helicopter should not exceed 50 mph. Optimum application speed for the firing operation is 25-35 mph.
- C. The Burn Boss/Ignition Specialist gives direction to the Pilot once the firing run has begun and during the dry run to assure correct placement of the injected spheres.
- D. Occupants of the helicopter shall be limited to the Pilot, PSD Operator, and Burn Boss/Ignition Specialist, instructor or trainees if essential to the mission.
- E. When the PSD helicopter leaves the burn area and crosses a fire control line with the intent of returning for another live firing run, the switches on the PSD are not required to be turned off. The Operator's right hand must remain on the feed control levers in the closed position. This is not required if locking handles are installed. If leaving the burn area the machine will be completely shut off.

General Features of Plastic Sphere

Material	High-impact Polystyrene
Mass empty	2.3 Grams
Mass KmnO	3.0 + 0.3 Grams
Mass total	5.3 + 0.3 Grams
Diameter	32 mm
1 box of 1000 spheres	16 LBS

Table 3

General Features for Premo Mark III Aerial Ignition Device

Specifications		
Measurement	metric	us
;Main Fame Mass, Glycol Full	27.5 kg	61.0 lb
Hopper and Chutes	10 kg	23.0 lb
Emergency Water Tank (Full)	3.8 kg	8.5 lb
Hopper Capacity (450 Spheres)	2.7 kg	6.0 lb
Approximate Operational Weight	44.5 kg	98.0 lb
Glycol Tank Volume	9.0 liter	2.4 US gal
Emergency Water Tank Volume	3.2 liter	0.8 US gal
PSD Dimensions – Length	68.5 cm	27.25 in
PSD Dimensions – Width	27.0 cm	10.5 in
PSD Dimensions – Height	66.0 cm	26.0 in
Overall Dimensions – Length	83.0 cm	33.0 in
Overall Dimensions – Width	33.0 cm	13.0 in
Overall Dimensions – Height	69.0 cm	27.0 in
Total Shipping Weight	45.0 kg	98.5 lb

Table 4

F. Power Requirements

1. 24-volt DC (control housing, motor, and pumps are coded red).
2. 12-volt DC (control housing, motor, and pumps are coded blue).

Note: A specially built crate with hinged top is provided with each PSD machine for maximum protection during shipping and storage of the equipment in the field.

XV. Ignition Spacing**A. Ignition spacing is a function of ground speed.**

	Motor Shaft Sprocket - 13 Teeth					
Ground speed in MPH Camshaft speed of 27 RPM (slow)	10	20	30	40	50	60
	Approximate feet between ignition points FT.					
USING						
1 PSD Chute	33'	65'	98'	130'	163'	195'
2 PSD Chutes	16'	33'	49'	65'	82'	97'
4 PSD Chutes	8'	16'	25'	33'	41'	50'
Camshaft speed of 41 RPM (fast)						
USING						
1 PSD Chute	22'	43'	64'	86'	107'	129'
2 PSD Chutes	11'	21'	32'	43'	54'	65'
4 PSD Chutes	6'	11'	16'	23'	27'	33'

Table 5

Using one chute requires the installation of the "Spacing Kit" which allows only one chute to be loaded with plastic spheres.

CAUTION: *To achieve continuous reliable feed when using two chutes it is imperative to only operate the center chute.*

XVI. Cleaning and Preventive Maintenance

A. Suggested Tools, Supplies, and Spare Parts

1. Suggested Tools
 - a. Small 3-inch slotted screwdriver
 - b. Medium 5-inch slotted screwdriver
 - c. No. 2 Robertson screwdriver (square tip)
 - d. Set of Allen wrenches
 - e. Small, smooth file for emergency touch-up of needles
 - f. Toothbrush
 - g. Set of adjustable tubing wrenches
 - h. Combination box end wrenches (5/16", 3/8", 7/16", 1/2", and 11/16")
 - i. Small, adjustable (crescent) wrench.
 - j. Toothbrush/Bottle brush
2. Suggested Supplies
 - a. Lubricant
 - b. Teflon tape
 - c. Brass wool
 - d. Scotch-Brite pad
3. Suggested Spare Parts
 - a. Fuses 5A, 3A, 1.5A (newer PSDs have circuit breakers)
 - b. Needles (set of 4)
 - c. Valve springs (set of 4)
 - d. "O" rings for valve stems (set of 4)
 - e. Bulbs for indicator lights
 - f. ¼ x 20 wing nuts (2)
 - g. Electric drive motor*
 - h. Electric fuel pump*
 - i. Solenoid valve*

* Items are field serviceable, but may result in delays of one to two hours.

B. Preventive Maintenance

1. Keep the needles sharp; sharpen to same angle.
2. Keep moving parts lubricated.
3. Keep clean by removing residuals from balls and potassium as soon as possible.
4. Check slipper blocks for powder build-up after approximately 6,000 spheres.

C. Cleaning and Storage

1. After each use clean as follows:
 - a. Use cleaner-degreaser and brush to clean slipper block area.
 - b. Dry machine.
 - c. Lubricate all moving parts.
 - d. Cycle by hand.
 - e. Wipe off excess lubricant.
 - f. Wipe down machine with cloth dampened with lubricant.
 - g. Wipe down helicopter floor when PSD is removed.
2. For prolonged storage perform the following:
 - a. Drain water reservoir.
 - b. Drain and flush glycol reservoir.
 - c. Remove and clean valve spring plugs, springs, and valves.
 - d. Remove and clean needles; sharpen if needed.
 - e. Lubricate all parts before reassembling.
 - f. Check drive chain and lubricate.
 - g. Check and clean electrical connections.

XVII. Troubleshooting the PSD

- A. Spheres Do Not Move Freely In Chute**
- Check the feed control handles.
 - Check to assure no jam has occurred in the hopper.
 - Check if only recommended chutes are used - either four, two center, or only one.
- B. Drive Motor Does Not Start**
- Check aircraft power supply connection, aircraft main switch circuit breaker, motor switch and fuses. Check quick disconnect to mainframe and control housing.
 - Check wiring to motor; repair wiring or replace motor.
- C. Motor Starts but PSD Jams**
- Turn off motor switch, if PSD jams.
 - Check for plastic sphere fragment, box staples, or other foreign objects.
 - Check for damaged needle, replace using box-end wrench to prevent damage. Crushed spheres will indicate damaged or dull needles.
 - Slipper blocks may seize and stop the motor, which will necessitate removal, cleaning, and lubricating.
- D. Glycol Pump Does Not Start**
- Bleed air from system by removing valve adjuster and operating pump.
 - Check glycol pump wiring; repair wiring or replace pump.
- E. Incorrect Amount of Glycol**
- Check glycol level in tank and pump operation.
 - Open or close adjustment valves on top of valve blocks; **DO NOT OVER CLOSE**. Needle should provide 1/4 to 1/3 full of glycol with each activation of valve.
 - Check needles for blockage; remove, clean, and/or replace.
- F. Leakage of Glycol**
- If leak occurs during flight, land to make repairs.
 - Check coupling for tightness.
 - Check valve stems and springs for obstructions in valve block.
 - Replace “O” rings on valve stems with neoprene “O” rings.

Note: *Any spilled glycol must be cleaned up.*

- G. Plastic Spheres Do Not Ignite**
- Check fluid level in glycol tank.
 - Taking precautions against delayed ignition, examine spheres.
 - Contents of Primed sphere appear too dry - insufficient glycol (see “E” or “F” above).
 - Contents of Primed sphere are soupy (too much liquid) – excess glycol (see “E” above).
 - Spheres receiving appropriate glycol - check glycol concentration or glycol quality.
- H. Ignition Too Soon (less than 20 seconds)**
- Follow bench test procedure to adjust glycol concentration.
- I. Water System Does Not Function**
- Check reservoir.
 - Check line for routing kinks or blockage.
 - Check water ports in valve block.
 - Check push button, wiring, solenoid, fuse, and pump.
 - Repair and replace as necessary.
 - Check for frozen lines when working in cold temperatures.

XVIII. Installation Procedures (General): Premo Mark III Aerial Ignition Device

Installation of the Premo Mark III AID will be specific to individual helicopter models. Model specific procedures are outlined later in this chapter. Consult the manufacturer of Premo Mark III for specific installation procedures for those helicopters not listed below. The following apply to all PSD installations.

- A. The operator must read the Premo Mark III Operator's Manual before installation.**
- B. Operator and the pilot must read the limitations section of the Flight Manual and be familiar with the limitation of flight with the door(s) removed.**
- C. Helicopters shall be equipped with a power source for Hand-held Infrared Imaging Systems or Premo Mark III Aerial Ignition Device. A bulkhead mounted MS 3112E- 12-3S, 3-pin connector shall be provided. Pin B shall be airframe ground. Pin A shall be +28 V.C., for a 28-volt aircraft system. Pin C shall be +14 for a 14 volt aircraft system. The circuit shall be protected by a 5-amp circuit breaker. The mating connector for the government furnished Infrared or Premo device shall be an MS 3116E-12-3P wired with the same pin assignments. Reference a wiring diagram in Appendix D.**
- D. Helicopter load calculation unit weight is 98.0 lbs. with all reservoirs filled.**
- E. The mounting area must be cleaned, which includes vacuuming if there is powder from broken spheres, and cleaning any glycol that may have spilled on the floor from previous installation. All carpet and porous floor coverings must be removed.**
- F. A one-gallon container of water and a sharp knife must be carried on board and be within reach of the operator.**
- G. Fire shelters for all occupants available and accessible.**

CAUTION: *Do not service the machine with glycol while it is installed in the helicopter.*

CAUTION: *Under no circumstances will extra ethylene glycol (anti-freeze) be carried in the same compartment with plastic spheres.*

XIX. Installation Procedures for Specific Helicopter Types

A. Bell 206 Series Helicopters

Note: *Consult flight manual for doors-off limitations and center-of-gravity.*

1. Remove right rear door of helicopter.
2. Use duct tape or other means to protect the paint finish around the right rear door sill. (consult with pilot/vendor before doing this)
3. Place the PSD mainframe over the door sill and connect the Y-end buckles of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down strap.
4. Install exit chute. Tighten and lock nuts.
5. Install hopper on the mainframe and make electrical hook-up between units.

6. Slide the assembled PSD as far forward as possible to provide leg-room between machine and rear seat. Some helicopters have a cabin fire extinguisher mounted on the rear of the pilot's seat and it may interfere with the opening of the hopper lid. The fire extinguisher must be removed from its holder and secured on the floor, or the machine must be slid far enough aft to allow the hopper lid to open. Either option must ensure enough room for access to the PSD control panel.
7. Connect and tighten the belly hold-down strap making sure the strap is not twisted and does not interfere with any external fittings, wiring, or release cables.
8. Make sure the PSD switches are in the OFF position, and connect the power supply plug from the helicopter to the PSD.
9. Turn the PSD on and watch the rotation of the hand wheel. Rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
10. Proceed with ignition timing tests, briefings, etc.
11. All manufacturer's safety precautions must be adhered to during operation of the PSD.

B. Hughes (McDonnell-Douglas) 500 Series

Note: Consult flight manual for doors-off limitations and center-of-gravity.

1. A plywood adapter board must be constructed to mount the PSD in the Hughes 500 Series helicopters (see figure 3).
2. Remove right rear door of helicopter.
3. Use duct tape or other means to protect the paint finish around the right rear door sill.
4. Place the plywood adapter on the floor and the PSD mainframe on the adapter and connect the Y-end clips of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down strap.
5. Install exit chute. Tighten and lock nuts.
6. Install the hopper on the mainframe and make electrical hook-up between the two units.
7. Slide the assembled PSD as far forward as possible to provide leg-room between machine and rear seat. The fire extinguisher may need to be removed from its holder and secured on the floor, or the machine must be slid far enough aft to allow the hopper lid to open. Either option must ensure enough room for access to the PSD control panel on the side of the mainframe.
8. Connect and tighten the belly hold-down strap ensuring it is not twisted and does not interfere with any external fittings, wiring, or release cables.
9. Make sure the PSD switches are in the OFF position and connect the power supply plug from the helicopter to the PSD.
10. CAUTION: A metal container shall be placed under the exit chute at this time to catch any spheres that may be triggered from the PSD during the polarity check.
11. Turn the PSD on and watch the rotation of the wheel. Rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
12. Proceed with ignition timing tests, briefings, etc.
13. Manufacturer's safety precautions must be adhered to during operation of the PSD.

Auxiliary support bracket for Hughes 500; construction is of 1-inch welded aluminum on a ¾-inch plywood base.

Adapter Bracket

	2"
	x
	6"
	x
	8
	½
	"
¾" Plywood x 8 ½" x 18"	

C. Aerospatiale 350-355 Series

Note: *Consult flight manual for doors-off limitations and center-of-gravity.*

1. A plywood adapter must be constructed to use the PSD in the Aerospatiale 350-355 series helicopters.
2. A one-foot extension must be added to the hold-down strap when using this type of helicopter. The extension must be added to the short buckle portion that is attached to the PSD. The smooth, flat portion of the hold-down strap must pass through the doorframe without hanging up.
3. Remove right forward and right rear doors of the helicopter.
4. Use duct tape or other means to protect the paint finish around the right rear door sill.
5. Place the plywood adapter on the floor and the PSD mainframe on the adapter, and connect the Y-end clips of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down strap.
6. Install exit chute. Tighten and lock nuts.
7. Install the hopper on the mainframe and make electrical hook-up between the two units.
8. Connect and tighten the belly hold-down strap making sure the strap is not twisted and does not interfere with any external fittings, wiring, or release cables.
9. Make sure PSD switches are in the OFF position, and connect the power supply plug from the helicopter to the PSD.
10. **CAUTION:** A metal container shall be placed under the exit chute at this time to catch any spheres that may be triggered from the PSD during the polarity check.
11. Turn the PSD on and watch the rotation of the hand wheel; rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
12. Proceed with ignition timing tests, briefings, etc.
13. All manufacturers safety precautions must be adhered to during operation of the PSD.

D. SA 315B Lama

Note: *Consult flight manual for doors-off limitations and center-of-gravity.*

1. A left passenger seat that has been modified in accordance with Heli-Support drawings and approved by the FAA must be installed. The seat has a high head restraint and is approved for aft-facing installation. The aft-facing position allows the operator ample room to operate the PSD.
2. Remove the left door.
3. Cover the forward left skid tube to prevent damage to the aircraft's finish.
4. If the floor is not covered by a ¼-inch thick piece of plywood or other material, the tie-down rings must be removed to allow the PSD to sit flat on the floor.
5. Place the PSD mainframe on the floor forward of the left cross tube.
6. Connect the Y-end clips of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down.
7. Install exit chute.
8. Install the hopper on the mainframe and make electrical hook-up between the two units.
9. Connect and tighten the belly hold-down strap ensuring the strap is not twisted and does not interfere with any external fittings, wiring, or release cables.
10. Make sure the PSD switches are in the OFF position and connect the power supply plug from the helicopter to the PSD.
11. **CAUTION:** A metal container shall be placed under the exit chute at this time to catch any spheres that may be triggered from the PSD during the polarity check.
12. Turn the PSD on and watch the rotation of the hand wheel; rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
13. Proceed with ignition timing tests, briefings, etc.
14. All manufacturers safety precautions must be adhered to during operation of the PSD.

E. Hiller 12E Series (Three-Place)

Note: *Consult flight manuals for doors-off limitation and center-of-gravity.*

1. This series helicopter must be flown from the left seat position, and the center position cyclic control must be removed.
2. Remove the right door.
3. An adapter block must be installed on the floor on the right side of the instrument pedestal.
4. Place the adapter block on the floor on the side of the instrument pedestal.
5. Place the PSD on the floor so it is snug against the block and is as far forward as possible.
6. Connect the Y-end buckles of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down strap.
7. Install exit chute. Tighten and lock nuts.
8. Install the hopper on the mainframe and make electrical hook-up between the two units.
9. Connect and tighten the belly hold-down strap, ensuring the strap is not twisted and does not interfere with any external fittings, wiring, or release cables.
10. Make sure the PSD switches are in the OFF position and connect the power supply plug from the helicopter to the PSD.
11. **CAUTION:** A metal container shall be placed under the exit chute at this time to catch any spheres that may be triggered from the PSD during the polarity check.
12. Turn the PSD on and watch the rotation of the hand wheel. Rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
13. Proceed with ignition timing tests, briefings, etc.
14. Manufacturer's safety precautions must be adhered to during operation of the PSD.

XX. MSDS (Material Safety Data Sheets)

See Appendix C.

Chapter IV – Helitorch Operations

I. Introduction

A Canadian conceived the idea for a helitorch, which dispensed a gasoline and diesel fuel mix, similar to that used in drip torches. Western Helicopters of Oregon working with the Canadians, refined the helitorch and field tested it. The torch concept was greatly improved by the development of fuel-thickening compounds which gelled the fuel, thus reducing its volatility. This also increased the safety in handling the fuel, improved its drop characteristics, put more fuel onto the ground (rather than burning off in the air), and increased residual burning time allowing the aircraft to be flown higher and faster.

During the evolution period, safety was identified as a critical limitation to the use of the helitorch. In a 1984 University of Montana survey, prescribed burn practitioners throughout the United States and Canada listed the following types of safety problems they had experienced relating to helitorch ignition: striking tree with helitorch; accidental torch jettison; fouling of helitorch suspension cables (one resulting in a fatality); unstable flight of helitorch; hazardous electrical malfunctions of the torch; dropping fuel outside the burn perimeter; dropping fuel on or near ground personnel and fire occurring during fuel mixing operations. Because of these safety concerns, all helitorch personnel need to complete a certified training program.

The Western Heli-craft Helitorch is a gelled fuel aerial ignition device that is attached to a helicopter's external cargo hook. The ignition and fuel feed are controlled by the pilot, through a simple electrical connector on the belly of the helicopter, usually the water bucket plug. The complete system is jettisonable by the pilot in case of emergency. The complete unit when attached to a standard empty fuel drum weighs approximately 100 pounds.

The main difference between this helitorch and the Simplex or Isolair Helitorches is that this helitorch does not have the fuel drums mounted on a carriage frame. This allows the helitorch to be easily disassembled and placed in its bag for transport and storage. The helitorch uses standard unmodified fuel drums for mixing and dispensing.

II. Advantages and Disadvantages of the Helitorch

ADVANTAGES	DISADVANTAGES
<p>Convection column can be developed quicker, increasing control over the fire.</p> <p>Thickened fuel provides a longer residual burning time on the ground.</p> <p>Helitorch has the potential of laying a more continuous line of fire.</p> <p>Helitorch can be easily jettisoned by the pilot in the event of an emergency.</p> <p>Helitorch can be more effective under marginal weather, site, or fuel conditions.</p> <p>Burning is possible in less accessible areas, reducing hazards to ground personnel.</p> <p>More acres can be burned in less time than in hand lighting.</p> <p>Emissions may be reduced due to widening of prescription window.</p>	<p>The use of gasoline is hazardous since it is highly flammable in its ungelled state.</p> <p>There is substantial resource outlay: three-to-five person crew, with one or two vehicle and/or trailer units for most burning operations.</p> <p>Crew requires extensive training and a certain degree of commitment to the program for the duration of the burning season.</p> <p>Bulk fuel and chemicals must be hauled to the site.</p> <p>Costs can be significant.</p> <p>Helicopter must return frequently to refill with gel.</p> <p>Operation requires considerable planning and set-up time to organize the mixing/loading site and helipad.</p> <p>Rigorous safety procedures must be followed. Hazmat removal and storage may be a problem.</p> <p>It's easier to establish a convection column, because of helitorch mass ignition; it is as easy to lose control of the column with a break in ignition.</p> <p>Helitorch does not lend itself to under-burning operation. The burning fuel globules can ignite tree crowns.</p>

Table 6

Advantages and Disadvantages of the Western Heli-Craft Helitorch

ADVANTAGES	DISADVANTAGES
<p>The small size of the torch allows it to be transported to remote areas inside any medium and most light helicopters.</p> <p>No need to transport large amounts of mixing equipment and supplies.</p> <p>Requires a smaller ground crew to mix gel, operate, and maintain.</p>	<p>Requires special pilot and ground crew techniques in order to operate effectively.</p>

Table 7

III. Situations Favorable for Helitorch Operations are:

- A. **On sites with sparse or patchy fuel distribution and higher fuel moisture content, the pattern of fire laid down by the torch can provide a greater chance of ignition, and under some conditions reduce emissions.**
- B. **The type of fire pattern laid by the torch and the fuel's residual burning time on the ground can aid in developing a continuous line of fire and achieving better consumption.**
- C. **In ignition of aerial fuels such as standing timber, blow-down, and/or poorly compacted fuels.**
- D. **In areas where the more intense ignition pattern of the torch can result in a more quickly established convection column.**
- E. **Where wildland fire burnout is the best option for safety and control. The helitorch can expedite the operation without compromising personnel safety.**

IV. Personnel Responsibilities:

- A. **Helitorch Manager**
 - 1. Supervise the overall helitorch operations on the helibase.
 - 2. Develop the helibase/helitorch operation plan.
 - 3. Assign personnel to helitorch positions.
 - 4. Procure all necessary equipment and assure all is on site.
 - 5. Develop communication plan.
 - 6. Establish operating area (100 feet X 100 feet) minimum for each Helitorch operation.
 - 7. Develop crash/rescue plan
 - 8. Conduct briefing and provide technical advice and information to involved parties.
 - 9. Ensures that a fire shelter is on board aircraft and accessible to the pilot, and that pilot is knowledgeable.
 - 10. Maintains equipment use log.
- B. **Parking Tender**
 - 1. Attend briefings.
 - 2. Oversees helicopter activities at the landing pad.
 - 3. Know and understand helicopter crash/rescue procedures.
 - 4. Attend to pilot's needs at the landing pad.
 - 5. Ensure that pump and ignition switches on the helitorch are turned off immediately after landing and turned on just prior to lift-off.
 - 6. Ensure all personnel are clear of safety circle during lift-off and landing operations.
 - 7. Have control over and maintain communications with the helicopter within the area of helibase.
 - 8. Hand off to Operations Section Chief or Burn Boss when helicopter departs helibase area.
 - 9. Check hook-up of the helitorch to helicopter, accomplish checkout procedures, staff fire extinguisher during drum removal and reloading.

Note: The Parking Tender may have simultaneous duties as a Helicopter Manager.

- C. **Mixmaster**
 - 1. Attend briefings.
 - 2. Plan and supervise the helibase mixing operations in conjunction with the Helitorch Manager.
 - 3. Place equipment and assure all is functioning properly.
 - 4. Determine quantities of fuel, gelling agent, etc. needed and manage time frames between batch mixes.
 - 5. Is responsible for hooking helitorch to the helicopter and for making the electrical connections from torch to helicopter.
 - 6. Supervise the helitorch fire protection organization.
 - 7. Conduct drills before actual operations are started to assure coordination exists among all

- personnel.
- 8. Perform preventative maintenance on helitorch.
- 9. Ensure equipment is clean after operation.

D. Helitorch Support Personnel

- 1. Attend briefings.
- 2. Mix gel and gelling agent.
- 3. Conduct drum exchange as applicable.
- 4. Refill helitorch drums.
- 5. Connects and disconnects vapor recovery/removal hoses as applicable.

E. Helibase Fire Protection Personnel

- 1. Staff nozzles and assure hoses are charged.
- 2. Follow instructions from Mixmaster.

F. Radio Operator

- 1. Receive orders from the Firing Boss/Burn Boss and relay to Helitorch Manager.
- 2. Maintain communication with appropriate aircraft.
- 3. Provide communication link between H/T Manager, Parking Tender, Helicopter Pilot, Ops Section Chief/Burn Boss and Dispatch.
- 4. Maintain activity/communications log.

G. Pilot

The Pilot will operate the helitorch according to the Burn Plan and under the direction of the Operations Section Chief or Burn Boss. Pilot-in-command is responsible for all matters related to flight safety. The pilot shall have approval for helitorch operations and receive a briefing on the operational objectives and ground and flight procedures. A briefing in fire behavior and terminology used during burning will be conducted before the burn. Ensure fire shelter is on board aircraft and accessible. The pilot must be familiar with fire shelter use.

- 1. Slip-turns should be avoided which could result in erratic helitorch movements that may throw burning fuel across fire lines or cause inconsistent drop patterns.
- 2. When leaving the burned area, helitorch must be turned off well before the boundary of the burn to avoid dropping ignited fuel outside the desired burn area.
- 3. Residual gel may cause flaming gel to drip after the pilot has stopped ignition. The pilot must ensure that the flame on the gel nozzle is extinguished before leaving the burn area. Persistent flame can be extinguished by increasing airspeed.
- 4. Whenever possible, the pilot's side of the helicopter should be kept toward the previously ignited area. This way the pilot can monitor heat build-up from the ignited burn area and avoid possible heat damage to the helicopter from extreme temperatures.
- 5. Sufficient altitude must be maintained.
- 6. A safe departure path from the burn must be maintained at all times in case of erratic fire behavior.
- 7. When landing, the descent must be slow until the helitorch contacts the ground. Helitorch should be in front of the ship upon landing.
- 8. Follow emergency procedures in helicopter flight manual. Jettison helitorch by electrical or manual release. Avoid flying over personnel, vehicles or congested areas.
- 9. At a minimum the pilot's door must be removed prior to burning operations.
- 10. Remove external cargo racks to provide a better view of the helitorch.
- 11. The electrical and manual cargo hook releases must be checked and operational.
- 12. Helitorch tip must clear the ground before forward flight.
- 13. Check that sufficient reserve power is available to hover and maneuver the helitorch.
- 14. Do not check for helitorch ignition unless over the burn area or other designated test area.
- 15. Take off into the wind, allowing sufficient clearance over obstacles.
- 16. Airspeed must be within limits for adequate controllability of the helicopter and the helitorch combination.
- 17. Monitor T.O.T. when operating in burn areas, as flying through preheated air may result in erratic or high T.O.T.
- 18. All load calculations will be completed and posted.

CAUTION: *If the cables become tangled over the helicopter's skids, UNDER NO CIRCUMSTANCES will any individual walk underneath the hovering helicopter to untangle the lines. The Parking Tender must direct the pilot to place the helitorch on the ground and release it before re-hooking.*

V. Helitorch Mixing/Loading Area

A. Safety

The location and layout of the fuel mixing and helitorch loading site is critical to reducing the risk of accidents with flammable materials, helicopter, and mixing/loading personnel. The fuel mixing/loading area is used for the purpose of blending fuel and gelling agent, exchanging drums on helitorches, or refilling drums from the mixing units.

This helitorch base, should be separated from the primary helibase and other helicopter operations. No smoking is permitted within the mixing/loading area. Precautions must be taken to eliminate sources of ignition where fuel vapors may be present.

B. Location

The helitorch mixing/loading area should meet the following criteria:

1. The mixing/loading area should be located close to the burn site and a reasonable distance from the helibase/refueling area.
2. The loading area is to be located upwind of the burn or where prevailing winds will keep the site clear of smoke and ember problems for the duration of the burn.
3. There should be an alternate loading area in case the mixing/loading site becomes unusable because of changing situations.
4. Helicopter flight paths into and out of the loading area will be free of hazards and must not pass over any personnel, residential areas, vehicles, camps or fuel caches.
5. While transporting the helitorch, the ignition helicopter should travel inside the burn area to reduce the risk of spot fires starting from residual fuel dripping from the torch, outside the burn boundaries.
6. There must be a marked, safe escape route from the mixing/loading area for all ground personnel in the event the work area is threatened.
7. The mixing/loading area should be located in an area relatively free of dust and loose debris. To achieve dust-free work conditions, the site should be treated with a binding agent or watered down adequately to prevent dust problems for the duration of the operation.

VI. Fuel Preparation

A. Safety

The Helitorch Manager must be aware of the procedures for safe storage, handling, and mixing of fuel according to agency or bureau policies.

1. The mixing areas should be set up with special attention to the safety equipment available and the training of the mixing crew.
2. Non-ferrous mixing equipment must be used and all bonding procedures must be followed.:
3. Ensure that precautions are exercised to eliminate direct exposure of skin to gelling agent or fuel.
4. Use a NIOSH approved dust mask when dispensing or handling gelling agent (powder). Use an organic vapor respirator when conducting maintenance operations or in the event of a spill. A known source is Laboratory Safety Supplies, Phone 1-800-356-0783. Refer to agency respiratory protection guidelines.
5. Mixing gelled fuel for the Western Canadian helitorch can easily be done with standard fuel drums and the liquid gelling agent "Petrol Gel." Two four-liter bottles of Petrol Gel will gel a 55-gallon

drum of unleaded gasoline. (With the standard helitorch ignition system, Jet A fuel did not perform well in this helitorch in either a gelled or un-gelled state).

B. Hazards

Hazards to mixing personnel include vapors from gasoline, flammability of gasoline, skin contact with fuel, and dust from the gelling agent. (Review MSDS's Appendix C)

1. Gasoline vapors are a depressant to the nervous system and a known carcinogen; prolonged and direct exposure to these vapors must be avoided.
2. Personnel should keep their hands out of gasoline and fuel mixtures. Special care must be taken to keep fuel from the mouth, eyes, open cuts, and abrasions.
3. Dust created in fuel mixing should be avoided. Mixing can only take place when all personnel involved in the operation are adequately trained and equipped. Personnel must be equipped with eye protection, fire retardant anti-static or 100 percent cotton coveralls, rubber gloves, and NIOSH approved dust masks.

C. Handling Gelling Agent and Fuel

1. Bulk transportation of fuel is recommended whenever possible using a fuel truck with its own pumping system.
2. When bulk fuel transportation is unavailable, a portable refueling system may be used that complies with requirements of appendix E.
3. The gelling agent must be kept dry. The chemical is non-toxic and can be disposed of in a landfill site; no spillage should remain on the site after the operation is completed.
4. DOT requirements (see Appendix E)

CAUTION: Only gelling agents with a current Material Safety Data Sheet (MSDS) are approved for use.

D. Mixing Procedures

1. Correct mixing is essential and clean fuel results in the best gelling and ignition. The optimum fuel temperature for gelling is 21 degrees Celsius or 70 degrees Fahrenheit. Colder gas takes longer to gel and requires more gelling agent for a proper mix.
2. Cleanliness of fuel, powder, and equipment must be assured. It is desirable to set up the mixing area well ahead of the desired ignition time to ensure all components of the set-up are operational.
3. Helitorch Manger checks to ensure all personnel are properly equipped and that all safety gear is in place.
4. Mixmaster ensures all drums, pumps, and tanks are properly grounded and bonded.
5. All drums and associated equipment must be clean.
6. Mix crew attaches the bonding cable and fuel nozzle to the mixing unit and add's fuel.
7. After fueling, the mixmaster adds the measured amount of gelling agent to the mixing unit while the fuel is being agitated. Gelling agent must be added slowly or improper gelling may occur.
8. Mixing of fuel and gelling agent continues until required amounts have been added (reference manufacture's mixing guidelines). Agitation continues until complete mixing has occurred and the mixture shows signs of gelling (waxy surface and thickening).
9. The Mixmaster determines if the gel is of the desired consistency.
10. Gelling agent added to partially gelled fuel will not totally dissolve and will cause lumping.
11. The mixed gel should sit for 10/15 minutes or until gelling is complete. Gel color may vary with different grades and brands of fuel.

E. Gelled Fuel Mixing Procedure for the Western Heli-Craft.

1. Remove the large bung from the fuel drum. Watch out for spraying fuel when the drum vents.
2. Agitate the Petrol Gel bottle until the mixture is smooth and there is no powered residue left on the bottom of the bottle. Be patient – this will take several minutes.

3. Stir fuel with a non-metallic or aluminum stick in one direction, until the fuel is moving rapidly in the drum.
4. Pour one bottle of well-mixed Petrol Gel in the drum into swirling fuel, then stir the fuel in the opposite direction until well blended.
5. Be sure that the entire content of the drum is being stirred. Move the stick up and down in the drum to ensure an even mix.
6. Pour other bottle of Petrol Gel into drum while the fuel is swirling, then stir until fuel is completely gelled.
7. Gelled fuel will become resistant to stirring when it reaches proper consistency. The proper consistency will be reached in 6 to 15 minutes depending on the temperature of the fuel.

CAUTION: *Fuel should not be gelled unless its use is likely. Fuel which has been gelled for more than two hours will begin to lose viscosity and may cause flaring during use.*

VII. Bench Testing the Helitorch

Helitorches will be kept clean and maintained to avoid operational delays. Once the helitorch has been cleaned and reassembled, it can be tested for serviceability on the ground. A 20 BC fire extinguisher must be readily available to a trained person during helitorch testing procedure. The helitorch will not be loaded with gelled fuel for bench testing.

The following outlines the steps to be performed during a bench test:

- A. **Connect two 12-volt batteries in series to produce 24 volts. (See Figure 4.)**
- B. **Ensure that both pumps and ignition switches are in the off position. Attach the power cord to the battery and the 9-pin plug to the helitorch.**
- C. **With the ignition switch on and the pump switch off, check to see that the igniter is producing a spark.**
- D. **With the pump switch on and the igniter switch off, check to see that the motor and pump operate normally, and the pulley rotates in the proper direction Clock wise when viewed from the control switch side of the helitorch.**
- E. **Turn both switches off and disconnect the plug from the battery adapter cord.**
- F. **Check all nuts, bolts and connectors for tightness and serviceability.**

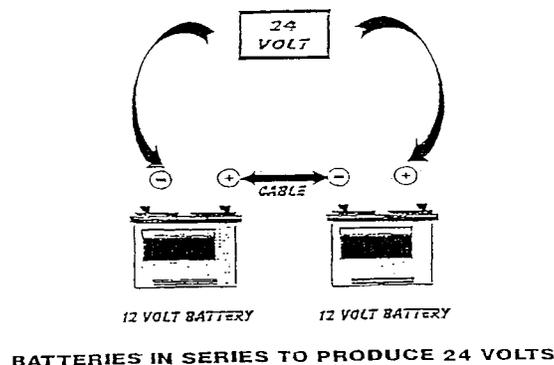
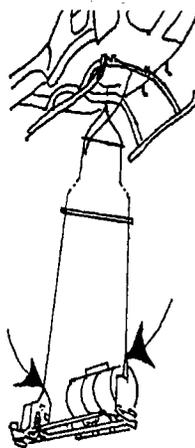


Figure 4

VIII. Helitorch Installation To Aircraft

- A. Have the pilot door removed.
- B. Insure that the suspension cables are correctly installed to the helitorch. The long cable is attached to the housing and the short cable is attached to the bail. (See Figure 5.) Inspect cables and connectors for security.



LOCATION OF ATTACHMENT POINTS OF SINGLE-POINT CABLE ASSEMBLY

Figure 5

Note: Single-point cable assembly attachment is the only attachment method approved for USDA Forest Service

- C. Place the helitorch on the ground in front of the helicopter with the nozzle end to the pilot's side of the aircraft and make sure the switches are off. (See Figure 6.)

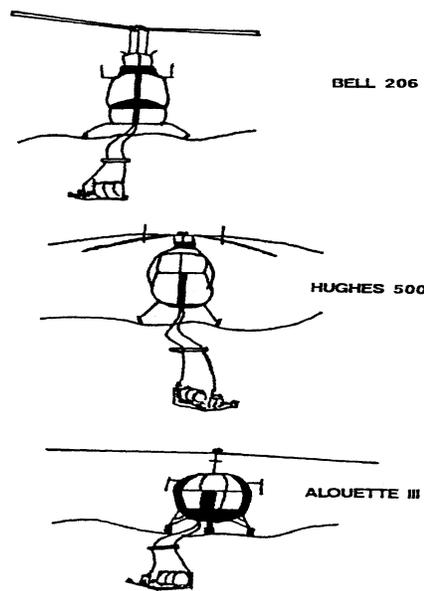


Figure 6

Correct helitorch orientation to above helicopter. Note position of helitorch in relationship to aircraft. (Lines are not over or under landing gear)

- D. Ensure that the pear-link adapter is correctly configured for the cargo hook on the helicopter. (See Figure 7.) Make sure that the cables are between the skids and will not become entangled during takeoff. Attach the pear-link to the cargo hook. At this time conduct a safety check of the cargo hook, both manual and electrical releases. After insuring that both switches are in the off position, secure the electrical cannon plug to the plug on the helicopter.

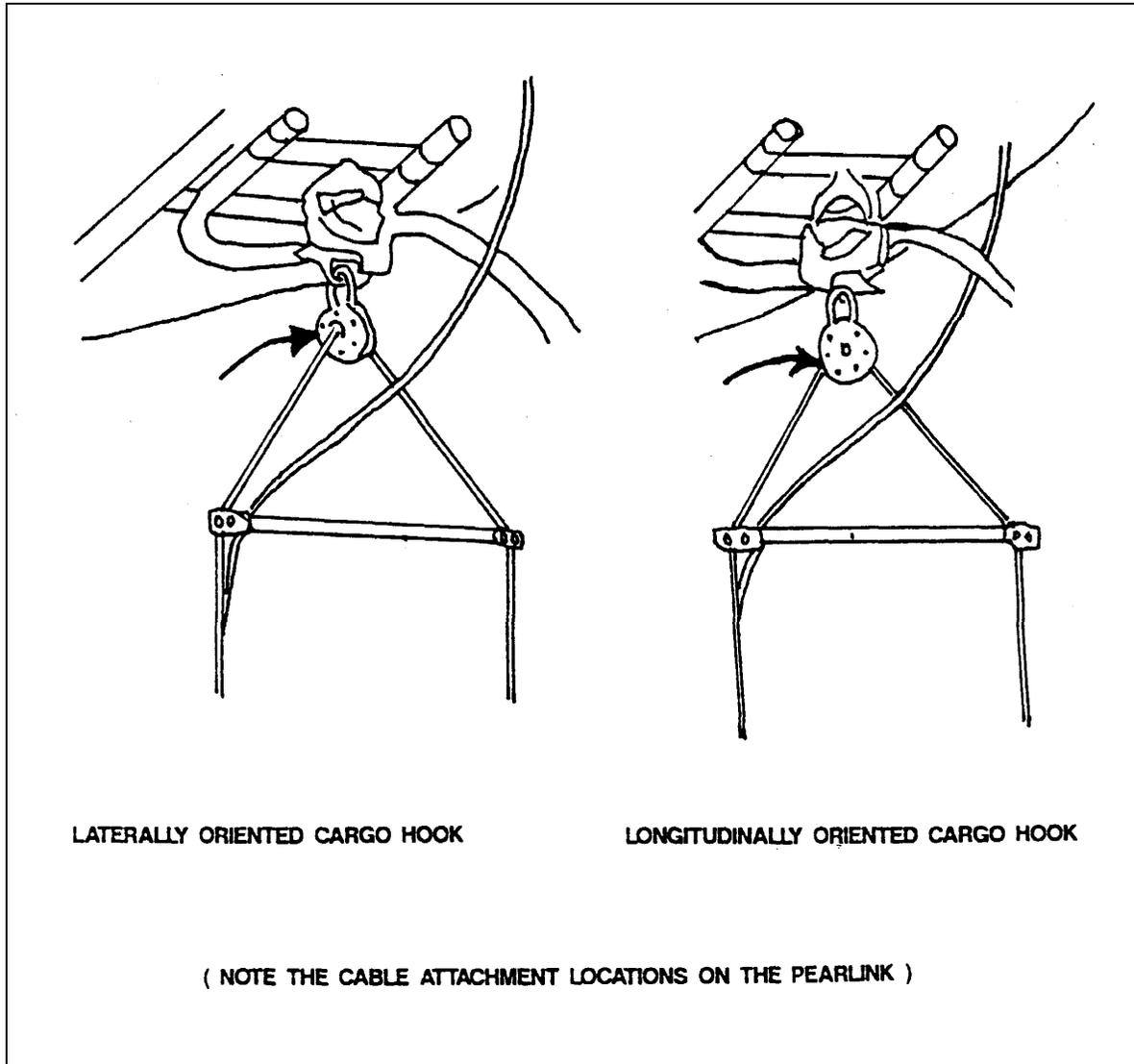


Figure 7

CAUTION: Before testing helitorch with the helicopter, disconnect pear-link from the aircraft cargo hook. Failure to follow this procedure can result in damage to the helicopter wiring if polarity is incorrect.

IX. Western Helicraft Helitorch Assembly and Set-up



Figure 8

A. Helitorch Assembly

1. Unwind the cables for the spreader bar assembly. The short steel cable wrapped with electrical cable is the spreader bar end and attaches to the aircraft cargo hook. The longer steel cable attaches from the foot of the bent leg frame to the eyebolt on the spreader bar. (See Figure 8.)
2. Straighten and check the suspension lines for damage and entanglements.
3. Check all connections to ensure that they are secure and properly safety wired.
4. Remove the two bolts from the sleeve portion of the bent leg frame.
5. Install the straight frame into the sleeve portion of the bent leg and secure it with the bolts, nuts and safety pins.

B. Gelled Fuel Helitorch Set-up Procedure

1. The pump-fin assembly is quick-pinned into place in the slot on the down-facing side of the straight-leg frame, below the ignition box.
2. One end of the 3/4 " hose fitting is connected to the outlet of the fuel pump. The other end is connected to the fuel nozzle inlet on the bent leg frame.
3. The 1½- inch fitting will attach to the 1½-inch coupler installed on the fuel drum.
4. The cannon plug on the pump assembly presses onto the receptacle on the ignition box.

CAUTION: *Mixing helitorch components between kits may cause compatibility problems due to differences in hose and/or nozzle length. If 1½-inch hose lengths are too long, the drum clamp may disconnect in flight.*

C. Adjusting the Igniter Tip

1. Igniter wire and nozzle terminus should be free of carbon deposits. Remove carbon deposits with sandpaper or a wire brush.
2. When properly adjusted, the igniter wire bends at the nozzle tip and parallels the nozzle terminus so that a gap of approximately ¼- to -inch exists between the two. This will allow multiple points for arcing to occur and prevent ignition failure.

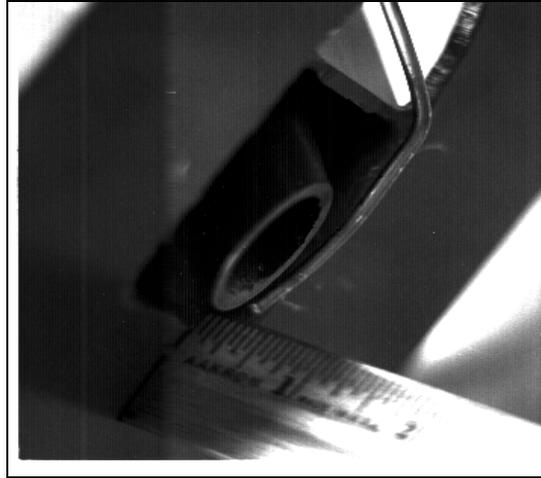


Figure 9

D. Fuel / Drum Valve Assembly

The Western Heli-Craft Helitorch uses unmodified standard 55-gallon fuel drums.

The ground crew must check the drums for fuel leaks and bent rims. Drums with bent rims on the vent bung side of the drum, or large dents in the side of the drum near drum rims, can not be used, since this is the area where the drum attaches to the helitorch. Any drum with damaged threads should not be used because it may leak or damage the threads of the helitorch vent or helitorch coupler.

1. Install small brass bleed-vent in the drum bung.



Figure 10

2. Check the bleed-vent for proper operation before installing by gently blowing on the brass end of the vent. If air does not go through the vent, or the vent is too loose, adjust the vent by tightening or loosening the vent's inset screw, which is located inside the vent.
3. The bleed-vent also serves as a check-valve. If it is adjusted too loosely, fuel will leak from the vent during flight. Use a bung plug gasket on the air vent and finger tighten to the drum.

4. The 1½-inch coupler is used for gelled fuels.
5. Put Teflon tape on the coupling valve to seal threads. Do not use the bung gasket with the coupler.
6. Close the coupler valve before inserting into the drum.
7. Use a pipe wrench attached to large bung adapter to tighten the coupler to the drum. **DO NOT USE THE COUPLER HANDLE.**
8. The coupler closure handle should face up toward the center of the drum after the coupler is tightened.
9. Keep drums upright until ready for use.
10. Fuel must be gelled before inserting drum coupler.

E. Attachment of Fuel Drum to Helitorch



Figure 11

Assure the fuel drum coupler valve is closed, then place the drum on it's side on a 6-inch diameter log, so that the small bung valve is in the upper-most position and the fuel coupler is in the lowest position.

F. Helitorch Installation to Aircraft



Figure 12

G. Initial Helitorch Hook-Up

1. Place the helitorch on the ground in front of the helicopter.
2. Orient nozzle terminus toward the pilot's side.
3. Helitorch should be placed close enough so that it can be hooked to the aircraft by a person crawling underneath the aircraft, and far enough away as to minimize cable slack.
4. Attach the spreader bar's pear ring to the aircraft cargo hook.
5. Place the spreader bar's "crow foot" over the skid.
6. Attach the helitorch electrical connection to the helicopter's external electrical plug.
7. Check the aircraft manual and electrical hook release to ensure that the helitorch can be jettisoned during an emergency.
8. Open fuel valve on drum half open.
9. Turn on both ignition and fuel switches on the helitorch as well as the manual valves for the mapp gas.
10. During lift-off assure that suspension lines do not become entangled with the helitorch and are not draped over the helicopter skid.

CAUTION: *Never tape the spreader bar's "crow foot" to the skid because this may prevent the helitorch from being jettisoned in an emergency.*

H. Model Specific Hook-up Considerations

1. **Bell and Hiller Model Helicopters**
The helitorch is manufactured with cable lengths suited for Bell 206 Series helicopters spreader bar must be perpendicular and horizontal to the skid (pilot's side) while the aircraft is on the ground to ensure the spreader bar will remain in the correct position during flight.
2. **Hughes, Aerospatiale Alouette II, and Aerospatiale Lamas**
The skids will move lower and closer to the center of the aircraft during flight. The spreader bar must be adjusted so it is in a horizontal and perpendicular position during flight.
3. **Aerospatiale A-Star**
Pilot view of helitorch may be obstructed due to seat position. This situation can be improved by adding a 20-foot cable extension to the helitorch

X. Testing Helitorch with Helicopter

Even if the helitorch has been bench tested, it should be tested on the helicopter while both are on the ground. At this point it is essential that you have conducted a pre-operational briefing with the pilot and crew. This briefing must include communications, any identified hazards, and emergency procedures. Make sure you have installed the desired nozzle tip on the helitorch, that there are no cables over the skids, and have a fire extinguisher staffed with a trained person.

A. Ignition Test

1. Insure the pump switch is off and turn the ignitor switch on.
2. Have pilot activate the helitorch control switch to test for proper ignition.
3. Have pilot release helitorch control switch and turn ignitor switch off.

B. Pump Test

1. Check dry-break connection and open hose valve.
2. Insure ignition switch is off and turn pump switch on.
3. Have pilot activate the helitorch control switch after having placed fuel catch vessel under fuel nozzle. Gelled fuel should flow through the nozzle tip. At this time all lines should be bled to insure fuel flow. If you hear the motor turning and no fuel flows, check for clogging, vapor lock, or polarity reversal. If the polarity is reversed, simply reverse the input wires or use a “backward-wired pig-tail. When polarity is correct, re-connect pear-ring to the aircraft cargo hook.
4. Check that the positive shut-off valve does not allow fuel to leak from the nozzle and that it operates freely.
5. Make sure both switches are off.
6. The torch is ready for operation.

XI. Prior to Each Take-Off (Final Check)

- A. Check helitorch structural integrity
- B. Igniter is clean.
- C. Helitorch and suspension system is positioned in front of the helicopter with the nozzle end toward the pilot’s side of the aircraft.
- D. The Mixmaster or parking tender will activate the ignition and pump switches, inform the pilot that the switches are on, and exit the area towards the parking tender.
- E. Parking tender directs takeoff.

CAUTION: At no time should there be anyone underneath or in close proximity of the helicopter with the helitorch attached.

XII. Filling helitorch from mixing unit.

- A. **The helicopter returns with an empty drum. The parking tender directs the helicopter to its landing position.**
- B. **Once the helicopter is on the ground, the pilot signals the Mixmaster or Parking tender to approach.**
- C. **The Mixmaster or Parking tender turns the switches off. Mixmaster now connects the vapor recovery and filler hoses on the helitorch drums. The Mixmaster signals the fuel mixing unit**

operator to pump gel. After fueling is complete, changes propane bottle if applicable.

- D. When the drum is full, the Mixmaster signals the mixing unit operator to shut off the pump. Then the Mixing unit operator closes the valve, removes fuel and vapor hoses, turns the switches on, and exits toward the parking tender.**
- E. The parking tender performs final checks that switches are on, cables are correct, dry-break handle is in the open position, visual check of propane gauge, and nozzle tip is clean.**
- F. Drum Exchanges for Western Helicraft helitorches**

Landing is the safest way to exchange drums. This practice reduces time spent under a hovering helicopter. This also reduces the amount of residual fuel that gets blown around a by rotor wash.

1. A full fuel drum, with coupler and bleed air vent attached is placed on a log so that the bung end of the drum is off the ground with the coupler on the bottom. Leave room on the down wind side of the log for the empty helitorch drum.
2. The helicopter hovers into the wind over the log with the empty helitorch. The parking tender directs the helicopter to lower the helitorch onto the down wind side of the log, next to the full drum. Two helitorch crewmembers (designated as Primary and Secondary) move in under the hovering helicopter and guide the helitorch onto the log, ensuring that the helitorch tip does not touch the ground.
3. The parking tender signals the pilot when to land on the down wind side of the exchange site. As the helicopter is landing, the parking tender will direct the pilot back so the cables on the torch remain slack free. The Primary crewmember turns off the ignition and pump switches, in line Mapp gas valve and turns off the fuel valve on the 1 ½” drum coupler. Both crewmembers then disconnect the helitorch from the empty drum. The Primary crewmember disconnects the fuel coupling.
4. Both helitorch crewmembers move the helitorch to the full drum. The Primary crewmember connects the fuel coupling. Both crewmembers attach the helitorch to the drum. The Primary crewmember turns the fuel valve on, half open for gelled fuel, turn on the pump, the two ignition switches, and opens inline Mapp gas valve.
5. The Primary and Secondary crewmembers remain at the exchange area to ensure that the cables do not get caught on the helitorch, and the helitorch tip does not contact the ground as the helicopter lifts the helitorch.
6. The parking tender signals the pilot to lift. The Primary crewmember remains under the helicopter and double checks to make sure that the pump and ignition switches are turned on. When the helitorch begins to lift, the Primary and Secondary crewmember exit toward the parking tender.
7. The parking tender signals the pilot when the helitorch crew is clear.
8. The parking tender signals the pilot to exit into the wind, and observes the helitorch until it is clear of the area.
9. The pilot avoids flying over personnel and equipment.
10. The ground crew monitors the helitorch until it is out of the helitorch base area.

XIII. Cleaning and Maintenance Of Helitorch and Related Equipment

The helitorch, drums, and mixing unit must have proper care to be dependable. Thoroughly flush all equipment with diesel fuel, and run through all nozzles, hoses, etc. Keep all equipment indoors or cover well.

XIV. MSDS (Material Safety Data Sheets)

See Appendix C

Chapter V – Other Aerial Ignition Devices

I. Introduction

Historically, a wide variety of aerial ignition devices and procedures for using those devices have been used. Many of these devices are still in use by different agencies at specific locations. In addition, several commercially manufactured devices have revised their products, or local agencies have constructed their own devices or modified commercial devices.

Policies concerning the use of an aerial ignition device or the procedures used in operating the device vary between agencies. Differences in policies and procedures generally cause little concern, except during interagency operations.

II. Other Aerial Ignition Devices Approved

All aerial ignition devices and procedures that are in use and have been approved by an agency can be used by that agency. Besides the aerial ignition devices listed in Chapters II, III and IV, the following devices are currently used and approved by various agencies. Nonstandard aerial ignition devices must be approved using the procedures outlined in Chapter I. These devices include:

- A. **Isolair Helitorch**
- B. **Ontario Aerial Ignition Device**
- C. **Fusee Dispenser**
- D. **Delayed Aerial Ignition Device**
- E. **California Division of Forestry Helitorch**
- F. **Fire Spec 2000 Helitorch and mixing system**

These devices may be used by agencies for burning operations when operated by qualified personnel of the agency approving their use.

III. Agency Manufactured or Modified Devices

If agency personnel modify a commercially obtained device, or construct their own devices, the agency assumes liability for the product. The USDA Forest Service strictly forbids the altering of any commercial aerial ignition device other than those approved through the Washington Office. The Department of the Interior and other agencies require their personnel to obtain bureau approval to use agency-manufactured or -modified commercial devices. The bureaus/agencies are responsible for conforming to the procedures prescribed in Chapter I of this guide.

IV. Manufacturer Modifications

Periodically, manufacturers of aerial ignition equipment modify or upgrade their equipment. As an example, Simplex has made several revisions of their helitorch and accessory equipment. Modifications made by the original manufacturer may require special authorization from an agency to be installed. (See Chapter I.) Bureaus and agencies are not required to install new modifications unless the agency or manufacturer requires installation of the modification for safe operation of the device.

V. New Aerial Ignition Devices

Future development of new aerial ignition devices or systems will require agency/bureau approval and development of operation plans for the devices. (See Chapter I.)

Appendix A – Organization Charts

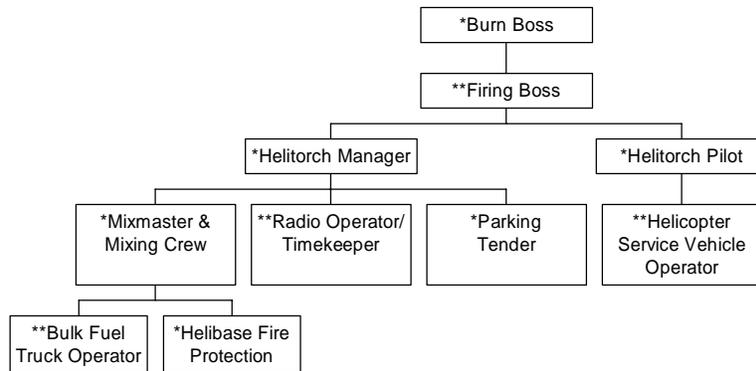
Helitorch Organization – Prescribed Fire

Helitorch Organization – Wildfire

PSD Organization – Prescribed Fire

PSD Organization – Wildfire

Helitorch Organization – Prescribed Fire

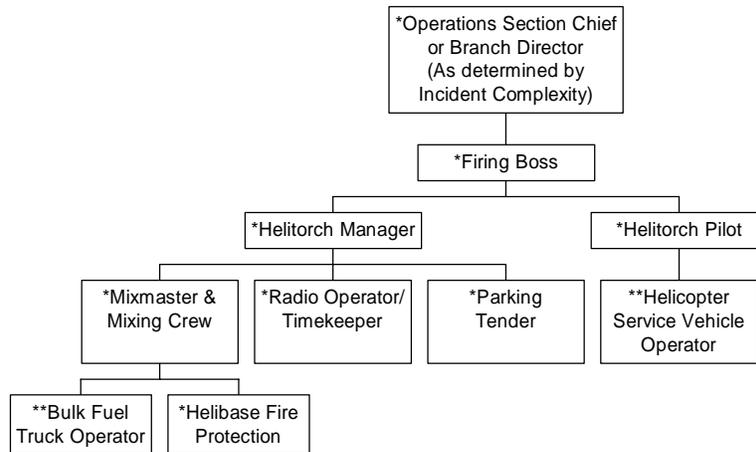


* Suggested minimum organization.

** Positions to be filled as needed to provide for efficiency on larger operations.

Note: Identify all trainees for given positions on organization chart.

Helitorch Organization-Wildfire

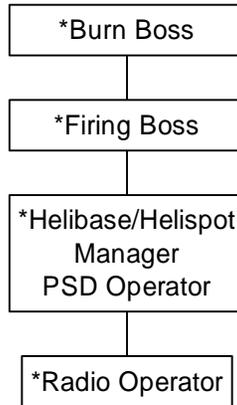


* Suggested minimum organization.

** Positions to be filled as needed to provide for efficiency on larger operations.

Note: Identify all trainees for given positions on organization chart.

PSD Organization – Prescribed Fire

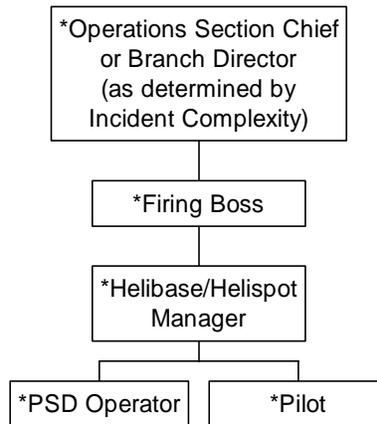


* Suggested minimum organization.

** Positions to be filled as needed to provide for efficiency on larger operations.

Note: Identify all trainees for given positions on organization chart.

PSD Organization – Wildfire



- Suggested minimum organization.

- Positions to be filled as needed to provide for an efficient and safe operation.

Note: Identify all trainees for given positions on organization chart.

Appendix B – Aerial Ignition Checklists and JHA's

Helitorch Operations Checklist

Helitorch Inspector Checklist

Batchmixer Checklist

Plastic Sphere Dispenser Air Operations Checklist/Safety Checklist

Simplex Helitorch JHA

Primo Mark III Sphere Dispenser JHA

Western Helicraft Helitorch JHA

HELITORCH OPERATIONS GO/NO GO CHECKLIST

Helitorch Manager		Date
Burn/Firing Boss		Date
DAILY INSPECTION		
ORGANIZATION		
a.	Helitack organization chart has been prepare and posted showing responsibility for functions by name.	
b.	All helitack positions are filled by qualified personnel.	
c.	Pilot and aircraft agency approved cards checked.	
d.	Helitorch module certified by agency aviation manager.	
HELIBASE OPERATIONS		
a.	Helibase manager	
b.	Has established separate radio frequencies as designated on communications plan.	
c.	Communications tested and operational.	
d.	Briefing, to include as a minimum all required helitack personnel, key firing personnel, and helitorch pilot.	
e.	Overhead responsibilities and authorities.	
f.	Flight routes include jettisoning torch considerations and alternate/emergency landing sites.	
g.	Area flight hazards.	
h.	Radio frequency assignments.	
i.	Personnel assignments.	
j.	Emergency procedures with torch, staff fire extinguisher.	
k.	Helibase emergency fire suppression procedures, medivac, foam/extinguisher.	
l.	NOTE: All personnel will be briefed on the adherence of alumagel and hazards from coming into contact with it.	
MIXING AREA		
a.	Separate from other helibases activities.	
b.	Traffic control.	
c.	Ground vehicles, personnel, aircraft	
d.	Helitorch fuel supply, available and properly located, static grounding measures.	
e.	Fire suppression equipment available.	
f.	Equipment operational.	
g.	Personnel available and briefed.	
h.	Personnel assignments.	
i.	Emergency procedures with helitorch, staffing extinguisher.	
j.	Emergency fire suppression procedures, medivac, foam/extinguisher.	
LANDING AREA		
a.	Located where safe approach and departure paths exist, and separate from other helibase activities.	
b.	Free from flight hazards within the landing area.	
c.	Traffic control of (1) ground vehicles, (2) personnel, and (3) aircraft.	
d.	Dust abatement measures taken.	

e.	Helicopter fuel truck security- parking area and driving route designed, located away from flight routes, landing areas, and personnel. Static grounding measures required.
f.	Helitorch loading procedures-briefed and personnel assignments.
g.	Fire suppression equipment available and operational.
h.	Fire suppression personnel available and briefed.
CRASH RESCUE PLAN	
a.	Follows Crash Rescue Guide
b.	Base helibase crash rescue personnel assigned.
c.	Posted as helibase and dispatch.
d.	Map showing flight routes, helitorch area, flight hazards, ground access routes, and alternate/emergency landing sites, posted on a bulletin board.
ORIENTATION FLIGHT	
a.	Completed
GO/NO-GO CHECK LIST	
a.	Completed

HELICOPTER CRASH RESCUE

GENERAL INSTRUCTIONS	
In the event of an accident the helibase manager will supervise and coordinate the crash rescue activities. Specific crash rescue duties will be assigned to helibase personnel each morning before flights of any kind. Crash rescue and first aid equipment will be located on or near the engine and the equipment's location made known to all helibase personnel. Information and instructions will be sent/received through the local dispatch office.	
SPECIFIC INFORMATION AND INSTRUCTIONS	
1	Nature of the injury/illness (Do not use names over the radio)
2	Is medical help needed ?
3	What transportation is needed ?
4	Location of victim.
5	Route to be taken (use landmarks as guide)
6	Equipment needed.
7	Name of contact at site.
8	Notify appropriate agency line officer.
AVAILABLE MEDIEVAL HELICOPTERS	
LIFE FLIGHT	
EMT(S) ON PROJECT	

HELICOPTER INSPECTION CHECKLIST

INSPECTOR		Date
DAILY INSPECTION		
FUEL DRUMS		
	a.	All welds
	b.	Handles secure and straight
	c.	Clean and flushed with diesel or solvent after use.
	d.	Latch and cover working properly.
	e.	Valve-clean and working properly.
FRAME		
	a.	No cracks or breaks.
	b.	Clean.
	c.	All bolts, pins in place, and tight
	d.	Bail security clips hold barrel secure.
	e.	Ignition system-clean and working.
	f.	Pump valve-clean and working.
MOTOR AND ELECTRICAL HOUSING		
	a.	Clean
	b.	Motor pulley and belt in good condition.
	c.	Electrical wiring-free from cracks and connected properly.
	d.	Pump motor lubricated.
	e.	All screws and bolts in place.
	f.	Pump operating (primed).
CONNECTORS		
	a.	Clean with clamp tight.
	b.	Valve Clean. Caution ! Do not open valve unless attached !
	c.	Grounding cable connectors complete.
	d.	Swivel rotates freely-hose not leaking.
SUSPENSION LEAD LINES AND ELECTRICAL CABLE		
	a.	Clean and free from kinks, nicks, and burrs.
	b.	Suspension line connectors secure and in good condition.
	c.	All bolts and nuts properly secured-Self locking.
	d.	Electrical connectors clean and tight, line properly attached to suspension cables.
	e.	Separator bars not cracked or broken-properly attached between cable swedges.

ACCESSORY CHECKLIST		
	a.	Windsock
	b.	Fire extinguishers-2, 20 B/C
	c.	Propane bottles.
	d.	Goggles
	e.	Respirator/dust mask.
	f.	First aid kit
	g.	2 5 gallon slop buckets.
	h.	Wire brush
	i.	WD-40
	j.	Wash basin, soap, and 5 gallons of water or hand cleaner and rags.
	k.	Scale and scoop for measuring gelling agent.
	l.	Cotton coveralls.
	m.	Flight helmet, flight suit, and gloves.
	n.	Tool kit.
	o.	Electric pump.
	p.	Rubber suction hose.
	q.	Dry lock connect.
	r.	Chainsaw, dolmar, chaps, and saw kit.
	s.	Orange paint/florescent flagging.
	t.	Grounding rods/cables
	u.	Credit card secured for batch mixer.
	v.	Emmery cloth and extra tip parts.
	w.	Funnel, coffee can.
	x.	Non,-ferrous, metal pipe wrench.
PERIODIC (ANNUAL) INSPECTION AND MAINTENANCE		
NOZZLE ASSEMBLY		
	a.	Disassemble/clean and lubricate.
	b.	Replace worn parts.
DRYBREAK VALVE		
	a.	Disassemble/clean and lubricate.
	b.	Replace worn parts.
BELT		
	a.	Replace
MOTOR/ELECTRICAL SYSTEM		
	a.	Replace brushes.
	b.	Lubricate bearings.
PUMP		
	a.	Lubricate.

BATCHMIXER INSPECTION CHECKLIST

INSPECTOR		Date
DAILY INSPECTION		
FUEL DRUMS		
	a.	All welds
	b.	Handles secure and straight
	c.	Clean and flushed with diesel or solvent after use.
	d.	Latch and cover working properly.
	e.	Check gasket on loading hopper.
	f.	Valve-clean and working properly.
	g.	Flammable signs clean and legible.
FRAME/TRAILER		
	a.	No cracks or breaks.
	b.	Clean.
	c.	All bolts, pins in place, and tight
	d.	Bail security clips hold barrel secure.
	e.	Gas motor-clean, serviced and working.
	f.	Pump motor-clean and working.
	g.	Pressure gauge on pump operational.
	h.	Tail lights clean and working.
	i.	Break system working.
	j.	Safety chains secure.
	k.	Tire pressure checked/spare tire.
	l.	Tongue to bumper assembly secure.
	m.	Drylock connects secure on hose reel.
MOTOR		
	a.	Gas tank full.
	b.	Oil clean and at operating level.
	c.	Air cleaner, cleaned and foam sponge lightly oiled.
	d.	Spark plug operational/spare.
	e.	Pump motor lubricated.
	f.	All screws and bolts in place..
	g.	5 gallon gas tank full.
CONNECTORS		
	a.	Clean with clamp tight.
	b.	Valve Clean. Caution ! Do not open valve unless attached to male connect-it will damage nozzle!
	c.	Grounding cable connectors complete.
	d.	Swivel rotates freely-hose not leaking.

TERRA TORCH		
	a.	Nozzle tip clean.
	b.	All bolts and nuts properly secured.
	c.	Electrical connectors clean and tight.
	d.	5 extra propane bottles.
	e.	Matches or lighter
	f.	Line clean after use.
	g.	Clean and flushed with diesel or solvent after use.
FIELD ACCESSORY CHECKLIST		
	a.	Fire extinguishers-2, 20 B/C
	b.	Propane bottles.
	c.	Goggles
	d.	Respirator/dust mask.
	e.	First aid kit
	f.	2 5 gallon slop buckets.
	g.	Wire brush
	h.	WD-40
	i.	Wash basin, soap, and 5 gallons of water or hand cleaner and rags.
	j.	Scale and scoop for measuring gelling agent.
	k.	Cotton coveralls.
	l.	Tool kit.
	m.	Electric pump.
	n.	Rubber suction hose.
	o.	Dry lock connect.
	p.	Chainsaw, dolmar, chaps, and saw kit.
	q.	Orange paint/florescent flagging.
	r.	Grounding rods/cables
	s.	Credit card secured for batch mixer.
	t.	Emmery cloth and extra tip parts.
	u.	Funnel, coffee can.
	v.	Non,-ferrous, metal pipe wrench.

PSD Air Operations/Safety Go/NO GO Checklist

Helibase Safety

- Qualified Helibase/Helispot Manager assigned.
- Helibase/helispot meet established standards.
- Organizational chart posted, assignments known.
- Communications chart posted. Frequency assignments known.
- Helibase/helispot fire protection meets established standards.
- Crash rescue/evacuation kits on the helibase/helispot.
- Emergency plan posted.
- All personnel briefed. Aerial ignition personnel briefed on in-flight operations.
- Separation of aircraft (if more than one used).
- Personal protective equipment meet established standards.
- Flight hazard map posted/hazards known to pilot.

Aircraft/Pilot(s)

- Check pilot and aircraft approval cards.
- Check pilot and aircraft limitations.
- Load calculations prepared and posted.
- Check aircraft radios.
- Remove all loose articles from aircraft.
- Fire shelter on board aircraft for each person.
- Water bucket ordered with aircraft (optional).
- Agency specific operator restraining device.

Plastic Sphere Dispenser

- Installation correct with restraints in place.
- Mechanical operation satisfactory.
- Extinguisher (water reservoir) system filled and operational.
- Glycol reservoir filled and tightly capped.
- 20-second ignition delay achieved.
- Intercom and aircraft-to-ground communications operable.
- Pilot has been briefed and agrees that all is in order.
- Sphere containers secured.
- Knife available for emergency use.
- Additional container of water available.
- Tool kit/Premo Mark III manual on board aircraft (optional).

Burning Operations

- All persons briefed and assignments known.
- Maps/photos of project area used/posted.
- Special weather considerations known/discussed.
- Communication plan posted and frequency assignments known.
- Emergency operations plan known and discussed.
- Personal protective equipment meets established standards.
- Special safety considerations known and discussed.

Support Equipment/Personnel

- Adequate support equipment/personnel to complete mission.
- Pump/engine operational checks.
- Radios/communications operationally checked.
- Support equipment/personnel prepositioned before actual operations begin.
- Adequate supply of plastic spheres and glycol to complete project.
- PSD checklist complete.

The following signatures certify that all of the above checklist items have been accomplished.

 PSD Operator

Date

 Burn Boss/Firing Boss

Date

U.S. Department of Agriculture Forest Service JOB HAZARD ANALYSIS (JHA) References-FSH 6709.11 and -12 (Instructions on Reverse)		FS-6700-7 (5/96)	
1. WORK PROJECT/ACTIVITY Plastic sphere dispenser operation		2. LOCATION	
4. NAME OF ANALYST		5. JOB TITLE	
7. TASKS/PROCEDURES		6. DATE PREPARED	
8. HAZARDS		9. ABATEMENT ACTIONS Engineering Controls * Substitution * Administrative Controls * PPE	
*Qualifications *Responsibilities *Bench testing *Personal Protective Equipment *Malfunctions *Ignition *Flight following *	Unqualified personnel Unknown responsibilities Possible malfunctions Injuries Possible fire in machine, machine not operating properly Firing pattern/ fire behavior Loss of communication	Sphere dispenser operator shall be certified annually. Pilot and helicopter will be certified annually for aerial ignition. Pilot will have two hours fire behavior and trained in use of the fire shelter. Prior to each project, operator will review appropriate portions of IHOG and Interagency Aerial Ignition Guide. The project briefing will cover responsibilities and emergency procedures. Bench testing will be done prior to mounting the machine in the helicopter and pilot shall have a fire shelter and wear flight helmet, nomex flight suit, nomex gloves and leather boots. The Burn Boss will be required to have the same PPE if riding in the helicopter. Malfunctions will be addressed in the project briefing. Operator will immediately notify pilot of a malfunction and take appropriate action to correct it. If the malfunction cannot be corrected in the air, the helicopter will set down. If a fire occurs in the machine that the operator cannot extinguish, the pilot will be notified and the machine will be jettisoned. Firing pattern will be determined by the Burn Boss to ensure objectives are met safely. Flight following will be done from the helibase during the project. Upon completion of the project, flight following will be turned over to dispatch.	
10. LINE OFFICER SIGNATURE		11. TITLE	
Previous edition is obsolete		12. DATE	

(over)

FS-6700-7 (5/96)

U.S. Department of Agriculture Forest Service JOB HAZARD ANALYSIS (JHA) References-FSH 6709.11 and -12 (Instructions on Reverse)	1. WORK PROJECT/ACTIVITY Helitorch Operations 4. NAME OF ANALYST	2. LOCATION 5. JOB TITLE	3. UNIT 6. DATE PREPARED
7. TASKS/PROCEDURES	8. HAZARDS	9. ABATEMENT ACTIONS Engineering Controls * Substitution * Administrative Controls * PPE	
*Module qualifications *Responsibilities *Mixing gelling agent *Transporting Hazardous materials *Parking Tender duties *Landings and takeoffs *Malfunctions and flight following *Ignition	unqualified personnel responsibilities are unknown working with raw gasoline & inhalation of gelling agent driving hazards Close proximity to operating helicopter helicopter entering and exiting ground effect torch operating improperly, loss of communication Improper firing patterns, extreme fire behavior	Helitorch module members shall be certified annually for the positions they occupy. Pilot and helicopter shall be certified annually for aerial ignition and pilot will have two hours of fire behavior and use of the fire shelter. Prior to each operation, module members shall review appropriate portions of IHOG and Interagency Aerial Ignition Guide. No smoking. Properly laundered cotton coveralls, proper bonding, only required personnel will be on the site, dust masks for mixing crew, as well as hard hats, rubber gloves, ear protection and boots. Driver of batch mixer shall have a current CDL with Hazmat endorsement and follow all requirements for transportation of hazardous materials. PPE = Hard hat, ear and eye protection, radio with discreet frequency, nomex flight suit, boots, gloves. If entanglement occurs, wait until the torch and helicopter are safely on the ground and the pilot has given approval to approach prior to untangling. When landing or taking off, pilot will be on discreet frequency with parking tender. After departing Helibase, pilot will communicate with Burn Boss. Any malfunction will immediately halt the project. Helicopter will set down until the problem is discovered and repaired. Flight following will be done from the Helibase during the project. Upon project completion, flight following will be turned over to dispatch. Firing pattern will be determined by the Burn Boss and the pilot to ensure objectives are being met safely.	
10. LINE OFFICER SIGNATURE Previous edition is obsolete	(over)	11. TITLE	12. DATE

Western Heli-craft Helitorch Job Hazard Analysis

Employee Occupation: Fire Suppression Specialists

Specific Work: Helitorch Operations

Protective Clothing and/or Equipment Needed: Head (SPH-4 or 5), Eye, and Foot Protection. Hand-held radio, SPH-4 or 5 to hand-held radio adapter, and Fire Extinguisher.

Work Steps	Hazards	Safe Procedures
Moving fuel barrels.	Muscle strains, drops, collisions, cuts.	Get help moving fuel drums. Lift with legs rather than back. Ensure route is unobstructed. Hand and foot protection.
Pressure release of fuel barrels.	Spraying Fuel when barrel vents.	Remove large barrel bung slowly to provide gradual release of pressure. Use eye protection.
	Hazardous Material exposure	See Material Safety Data Sheet in appendix of operating manual.
Barrel Exchanges	Working under hovering helicopters; rotor wash.	Maintain good visual and radio communications between pilot and ground crew. SPH-4 with adapter for hand-held radio will help accommodate this.
	Hazardous Material exposure	See Material Safety Data Sheet in appendix of operating manual.
	Twisting suspension cables.	Maintain visual contact with cables. Primary crewmember ensures cable do not twist as helicopter lifts.
Ignition Testing	Swinging helitorch/ electrical shock	Do not attempt to make contact with the helitorch until it has come to rest on the ground.
	Fire	Fuel valve must be off and helitorch terminus clean of fuel prior to testing. Marshaller has responsibility to keep fire extinguisher within reach.
Component changes	Fuel leaks, in-flight barrel separation.	Mixing of helitorch components between kits may cause compatibility problems due to differences in hose and/or nozzle length. If 1 1/2 inch hose lengths are too long, the barrel clamp may disconnect in flight.

Appendix C – Material Safety Data Sheets

BERNZOMATIC -- MAPP GAS - METHYLACETYLENE PROPADIENE
H&H GAS -- LIQUEFIED PETROLEUM GAS OR PROPANE
AMOCO OIL -- AMOCO REGULAR LEAD-FREE GASOLINE - GASOLINE, UNLEADED
AIR BP BP OIL LTD -- JET A-1 - TURBINE FUEL, AVIATION
AMOCO OIL -- JET FUEL JP-4 - TURBINE FUEL, AVIATION
AMOCO OIL -- LS NO. 2 DIESEL FUEL - DIESEL FUEL
ALDRICH CHEMICAL SUB OF SIGMA-ALDRICH -- 22346-8 POTASSIUM PERMANGANATE 99%
PETROL JEL LIQUID FUEL GELLING AGENT
FIRE-TROL FIREGEL CHEMONICS INDUSTRIES, INC.
INHIBITED ETHYLENE GLYCOL QUAKER STATE ANTIFREEZE

BERNZOMATIC -- MAPP GAS - METHYLACETYLENE PROPADIENE
MATERIAL SAFETY DATA SHEET
NSN: 683000D020183
Manufacturer's CAGE: 70785
Part No. Indicator: A
Part Number/Trade Name: MAPP GAS

General Information

Item Name: METHYLACETYLENE PROPADIENE
Company's Name: BERZOMATIC CORP
Company's Street: ONE BERZOMATIC DRIVE
Company's City: MEDINA
Company's State: NY
Company's Country: US
Company's Zip Code: 14103-1648
Company's Emerg Ph #: 716-798-4949
Company's Info Ph #: 716-798-4949
Distributor/Vendor # 1: BALKAMP INC (317-248-0760)
Distributor/Vendor # 1 Cage: 70842
Distributor/Vendor # 2: NAPA
Distributor/Vendor # 2 Cage: 050Q3
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SM
Date MSDS Prepared: 30MAY90
Safety Data Review Date: 22DEC96
Supply Item Manager: CX
MSDS Serial Number: CCHPV
Specification Number: UNKNOWN
Spec Type, Grade, Class: UNKNOWN
Hazard Characteristic Code: G2
NRC/State License Number: NONE
Net Propellant Weight-Ammo: NONE

Ingredients/Identity Information

Proprietary: NO
Ingredient: METHYL ACETYLENE (PROPYNE)
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: UK4250000
CAS Number: 74-99-7
OSHA PEL: 1000 PPM
ACGIH TLV: 1000 PPM; 9394
Other Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

Appearance And Odor: COLORLESS, UNPLEASANT ODOR AT APPROX. 100 PPM
Boiling Point: -36F,-38C
Melting Point: NOT GIVEN
Vapor Pressure (MM Hg/70 F): 109 PSIG
Vapor Density (Air=1): 1.48
Specific Gravity: .571
Decomposition Temperature: NOT GIVEN

Evaporation Rate And Ref: NOT GIVEN
Solubility In Water: SLIGHT
Corrosion Rate (IPY): UNKNOWN

Fire and Explosion Hazard Data

Flash Point: -99F,-73C
Flash Point Method: CC
Lower Explosive Limit: 3.0
Upper Explosive Limit: 11.0
Extinguishing Media: ELIMINATE OXYGEN SOURCE OR STOP FLOW OF GAS. USE WATER TO COOL CYLINDER. DRY CHEMICAL OR CARBON DIOXIDE TO REDUCE OXYGEN
Special Fire Fighting Proc: COOL CYLINDERS WITH WATER. KEEP PERSONNEL AWAY.
Unusual Fire And Expl Hazrds: VAPOR IS FLAMMABLE AND HEAVIER THAN AIR AND MAY TRAVEL TO SOURCE OF IGNITION AND FLASHBACK. USE WATER TO KEEP FIRE EXPOSED CONTAINERS COOL TO REDUCE PRESSURE.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): DO NOT EXPOSE TO TEMPERATURES ABOVE 125F.
Materials To Avoid: EXTREMELY FLAMMABLE. AVOID UNCONTROLLED CONTACT WITH OXIDIZERSS
Hazardous Decomp Products: NORMAL BY-PRODUCTS OF COMBUSTION.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): WILL NOT OCCUR.

Health Hazard Data

LD50-LC50 Mixture: LD50 (ORAL RAT) IS UNKNOWN
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: ASPHYXIANT. MAY REDUCE OXYGEN REQUIRED FOR BREATHING. LIQUID GAS MAY FREEZE SKIN.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: THIS COMPOUND CONTAINS NO INGREDIENTS AT CONCENTRATIONS OF 0.1% OR GREATER THAT ARE CARCINOGENS OR SUSPECT CARCINOGENS.
Signs/Symptoms Of Overexp: DIZZINESS TO UNCONSCIOUSNESS IF HIGH CONCENTRATIONS OF GAS REPLACE OXYGEN FOR BREATHING.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: REMOVE EXPOSED PERSON TO FRESH AIR. UF UNCONSCIOUS, SEEK MEDICAL ATTENTION.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: REMOVE IGNITION SOURCES AND VENTILATE AREA.
Neutralizing Agent: NO INFORMATION GIVEN BY MFR ON MSDS.
Waste Disposal Method: VENT TO ATMOSPHERE IN OUTDOOR AREA FREE OF ALL SOURCES OF IGNITION.
Precautions-Handling/Storing: STORE IN WELL VENTILATED AREA AWAY ROM ALL IGNITION SOURCES. STORE AT TEMPERATURES BELOW 125F. STORE OUT OF DIRECT

SUNLIGHT.

Other Precautions: NONE SPECIFIED BY MANUFACTURER.

 =====
 Control Measures
 =====

 =====
 Respiratory Protection: NOT REQUIRED WITH NORMAL USE.
 Ventilation: LOCAL EXHAUST ADVISABLE WHEN WELDING, OTHERWISE "N/A".
 Protective Gloves: ADVISABLE WHEN WELDING.
 Eye Protection: FILTER SHADE #4 OR DARKER FOR WELDING
 Other Protective Equipment: NONE SPECIFIED BY MANUFACTURER.
 Work Hygienic Practices: WASH HANDS THOROUGHLY WITH SOAP AND WATER BEFORE
 EATING, DRINKING, SMOKING OR USING TOILET FACILITIES.
 Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.
 =====

 =====
 Transportation Data
 =====

 =====
 Trans Data Review Date: 96327
 DOT PSN Code: LLG
 DOT Proper Shipping Name: PETROLEUM GASES, LIQUEFIED OR LIQUEFIED
 PETROLEUM GAS
 DOT Class: 2.1
 DOT ID Number: UN1075
 DOT Label: FLAMMABLE GAS
 IMO PSN Code: LMX
 IMO Proper Shipping Name: PETROLEUM GASES, LIQUEFIED o
 IMO Regulations Page Number: 2147
 IMO UN Number: 1075
 IMO UN Class: 2(2.1)
 IMO Subsidiary Risk Label: -
 IATA PSN Code: TJL
 IATA UN ID Number: 1075
 IATA Proper Shipping Name: PETROLEUM GASES, LIQUEFIED
 IATA UN Class: 2.1
 IATA Label: FLAMMABLE GAS
 AFI PSN Code: TJL
 AFI Symbols: 0
 AFI Prop. Shipping Name: PETROLEUM GASES, LIQUEFIED OR LIQUEFIED PETROLIUM
 GAS
 AFI Class: 2.1
 AFI ID Number: UN1075
 AFI Basic Pac Ref: A6.3,A6.5
 N.O.S. Shipping Name: METHYLACETYLENE (PROPYNE)
 =====

 =====
 Disposal Data
 =====

 =====
 Label Data
 =====

 =====
 Label Required: YES
 Technical Review Date: 22NOV96
 MFR Label Number: NONE
 Label Status: F
 Common Name: MAPP GAS
 Chronic Hazard: NO
 Signal Word: CAUTION!
 Acute Health Hazard-Slight: X
 =====

Contact Hazard-Slight: X

Fire Hazard-Slight: X

Reactivity Hazard-None: X

Special Hazard Precautions: STORE IN WELL VENTILATED AREA AWAY FROM ALL IGNITION SOURCES. STORE AT TEMPERATURES BELOW 125F. STORE OUT OF DIRECT SUNLIGHT. FIRST AID: REMOVE EXPOSED PERSON TO FRESH AIR. IF UNCONSCIOUS, SEEK MEDICAL ATTENTION.

Protect Eye: Y

Protect Skin: Y

Label Name: BERNZOMATIC CORP

Label Street: ONE BERNZOMATIC DRIVE

Label City: MEDINA

Label State: NY

Label Zip Code: 14103-1648

Label Country: US

Label Emergency Number: 716-798-4949

H&H GAS -- LIQUEFIED PETROLEUM GAS OR PROPANE
 MATERIAL SAFETY DATA SHEET
 NSN: 683000N068823
 Manufacturer's CAGE: HHGAS
 Part No. Indicator: A
 Part Number/Trade Name: LIQUEFIED PETROLEUM GAS OR PROPANE

=====
 General Information
 =====

Company's Name: H&H GAS CORP
 Company's P. O. Box: 208
 Company's City: HIGHTSTOWN
 Company's State: NJ
 Company's Country: US
 Company's Zip Code: 08520
 Company's Emerg Ph #: 609-448-3232
 Company's Info Ph #: 609-448-3232
 Record No. For Safety Entry: 001
 Tot Safety Entries This Stk#: 001
 Status: SMJ
 Date MSDS Prepared: 27JUL95
 Safety Data Review Date: 29FEB96
 Preparer's Company: NATIONAL PROPANE GAS ASSOC
 Preparer's St Or P. O. Box: 1600 EISENHOWER LN STE 100
 Preparer's City: LISLE
 Preparer's State: IL
 Preparer's Zip Code: 60532
 MSDS Serial Number: CBJMY

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 Ingredients/Identity Information
 =====

Proprietary: NO
 Ingredient: PROPANE % WT: 2.15-9.60
 Ingredient Sequence Number: 01
 Percent: <9.60
 NIOSH (RTECS) Number: TX2275000
 CAS Number: 74-98-6
 OSHA PEL: 1000 PPM
 ACGIH TLV: ASPHYXIAN

 Proprietary: NO
 Ingredient: AIR, COMPRESSED
 Ingredient Sequence Number: 02
 NIOSH (RTECS) Number: 1004033AC
 CAS Number: 25635-88-5
 OSHA PEL: N/K (FP N)
 ACGIH TLV: N/K (FP N)

 Proprietary: NO
 Ingredient: SUPDAT: TO CLEAN SINCE RESIDUE IS DFCLT TO REMOVE. ALL CNTNRS
 SHOULD BE DISPOSED OF IN ENVIRONMENTALLY SAFE (ING 4)
 Ingredient Sequence Number: 03
 NIOSH (RTECS) Number: 9999999ZZ
 OSHA PEL: NOT APPLICABLE
 ACGIH TLV: NOT APPLICABLE

Proprietary: NO

Ingredient: ING 3: MANNER & IN ACCORDANCE WITH GOVERNMENTAL REGULATIONS.

Ingredient Sequence Number: 04

NIOSH (RTECS) Number: 999999ZZ

OSHA PEL: NOT APPLICABLE

ACGIH TLV: NOT APPLICABLE

Proprietary: NO

Ingredient: HAZ DECOMP PRODS: OR WHEN USED AS AN ENGINE FUEL.

Ingredient Sequence Number: 05

NIOSH (RTECS) Number: 999999ZZ

OSHA PEL: NOT APPLICABLE

ACGIH TLV: NOT APPLICABLE

Physical/Chemical Characteristics

Appearance And Odor: VAPOR AND LIQUID ARE COLORLESS. PRODUCT CONTAINS AN ODORANT (UNPLEASANT ODOR).

Boiling Point: -44F,-42C

Vapor Pressure (MM Hg/70 F): 205 PSIG

Vapor Density (Air=1): 1.52

Specific Gravity: 0.51 (H*2O=1)

Evaporation Rate And Ref: GAS AT NORM AMBIENT TEMPS

Solubility In Water: SLIGHTLY

Percent Volatiles By Volume: 100

Fire and Explosion Hazard Data

Flash Point: -156F,-104C

Flash Point Method: CC

Lower Explosive Limit: 2.15%

Upper Explosive Limit: 9.60%

Extinguishing Media: WATER SPRAY - CLASS A-B-C OR BC FIRE EXTINGUISHER.

Special Fire Fighting Proc: USE NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP (FP N). STOP FLOW OF GAS. USE WATER TO KEEP FIRE EXPOS CNTNRS COOL. USE WATER SPRAY TO DISPERSE UNIGNITED (SUPDAT)

Unusual Fire And Expl Hazrds: EMPTY CNTNRS RETAIN RESIDUE (LIQ &/OR VAP) & CAN BE DANGEROUS. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CNTNRS TO HEAT, (SUPDAT)

Reactivity Data

Stability: YES

Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.

Materials To Avoid: MIXING WITH OXYGEN OR AIR, EXCEPT AT BURNER.

Hazardous Decomp Products: UNDER FIRE CNDTNS:FUMES, SMOKE, CARBON MONOXIDE, ALDEHYDES & OTHER DECOMP PRODS IN CASE OF INCOMPLETE COMBUST (ING

5)

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NOT RELEVANT

Health Hazard Data

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: NO
 Route Of Entry - Ingestion: NO
 Health Haz Acute And Chronic: INHALATION: CONCENTRATIONS CAN LEAD TO MODERATE IRRITATION. CONTACT WITH LIQUID CAUSES BURNS SIMILAR TO FROSTBITE.
 Carcinogenicity - NTP: NO
 Carcinogenicity - IARC: NO
 Carcinogenicity - OSHA: NO
 Explanation Carcinogenicity: NOT RELEVANT
 Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.
 Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
 IMMEDIATELY FLUSH W/POTABLE WATER FOR A MINIMUM OF 15 MINUTES, SEEK ASSISTANCE FROM MD (FP N). SKIN: FLUSH W/COPIOUS AMOUNTS OF WATER. CALL MD (FP N). INHAL: REMOVE TO FRESH AIR. GUARD AGAINST SELF INJURY. APPLY ARTIFICIAL RESPIRATION IF BREATHING HAS STOPPED.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: KEEP PUBLIC AWAY. SHUT OFF SUPPLY OF GAS. ELIMINATE SOURCES OF IGNITION. VENTILATE THE AREA. DISPERSE WITH WATER SPRAY. CONTACT BETWEEN SKIN AND THESE GASES IN LIQUID FORM CAN CAUSE FREEZING OF TISSUE CAUSING INJURY SIMILAR TO THERMAL BURN.
 Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
 Waste Disposal Method: DISPOSAL MUST BE IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS (FP N). CONTROLLED BURNING. CONTACT SUPPLIER.
 Precautions-Handling/Storing: KEEP CONTAINERS AWAY FROM HEAT SOURCES AND STORE IN UPRIGHT POSITION. CONTAINERS SHOULD NOT BE DROPPED. KEEP CONTAINER VALVE CLOSED WHEN NOT IN USE.
 Other Precautions: INSTALL PROTECTIVE CAPS AND PLUG CONTAINER SERVICE VALVE WHEN NOT CONNECTED FOR USE.

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Control Measures

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Respiratory Protection: STAY OUT OF GAS OR VAPOR (BECAUSE OF FIRE HAZARD). USE NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).
 Ventilation: EXPLOSION-PROOF MOTORS AND KEEP SOURCES OF IGNITION AT SAFE DISTANCES.
 Protective Gloves: RESISTANT TO ACTIONS OF LP-GASES.
 Eye Protection: ANSI APPRVD CHEM WORKERS GOGGLES (FP N).
 Other Protective Equipment: ANSI APPROVED EYE WASH & DELUGE SHOWER (FP N).
 Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
 Suppl. Safety & Health Data: FIRE FIGHT PROC: GAS/VAP. IF IGNIT HAS OCCURRED & NO WATER AVAIL, TANK METAL MAY WEAKEN FROM OVERHEATING. EVACUATE AREA. IF GAS HAS NOT IGNITED, LP-GAS LIQ OR VAP MAY BE DISPERSED BY WATER SPRAY OR FLOODING. EXPLO HAZ: FLAME, SPKS OR OTHER SOURCES OF IGNIT; THEY MAY EXPLODE & CAUSE INJURY/DEATH. DO NOT ATTEMPT (ING 3)

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Transportation Data

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Disposal Data

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Label Data

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Label Required: YES
Technical Review Date: 29FEB96
Label Date: 17JAN96
Label Status: G
Common Name: LIQUEFIED PETROLEUM GAS OR PROPANE
Chronic Hazard: NO
Signal Word: DANGER!
Acute Health Hazard-Moderate: X
Contact Hazard-Severe: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
CONCENTRATIONS CAN LEAD TO SYMPTOMS RANGING FROM DIZZINESS TO ANESTHESIA
AND RESPIRATORY ARREST. EYES: MODERATE IRRITATION. CONTACT WITH LIQUID
CAUSES BURNS SIMILAR TO FROSTBITE. CHRONIC: NONE LISTED BY MANUFACTURER.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: H&H GAS CORP
Label P.O. Box: 208
Label City: HIGHTSTOWN
Label State: NJ
Label Zip Code: 08520
Label Country: US
Label Emergency Number: 609-448-3232

AMOCO OIL -- AMOCO REGULAR LEAD-FREE GASOLINE - GASOLINE,UNLEADED
 MATERIAL SAFETY DATA SHEET
 NSN: 9130012084172
 Manufacturer's CAGE: 15958
 Part No. Indicator: B
 Part Number/Trade Name: AMOCO REGULAR LEAD-FREE GASOLINE

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General Information

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Item Name: GASOLINE,UNLEADED
 Company's Name: AMOCO OIL COMPANY
 Company's Street: 200 EAST RANDOLPH DRIVE
 Company's City: CHICAGO
 Company's State: IL
 Company's Country: US
 Company's Zip Code: 60601
 Company's Emerg Ph #: 800-447-8735 (HEALTH)
 Company's Info Ph #: 312-856-3907
 Record No. For Safety Entry: 022
 Tot Safety Entries This Stk#: 064
 Status: FE
 Date MSDS Prepared: 24SEP93
 Safety Data Review Date: 20OCT94
 Supply Item Manager: KY
 MSDS Preparer's Name: DONALD M. BARKER, DIR
 Preparer's Company: PRODUCT STEWARDSHIP & TOXICOLOY
 Preparer's St Or P. O. Box: (MSDS#:02003992)
 MSDS Serial Number: BVHJH
 Specification Number: VV-G-1690
 Spec Type, Grade, Class: CIVGAS
 Hazard Characteristic Code: F2
 Unit Of Issue: DR
 Unit Of Issue Container Qty: 55 GALLONS
 Type Of Container: DRUM, 18 GAGE
 Net Unit Weight: 343.5 LBS

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Ingredients/Identity Information

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Proprietary: NO
 Ingredient: GASOLINE
 Ingredient Sequence Number: 01
 Percent: N/GIVEN
 NIOSH (RTECS) Number: LX3300000
 CAS Number: 8006-61-9
 OSHA PEL: 300 PPM
 ACGIH TLV: 300 PPM/500STEL;9394
 Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
 Ingredient: BENZENE (SARA III)
 Ingredient Sequence Number: 02
 Percent: 4
 NIOSH (RTECS) Number: CY1400000
 CAS Number: 71-43-2
 OSHA PEL: SEE 1910.1028
 ACGIH TLV: 10 PPM; A2; 9394

Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: ETHYL BENZENE (SARA III)
Ingredient Sequence Number: 03
Percent: 2
NIOSH (RTECS) Number: DA0700000
CAS Number: 100-41-4
OSHA PEL: 100 PPM
ACGIH TLV: 100 PPM/125STEL;9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: TOLUENE (SARA III)
Ingredient Sequence Number: 04
Percent: 22
NIOSH (RTECS) Number: XS5250000
CAS Number: 108-88-3
OSHA PEL: 200 PPM; Z-2
ACGIH TLV: S, 50 PPM; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: CYCLOHEXANE (SARA III)
Ingredient Sequence Number: 05
Percent: 5
NIOSH (RTECS) Number: GU6300000
CAS Number: 110-82-7
OSHA PEL: 300 PPM
ACGIH TLV: 300 PPM, 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: XYLENES (O-,M-,P- ISOMERS) (SARA III)
Ingredient Sequence Number: 06
Percent: 10
NIOSH (RTECS) Number: ZE2100000
CAS Number: 1330-20-7
OSHA PEL: 100 PPM
ACGIH TLV: 100 PPM/150STEL;9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: METHYL TERT-BUTYL ETHER (SARA III)
Ingredient Sequence Number: 07
Percent: 15
NIOSH (RTECS) Number: KN5250000
CAS Number: 1634-04-4
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: BUTANE
Ingredient Sequence Number: 08
Percent: N/GIVEN

NIOSH (RTECS) Number: EJ4200000
 CAS Number: 106-97-8
 OSHA PEL: 800 PPM
 ACGIH TLV: 800 PPM; 9394
 Other Recommended Limit: NONE RECOMMENDED

 Proprietary: NO
 Ingredient: N-HEPTANE
 Ingredient Sequence Number: 09
 Percent: N/GIVEN
 NIOSH (RTECS) Number: MI7700000
 CAS Number: 142-82-5
 OSHA PEL: 500 PPM
 ACGIH TLV: 400 PPM/500STEL;9394
 Other Recommended Limit: NONE RECOMMENDED

 Proprietary: NO
 Ingredient: HEXANE (N-HEXANE)
 Ingredient Sequence Number: 10
 Percent: N/GIVEN
 NIOSH (RTECS) Number: MN9275000
 CAS Number: 110-54-3
 OSHA PEL: 500 PPM
 ACGIH TLV: 50 PPM; 9394
 Other Recommended Limit: NONE RECOMMENDED

 Proprietary: NO
 Ingredient: PENTANE
 Ingredient Sequence Number: 11
 Percent: N/GIVEN
 NIOSH (RTECS) Number: RZ9450000
 CAS Number: 109-66-0
 OSHA PEL: 1000 PPM
 ACGIH TLV: 600 PPM/750STEL;9394
 Other Recommended Limit: NONE RECOMMENDED

 Proprietary: NO
 Ingredient: TRIMETHYL BENZENE (SARA III)
 Ingredient Sequence Number: 12
 Percent: N/GIVEN
 NIOSH (RTECS) Number: DC3220000
 CAS Number: 25551-13-7
 OSHA PEL: 25 PPM
 ACGIH TLV: 25 PPM; 9394
 Other Recommended Limit: NONE RECOMMENDED

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Physical/Chemical Characteristics

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Appearance And Odor: CLEAR, BRIGHT LIQUID, CHARACTERISTIC ODOR.
 Boiling Point: 80.0F,26.7C
 Vapor Pressure (MM Hg/70 F): 7-15LBS
 Vapor Density (Air=1): 3-4
 Specific Gravity: 0.75
 Solubility In Water: NEGLIGIBLE, <0.1%
 Autoignition Temperature: 495F

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Fire and Explosion Hazard Data

Flash Point: -45F,-43C
 Lower Explosive Limit: 1.3
 Upper Explosive Limit: 7.6
 Extinguishing Media: AGENTS APPROVED FOR CLASS B HAZARDS (E.G. DRY CHEMICAL, CARBON DIOXIDE, HALOGENATED AGENTS, FOAM, STEAM) OR WATER FOG.
 Special Fire Fighting Proc: NONE SPECIFIED BY MFG. HOWEVER WEAR SELF-CONTAINED BREATHING APPARATUS & PROTECTIVE EQPMT IF SITUATION WARRANTS.
 Unusual Fire And Expl Hazrds: EXTREMELY FLAMM VAP/AIR MIXTURES FORM. EXTINGUISHMENT OF FIRE BEFORE SURCE OF VAP IS SHUT OFF CAN CREATE AN EXPLOSIVE MIXTURE IN AIR.

Reactivity Data

Stability: YES
 Cond To Avoid (Stability): BURNING CAN BE STARTED EASILY. KEEP AWAY FROM IGNITION SOURCES (D.G. HEAT/SPARKS/OPEN FLAMES).
 Materials To Avoid: AVOID CHLORINE, FLUORINE AND OTHER STRONG OXIDIZERS.
 Hazardous Decomp Products: BURNING CAN PRODUCE CARBON MONOXIDE &/OR CARBON DIOXIDE AND OTHER HARMFUL PRODUCTS.
 Conditions To Avoid (Poly): NONE SPECIFIED BY MFG.

Health Hazard Data

LD50-LC50 Mixture: LD50 (ORAL, RATS) = 18.8ML/KG.
 Route Of Entry - Inhalation: YES
 Route Of Entry - Skin: YES
 Route Of Entry - Ingestion: NO
 Health Haz Acute And Chronic: EYE:HIGH CONCEN OF VAP/MIST MAY CAUSE DISCOMFORT. SKIN:PRLONG/REPEAT CONTACT CAN DEFAT & LEAD TO IRRIT &/OR DERM. INHAL:VAPOUR HARMFUL. HIGH VAP CONCEN CAN CAUSE HEADACHES, DIZZINESS, DROWSINESS, NAUSEA. INGEST:LOW VISCOSITY PRODUCT. HARMFUL/FATAL IF ASPIRATED INTO LUNGS CAUSING CHEM PNEUMONIA/FATAL.
 Carcinogenicity - NTP: YES
 Carcinogenicity - IARC: YES
 Carcinogenicity - OSHA: YES
 Explanation Carcinogenicity: CONTAINS BENZENE WHICH IS KNOWN TO CAUSE CANCER.
 Signs/Symptoms Of Overexp: MAY PRODUCE HEADACHES, DIZZ, NAU, DROWSINESS, IRRIT OF EYE/NOSE/THROAT/CNS DEPRESSION.
 Med Cond Aggravated By Exp: NONE SPECIFIED BY MFG.
 Emergency/First Aid Proc: EYE:FLUSH W/PLENTY OF WATER. GET MED ATTN IF IRRIT PERSISTS. SKIN:WASH W/SOAP & WATER. REMOVE CONTAMIN CLOTHING/SHOES. GET MED ATTN IF IRRIT DEVELOPS. INHAL:REMOVE TO UNCONTAMINATED AREA. GIVE ARTIFICIAL RESP IF NOT BREATHING. GET MED ATTN. INGEST:DO NOT INDUCE VOMIT. GET IMMED MED ATTN.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: REMOVE/SHUT OFF ALL IGN SOURCES.USE WATER SPRAY TO DISPERSE VAP.INCREASE VENTILATION IF POSSIBLE.CONTAIN ON ABSORBENT MATL(SAND/SAWDUST/DIRT/CLAY).KEEP OUT OF SEWERS & WATERWAYS.REPORT SPILLS TO APPROPRIATE AUTHORITIES.
 Neutralizing Agent: NONE SPECIFIED BY MFG.
 Waste Disposal Method: RESIDUES/SPILLED MATL ARE HAZ WASTE DUE TO

IGNITABILITY. DISPOSAL MUST BE IAW APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS. ENCLOSED-CONTROLLED INCINERATION IS RECOMMENDED UNLESS DIRECTED OTHERWISE BY APPLICABLE ORDINANCES.

Precautions-Handling/Storing: STORE IN FLAMM LIQ STORAGE AREA. KEEP CNTNR CLOSED. STORE AWAY FROM HEAT/ING SOURCES/OPEN FLAME IAW APPLICABLE FED/ STATE/LOC REGS.

Other Precautions: KEEP AWAY FROM IGNITION SOURCES. KEEP CONTAINER CLOSED. USE W/ADEQUATE VENTILATION. AVOID BREATHING VAPOR &/OR MIST. USE AS MOTOR FUEL ONLY. AVOID STRONG OXIDIZERS.

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Control Measures
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Respiratory Protection: IF VENTILATION IS INADEQUATE USE NIOSH/MSHA CERTIFIED RESP WHICH WILL PROTECT AGAINST ORGANIC VAP/MIST.

Ventilation: USE WITH ADEQUATE VENTILATION.

Protective Gloves: RECOMMENDED-PVC.

Eye Protection: RECOMMENDED-SAFETY GLASSES/GOGGLES.

Other Protective Equipment: WEAR PROTECTIVE CLOTHING IF PRLONGED/REPEATED CONTACT IS LIKELY.

Work Hygienic Practices: THOROUGHLY CLEAN/DRY CONTAMIN CLOTHING BEFORE REUSE. WASH HANDS AFTER HANDLING & BEFORE EAT/SMOKE/DRINK.

Suppl. Safety & Health Data: LONG-TERM INHAL STUDY OF WHOLE UNLEADED GASOLINE VAP EXPOSURE-RELATED KIDNEY DAMAGE/TUMORS WERE OBSERVED IN MALE

RATS & NOT SEEN IN FEMALES.CHRONIC EXPOSURE TO BENZENE CAUSES LEUKEMIA IN HUMAND & OTHER ADVERSE BLOOD EFFECTS (ANEMIA).

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Transportation Data
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Trans Data Review Date: 94293

DOT PSN Code: GTN

DOT Proper Shipping Name: GASOLINE

DOT Class: 3

DOT ID Number: UN1203

DOT Pack Group: II

DOT Label: FLAMMABLE LIQUID

IMO PSN Code: HRV

IMO Proper Shipping Name: GASOLINE

IMO Regulations Page Number: 3141

IMO UN Number: 1203

IMO UN Class: 3.1

IMO Subsidiary Risk Label: -

IATA PSN Code: MUC

IATA UN ID Number: 1203

IATA Proper Shipping Name: GASOLINE

IATA UN Class: 3

IATA Label: FLAMMABLE LIQUID

AFI PSN Code: MUC

AFI Prop. Shipping Name: GASOLINE

AFI Class: 3

AFI ID Number: UN1203

AFI Pack Group: II

AFI Basic Pac Ref: 7-7

Additional Trans Data: PER MSDS:DOT SHIPPING DESCRIPTION:GASOLINE, 3, UN1203, II.

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 20OCT94
Label Status: F
Common Name: AMOCO REGULAR LEAD-FREE GASOLINE
Signal Word: DANGER!
Acute Health Hazard-Moderate: X
Contact Hazard-Moderate: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
Special Hazard Precautions: EYE:HIGH CONCEN OF VAP/MIST MAY CAUSE DISCOMFORT. SKIN:PROLONG/REPEAT CONTACT CAN DEFAT & LEAD TO IRRIT &/OR DERM. INHAL:VAPOUR HARMFUL. HIGH VAP CONCEN CAN CAUSE HEADACHES, DIZZINESS, DROWSINESS, NAUSEA. INGEST:LOW VISCOSITY PRODUCT. HARMFUL/FATAL IF ASPIRATED INTO LUNGS CAUSING CHEM PNEUMONIA/FATAL. 1ST AID:EYE:FLUSH W/ PLENTY OF WATER.IRRIT PERSISTS GET MED ATTN.SKIN:WASH W/SOAP & WATER.REMOVE CONTAMIN CLOTH/SHOES.IRRIT DEVELOPS GET MED ATTN.INHAL:REMOVE TO UNCONTAMIN AREA.GIVE ARTIFICIAL RESP IF NOT BREATHING.GET MED ATTN.INGEST:DO NOT INDUCE VOMIT.GET IMMED MED ATTN.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: AMOCO OIL COMPANY
Label Street: 200 EAST RANDOLPH DRIVE
Label City: CHICAGO
Label State: IL
Label Zip Code: 60601
Label Country: US
Label Emergency Number: 800-447-8735 (HEALTH)

AIR BP BP OIL LTD -- JET A-1 - TURBINE FUEL, AVIATION
 MATERIAL SAFETY DATA SHEET
 NSN: 9130010315816
 Manufacturer's CAGE: 0NDT1
 Part No. Indicator: A
 Part Number/Trade Name: JET A-1

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 General Information
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Item Name: TURBINE FUEL, AVIATION
 Company's Name: AIR BP, BP OIL LTD
 Company's Street: CLEVELAND HOPKINS INTL AIRPORT
 Company's City: CLEVELAND
 Company's State: OH
 Company's Country: US
 Company's Zip Code: 44135
 Company's Emerg Ph #: 216-267-3550
 Company's Info Ph #: 216-267-3550
 Distributor/Vendor # 1: BP OIL INTERNATIONAL LTD
 Distributor/Vendor # 1 Cage: 7X331
 Record No. For Safety Entry: 006
 Tot Safety Entries This Stk#: 041
 Status: SE
 Date MSDS Prepared: 16AUG90
 Safety Data Review Date: 22JAN93
 Supply Item Manager: KY
 MSDS Serial Number: BPVGD
 Specification Number: MIL-T-83133
 Spec Type, Grade, Class: CLASS JP-8
 Hazard Characteristic Code: F4
 Unit Of Issue: GL
 Unit Of Issue Container Qty: BULK
 Type Of Container: BULK
 Net Unit Weight: BULK

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 Ingredients/Identity Information
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Proprietary: NO
 Ingredient: KEROSENE, MAY CONTAIN SMALL AMOUNTS OF PROPRIETARY PERFORMANCE
 ADDITIVES.
 Ingredient Sequence Number: 01
 Percent: UNKNOWN
 NIOSH (RTECS) Number: OA5500000
 CAS Number: 8008-20-6
 OSHA PEL: 100 PPM
 ACGIH TLV: 100 PPM 9091
 Other Recommended Limit: NONE RECOMMENDED

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 Physical/Chemical Characteristics
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Appearance And Odor: PALE YELLOW LIQUID.
 Boiling Point: 156 TO 258C
 Specific Gravity: 0.804
 Decomposition Temperature: UNKNOWN
 Viscosity: 3.5 CST
 Corrosion Rate (IPY): UNKNOWN

Fire and Explosion Hazard Data

Flash Point: 111F,44C

Extinguishing Media: EXTINGUISH USING DRY POWDER, FOAM, WATER FOG, OR (FOR SMALL FIRES) CARBON DIOXIDE OF BCF.

Special Fire Fighting Proc: FIRES IN CONFINED SPACES SHOULD BE DEALT WITH BY TRAINED PERSONNEL WEARING BREATHING APPARATUS. FOR MAJOR FIRES CALL THE FIRE SERVICE.

Unusual Fire And Expl Hazrds: INCOMPLETE COMBUSTION WILL GENERATE SMOKE & HAZARDOUS GASES, INCLUDING CARBON MONOXIDE. SPRAY APPLICATIONS INCREASES THE FIRE, & POSSIBLY EXPLOSION, HAZARD.

Reactivity Data

Stability: YES

Cond To Avoid (Stability): STABLE AT AMBIENT TEMPERATURES.

Materials To Avoid: AVOID CONTACT WITH STRONG OXIDIZING AGENTS.

Hazardous Decomp Products: THERMAL DECOMPOSITION CAN PRODUCE A VARIETY OF COMPOUNDS, THE PRECISE NATURE OF WHICH WILL DEPEND ON THE DEC. CONDITIONS

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NOT APPLICABLE

Health Hazard Data

LD50-LC50 Mixture: LD50 (ORAL RAT) IS UNKNOWN

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: YES

Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: PROLONGED OR REPEATED SKIN EXPOSURE MAY LEAD TO DERMATITIS. INGESTION OF LARGE AMOUNTS MAY CAUSE GASTRO-INTESTINAL EFFECTS. THIS MATERIAL WILL INJURE THE LUNGS IF ASPIRATION OCCURS. MAY CAUSE IRRITATION TO THE EYES, NOSE & THROAT DUE TO EXPOSURE TO VAPOUR, MIST OR FUMES GENERATED DURING NORMAL USE.

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: THIS COMPOUND CONTAINS NO INGREDIENTS AT CONCENTRATIONS OF 0.1% OR GREATER THAT ARE CARCINOGENS OR SUSPECT CARCINOGENS.

Signs/Symptoms Of Overexp: TRANSIENT STINGING OR REDNESS IF ACCIDENTAL EYE CONTACT OCCURS. INGESTION OF LARGE AMOUNTS MAY CAUSE DISCOMFORT, VOMITING AND DIARRHEA.

Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.

Emergency/First Aid Proc: SKIN-WASH THOROUGHLY WITH SOAP/WATER AFTER CONTACT. EYES-WASH EYES THOROUGHLY WITH COPIOUS QUANTITIES OF WATER, ENSURING EYELIDS ARE OPEN. INGESTION-IF CONTAMINATION OFB THE MOUTH OCCURS, WASH IT OUT THOROUGHLY WITH WATER. OBTAIN MEDICAL ADVICE IF LARGE QUANTITIES ARE SWALLOWED-DO NOT INDUCE VOMITING. INHALATION-IF INHALATION CAUSES IRRITATION, REMOVE TO FRESH AIR. OBTAIN MEDICAL HELP IN ALL CASES

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: RECOVER ALL SPILLAGE USING ABSORBANTS OR

OTHER APPROPRIATE COLLECTION TECHNIQUES. DO NOT WASH INTO DRAINAGE SYSTEM. ISOLATE SPILLAGE FROM ALL IGNITION SOURCES. IN EVENT OF LARGE SPILL INFORM THE LOCAL AUTHORITY.

Neutralizing Agent: NOT APPLICABLE

Waste Disposal Method: DISPOSE OF BY INCINERATION OR OTHER SUITABLE MEANS UNDER CONDITIONS APPROVED BY THE LOCAL AUTHORITY. DISPOSAL OF LARGE QUANTITIES SHOULD BE AFFECTED BY SPECIALIST PERSONNEL.

Precautions-Handling/Storing: STORE AT AMBIENT TEMPERATURES AWAY FROM IGNITION SOURCES. ENSURE EQUIPMENT IS ELECTRICALLY BONDED & EARTHED TO PREVENT STATIC ACCUMULATION.

Other Precautions: CLEAN UP SPILLED MATERIAL IMMEDIATELY. DO NOT ENTER STORAGE TANKS BREATHING APPARATUS UNLESS THE TANKS HAS BEEN WELL VENTILATED

& THE TANK ATMOSPHERE HAS BEEN SHOWN TO CONTAIN HYDROCARBON VAPORS LEVELS

OF LESS THAN 1% OF THE LOW FLAME LIMIT

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Control Measures
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Respiratory Protection: WEAR A NIOSH/MSHA APPROVED CHEMICAL CARTRIDGE RESPIRATOR WITH FULL FACEPIECE AND ORGANIC VAPOR CARTRIDGES IN COMBINATION

WITH A HIGH-EFFICIENCY PARTICULATE FILTER.

Ventilation: LOCAL AND MECHANICAL(GENERAL) EXHAUST TO PROVIDE ADEQUATE VENTILATION.

Protective Gloves: IMPERVIOUS GLOVES HSOULD BE WORN

Eye Protection: WEAR FACE VISOR OR GOGGLES

Other Protective Equipment: PROTECTIVE CLOTHING SHOULD BE REGULARLY INSPECTED AND MAINTAINED; OVERALLS SHOULD BE DRY-CLEANED & LAUNDERED.

Work Hygienic Practices: WASH THOROUGHLY AFTER USE AND ALWAYS WASH HANDS BEFORE EATING, DRINKING OR USING THE TOILET.

Suppl. Safety & Health Data: AVOID INHALATION OF MISTS, FUMES OR VAPORS GENERATED DURING USE. AVOID EYE CONTACT. AVOID CONTACT WITH SKIN & OBSERVE GOOD PERSONNEL HYGIENE. ENSURE GOOD VENTILATION. USE SINGLE-USE DISPOSABLE CLOTHS & DISCARD WHEN SOILED.**UNLIKELY TO HARM AQUATIC ORGANISMS. SPILLED MATERIAL MAY MAKE SURFACE SLIPPERY.

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Transportation Data
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Trans Data Review Date: 93022

DOT PSN Code: GOA

DOT Proper Shipping Name: FUEL, AVIATION, TURBINE ENGINE

DOT Class: 3

DOT ID Number: UN1863

DOT Pack Group: III

DOT Label: FLAMMABLE LIQUID

IMO PSN Code: HNZ

IMO Proper Shipping Name: FUEL OIL NO. 1

IMO Regulations Page Number: SEE 3375

IMO UN Number: 1223

IMO UN Class: 3.3

IMO Subsidiary Risk Label: -

IATA PSN Code: ZZZ

IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION

AFI PSN Code: MMF

AFI Prop. Shipping Name: FUEL, AVIATION, TURBINE ENGINE

AFI Class: 3
AFI ID Number: UN1863
AFI Pack Group: III
AFI Basic Pac Ref: 7-7
MMAC Code: NR
N.O.S. Shipping Name: FUEL, AVIATION, TURBINE ENGINE, FLAMMABLE.

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Disposal Data
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Label Data
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Label Required: YES
Technical Review Date: 22JAN93
MFR Label Number: UNKNOWN
Label Status: F
Common Name: JET A-1
Signal Word: WARNING!
Acute Health Hazard-Moderate: X
Contact Hazard-Slight: X
Fire Hazard-Moderate: X
Reactivity Hazard-None: X
Special Hazard Precautions: STORE AT AMBIENT TEMPERATURES AWAY FROM
IGNITION SOURCES. ENSURE EQUIPMENT IS ELECTRICALLY BONDED & EARTHED TO
PREVENT STATIC ACCUMULATION. INCOMPLETE COMBUSTION WILL GENERATE SMOKE
&
HAZARDOUS GASES, INCLUDING CARBON MONOXIDE. SPRAY APPLICATIONS INCREASES
THE FIRE, & POSSIBLY EXPLOSION, HAZARD. IN CASE OF SPILL: RECOVER ALL
SPILLAGE USING ABSORBANTS OR OTHER APPROPRIATE COLLECTION TECHNIQUES. DO
NOT
WASH INTO DRAINAGE SYSTEM. ISOLATE SPILLAGE FROM ALL IGNITION SOURCES. IN
EVENT OF LARGE SPILL INFORM THE LOCAL AUTHORITY.
Protect Eye: Y
Protect Skin: Y
Label Name: AIR BP, BP OIL LTD
Label Street: CLEVELAND HOPKINS INTL AIRPORT
Label City: CLEVELAND
Label State: OH
Label Zip Code: 44135
Label Country: US
Label Emergency Number: 216-267-3550

AMOCO OIL -- JET FUEL JP-4 - TURBINE FUEL, AVIATION
 MATERIAL SAFETY DATA SHEET
 NSN: 9130002568613
 Manufacturer's CAGE: 15958
 Part No. Indicator: B
 Part Number/Trade Name: JET FUEL JP-4

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General Information

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Item Name: TURBINE FUEL, AVIATION
 Company's Name: AMOCO OIL CO
 Company's Street: 200 E RANDOLPH DR MC 1408
 Company's City: CHICAGO
 Company's State: IL
 Company's Country: US
 Company's Zip Code: 60601-6401
 Company's Emerg Ph #: 800-447-8735 (HEALTH)
 Company's Info Ph #: 312-856-3907
 Record No. For Safety Entry: 022
 Tot Safety Entries This Stk#: 063
 Status: FE
 Date MSDS Prepared: 24SEP93
 Safety Data Review Date: 29SEP94
 Supply Item Manager: CX
 MSDS Preparer's Name: G. I. BRESNICK
 MSDS Serial Number: BNBZX
 Specification Number: MIL-T-5624
 Spec Type, Grade, Class: GRADE JP-4
 Hazard Characteristic Code: F2
 Unit Of Issue: GL
 Unit Of Issue Container Qty: BULK
 Type Of Container: NOT KNOWN
 Net Unit Weight: NOT KNOWN

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Ingredients/Identity Information

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Proprietary: NO
 Ingredient: JET FUEL JP-4 (A WIDE BOILING ALIPHATIC AND AROMATIC
 DISTILLATE) SEE THE FOLLOWING IDENTIFIABLE COMPONENTS.
 Ingredient Sequence Number: 01
 Percent: 100
 NIOSH (RTECS) Number: NY9340000
 OSHA PEL: NOT ESTABLISHED
 ACGIH TLV: NOT ESTABLISHED
 Other Recommended Limit: USAF 8HR TWA 200 PPM

Proprietary: NO
 Ingredient: TOLUENE (SARA III)
 Ingredient Sequence Number: 02
 Percent: 22 %
 NIOSH (RTECS) Number: XS5250000
 CAS Number: 108-88-3
 OSHA PEL: 200 PPM/150 STEL
 ACGIH TLV: 50 PPM; 9293
 Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: XYLENES (O-,M-,P- ISOMERS) (SARA III)
Ingredient Sequence Number: 03
Percent: 10 %
NIOSH (RTECS) Number: ZE2100000
CAS Number: 1330-20-7
OSHA PEL: 100 PPM/150 STEL
ACGIH TLV: 100 PPM/150STEL;9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: ETHYL BENZENE (SARA III)
Ingredient Sequence Number: 04
Percent: 2 %
NIOSH (RTECS) Number: DA0700000
CAS Number: 100-41-4
OSHA PEL: 100 PPM/125 STEL
ACGIH TLV: 100 PPM/125STEL 9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: BENZENE (SARA III)
Ingredient Sequence Number: 05
Percent: 4 %
NIOSH (RTECS) Number: CY1400000
CAS Number: 71-43-2
OSHA PEL: 1PPM/5STEL;1910.1028
ACGIH TLV: 10 PPM; A2; 9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: CYCLOHEXANE (SARA III)
Ingredient Sequence Number: 06
Percent: 5 %
NIOSH (RTECS) Number: GU6300000
CAS Number: 110-82-7
OSHA PEL: 300 PPM
ACGIH TLV: 300 PPM, 9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: METHYL TERT-BUTYL ETHER (SARA III)
Ingredient Sequence Number: 07
Percent: 7 %
NIOSH (RTECS) Number: KN5250000
CAS Number: 1634-04-4
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE SPECIFIED

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Physical/Chemical Characteristics

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Appearance And Odor: COLORLESS LIQUID, FUEL OIL ODOR
Boiling Point: 250-549F
Melting Point: NOT GIVEN
Vapor Pressure (MM Hg/70 F): 2-3 PSI

Vapor Density (Air=1): NOT GIVEN
Specific Gravity: 0.75 -0.8
Decomposition Temperature: UNKNOWN
Evaporation Rate And Ref: NOT GIVEN
Solubility In Water: NEGLIGIBLE
Corrosion Rate (IPY): UNKNOWN
Autoignition Temperature: 468F

Fire and Explosion Hazard Data

Flash Point: -10F,-23C
Flash Point Method: CC
Lower Explosive Limit: 1.3 %
Upper Explosive Limit: 8 %
Extinguishing Media: AGENTS APPROVED FOR CLASS B HAZARDS (DRY CHEMICAL, CARBON DIOXIDE, HALOGENATED AGENTS, FOAM, STEAM) AND WATER FOG.
Special Fire Fighting Proc: FIRE FIGHTERS SHOULD USE NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT WHEN FIGHTING CHEMICAL FIRE. USE WATER SPRAY TO COOL NEARBY CONTAINERS EXPOSED TO FIRE.
Unusual Fire And Expl Hazrds: DO NOT USE DIRECT STREAM OF WATER ON FIRE. TOXIC GASES ARE RELEASED DURING COMBUSTION. VAPOR MAY EXPLODE IF IGNITED IN ENCLOSED AREA.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): HEAT, OPEN FLAME, SPARKS
Materials To Avoid: STRONG OXIDIZING AGENTS
Hazardous Decomp Products: CARBON MONOXIDE, CARBON DIOXIDE, UNIDENTIFIED ORGANIC COMPOUNDS.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NONE. WILL NOT OCCUR.

Health Hazard Data

LD50-LC50 Mixture: NOT GIVEN FOR PRODUCT AS A WHOLE
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: MAY BE MILDLY IRRITATING TO THE EYES. PROLONGED OR REPEATED CONTACT MAY CAUSE DERMATITIS. VAPORS MAY IRRITATE THE NOSE, THROAT AND UPPER RESPIRATORY TRACT AND CAUSE CENTRAL NERVOUS SYSTEM DEPRESSION. ASPIRATION HAZARD.
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: YES
Explanation Carcinogenicity: CONTAINS Benzene [71-43-2] WHICH IS LISTED BY NTP AND IARC AND REGULATED BY OSHA AS A CARCINOGEN.
Signs/Symptoms Of Overexp: EYE IRRITATION, SKIN IRRITATION, DERMATITIS, UPPER RESPIRATORY TRACT IRRITATION, NAUSEA, VOMITING, DIARRHEA, HEADACHES, DIZZINESS, DROWSINESS.
Med Cond Aggravated By Exp: PRE-EXISTING SKIN AND/OR RESPIRATORY DISORDERS MAY BE AGGRAVATED BY EXPOSURE TO THIS PRODUCT.
Emergency/First Aid Proc: EYES: FLUSH WITH WATER FOR 15 MINUTES WHILE

HOLDING EYELIDS OPEN. GET MEDICAL ATTENTION. SKIN: REMOVE CONTAMINATED CLOTHING. WASH WITH SOAP AND WATER. IF IRRITATION PERSISTS, GET MEDICAL ATTENTION. INHALATION: REMOVE TO FRESH AIR. RESTORE BREATHING. GET MEDICAL ATTENTION. INGESTION: DO NOT INDUCE VOMITING. GET MEDICAL ATTENTION.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: ELIMINATE SOURCES OF IGNITION. EVACUATE AREA. WEAR PROPER PERSONAL PROTECTIVE EQUIPMENT. CONTAIN SPILL. STOP LEAK IF CAN DO SO WITHOUT RISK. ABSORB LIQUID WITH SUITABLE ABSORBENT MATERIAL. COLLECT FOR DISPOSAL.

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Method: PREVENT WASTE FROM CONTAMINATING SURROUNDING ENVIRONMENT. DISCARD ANY PRODUCT, RESIDUE, DISPOSAL CONTAINER OR LINER IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS.

Precautions-Handling/Storing: STORE IN A FLAMMABLE LIQUIDS AREA. STORE AWAY FROM HEAT, IGNITION SOURCES AND OPEN FLAMES IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE AND LOCAL RULES

Other Precautions: AVOID SKIN CONTACT. LAUNDRER CONTAMINATED CLOTHING BEFORE REUSE.

Control Measures

Respiratory Protection: AVOID BREATHING VAPOR AND/OR MIST. USE WITH ADEQUATE VENTILATION. IF VENTILATION IS INADEQUATE, USE NIOSH/MSHA CERTIFIED RESPIRATOR WHICH WILL PROTECT AGAINST ORGANIC VAPOR/MIST.

Ventilation: LOCAL EXHAUST AND MECHANICAL (GENERAL) VENTILATION TO MAINTAIN EXPOSURE LEVELS.

Protective Gloves: IMPERVIOUS

Eye Protection: SAFETY GLASSES OR GOGGLES

Other Protective Equipment: PROTECTIVE CLOTHING AS REQUIRED TO AVOID SKIN CONTACT. AN EMERGENCY EYE WASH STATION AND SHOWER SHOULD BE AVAILABLE.

Work Hygienic Practices: WASH WITH SOAP AND WATER AFTER HANDLING PRODUCT AND BEFORE EATING DRINKING OR SMOKING.

Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

Transportation Data

Trans Data Review Date: 93222

DOT PSN Code: GNZ

DOT Proper Shipping Name: FUEL, AVIATION, TURBINE ENGINE

DOT Class: 3

DOT ID Number: UN1863

DOT Pack Group: II

DOT Label: FLAMMABLE LIQUID

IMO PSN Code: HNV

IMO Proper Shipping Name: FUEL, AVIATION, TURBINE ENGINE

IMO Regulations Page Number: 3271

IMO UN Number: 1863

IMO UN Class: 3.2

IMO Subsidiary Risk Label: -

IATA PSN Code: MMA

IATA UN ID Number: 1863

IATA Proper Shipping Name: FUEL, AVIATION, TURBINE ENGINE

IATA UN Class: 3

IATA Label: FLAMMABLE LIQUID

AFI PSN Code: MMA
AFI Prop. Shipping Name: FUEL, AVIATION, TURBINE ENGINE
AFI Class: 3
AFI ID Number: UN1863
AFI Pack Group: II
AFI Basic Pac Ref: 7-7

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Disposal Data

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Label Data

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Label Required: YES
Technical Review Date: 06JUL92
MFR Label Number: UNKNOWN
Label Status: F
Common Name: TURBINE FUEL, AVIATION JP-4
Chronic Hazard: YES
Signal Word: DANGER!
Acute Health Hazard-Moderate: X
Contact Hazard-Slight: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
Special Hazard Precautions: EYE/SKIN/RESPIRATORY TRACT:IRRITATION. MOST HAZARDOUS IS EXPOSURE TO AIRBORNE MIST OR OTHER ASPIRATION INTO THE LUNGS. ONCE INTO THE LUNGS, THIS MATERIAL IS VERY DIFFICULT TO REMOVE AND CAN CAUSE DEATH. PROLONGED AND REPEATED EXPOSURES CAN CAUSE DAMAGES TO THE LIVER, KIDNEYS AND CENTRAL NERVOUS SYSTEM. THIS MATERIAL CONTAINS BENZENE, A KNOWN CARCINOGEN. STORE IN A COOL, DRY, WELL VENTILATED AREA AWAY FROM SOURCES OF IGNITION OR OXIDIZERS. KEEP CONTAINER CLOSED WHEN NOT IN USE. PROTECT FROM DAMAGE. FIRST AID: AVOID VOMITING. EYES/SKIN:REMOVE CONTAMINATED CLOTHING & FLUSH WITH WATER FOR 15 MINUTES. GET MEDICAL ATTENTION.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: AMOCO OIL CO
Label Street: 200 E RANDOLPH DR MC 1408
Label City: CHICAGO
Label State: IL
Label Zip Code: 60601-6401
Label Country: US
Label Emergency Number: 800-447-8735/800-424-9300 CHEMTREC

AMOCO OIL -- LS NO. 2 DIESEL FUEL - DIESEL FUEL
 MATERIAL SAFETY DATA SHEET
 NSN: 9140002865294
 Manufacturer's CAGE: 15958
 Part No. Indicator: A
 Part Number/Trade Name: LS NO. 2 DIESEL FUEL

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 General Information
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Item Name: DIESEL FUEL
 Company's Name: AMOCO OIL COMPANY
 Company's Street: 200 EAST RANDOLPH DRIVE
 Company's City: CHICAGO
 Company's State: IL
 Company's Country: US
 Company's Zip Code: 60601
 Company's Emerg Ph #: 800-447-8735/800-424-9300
 Company's Info Ph #: 312-856-3907
 Distributor/Vendor # 1: AMOCO INTERNATIONAL OILCO
 Distributor/Vendor # 1 Cage: 6G027
 Distributor/Vendor # 2: SPENCER OIL CORP (810-775-5022)
 Distributor/Vendor # 2 Cage: 5W753
 Record No. For Safety Entry: 039
 Tot Safety Entries This Stk#: 112
 Status: SE
 Date MSDS Prepared: 24SEP93
 Safety Data Review Date: 07SEP94
 Supply Item Manager: KY
 MSDS Preparer's Name: DONALD M. BARKER,DIR
 Preparer's Company: PRODUCT STWEARDSHIP & TOXICOLOGY, AMOCO
 MSDS Serial Number: BJPSG
 Specification Number: VV-F-800
 Spec Type, Grade, Class: DF-2
 Hazard Characteristic Code: F4
 Unit Of Issue: GL
 Unit Of Issue Container Qty: BULK
 Type Of Container: BULK
 Net Unit Weight: BULK

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 Ingredients/Identity Information
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Proprietary: NO
 Ingredient: PETROLEUM DISTILLATE, NO. 2 FUEL OIL
 Ingredient Sequence Number: 01
 Percent: N/GIVEN
 NIOSH (RTECS) Number: LS8930000
 CAS Number: 68476-30-2
 OSHA PEL: NOT ESTABLISHED
 ACGIH TLV: NOT ESTABLISHED
 Other Recommended Limit: NONE RECOMMENDED

 Proprietary: NO
 Ingredient: NAPHTHALENE (SARA III)
 Ingredient Sequence Number: 02
 Percent: 1
 NIOSH (RTECS) Number: QJ0525000

CAS Number: 91-20-3
 OSHA PEL: 10 PPM
 ACGIH TLV: 10 PPM/15 STEL; 9394
 Other Recommended Limit: NONE RECOMMENDED

 Proprietary: NO
 Ingredient: XYLENES (O-,M-,P- ISOMERS) (SARA III)
 Ingredient Sequence Number: 03
 Percent: 1
 NIOSH (RTECS) Number: ZE2100000
 CAS Number: 1330-20-7
 OSHA PEL: 100 PPM
 ACGIH TLV: 100 PPM/150STEL;9394
 Other Recommended Limit: NONE RECOMMENDED

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Physical/Chemical Characteristics

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Appearance And Odor: CLEAR, WATER SHITE TO BLUE-GREEN LIQUID.
 Boiling Point: 340F,171C
 Specific Gravity: 0.85-0.88
 Solubility In Water: NEGLIGIBLE (<0.1%)
 Viscosity: >1.8 CST

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Fire and Explosion Hazard Data

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Flash Point: 120F,49C
 Flash Point Method: TCC
 Lower Explosive Limit: 0.6
 Upper Explosive Limit: 7.5
 Extinguishing Media: AGENTS APPROVED FOR CLASS B HAZ (E.G. DRY CHEMICAL,
 CARBON DIOXIDE, HALOGENATED AGENTS, FOAM, STEAM) OR WATER FOG.
 Special Fire Fighting Proc: NONE SPECIFIED BY MFG; HOWEVER WEAR
 APPROPRIATE PROTECTIVE EQUIPMENT.
 Unusual Fire And Expl Hazrds: COMBUSTIBLE LIQUID.

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Reactivity Data

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Stability: YES
 Cond To Avoid (Stability): KEEP AWAY FROM IGNITIN SOURCES (E.G. HEAT AND
 OPEN FLAMES).
 Materials To Avoid: AVOID CHLORINE, FLUORINE, AND OTHER STRONG OXIDIZERS.
 Hazardous Decomp Products: INCOMPLETE BURNING CAN PRODUCE CARBON MONOXIDE
 &/OR CARBON DIOXIDE AND OTHER HARMFUL PRODUCTS.
 Conditions To Avoid (Poly): NONE SPEICIFED BY MFG.

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Health Hazard Data

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LD50-LC50 Mixture: LD50,ORAL FOR SIMILAR PRODUCT >5G/KG.
 Route Of Entry - Inhalation: YES
 Route Of Entry - Skin: YES
 Route Of Entry - Ingestion: NO
 Health Haz Acute And Chronic: NO SIGNIFICANT EYE HEALTH HAZ IDENTIFIED.
 CAN CAUSE SKIN IRRIT ON PROLONG/REPEAT CONTACT. NO SIGNIFICANT INHAL HEALTH
 HAZ IDENTIFIED FOR THE LIQUID FUEL.LOW VISCOSITY PRODUCT. HARMFUL OR FATAL
 IF SWALLOWED & THEN ASPIRATED INTO LUNGS CAUSING CHEM PNEUMONIA & DEATH.
 KIDNEY DAMAGE IN MALE RATS W/MATLS OF THIS TYPE.

Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: PER MSDS NO INGRED PRESENT @ LEVELS FOR
CARCINO.NIOSH RECOMMENDS WHOLE DIESEL EXHAUST REGARDED AS POTENTIAL
OCCUP
CARCIN

Signs/Symptoms Of Overexp: INHAL OF VAPORS FROM HEATED MATL IN CONFINED
AREA CAUSES DIZZINESS, HEADACHE, NAUSEA, POSSIBLE IRRIT OF EYE/NOSE/THROAT.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MFG.

Emergency/First Aid Proc: EYE:FLUSH W/PLENTY OF WATER. SKIN:WASH W/ SOAP &
WATER. REMOVE CONTAMIN CLOTHING/SHOE. INHAL:IF ADVERSE EFFECTS OCCUR
REMOVE
TO UNCONTAMINATED AREA. INGEST:DO NOT INDUCE VOMIT. GET IMMED MED ATTN.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: REMOVE OR SHUT OFF ALL SOURCES OF IGNITION.
PREVENT SPREADING BY DIKING, DITCHING, OR ABSORBING ON INERT MATERIALS. IF
SPILLED INTO WATERS FO USA IT MAY BE REPORTABLE UNDER 33 CFR PART 153 IF IT
PRODUCES A SHEEN.

Neutralizing Agent: NONE SPECIFIED BY MFG.

Waste Disposal Method: DISPOSAL MUST BE IN ACCORDANCE W/APPLICABLE LOCAL,
STATE AND FEDERAL REGULATIONS. ENCLOSED-CONTROLLED INCINERATIN IS
RECOMMENDED UNLESS DIRECTED OTHERWISE BY APPLICABLE ORDINANCES.
PRODUCT

EXEMPT FROM CERCLA REPORTING REQMTS UNDER 40CFRPART302.4.

Precautions-Handling/Storing: STORE IN COMBUSTILBLE LIQUIDS STORAGE AREA.
STORE AWAY FROM HEAT, IGNITIN SOURCES, AND OPEN FLAME IN ACCORDANCE W/
APPLICABLE FED/STATE/LOC REGS.

Other Precautions: THE CONTAINER FOR THIS PRODUCT CAN PRESENT EXPLOSION OR
FIRE HAZARDS, EVEN WHEN EMPTIED. TO AVOID RISK OF INJURY, DO NOT CUT,
PUNCTURE OR WELD ON OR NEAR THIS CONTIANER.

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Control Measures

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Respiratory Protection: NONE SPECIFIED BY MFG. HOWEVER, USE WITH ADEQUATE
VENTILATION. IF AIR CONTAMINANTS LEVEL ABOVE ESTABLISHED EXPOUSRE LIMITS
USE APPROPRIATE NIOSH APPROVED RESP.

Ventilation: USE WITH ADEQUATE VENTILATION.

Protective Gloves: WEAR PROTECTIVE GLOVES.

Eye Protection: NONE REQUIRED;HOWEVER USE EYE PROTECTION

Other Protective Equipment: WEAR PROTECTIVE CLOTHING IF PROLONG/REPEAT
CONTACT. EYE PROTECTION IS GOOD INDUSTRIAL PRACTICE.

Work Hygienic Practices: WASH HANDS AFTER HANDLING.PRACTICE GOOD PERSONAL
HYGENIC PRACTICES.THOROUGHLY CLEAN & DRY CONTAMIN CLOTHING BEFORE REUSE

Suppl. Safety & Health Data: BOILING PT RANGE:340F-675F APPROX. FROM
SKIN-PAINTING STUDIES OF PETRO DISTILLATES OF SIMILAR COMPOSITION &
DISTILLATE RANGE HAS BEEN SHOWN THESE MATLS OFTEN POSSES WEAK
CARCINOGENIC

ACTIVITY IN LAB ANIMALS.MFG HAVE CHOSEN TO BE CAUTIOUS IN LIGHT OF FINDINGS
W/OTHER DISTILLATED STREAMS.

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Transportation Data

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Trans Data Review Date: 94250

DOT PSN Code: EXF
 DOT Symbol: D
 DOT Proper Shipping Name: DIESEL FUEL
 DOT Class: 3
 DOT ID Number: NA1993
 DOT Pack Group: III
 DOT Label: NONE
 IMO PSN Code: HIA
 IMO Proper Shipping Name: FLAMMABLE LIQUID, N.O.S. o
 IMO Regulations Page Number: 3345
 IMO UN Number: 1993
 IMO UN Class: 3.3
 IMO Subsidiary Risk Label: -
 IATA PSN Code: MCA
 IATA UN ID Number: 1993
 IATA Proper Shipping Name: FLAMMABLE LIQUID, N.O.S. *
 IATA UN Class: 3
 IATA Label: FLAMMABLE LIQUID
 AFI PSN Code: JEV
 AFI Symbols: D
 AFI Prop. Shipping Name: DIESEL FUEL
 AFI Class: 3
 AFI ID Number: UN1202
 AFI Pack Group: III
 AFI Basic Pac Ref: 7-7
 N.O.S. Shipping Name: FUEL OIL, NO.2
 Additional Trans Data: PER MSDS:DOT SHIPPING DESCRIPTION DIESEL FUEL
 COMBUSTIBLE LIQUID NA1993, III. IMO & IATA DO NOT HAVE CODES FOR THIS
 THEREFORE USED FLAMM LIQ NOS, III.

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Disposal Data

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Label Data

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Label Required: YES
 Technical Review Date: 07SEP94
 Label Status: F
 Common Name: LS NO. 2 DIESEL FUEL
 Chronic Hazard: NO
 Signal Word: WARNING!
 Acute Health Hazard-Moderate: X
 Contact Hazard-Moderate: X
 Fire Hazard-Moderate: X
 Reactivity Hazard-None: X
 Special Hazard Precautions: WARANING! COMBUSTIBLE. NO SIGNIFICANT EYE
 HEALTH HAZ IDENTIFIED. CAN CAUSE SKIN IRRIT ON PROLONG/REPEAT CONTACT. NO
 SIGNIFICANT INHAL HEALTH HAZ IDENTIFIED FOR THE LIQUID FUEL. LOW VISCOSITY
 PRODUCT. HARMFUL OR FATAL IF SWALLOWED & THEN ASPIRATED INTO LUNGS
 CAUSING
 FLUSH W/PLENTY OF WATER. SKIN:WASH W/SOAP & WATER. REMOVE CONTAMIN
 CLOTHING/SHOE. INHAL:IF ADVERSE EFFECTS OCCUR REMOVE TO UNCONTAMINATED
 AREA. INGEST:DO NOT INDUCE VOMIT. GET IMMED MED ATTN.
 Protect Eye: Y
 Protect Skin: Y
 Protect Respiratory: Y

Label Name: AMOCO OIL COMPANY
Label Street: 200 EAST RANDOLPH DRIVE
Label City: CHICAGO
Label State: IL
Label Zip Code: 60601
Label Country: US
Label Emergency Number: 800-447-8735/800-424-9300

ALDRICH CHEMICAL SUB OF SIGMA-ALDRICH -- 22346-8 POTASSIUM PERMANGANATE 99%
A C S REAGENT
MATERIAL SAFETY DATA SHEET
NSN: 650500F037055
Manufacturer's CAGE: 60928
Part No. Indicator: A
Part Number/Trade Name: 22346-8 POTASSIUM PERMANGANATE 99% A C S REAGENT

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General Information
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Company's Name: ALDRICH CHEMICAL CO SUB OF SIGMA-ALDRICH
Company's Street: 1001 W ST PAUL AVE
Company's P. O. Box: 355
Company's City: MILWAUKEE
Company's State: WI
Company's Country: US
Company's Zip Code: 53201-5000
Company's Emerg Ph #: 414-273-3850/314-771-5765
Company's Info Ph #: 414-273-3850/314-771-5765
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 11JUL91
Safety Data Review Date: 27OCT94
Preparer's Company: ALDRICH CHEMICAL CO SUB OF SIGMA-ALDRICH
Preparer's St Or P. O. Box: 1001 W ST PAUL AVE
Preparer's City: MILWAUKEE
Preparer's State: WI
Preparer's Zip Code: 53201-5000
MSDS Serial Number: BVSYL
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Ingredients/Identity Information
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Proprietary: NO
Ingredient: POTASSIUM PERMANGANATE *94-3*
Ingredient Sequence Number: 01
Percent: 99
NIOSH (RTECS) Number: SD6475000
CAS Number: 7722-64-7
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Physical/Chemical Characteristics
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Appearance And Odor: BLACK/DEEP PURPLE CRYSTALS.
Specific Gravity: 2.7
Decomposition Temperature: 302F
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Fire and Explosion Hazard Data
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Extinguishing Media: WATER SPRAY
Special Fire Fighting Proc: WEAR SELF CONTAINED BREATHING APPARATUS &
PROTECTIVE CLOTHING TO PREVENT CONTACT W/SKIN & EYES.
Unusual Fire And Expl Hazrds: STRONG OXIDIZER. CONTACT W/OTHER MATERIAL
MAY CAUSE FIRE.
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Reactivity Data
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Stability: YES

Cond To Avoid (Stability): HEAT, SPARKS, OPEN FLAME, OTHER IGNITION

SOURCES

Materials To Avoid: ACIDS, STRONG REDUCING AGENTS, FINELY POWDERED METALS, PEROXIDES, ALUMINUM, ZINC, LEAD, COPPER & THEIR ALLOYS.

Hazardous Poly Occur: NO

Health Hazard Data

LD50-LC50 Mixture: ORAL LD50(RAT): 1090 MG/KG

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: YES

Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: HARMFUL IF SWALLOWED, INHALED/ABSORBED THROUGH THE SKIN. EXTREMELY DESTRUCTIVE TO TISSUE OF THE MUCOUS MEMBRANES/

UPPER RESPIRATORY TRACT/EYES/SKIN. INHALATION MAY BE FATAL AS A RESULT OF SPASM, INFLAMMATION & EDEMA OF THE LARYNX & BRONCHI, CHEMICAL PNEUMONITIS &

PULMONARY EDEMA. CORROSIVE.

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: NONE

Signs/Symptoms Of Overexp: BURNING SENSATION, COUGHING, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA & VOMITING.

Emergency/First Aid Proc: EYES/SKIN: IMMEDIATELY FLUSH W/COPIOUS AMOUNTS OF WATER FOR 15 MINS. INHALATION: REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE CPR/OXYGEN IF NECESSARY. INGESTION: WASH OUT MOUTH W/WATER IF CONSCIOUS. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE AREA. SHUT OFF ALL IGNITION SOURCES. WEAR SCBA, RUBBER BOOTS & HEAVY RUBBER GLOVES. COVER W/DRY-LIME, SAND/SODA ASH. PLACE IN COVERED CONTAINERS USING NON-SPARKING TOOLS & TRANSPORT OUTDOORS. VENTILATE & WASH SITE AFTER MATERIAL PICKUP.

Waste Disposal Method: ACIDIFY A 3% SOLUTION/A SUSPENSION OF THE MATERIAL TO PH 2 W/SULFURIC ACID. ADD A 50% EXCESS OF AQUEOUS SODIUM BISULFITE STIRRING AT ROOM TEMP. AN INCREASE IN TEMP INDICATES A REACTION. (SEE SUPPLEMENTAL DATA)

Precautions-Handling/Storing: KEEP TIGHTLY CLOSED & AWAY FROM COMBUSTIBLE MATERIALS, HEAT, SPARKS & OPEN FLAME. STORE IN A COOL, DRY PLACE. AVOID BREATHING DUST.

Other Precautions: DON'T GET IN EYES, ON SKIN/ON CLOTHING. AVOID PROLONGED/REPEATED EXPOSURE.

Control Measures

Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATOR

Ventilation: USE ONLY IN A CHEMICAL FUME HOOD

Protective Gloves: CHEMICAL RESISTANT

Eye Protection: SAFETY GOGGLES

Other Protective Equipment: PROTECTIVE CLOTHING, SAFETY SHOWER & EYE BATH

Work Hygienic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. WASH THOROUGHLY AFTER HANDLING.

Suppl. Safety & Health Data: IF NO REACTION IS OBSERVED ON THE ADDITION OF 10% SODIUM BISULFITE, ADD MORE ACID. IF MANGANESE/CHROMIUM/MOLYBDENUM ARE PRESENT ADJUST PH TO 7 & TREAT W/SULFIDE TO PRECIPITATE FOR BURIAL AS HAZARDOUS WASTE. DESTROY EXCESS SULFIDE/NEUTRALIZE/FLUSH DOWN THE DRAIN IAW/LOCAL, STATE & FEDERAL REGULATIONS.

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Transportation Data
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Disposal Data
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Label Data
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Label Required: YES

Label Status: G

Common Name: 22346-8 POTASSIUM PERMANGANATE 99% A C S REAGENT

Special Hazard Precautions: HARMFUL IF SWALLOWED, INHALED/ABSORBED THROUGH THE SKIN. EXTREMELY DESTRUCTIVE TO TISSUE OF THE MUCOUS MEMBRANES/UPPER RESPIRATORY TRACT/EYES/SKIN. INHALATION MAY BE FATAL AS A RESULT OF SPASM, INFLAMMATION & EDEMA OF THE LARYNX & BRONCHI, CHEMICAL PNEUMONITIS & PULMONARY EDEMA. CORROSIVE. BURNING SENSATION, COUGHING, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA & VOMITING.

Label Name: ALDRICH CHEMICAL CO SUB OF SIGMA-ALDRICH

Label Street: 1001 W ST PAUL AVE

Label P.O. Box: 355

Label City: MILWAUKEE

Label State: WI

Label Zip Code: 53201-5000

Label Country: US

Label Emergency Number: 414-273-3850/314-771-5765

MATERIAL SAFETY DATA SHEET
PETROL JEL™ LIQUID FUEL GELLING AGENT
EFFECTIVE DATE: SEPTEMBER 15, 1990

Chemonics Industries, Inc.
734 E. Southern Pacific Drive
Phoenix, AZ 85034
(602) 262-5401 (7:00 a.m. to 5:00 p.m. weekdays)
(916) 865-4932 (24 hour answering service)

WARNING STATEMENT

Danger. Methanol solution. May be fatal if swallowed. May cause blindness. Cannot be made non-poisonous. Can be absorbed through the skin. Harmful if inhaled. Use only in a well-ventilated area. Flammable. Keep away from heat and open flame.

CLASSIFICATION: FLAMMABLE LIQUID

- A. Product Identification. PETROL JEL is a liquid thickener for gelling petroleum fuels for use in prescribed burning or wildfires. It is a proprietary mixture of powdered gelling agent (metal stearate) and methanol (CAS 67-56-1) with dispersing agents.
- B. Occupational Control Procedures.
1. Avoid eye contact. Wear goggles with a full seal around the eyes when handling. Do not wear contact lenses. Keep an eye wash bottle in work area.
 2. Avoid skin contact. Use rubber or plastic gloves when handling.
 3. Avoid excessive inhalation of vapors. Use in a well-ventilated area. OSHA permissible exposure limit 200 ppm (TIME WEIGHTED AVERAGE), 250 ppm (STEL) skin. If the exposure limit is exceeded, use an air supplied, full face respirator or self-contained breathing apparatus.
 4. Wear protective clothing to minimize exposure.
 5. Ventilation required: Mechanical.
 6. Do not ingest.
- C. Fire Protection/Explosion Hazards.
1. Flammability: Very flammable.

Chemonics Industries, Inc.
September 15, 1990

foam, or water spray. Class A, BC, or ABC fire extinguishers. Sand/earth.

3. Special fire fighting procedures in enclosed areas: In case of accident or fire involving PETROL JEL, use chemical extinguishers or water to keep fire exposed containers cool and to flush non-ignited spills or vapors away from fire. Vapors can flow along surfaces to distant ignition sources and flash back. Wear an approved self-contained breathing apparatus and protective clothing.
 4. Flashpoint: 54 °F, Open Cup
 5. Upper Flammable Limit (%): 36
 6. Lower Flammable Limit (%): 6.7
 7. Auto Ignition Temperature: 867 °F
 8. Hazardous Combustion Products: When PETROL JEL is heated to point of combustion, carbon dioxide (CO₂) and carbon monoxide (CO) will be formed.
 9. Explosion Data: Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Moderate explosion hazard and dangerous fire hazard when exposed to heat, sparks and flames.
- Sensitivity to Impact: Not applicable.
Sensitivity to Static Discharge: Not applicable.

Physical Data.

1. Physical State: Low viscosity slurry.
2. Odor and Appearance: Slight perfume. Blue/yellow liquid.
3. Odor Threshold (ppm): No data available.
4. Vapor Pressure (mm Hg): 92° at 70° F
5. Vapor Density (Air = 1): 1.11
6. Evaporation Rate: (Butyl Acet = 1): 3.5, evaporates readily.
7. Boiling Point: 148 °F
8. Freezing Point: -144 °F
9. pH: 6.5
10. Specific Gravity: 1.035
11. Coeff. Water/Oil Dist.: No data available.

Chemonics Industries, Inc.

1. **Stability:** Excellent long-term stability. PETROL JEL will settle out but can be easily put back into suspension through agitation. Hazardous polymerization will not occur.
2. **Incompatibility:** Avoid strong oxidizers such as hydrogen peroxide, bromine, chromic acid, perchlorates or sulfuric acid. Will attack some forms of plastics, rubber and coatings. May react with metallic aluminum and generate hydrogen gas.
3. **Reactivity:** Not applicable.
4. **Hazardous Decomposition Products:** Carbon dioxide, carbon monoxide and formaldehyde.
5. **Storage:** Store in original container until used. Protect against physical damage. Store in a cool, well-ventilated area. Inside storage should be in standard flammable liquid storage room or cabinet. Storage and use must be in "No Smoking" areas. Spark proof tools and explosion proof equipment must be used in storage areas.

F. Toxicological Properties.

1. **Routes of Entry:** Vapors can be expected to be the most likely source of exposure to PETROL JEL. Slight irritant to mucous membranes. Toxic effects if excessive amounts inhaled. Toxic effects if excessive amounts absorbed through the skin.
2. **Toxicological data estimated from the Methyl Alcohol carrying agent.**

Oral LD50 (Rat): >5000 mg/kg
Dermal LD50 (Rabbit): 2000 mg/kg
3. **Effects of Acute Exposure:** Affects central nervous system, especially the optic nerve. Causes dizziness, nausea, muscle weakness, narcosis and respiratory failure. Ingestion can produce blindness. (100 ml can be fatal.)
4. **Effects of Chronic Exposure:** Marked impairment of vision and enlargement of liver. Skin irritation from prolonged exposure.
5. **Carcinogenicity:** Not listed by NTP or IARC.

Chemonics Industries, Inc.

7. Mutagenicity: Not listed by NTP or IARC.

8. Reproductive toxicity: Not listed by NTP or IARC.

G. Spill, Leak, and Disposal Information. Ventilate area of leak or spill. Remove all sources of ignition. Clean-up personnel require protective clothing and respiratory protection from vapors. Contain and remove liquid where possible. ABSORB WITH SAWDUST OR VERMICULITE FOR DISPOSAL AS A HAZARDOUS WASTE IN A RCRA APPROVED FACILITY. Do not flush to sewer.

H. Transportation Data.

1. DOT Hazard Class: Flammable liquid UN1230.
2. Reportable Quantity: (RQ) (CWA/CERCLA): 5,000#
3. Freight Classification: Hazardous: Flammable liquid.
4. Flammable liquid, ingestion can cause blindness and death. Cannot be made non-poisonous. Causes irritation.

I. Environmental Effects.

1. Do not dispose to sewer.
2. Relatively low toxicity to aquatic life. 96 hr. LC50 Juvenile Rainbow Trout: > 1000 mg/liter.
3. Use and disposal employing proper environmental control practices should not cause significant environmental impact.

J. First Aid Procedures.

1. Inhalation: Remove to fresh air and give oxygen if breathing is difficult. If not breathing, give artificial respiration. Get medical attention.
2. Ingestion: If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down the throat. Never give anything by mouth to an unconscious person. Get medical attention immediately.
3. Skin Contact: Remove contaminated clothing. Wash with soap and water for at least fifteen minutes. Get medical attention if irritation develops.

CHEMONICS INDUSTRIES, INC.
MATERIAL SAFETY DATA SHEET
FIRE-TROL® FIREGEL™

Chemonics Industries, Inc.
734 E. Southern Pacific Drive
Phoenix, AZ 85034
(602) 262-5401
(916) 865-4932 (24 hr. number)

CAUTION

Avoid eye contact; may be irritating. Avoid unprotected exposure of the skin. Work in a ventilated area to avoid possible irritation of respiratory tract.

CLASSIFICATION: NON-HAZARDOUS

- A. Product Identification. FIRE-TROL FIREGEL is an aluminum soap for use in thickening gasoline, kerosene or mineral spirits.
- B. Occupational Control Procedures
1. Avoid eye contact. Wear goggles when handling.
 2. Avoid skin contact. Use rubber or plastic gloves to avoid prolonged skin contact.
 3. Avoid excessive inhalation of powder by wearing an OSHA approved dust mask.
 4. Handle product in a well ventilated area. Permissible concentration in air of 10 mg/m3. (Nuisance dust.)
 5. Avoid ingestion. (Estimated LD₅₀>50 mg/kg; oral, rat.)
- C. Fire Protection Information
1. Extinguishing media for concentrate: Carbon dioxide, dry chemical, foam, or water spray. Class A, BC, or ABC fire extinguishers, sand/earth.
 2. Special fire fighting procedures in enclosed areas: Fire fighters must be equipped to prevent breathing of vapors or products of combustion. Wear an approved self-contained breathing apparatus and protective clothing.
 3. Unusual fire or explosion hazards: Hazardous only when present as a dust. Dust explosions can occur under conditions of high dust concentration in the presence of a spark or open flame.
- D. Physical Data
- | | |
|--------------------------------|--|
| 1. Color: | Greenish powder |
| 2. Odor: | Mild fatty |
| 3. Specific gravity: | 1.01 to 1.03 (approximately), whereas water is 1.0 |
| 4. Melting point: | Over 390°F |
| 5. pH: | 5 to 8 in a 5% dispersion |
| 6. Percent volatile by weight: | 1.5% (moisture) |

FIRE-TROL® FIREGEL MSDS

March, 1992

Page 2 of 2

E. Reactivity Data

1. Stability: Product has excellent long-term stability for an indefinite period.
2. Hazardous decomposition products: Carbon monoxide, carbon dioxide - these gases can be harmful in enclosed areas so fire fighters must wear an approved self-contained breathing apparatus and protective clothing.
3. Hazardous polymerization will not occur.
4. Incompatibility (keep away from): Flames and sparks under dusty conditions. Avoid strong acids and oxidizers.

F. Spill, Leak and Disposal Information. Sweep up and discard in closed containers. Dispose of in accordance with all applicable federal, state and local regulations.

G. Transportation Data

1. DOT: Not regulated
2. Reportable Quantity: Not applicable
3. Freight Classification: Metallic soaps of fatty acids
4. Non-hazardous, non-flammable, non-corrosive

H. Emergency & First Aid Procedures (for Concentrate)

1. Eye Contact. Flush eyes immediately with plenty of water for at least fifteen minutes and call a physician.
2. Skin Contact. Wash off with detergent and water.
3. Inhalation. Remove person to fresh air and provide oxygen if breathing is difficult. Get medical attention.
4. If swallowed, call a physician immediately.

NOTICE OF WARRANTY: Chemonics Industries, Inc. warrants that FIRE-TROL products are reasonably fit for the purposes for which they were developed only when used in accordance with recommended use practices under normal conditions. In no case shall Chemonics be liable for consequential, special, or indirect damages resulting from the use or handling of these products. ALL such risks shall be assumed by the buyer. CHEMONICS MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESSED OR IMPLIED WARRANTY EXCEPT AS STATED ABOVE.

Effective Date: March, 1992

Supersedes all previous dates for FIRE-TROL® FIREGEL™

FIRE-TROL® FIREGEL MSDS
March, 1992
Page 2 of 2

E. Reactivity Data

1. **Stability:** Product has excellent long-term stability for an indefinite period.
2. **Hazardous decomposition products:** Carbon monoxide, carbon dioxide - these gases can be harmful in enclosed areas so fire fighters must wear an approved self-contained breathing apparatus and protective clothing.
3. **Hazardous polymerization will not occur.**
4. **Incompatibility (keep away from):** Flames and sparks under dusty conditions. Avoid strong acids and oxidizers.

F. Spill, Leak and Disposal Information. Sweep up and discard in closed containers. Dispose of in accordance with all applicable federal, state and local regulations.

G. Transportation Data

1. **DOT:** Not regulated
2. **Reportable Quantity:** Not applicable
3. **Freight Classification:** Metallic soaps of fatty acids
4. **Non-hazardous, non-flammable, non-corrosive**

H. Emergency & First Aid Procedures (for Concentrate)

1. **Eye Contact.** Flush eyes immediately with plenty of water for at least fifteen minutes and call a physician.
2. **Skin Contact.** Wash off with detergent and water.
3. **Inhalation.** Remove person to fresh air and provide oxygen if breathing is difficult. Get medical attention.
4. **If swallowed, call a physician immediately.**

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Effective Date: March, 1992

Supersedes all previous dates for FIRE-TROL® FIREGEL™

IV. HEALTH HAZARD DATA

TLV AND SOURCE: 50 ppm C* TWA (ACGIH) 1983-1984

ACUTE EFFECTS OF OVEREXPOSURE

- SWALLOWING** : Ingestion will cause acute poisoning resulting in severe abdominal disturbances, Central Nervous System depression, possible respiratory and/or renal failure. NOTE: Acute ORAL LD₅₀ (rat) 13.8 ml/kg. Human lethal dose reported to be 100 cc.
- SKIN ABSORPTION:** Is absorbed slowly. Should not be a problem unless gross exposure occurs and material is not promptly removed. NOTE: LD₅₀ rabbit 1,000 mg/kg.
- INHALATION** : Prolonged exposure to high concentrations can cause respiratory irritation and may result in unconsciousness.
- SKIN CONTACT** : Prolonged skin contact with liquid ethylene glycol has a dehydrating effect which can result in temporary irritation. Vapors have little or no effect on the skin.
- EYE CONTACT** : Contact with liquid ethylene glycol can result in temporary irritation. No corneal injury likely. Eye contact with vapors may result in temporary irritation.

CHRONIC EFFECTS OF OVEREXPOSURE

See below.

EMERGENCY AND FIRST AID PROCEDURES

- SWALLOWING** : Toxic by ingestion. Induce vomiting immediately and seek medical attention.
- SKIN** : Wash affected skin areas with soap and water. If irritation develops, consult a physician. Wash clothing before reuse.
- INHALATION** : Remove to fresh air. If breathing has stopped, start artificial respiration. Seek medical attention.
- EYES** : Irrigate eyes immediately with large amounts of water (15 mins.). If irritation occurs, consult a physician.

NOTES TO PHYSICIAN

Overexposure may cause liver and kidney damage and metabolic acidosis. Anesthetic or narcotic affect may occur. Early administration of ethanol may counter the toxic affects of ethylene glycol. Consult standard literature. Treatment should be based on sound judgment of physician and individual reactions of the patient.

Eyes: Although permanent injury is unlikely, stain for evidence of corneal injury.

Skin: In cases of irritation, treat as any contact dermatosis. Material may be absorbed (although slowly) in acutely toxic amounts upon gross contact.

*C denotes ceiling value as well as TWA.

V. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT [test method(s)]: 240° F COC

AUTO IGNITION TEMPERATURE: 740° F

FLAMMABLE LIMITS IN AIR, % BY VOLUME: N/A

EXTINGUISHING MEDIA: Water fog, alcohol resistant foam, CO₂, Dry Chemical.

SPECIAL FIRE FIGHTING PROCEDURES: For fires involving large quantities of antifreeze where self-contained breathing apparatus and full turn-out gear.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Heated vapors are heavier than air and may travel to a source of ignition.

VI. REACTIVITY DATA

STABILITY: Stable

CONDITIONS TO AVOID: None known

INCOMPATIBILITY (materials to avoid): Strong oxidizing materials.

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS: None known

HAZARDOUS POLYMERIZATION: Will not occur

CONDITIONS TO AVOID: None known

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: For small spills, soak up with absorbent material.

For large spills, dike and pump into suitable containers. Clean up residual with water.

WASTE DISPOSAL METHOD: Incinerate according to local, state and federal regulations or salvage.

VIII. PERSONAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type): None normally needed for intended use. Approved organic vapor type respiratory protection required in absence of proper environmental controls in case of large spills.

VENTILATION: None normally needed for intended use.

PROTECTIVE GLOVES: Where skin contact may occur it is recommended chemical impervious gloves be worn.

EYE PROTECTION: If splashing may occur, use chemical goggles or full face shield.

OTHER PROTECTIVE EQUIPMENT: None normally needed.

IX. SPECIAL PRECAUTIONS

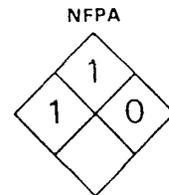
CAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Practice reasonable care and cleanliness. Avoid breathing any mists if generated.

X. REGULATORY INFORMATION

At:

Title III:

Right To Know: REPORTABLE CONTENTS:
Ethylene Glycol 107-21-1
Diethylene Glycol 111-46-6
Water 7732-18-5



HAZARD IDENTIFICATION

NOTES

Appendix D – Training and Experience Records

Plastic Spheres Dispenser Operator (PSDO)
Helitorch (HTMG, HTMM, HTPT)

Appendix E D.O.T. Concerns & Transportation requirements

AERIAL/GROUND IGNITION AND FUEL TRANSPORT SYSTEMS: SERIOUS SAFETY CONCERNS RAISED

FEBRUARY 22 -- BOISE, ID:

The Department of the Interior and USDA Forest Service fire directors have issued a letter concerning potentially serious safety problems with aerial/ground ignition systems and fuel transport/container systems, and practices utilized with these systems. In recently completed assessments, it was determined that of the limited number of ground firing systems now available commercially, none of those examined meet all applicable OSHA and DOT regulations requiring protection of flammable liquids from sources of ignition and standards for transporting, storing, and handling flammable liquids. **The assessments were done by Bureau of Land Management Compliance, Assessment, Safety, Health and the Environment (CASHE) personnel. (Applicable regulations and codes are: DOT 49 CFR 171, 172, 173, 178, 180, and 397; OSHA 1910.106 etal; NFPA 30 etal.)**

Standardized operating procedures for transporting and operating aerial/ground based firing systems that meet these codes and regulations have to be established. The Forest Service's Missoula Technology and Development Center (MTDC) has just initiated a three year project to establish minimum specifications for this equipment, as well as protocols and procedures for transport of these systems, and training and certification requirements for operators.

The letter signed by the fire directors of the Forest Service, Bureau of Land Management, National Park Service, Fish and Wildlife Service and Bureau of Indian Affairs, instructs agency fire personnel to implement the following steps immediately:

- **Include specifications in the purchase of all new aerial or ground fire systems requiring the manufacturer to meet all applicable DOT and OSHA regulations and NFPA codes.**
- **Ensure that all managers and personnel operating existing ground firing systems are aware of the regulations governing their transport and use, and place a high priority on maintaining compliance with safe operating practices and procedures.**
- **Ensure that practices followed in the transportation, mixing and dispensing of flammable liquids will be in compliance with applicable DOT and OSHA regulations and NFPA codes as soon as reasonably possible.**

More information on these issues will be coming soon. In the meantime, any questions pertaining to this matter should be directed to Alice Forbes, USDA Forest Service, (530)226-2727, or Paul Naman, BLM, National Interagency Fire Center, (208)387-5421.

Notes Page:

AERIAL IGNITION
STANDARDS AND GUIDELINES

	BARRELS or TANKS Less than 119 gallons	TANKS 119 gallons or greater
MARKINGS	Tested and Marked with DOT Performance Orientated Packaging Rating (POP) that usually starts with a UN1A1 or UN1A2 designation or has appropriate DOT designation.	Bulk Tank specification plate (MC306 or DOT406) or IBC.
LABEL	Labeled as "FLAMMABLE LIQUID" and marked " UN1203 – GASOLINE".	Placarded as "FLAMMABLE LIQUID" and Marked "UN1203"
COLOR	Painted RED.	No color requirement.
SEALED	<p>Designed so that there is no leakage in case of rollover or accident.</p> <p>Not filled over 90% of volume.</p> <p>DOT approved Vacuum / Pressure Bypass valve <u>NOT PERMITTED</u> during transport (unless approved to POP standards).</p> <p>DOT approved Vacuum / Pressure Bypass valve <u>REQUIRED</u> during use and storage.</p> <p>Shut off valves that protected and not protruding from the vehicle.</p>	<p>Designed so that there is no leakage in case of rollover or accident.</p> <p>Shut-off valves that are protected and not protruding from the vehicle.</p> <p>Have appropriate fittings to accommodate bypass for vacuum and pressure (must meet DOT and NFPA Tank Standards).</p> <p>Have appropriate fittings to accommodate vapor removal or recovery.</p>
FILLING	<p>Vapor control required either by removal or recovery.</p> <p>For tanks over 60 gallons, fill spout extends within 6 inches of bottom. Splash filling not permitted.</p>	<p>Vapor control required either by removal or recovery.</p> <p>Fill spout within extends within 6 inches of bottom. Splash filling not permitted. Bottom filling configuration is the preferred method.</p>
DELIVERY AND STATIC CONTROL	Have approved (DOT, NFPA and within the scope of OSHA 29CFR 1910.106) petroleum fuel dispensing and vapor recovery / removal hoses and static bonding wire.	Have approved (DOT, NFPA and within the scope of OSHA 29CFR 1910.106) petroleum fuel dispensing and vapor recovery / removal hoses and static bonding wire.
THICKENING AGENTS	A written procedure for dispensing thickening agent to comply with OSHA general requirements for minimizing inhalation / exposure as listed on the chemical's Material Data Safety Sheet. Dumping powder through manhole is not acceptable, use appropriate dispensing mechanism for dispensing power.	A written procedure for dispensing thickening agent to comply with OSHA general requirements for minimizing inhalation / exposure as listed on the chemical's Material Data Safety Sheet. Dumping powder through manhole is not acceptable, use appropriate dispensing mechanism for dispensing power.

	BARRELS or TANKS Less than 119 gallons	TANKS 119 gallons or greater
BY MARCH 1, 2001 & ANNUALLY THERAFTER	Visually inspect tanks yearly for degradation and compliance.	Visual Leak Inspection (VK) performed by DOT registered vendor.
BY MARCH 1, 2001 & EVERY FIVE YEARS THEREAFTER	None.	Internal Pressure Test (IP) performed by DOT registered vendor.
POST INSPECTION LABELLING	None.	Inspector will apply label with VK and IP expiration dates.
TANK MODIFICATION CRITERIA	None.	Alteration of the (tank) original design specification (MC306 or DOT406) must be accomplished at DOT registered vendor.
TANK MODIFICATION INSPECTIONS	If required, re-inspected by local Hiway Patrol Hazmat enforcement officer.	Inspected by local Hiway Patrol Hazmat enforcement officer.
GENERAL	Compliance with STANDARDS and GUIDELINES.	Permanent 2" cam lock fitting with recovery removal hose at least 50 feet in length and 2" in diameter. Compliance with STANDARDS and GUIDELINES.
COMPLIANCE	Tanks and Barrels that do not comply with the STANDARDS and GUIDELINES and the COMPLIANCE CRITERIA, and which cannot be modified by a registered vendor to meet those requirements, shall be taken out of service no later then March 1, 2001.	Tanks that do not comply with the STANDARDS and GUIDELINES and the COMPLIANCE CRITERIA, and which cannot be modified by a registered vendor to meet those requirements, shall be taken out of service no later then March 1, 2001.

COMPLIANCE CRITERIA

HELITORCH TANKS / BARREL COMPLIANCE

	BARRELS or TANKS Less than 119 gallons	TANKS 119 gallons or greater
ALL HELITORCH BARRELS AND TANKS BY MARCH 1, 2001	Meet Standards and Guidelines, and the, Compliance Criteria or be taken out of service.	Meet Standards and Guidelines, and the, Compliance Criteria or be taken out of service.
UN DESIGNATION	Performance Orientated Packaging (POP) showing that testing was done in the "AS SUPPLIED" configuration. (usually marked as 1A1 or 1A2).	Compliance with STANDARDS and GUIDELINES
LABELLING	Compliance with STANDARDS and GUIDELINES.	Compliance with STANDARDS and GUIDELINES.
VAPOR CONTROL	Removable 2" cam lock fitting with recovery/removal hose at least 50 feet in length and 2" in diameter. Compliance with STANDARDS and GUIDELINES.	Permanent 2" cam lock fitting with recovery/removal hose at least 50 feet in length and 2" in diameter. Compliance with STANDARDS and GUIDELINES.
VOLUME CONTROL	Site glass installed in barrel bungs or other method to control volume not to exceed 90% of capacity. (Use 2" site glass, 3 ea. in barrel bungs).	Compliance with STANDARDS and GUIDELINES.
BYPASS VALVES	Safety bypass valve to allow air to enter and exit during gelled fuel pumping operations to prevent container implosion / explosion. (Clay or Bailey type bypass valve).	Safety bypass valve to allow air to enter and exit during gelled fuel pumping operations to prevent container implosion / explosion.

HELITORCH OPERATIONAL CRITERIA

	BARRELS or TANKS Less than 119 gallons
HELITORCH FILLING OR EMPTYING	Vapors shall be recovered or routed down wind from the operation a distance of 50 feet using petroleum rated hose. (Use 2-inch cam lock hose connected between the supply and receiving tanks. Place cam lock plugs in hose and tanks fittings when not in use.
TRANSPORTATION OF HELITORCH BARRELS	<p>Must be DOT approved and meet the STANDARDS and GUIDELINES.</p> <p>Must be located in a protected area on the vehicle and securely fastened to prevent moving within the vehicle in case of accident or rollover.</p> <p>Must contain less than 1 gallon of residual fuel.</p> <p>Must comply with local and state Hiway Patrol Hazmat regulations.</p>
TRANSPORTATION OF NON-COMPLYING HELITORCH BARRELS	<p>All non-complying tanks and barrels should be inspected by state authorities (in most states this will be the state police) for approval prior to transportation.</p> <p>Without prior approvals, any citations issued by state authorities for lack of compliance are the responsibility of the driver of the vehicle.</p> <p><u>All non-complying barrels and tanks must be disposed of by March 1, 2001, or taken out of service sooner if practical.</u></p> <p>Transportation of non-complying barrels may be accomplished by following GUIDELINES and STANDARDS for packaging, markings, securing and POP standards.</p> <p>Non-complying barrels MUST be triple rinsed to insure <u>no flammable residue or flammable vapors</u> are present. Rinse liquid must be captured into an approved DOT container and may be used in a batch of gel, or disposed at an EPA approved Hazwaste disposal site or by hazardous material removal contractor.</p>

Equipment Retrofit Options and Availability

Several vendors are currently working on equipment and procedures for retrofitting helitorches, batchmixers, and terratorches. Contact your Regional Helicopter Operations Specialist for these companies prior to retrofitting existing equipment or the purchase of new equipment.

The approximate costs for a complete retrofit kit for the Simplex model #5400 helitorch (including DOT barrel) is \$1,000.

Retrofit Kit (includes)

UN 1A2 type DOT barrel
 2-inch site glass (3)
 2-inch relief valve (Clay and Bailey)
 2-inch male Cam Lock fitting
 2-inch Cam Lock dust cover (Cap)
 Cable tie downs (barrel) with nuts
 Metal frame (adapter) with bolts

Accessories

Vapor removal/recovery hose
 2-inch female Cam Lock fitting
 2-inch Cam Lock dust plug
 Emco Wheaton 2-inch adapter
 Emco Wheaton 2-inch coupler
 Civacon 2-inch male adapter
 Civicon 2-inch coupler

HELITORCH OPERATIONAL TRAINING CRITERIA

TRAINING	<p>Written programs that apply and shall be in place under OSHA:</p> <p>Right To Know – Hazardous Materials Awareness (Hazardous Waste and Toxic Substances)</p> <p>Material Data Safety Sheet compliance with dry and wet chemicals in use</p> <p>Personal Protective Equipment (PPE) for the chemicals in use</p> <p>General Health and Safety Standards (1910)</p> <p>Hand and Power Tools Use</p> <p>Fire Safety (extinguishers, prevention and survival)</p> <p>Machine (moving pump shaft, belt and wheel) Guarding</p> <p>Confined Space (if entering tanks)</p> <p>Respiratory Protection (if required on MSDS) and Fitting Program</p> <p>Lock Out Tag Out Program (control of unexpected equipment movement and power sources during repair, use, modification or cleaning).</p> <p>Ergonomics (proper body position, equipment use and lifting)</p> <p><i>Remember!</i> All training must be documented with the trainers name, date of training, subjects covered, attendee's full name, signature and date. The key is "If the training was not documented then it did not occur".</p> <p>Additional training is required for all employees that fall outside of the "Materials of Trade" exceptions delineated by the DOT.</p> <p>For flammable liquids, this includes any container larger than 8 gallons or any load larger than 440 pounds total aggregate weight including the containers. DOT has designated this training as "HM-126F" which includes four basic parts:</p> <ol style="list-style-type: none"> 1. General Awareness 2. Safety Training 3. Function Specific Training and 4. Drivers Training. <p>Loads greater than 119 gallons or 1000 pounds automatically require a commercial drivers license with a hazardous materials endorsement, and extensive drivers training which may include the requirement for a tank endorsement.</p>
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TRANSPORTING CLASS 3 FLAMMABLE LIQUIDS
 Requirements of the
 Department of Transportation

	REQUIRED TRAINING							REQUIRED DOCUMENTATION				REMARKS	
	HAZCOM-GEN- HAZ	ERG EMERGEN- RESPONSE	HNI-12AF HAZMAT	EXTENSIVE DRIVER TRNG	MSDS SHEETS	EMERGENCY RESPONSE GUIDE	HAZMAT BEL OR LOADING	CDL LICENSE					
CLASS 3 FLAMMABLE LIQUID PG II OR III (GASOLINE, DRIP-FORCH FUEL, PAINT) CONTAINER SIZE AND CARGO WEIGHT THRESHOLDS													
Containers less than 6 gallons (23 liters) and total cargo weight is less than 440 lbs (200 kg)	X				X								DOT performance-oriented packaging has United Nations I.D. system
OR													OSHA-approved container has "Gasoline" label and has laboratory approval (Underwriter's Lab or any), and is stored in 5-gallon (20L) containers.
OSHA 5-gallon (20L) containers and total cargo weight is less than 440 lbs.	X				X								DOT performance-oriented packaging has United Nations I.D. system
Containers less than 6 gallons (23 liters) and total cargo weight is more than 440 lbs (200 kg), but less than 1001 lbs (454 kg).		X	X		X	X	X						DOT performance-oriented packaging has United Nations I.D. system
Containers from 6 to 119 gallons (23 to 450 liters), and cargo weight is less than 1001 lbs (454 kg).		X	X	R	X	X	X	X					Containers over 6 gallons must be performance-oriented packaging (DOT)
		X	X	R	X	X	X	X					(Same as above)
More than 119 gallons (454 kg), or more than 1001 lbs (454 kg) cargo weight.		X	X	X	X	X	X	X					Such packaging must have relief valves, rollover protection, and automatic shut-off valves. Tanks over 119 gallons require regular inspections.

Abbreviations: DOT=Department of Transportation; OSHA=Occupational Safety and Health Administration; ERG=Emergency Response Guide; CDL=Commercial Driver's License with HazMat and tank endorsements; X=Required; H=Hazardous; B=Safety; C=General equipment; R=Specialty; C=Function specific; B=Driver; and PG=Packaging group.

Appendix F Examples of Project Aviation Safety Plans

Plastic sphere operations safety plan
Helitorch operations safety plan

AIR OPERATIONS PLAN
 DISTRICT AERIAL IGNITION
 UMATILLA NATIONAL FOREST
 HEPPNER RANGER DISTRICT
 2000 SEASON

Prepared By: _____
 District Aviation Officer

Reviewed By: _____
 Forest Aviation Officer

Approved By: _____
 District Ranger

This Air Operations Plan contains all the requirements of the air operations portion of a prescribed burning plan as required in FSM 5711.11 and 5703.4. Approval of this plan by the approving line officer constitutes the authority to burn while using an aerial ignition system.

A. OBJECTIVE

This Air Operations Plan is to be used as an integral part of the Heppner District Prescribed Burning Plans for the 2000 field season. The primary objective of this plan is to assure a safe and efficient aerial ignition operation on our prescribed burns. It shall be used in conjunction with the Interagency Aerial Ignition Guide as described in Chapter 3, Plastic Sphere Dispenser Operations.

B. TREATMENT AREA: (Maps are at district office and on file with FAO)

1. BURN NAME:

- Lower Skookum Underburn with approved burn plans.
- Upper Skookum Underburn with approved burn plans.
- Bologna Basin Underburn with approved burn plans

2. BURN LOCATION:

- Lower Skookum - T6S, R27E; T7S, R27E; T7S, R28E, various sections.
- Upper Skookum - T5S, R27E; T6S, R27E, various sections
- Bologna Basin – T8S, R26 E, various sections

3. SIZE:

- Lower Skookum - 6,572 acres
- Upper Skookum - 1,587 acres
- Bologna Basin – 5868 acres

4. AREA FLIGHT HAZARDS:

The Heppner Ranger District has a military training route over the district. IR 343 is a low altitude, high-speed route with continuous hours of operation. When it is determined by the district aviation officer that military activity along this route will conflict with aerial ignition operations the PICC dispatcher will be notified to assist with airspace management and coordination. The district aviation officer may ask for a local advisory NOTAM or ask the military for a voluntary cessation of activity along the route. Flight patterns shall be planned to avoid overflights of buildings and structures in the burn area with the sphere dispenser aboard. The helicopter will maintain an elevation of at least 150 feet above treetops and other obstacles during recon and ignition flights. Other known flight hazards will be made known to the pilot during the pre-operational briefing.

C. AIR OPERATIONS ORGANIZATION: See attached Organization Chart.

1. Personnel Assignments

- Firing/Burn Boss _____
- Helicopter Manager _____
- Dispenser Operator _____
- Helispot Mgr/Radio Operator _____
- Pilot _____
- Forest Dispatcher _____

D. HELICOPTER INFORMATION

1. HELICOPTER

- Helicopter FAA No. _____
- Make and Type of Aircraft _____
- Vendor Name and Address _____
- _____
- _____

2. SPHERE DISPENSER

Model PREMO MARK III

E. HELICOPTER FLIGHT

1. RECON FLIGHT

A reconnaissance flight shall be taken prior to ignition to establish the ignition pattern with the pilot. The burn boss, firing boss and dispenser operator shall be on this flight. All operational, alternate, and emergency helispots shall be identified during this flight to insure pilot familiarity with available helispots. During the recon flight, the proposed burn area will be thoroughly checked for any people and or big game wildlife that might be in the area and be threatened by the helicopter operation. If people are present within the burn area boundaries, the burn boss will make a no-go decision on ignition until any people are confirmed to be clear of the burn area. Other burn personnel, such as holding crews or observers, will be briefed on procedures to be followed during ignition.

2. IGNITION FLIGHT

Although the ignition pattern will be directed by the firing boss, the helicopter pilot has final authority for flight safety and decisions as to which flight maneuvers may be conducted safely.

F. COMMUNICATIONS

Helicopter mission crewmembers and pilot shall have interphone capability and VHF-FM air-to-ground radio contact at all times. Priorities in use of intercom/radio will be discussed to insure that the dispenser operator can talk to the pilot and burn boss whenever necessary. The helispot manager will perform as project radio operator. In the event of loss of any radio capability, the helicopter will immediately return to the helispot.

1. FREQUENCIES

In order to minimize radio traffic on the forest net frequency, air-to-ground communications will be conducted on VHF-FM 167.950. Communication with the PICC Dispatcher will be via Umatilla Channel 1, VHF-FM 164.125 tone 131.8. The helicopter will flight follow with the project helispot/helicopter manager via Umatilla Channel 4, 167.950. The helispot mgr/radio operator will monitor VHF-FM 164.125, 164.9625, and 167.950 (UMA 1, 3, & 4) and VHF-AM 122.900 for any possible civilian aircraft in the burn area. The helicopter manager will check in with PICC every 30 minutes to give a status report. The helispot manager will be on alert for any intrusions into the project area by military aircraft.

COMMUNICATIONS CHART:

	Pilot	Burn Boss	Helispot	PICC	Support Personnel
Burn Boss	Intercom		167.950 (4)	164.125 (1)	167.950 (4)
Premo Operator	Intercom	Intercom			
Helispot	167.950 (4)	167.950		164.125 (1)	164.125 (1) 164.9625 (3)
PICC	164.125 (1)	164.125 (1)	164.1250 (1)		164.125 (1)
Support Personnel	167.950 (4) 164.9625 (3)	167.950 (4) 164.9625 (3)	164.9635 (3)	164.125 (1)	164.9625 (3)
Air Traffic	122.900		122.900		

(Numbers in parenthesis are Umatilla channel numbers)

G. BURNING OPERATIONS REQUIREMENTS

1. SAFETY

1. Qualified helicopter personnel assigned.
2. Heliport/Helibase meets established standards.

3. Organizational chart posted.
4. Communications plan posted. Frequency assignments known.
5. Heliport/Helibase fire protection meets established standards.
6. Crash rescue/evacuation kits on the heliport/helibase.
7. Emergency plan posted/discussed.
8. All personnel briefed and assignments known.
9. Separation of aircraft provided (if more than one used).
10. Personal protective equipment meets established standards.
11. Air hazard map posted/hazards known to pilot.
12. Weather considerations known/discussed.

2. AIRCRAFT/PILOT

1. Pilot and aircraft approved for mission.
2. Pilot duty limitations status satisfactory.
3. Load calculations prepared and posted.
4. Aircraft radios functioning.
5. Electrical/mechanical releases functioning.

3. DISPENSER

1. Installation as instructed with restraints in place.
2. Mechanical operation satisfactory.
3. Extinguishing system filled and operational.
4. Glycol reservoir filled and tightly capped.
5. Adequate ignition delay achieved.
6. Intercom operable.
7. Pilot has been briefed and agrees that all is in order.
8. Sphere container secured in place.
9. Knife available for emergency use.
10. Additional container of water available.

4. SUPPORT EQUIPMENT/PERSONNEL

1. Adequate support equipment/personnel to complete mission.
2. Pump/engine operational checks complete.
3. Radios/communications operational check.
4. Support equipment/personnel prepositioned before actual operations begin.
5. Adequate supply of plastic spheres and glycol to complete project.

H. HELIBASE LOCATION

1. Helibase

- a. T. 6 S., R. 27 E., section 9, Tupper Guard Station.
- b. Dust Abatement: Has not been a problem.

2. Helispots

In addition to the main helibase, other helispots within or near the proposed burn area may be used to land and get spheres (NO GLYCOL) out of the cargo compartment. These spots will be identified and approved by the pilot and manager during the recon flight. Their location and names will be identified to the helibase radio operator.

I. IGNITION PATTERN

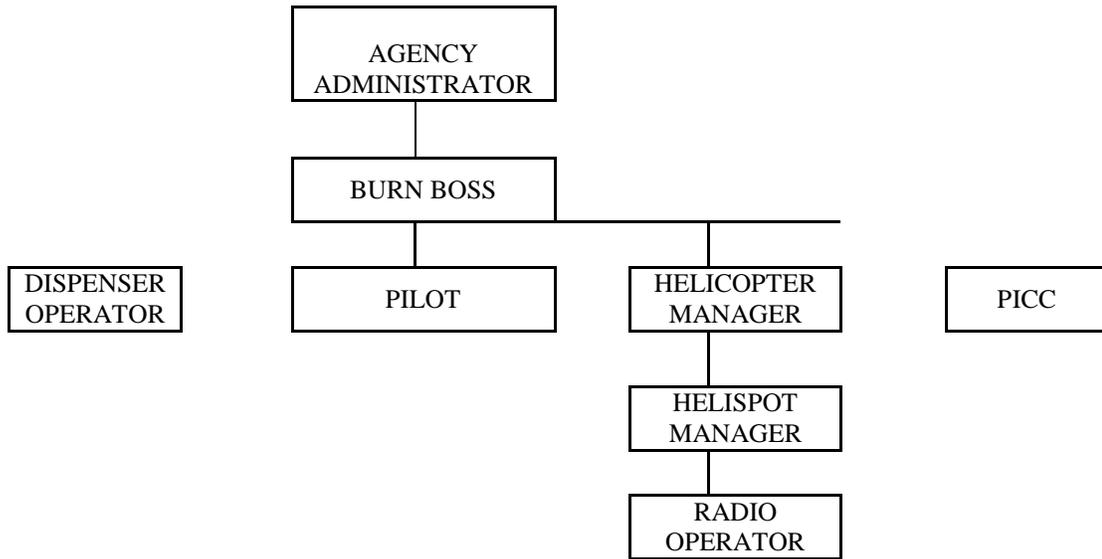
The exact ignition sequence will be determined by the burn boss prior to the burn. The general ignition pattern is a strip head/backing fire. The sequence of ignition will be based on current and predicted weather, especially upper air flow and stability of the air mass. The most windward portion of the unit will be ignited last. The burn boss will identify the ignition pattern to the pilot during the recon flight.

COMMUNICATIONS

Channel Name	RX	TX	TXCG	Purpose
1	UMA South	164.1250	164.1250	131.8 Commo with PICC/ Heppner
3	UMA Project	164.9625	164.9625	none overall project coordination
4	Air/Ground	167.950	167.950	none Air to Ground, flight-following
		122.900	122.900	Civilian air traffic
		122.800	122.800	Civilian air traffic

Intercom: Communication between the burn boss, pilot, and dispenser operator

ORGANIZATION CHART



PLASTIC SPHERE DISPENSER
 AIR OPERATIONS/SAFETY PLAN
 FOR _____ BURN

Date: _____

NATIONAL FOREST _____
RANGER DISTRICT _____

Submitted by

Fire Management officer Date

Reviewed by

Forest Air Officer Date

Reviewed by

Forest Fire Staff Date

Approved by

District Ranger Date

_____ BURN OPERATION/SAFETY PLAN

PLASTIC SPHERE DISPENSER
REQUIREMENTS, RESTRICTIONS, AND APPROVALS

- A. The helicopter and pilot must be carded for aerial ignition missions in accordance with FSH 5709.12.

- B. Pilots and PSD operators shall receive required training and be properly designated to perform PSD operations.

- C. All people involved in the project will be thoroughly briefed in helicopter safety and aerial ignition operations on the morning of the burn prior to any flights. A Job Hazard Analysis for the project will be reviewed.

- D. All helicopter/sphere dispenser operations will be conducted in accordance with current 5700 and 5709.12 Forest Service Manual and Handbook direction, R-4 guidelines, and Washington Office directives concerning PSD operations.

- E. Occupants in the helicopter shall be limited to the pilot, dispenser operator, and the firing boss when necessary.

- F. Air to ground radio communications must be maintained throughout all flight operations.

- G. Glycol must not be carried aboard the helicopter except that contained within the dispenser.

- H. The dispenser must be at least 25 feet away from the helicopter when being filled with glycol.

- I. Aerial Ignition Burn Boss must meet requirements of FSM 5143 and 5144.

OPERATION AND SAFETY PLAN

A. TRAINING (prior to burn)

1. Identify equipment and personnel to be used in aerial ignition.
2. Conduct training session on use of the dispenser, assuring that all necessary equipment and supplies are available and in proper working order for day of burn and that the dispenser operator is thoroughly familiar with operational procedures, equipment maintenance, and safety concerns.

B. DAY PRIOR TO BURN (or early morning on day of burn)

1. Deliver necessary equipment and supplies to project helibase.
2. Set up helibase, i.e. landing area, wind indicator, parking area, personnel area, security, and provisions for flight following.

C. DAY OF BURN (following items done daily on multiple day projects)

1. Deliver all personnel and equipment to project helibase (see map for helibase location).
2. Burn Boss/Firing Boss, Pilot, and PSD Operator hold briefing on project explaining it in detail, i.e., specific duties of each person, escape routes, communication plan, map orientation, flight paths or patterns, and emergency procedures.
3. Address all safety aspects in conjunction with #2 above (fire shelters, fire behavior, helicopter safety, and personnel protective equipment).
4. Helicopter Manager conduct operational and safety procedures briefing concerning helicopter and Sphere Dispenser.

NOTE - The Helicopter Manager, Helibase Manager and Dispenser Operator can be one in the same person.

5. Every person involved in the project will know exactly why, when, where, and what they are to do and how they are to do it.
6. Make an orientation flight with necessary project overhead. On multiple day burns, orientation flight may be waived after first day's operation if there will be no significant changes. This decision will be made jointly by the Burn Boss/Firing Boss, Helicopter Manager, and pilot.

OPERATIONAL SEQUENCE (CONT.)

Orientation flight will include:

- a. Recon of burn site.
 - b. Flight routes and ignition patterns.
 - c. Identification of local hazards.
 - d. Personnel and equipment locations during the burn.
 - e. Locations of project helispots and landing areas (see map)
 - f. Make practice landings at project helispots if pilot feels it is necessary.
7. Begin shuttle of personnel and equipment from helibase to project helispot(s), as necessary. Helicopter will return to base helibase and shut down when shuttle is completed giving ground personnel time to get into position and to mount the sphere dispenser.
8. Filling of Plastic Sphere Dispenser with Glycol will be done at least 25 feet from aircraft. Dispenser will then be installed in helicopter and dispenser operation checked on ground. (see attached "Aerial Ignition Check") NOTE - All spent balls will be secured and disposed of in a safe manner.
9. Ignition will begin under close direction of the Burn Boss/ Firing Boss. The Burn Boss/Firing Boss will have direct communication with pilot and ground forces at all times (see communication plan).
10. When ignition is completed, helicopter will return to helibase and shut down.
11. Post burn briefing/critique will be conducted by Burn Boss/Firing Boss and Helicopter Manager.

OPERATION AND SAFETY PLAN

HELIBASE OPERATON

Qualified personnel will fill all mandatory positions at the helibase. (see organization chart). All air operations will be in compliance with R-4 standards.

Helibase Operational Procedures

1. Helicopter fuel truck and all non-essential personnel will be staged 100 feet or more from helicopter landing area.
2. Fire protection will be provided by 2, 20lb fire extinguishers, one of which will be located in the immediate area of the helicopter landing pad.
 - a. For fires on the ground an engine or at a minimum one bladder bag full of water will be available.
 - b. In flight a 1 gallon canteen of water will be in the helicopter. This is in addition to the sphere dispensers built in fire extinguisher system.
 - c. In flight a fire shelter will be available for each person on the aircraft including the pilot.
3. Helicopter will not take off or land unless landing area is clear of all personnel. Once the helicopter is off the ground, personnel shall not move under the helicopter.
4. Helicopter takeoffs and landings will be directed by the Helicopter Manager.
5. Flight following of helicopter will be done by the Helibase Radio Operator, Helicopter Manager, or the Forest Dispatch Office. 15 minute maximum check-in required.
6. No one is allowed in the landing area except those authorized by the Helicopter Manager.
7. Except when actually involved in firing operations, the helicopter is under the control of the Helicopter Manager. As always, the pilot has the final say and shall not be pressured in any way to do something that s/he is not comfortable with.
8. Handling of spheres and glycol will be managed by a certified PSD operator.

HELIBASE OPERATION CONTINUED

Helibase Safety

1. Helibase/Helicopter Manager

a. The Helibase/Helicopter Manager is directly responsible for helibase safety. This includes the following:

(1) All personnel clear of the landing area during all takeoffs and landings.

(2) All helibase personnel are properly equipped with safety clothing. This includes:

(a) Helmet (SP-4) or hardhats with chin straps.

(b) Hearing protection.

(c) Safety goggles.

(d) Nomex clothing.

(e) Leather gloves.

(3) Fire extinguishers, evacuation kit and crash rescue kit will be positioned for immediate access and use.

(4) A hazard map is posted and all personnel, including the pilot will be briefed on any hazards in the area.

CRASH RESCUE PLAN

In the event of an accident during the project, the Helibase Radio operator will coordinate the crash rescue activities. Specific crash rescue duties will be assigned to helibase personnel each morning before flights of any kind. Crash rescue and first-aid equipment will be located in close proximity to the helipad and its location made known to all helibase personnel. The Dispatch Office will coordinate any additional support needs.

* It is the Helicopter Managers responsibility, the day of the burn, to ensure that dispatch know exactly where to obtain a Life Flight helicopter or something comparable on a moments notice.

EQUIPMENT AND PERSONNEL LIST

HELIBASE MANAGER/PSD OPERATOR UNITS WILL PROVIDE

- | | |
|-------------------------|---------------------------|
| -PSD Machine & Operator | -Glycol |
| -PPE | -Plastic Spheres |
| -Radios for Air Ops | -Hazard Map showing |
| -Helitack Personnel & | local aerial hazards |
| Transportation | -Map showing helispot and |
| | helibase location |

COMMUNICATION PLAN

- * The air to ground radio frequency for this project will be _____. This frequency will be used for communication between the pilot, Burn Boss, Lighting Boss and helibase during ignition operations. This frequency will be used for flight following during ignition operations and tactical coordination between ground personnel and the aircraft.
- * Flight following for any flights other than ignition operations will be done on Forest Net simplex, frequency _____, or Forest Net repeat, frequency _____, tone _.
- * _____ Dispatch will be staffed during entire operation.
- * Communication will be established between Burn Boss/Firing Boss, Helicopter Manager, Helibase Radio Operator and _____ Dispatch prior to start of operations on Forest Net repeat, frequency _____, tone _.
- * All communications will be checked prior to start of operation and rechecked before ignition operations commence.

SIMPLEX FREQUENCY	AIR TO GROUND FREQUENCY
_____ TX _____ RX	_____ TX _____ RX
Holding Boss and holding crew	Pilot and Dispenser Operator
Burn Boss/Firing Boss	Burn Boss/Firing Boss
*Helibase Radio Operator	*Helibase Radio operator

REPEAT FREQUENCY	
_____ TX _____ RX	
_____ Dispatch	*Monitors designated Forest Freq. _____ & designated Air to Ground Freq. _____.

PLASTIC SPHERE DISPENSER CHECKLIST

The helicopter operations on this project require the use of the "Plastic Sphere Dispenser Checklist", contained in FSH 5709.12 (sec.45.43) If all items are not checked as satisfactory the flying operation will be aborted.

The checklist shall be updated daily as necessary.

A. SAFETY

1. Qualified Helibase Manager assigned.....| |
2. Helibase/Helispot meets established standards.....| |
3. Organizational chart posted.....| |
4. Communications plan posted. Frequency assignments known.....| |
5. Helibase/Helispot fire protection meets established standards.....| |
6. Crash rescue/evacuation kits on the Helibase/Helispot.....| |
7. Emergency plan posted/discussed.....| |
8. All personnel briefed and assignments known.....| |
9. Separation of aircraft provided (if more than one used).....| |
10. Personal protective equipment meets established standards.....| |
11. Air Hazard Map posted/hazards known to pilot(s).....| |
12. Weather considerations known/discussed.....| |

B. Aircraft/Pilots

- 1. Pilot and aircraft approved for mission.....| |
- 2. Pilot duty limitations status satisfactory.....| |
- 3. Load calculations prepared and posted.....| |
- 4. Aircraft radios functioning..... | |
- 5. Electrical/mechanical releases functioning.....| |

C. Dispenser

- 1. Installation as instructed with restraints in place.....| |
- 2. Mechanical operation satisfactory.....| |
- 3. Extinguishing system filled and operational.....| |
- 4. Glycol reservoir filled and tightly capped..... | |
- 5. 20-second ignition delay achieved.....| |
- 6. Intercom operable.....| |
- 7. Pilot has been briefed and agrees that all is in order.....| |
- 8. Sphere container secured in place.....| |
- 9. Knife available for emergency use.....| |
- 10. Additional container of water available.....| |

D. Support Equipment/Personnel

- 1. Adequate support equipment/personnel to complete mission.....| |
- 2. Pump/engine operational checks complete.....| |
- 3. Radios/communications operational check.....| |
- 4. Support equipment/personnel prepositioned before actual operations begin.....| |
- 5. Adequate supply of plastic spheres and glycol to complete project...| |
- 6. Plastic Sphere Dispenser Checklist completed.....| |

CERTIFICATION - All items of the Plastic Sphere Dispenser Checklist have been accomplished.

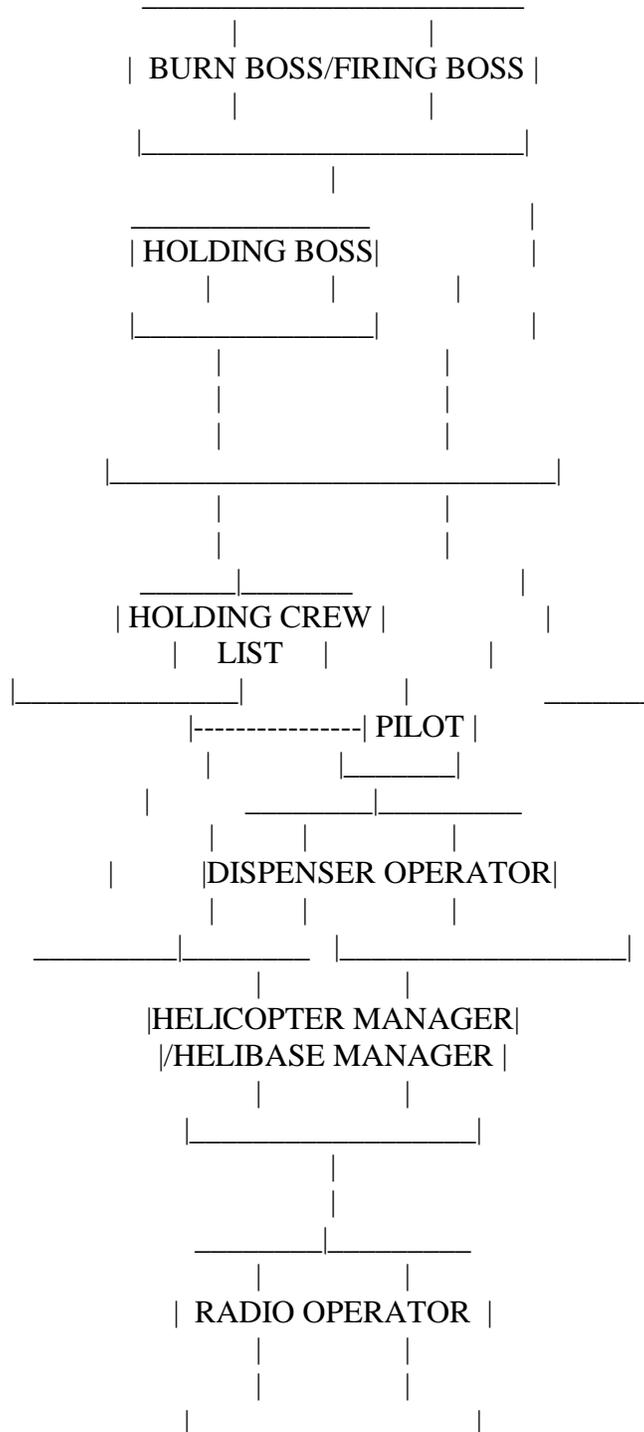
Helibase Manager _____

Burn Boss/Firing Boss

Date _____

Date _____

ORGANIZATION CHART



POTASSIUM PERMANGANATE

Fire & explosion hazards:

1. Heat
2. Concentrated acids (explosive with sulphuric acid)
3. Hydrogen peroxide (may be explosive)
4. Reducing agents (ferrous salts, oxalates, iodides)
5. Organic substances ?
6. Metallic powders, phosphorus, carbon, sulphur, hydrazine, metal hydrides, alcohol
7. Ethylene glycol
8. Charcoal
9. Hyposulfites & hypophosphates

AVOID:

1. Contact with actual material or dust from it
2. Inhalation of fumes from burning material and plastic

FIRST AID:

1. Eye contact - flush with running water 15 min including under eyelids
2. Skin contact - remove contaminated clothing, wash exposed areas with soap and water
3. Inhalation - move to fresh air, restore/support breathing
4. Ingestion - dilute with 2 glasses water or milk, induce vomiting or gastric lavage. Lemon or orange juice are good.

ETHYLENE GLYCOL

1. Strong oxidizing materials
2. Flash point 240 F - autoignition 740 F
3. When heated or misted, may be fire or explosion hazard
4. Lethal ingestion at 3-4 ounces
5. Sub-lethal symptoms - lack of appetite, spasmodic motion of eye, dizziness, abdominal pain, respiratory arrest, cardiovascular collapse.
6. May be absorbed thru the skin

AVOID:

1. Breathing mists
2. Ingestion
3. Prolonged skin contact

FIRST AID:

1. Eye contact - wash with running water for 15 minutes
2. Skin contact - rinse with water, then use soap & water
3. Inhalation - move victim to fresh air, restore breathing
4. Ingestion - give 3 glasses milk or water and induce vomiting at once! Gastric lavage recommended, support breathing

PROJECT AVIATION SAFETY PLAN
K1 and K3 HELITORCH RX FIRE
SISKIYOU ZONE
Applegate and Ashland RD

SUPERVISION: The project will have an Aviation Safety Officer, and qualified personnel performing the duties of Helicopter Manager, Helitorch Manager, Parking Tender, and Mix Master during the appropriate phases of project.

AVIATION POSITIONS ROLES AND RESPONSIBILITIES: Project aviation safety officer is responsible for the safety planning, coordination, implementation, followup and critique of aviation activities associated with the project.

Helicopter Manager is responsible for contract administration and coordinating tactical or logistical helicopter missions for the project.

Helitorch Manager is responsible for identification of safety requirements for helitorch crew including PPE and pilot, ensures positive hook-up and operation of torch apparatus, checks static bonding in mixing area and helicopter.

Parking Tender directs pilot during landings and takeoffs. Insures all personnel are clear of safety circle during take-off and landings.

Mix Master supervises mixing, filling and/or loading of mixed barrels. Follows grounding procedures. Determines proper amount of gelling agent to add to fuel. Monitors fuel consistency.

PROJECT NAME, AND OBJECTIVES: K1 and K3 Prescribed Burning Project. The objective is to apply aerial ignition to approximately 200 acres of knobcone pine, and 400 acres of brush (green leaf and white leaf manzanita, ceanothus, silk tassel), canyon live and scattered white oak and grass. Prescriptions will stipulate a mosaic of intensities resulting from ignition patterns and rapidity specific to various vegetation types. Location of Rx fire is within the K1 and K3 project area boundaries of the Applegate Ranger District, Rogue River National Forest. The area to be burned has no road access. Equipment may be delivered via external load (long line may be required) to the top of the burn area near K1. Road access is limited to Kinney Creek. The project area is roadless. The equipment delivered by external load will also need to be retrieved, after the burn is completed. All external loads will be managed by qualified agency personnel. The Burn Boss and Igniting Boss may request an aerial recon in the helicopter prior to beginning the burn and during the operation (helitorch removed), if a better view is needed.

JUSTIFICATION: Fire will be reintroduced into the K1 and K3 ecosystem with the objective of maintaining the compliment of fire dependent species. Additionally, decadent shrubs that are prescribed burned will respond and rejuvenate with new growth, improving wildlife forage and shrub palatability. Aerial ignition will be utilized on the steep, rocky areas where shrubs and knob cone pine is to be prescribed burned. Areas with pockets or concentrations of conifers or older white/black oak will not be purposely ignited. Ignitions will take place on the upper and middle third of south facing slopes above Kinney Creek. Steepness of slopes and density of vegetation make hand ignition near impossible under the required prescribed live and dead fuel moisture conditions. For those areas dominated by shrubs, rapid ignition will be necessary. Aerial ignition will be the safest and most cost effective way to achieve the desired objectives for this area.

PROJECT DATES: Exact date(s) will vary, due to the following:

- * Weather/atmospheric conditions which will allow objectives to be met, while preventing smoke intrusions into sensitive area or the smoke mgt "designated area", of the Rogue Valley.
- * Live and dead fuel moistures within project areas (dominated by south facing slopes) as compared to north facing slopes/divide and their fuel moisture conditions.
- * Availability of the contract heli-torch unit and personnel.
- * Availability of Project Aviation Officer, Helicopter Manager, Burn Boss, Igniting Boss, Holding Boss, Helitorch Manager, Mix Master, Parking Tender.

Estimated Date: Up to, two days, between Late Feb 1998 and March 1998 depending on how this winter's weather materializes with El Nino.

PROJECT LOCATION: The project location will be within the K1 and the K3 prescribed burn area which is above and north of Kinney Creek primarily on south facing slopes, on the Applegate Ranger District, Rogue River National Forest. The K1 and K3 Rx fire projects are 21 air miles, at 219 degrees from true north from Medford, OR. Closest road mileage to the project sites is 7 miles from the Applegate Ranger Station. The legal description of the K1 and K3 prescribed burn is T40S, R4W, southern portions of sections 10 and 11 (Lat: 42 degrees, 6.3 minutes. Long: 123 degrees, 9.5 minutes).

- * The primary helispot will be located on Road 1090 (Kinney Creek Road) on top of the ridge in T40S, R4W, Sec 14, SWSW 1/4.
- * An alternate helispot is located on the 1090800 road at T40S, R4W, Sec 14, SE 1/4.
- * An emergency medivac helispot is located at the primary helispot described above.
- * A secondary emergency medivac helispot is located at a rock quarry and on the 1090 Kinney Creek road, located at T40S, R4W, Sec 13, SENW 1/4.

PROJECTED COSTS OF AVIATION RESOURCES: Qualified agency personnel will perform mixing and filling and manipulation of torch barrels. Helicopter and helitorch will be contracted. Up to 15 hours of flight time are estimated for the project over a 2 day period, including ferry time, recon, prepositioning of equipment on the unit, and removal of equipment after mop-up/patrol is completed, at a cost of \$575/hour. Aerial porta-tank at \$150 day. Aluma gel at \$3.75 a gal. Service truck at \$0.25 a mile. Batch truck and operator will be committed up to 2 days, at a cost of \$500/day. Total cost of the aviation services will be about \$16,000 including FS aviation personnel needed to manage the aerial operation as well as personnel for the prescribed fire holding or patrol.

AIRCRAFT AND BATCH TRUCK: Greyback Aviation, Hughes 500E, Simplex 5400 heli-torch with 50 gal. tank. Other approved helicopters and support equipment can be used if this vendor is not available. The Rogue River National Forest has chosen to utilize the regional call when needed contract to supply the aircraft and batch mixer in support of helitorch operations on the unit. This procurement is based on the availability of agency personnel trained in mixing of chemicals and knowledge in heli-torch operations meeting regional direction, agency qualifications and aerial ignition handbook procedures.

PILOT: Lee Wise, of Greyback Aviation, is the carded pilot that would fly the helitorch project.

PARTICIPANTS: Aside from contractor personnel, the Forest Service will supply a Helicopter Manager, Helitorch Manager, Mix Master, Parking Tender, a Burn Boss (RXB1), Igniting Boss, Holding Boss, a Model 30 engine with 2 persons, and a Prescribed Fire Manager (RXM1). The RXB1 and Igniting Boss will be the only agency person to fly in the aircraft, for recon purposes only. Recon will not take place with sling or heli-torch attached.

PUBLIC SAFETY & TRAFFIC HAZARDS: Road access to K1 and K3 burn areas (Kinney Creek area and road 1090) will be blocked, signed and closed to public access during the prescribed burning phase of the operation.

FLIGHT FOLLOWING, SEARCH AND RESCUE: Flight following will be done by the helicopter manager during the application. MFC dispatch will flight follow during the ferry flights. The helicopter manager will be provided with flight package to include maps and radio frequencies. Flight following check-ins will be done on 15 minute intervals. Initial flight following from helicopter contractors helibase to project area will be through Medford Fire Center. Flight following at project site will be through the project helibase. If the check-in is not received within the following 15 minutes, the Aircraft Crash, Search and Rescue Guide will be activated (see Forest Aviation Plan).

AERIAL HAZARD ANALYSIS

PHASE	HAZARD/RISK ID	RISK	CONTROL OPTIONS	
			ASSESSMENT	RISK
Recon	Flight below 500' AGL	MOD.	Conduct high level recon prior to descent. Advise Mgr of location, departures and arrivals. Safety briefing. All operations conform to IHOG. Flight below 500' AGL will be at the discretion of the pilot.	LOW
			Safety briefing. All operations conform to IHOG standards.
	Chemical exposure	MOD.	Have qualified personnel do all mixing of gasoline and thickening agent.	... LOW
Helibase Ops.	Carrying of heavy drums	MOD.	Have qualified personnel operate batch truck to load single barrel remaining on helitorch.	... LOW
			Safety briefing. All operations conform to IHOG standards.
Burning Ops. & External Loads	Low Alt. Tree Tops Steep Slopes Visibility	Very High	Conduct mid level recon of all units, noting hazards on project map, prior to burning. Minimum application ht. 50' above tree tops. Flight paths to contour the slopes. Maintain VFR conditions, avoid smoke, egress & advise mgr. Advise mgr. of any changes to plans (set-downs, moves to other units; to accommodate prescribed burn needs)	HIGH
			
			
			
			
			
			
	Long Line	MOD.	Abide with established safety procedures, validated radio-contact and pilot briefing.	LOW-MOD
	Personnel	MOD.	Provide good briefing and direction. Manage aircraft.	... LOW
	Public	LOW	Sign and block access roads	. LOW.
	Hazards Map	MOD	Review hazard map for currency. Update if needed. Brief aviation personnel of changes.LOW

PROTECTIVE CLOTHING/EQUIPMENT: Normal personal protective clothing required for the contract will be worn by the pilot. Protective clothing (NOMEX) flight suits and minimum 8" top leather boots shall be worn by agency passengers. The helicopter mgr. shall provide flight gloves and a flight helmet with communication capability. Mixing personnel shall wear cotton clothing, use cotton gloves, in addition to eye protection, hard hat with chin strap and dust mask.

LOAD CALCULATIONS, WEIGHT, AND BALANCE: The load calculations, weight, and balance limits will be confirmed during the pre-project briefing. The pilot and helicopter mgr. are responsible for the proper loading of the helicopter.

COMMUNICATION PLAN:

- * ground to air #1- 169.975 (Rogue River N.F. south direct).
- * ground to air #2- 170.500 (Rogue River N.F. project).
- * Flight following from Grayback Forestry Contractors helibase to until arrival to project area - 169.975 (Rogue River N.F. south direct) thru Medford Fire Center.
- * Flight following at project area- 169.975 (Rogue River N.F. south direct)

Discrete Frequency for communications with the Burn Boss, Igniting Boss, Helicopter Manager and Pilot will be established and understood before project implementation.

Helicopter manager monitors both frequencies (169.975 and 170.500)

There is the possibility that helicopter logging may be taking place within 2air miles from the project area. If this is the case the helicopter pilot will be advised to establish radio contact with other helicopters in the area, using VHF-AM Frequencies for aircraft separation and coordination. Project Aviation Safety Officer will brief the pilot and provide frequencies to make contact.

MILITARY TRAINING ROUTES: There is a military training route southeast of the project area approximately 11 air miles.

s/ 2/6/97
Line Officer Signature & Date

s/ 2/6/97
Project Aviation Officer Signature & Date

s/ 2/6/97
Helicopter Mgr/Siskiyou Zone Aviation Officer Signature & Dates/

S/ 2/6/97
Forest Aviation Officer Signature & Date

Approved by

DISTRICT RANGER Date

AIR OPERATIONS/SAFETY PLAN

HELITORCH MODULE

REQUIREMENTS, RESTRICTIONS, AND APPROVALS

- A. The helicopter and Pilot must be carded for helitorch use in accordance with the Interagency Helicopter Rappel Guide (IHOG).
- B. Pilots and ground personnel accomplishing the mixing, loading, and application of the gelled fuel shall receive special training and be properly designated to perform helitorch operations.
- C. All personnel involved in the project will be thoroughly briefed in helicopter safety and the helitorch operation on the morning of the burn prior to flights of any kind. Substitution of module personnel is acceptable.
- D. All elements of the helitorch module will be certified by the R-4 Helicopter Specialist in writing. Positions requiring written certification are, the Helitorch Manager, and the Parking Tender. The helitorch must be built or modified to current standards identified in the Aerial Ignition Guide. Provide additional Radio Operators, Mixing Crew, and Crash/Rescue personnel as necessary to accomplish the mission safely.
- E. All helitorch/helicopter operations will be conducted in accordance with current FSM 5700, IHOG, and Aerial Ignition Guide direction, R-4 guidelines, and Washington Office directives concerning helitorch operations.
 - 1. Hover hook-ups are not authorized.
 - 2. Only the Pilot shall be allowed in the helicopter during actual operations.
- F. A job hazard analysis shall be completed for each helitorch operation and attached to the burn plan.

G. A discrete radio frequency is required for any helitorch operation. This can be obtained thru your local dispatch office.

H. The helitorch fuel mixing operation will be done in accordance with Aerial Ignition Guide procedures and standards regarding handling, mixing, transportation, and storage of the fuel.

OPERATION AND SAFETY PLAN

A. TRAINING (prior to burn)

1. Assemble helitorch module personnel and equipment.
2. Conduct training and review session on helitorch, assuring that all necessary equipment and supplies are available and in proper working order for day of burn and that all personnel are thoroughly familiar with operational procedures and equipment maintenance.

B. DAY PRIOR TO BURN (or early morning on day of burn)

1. Deliver necessary equipment and supplies to project helibase.
2. Set up helibase, i.e., landing area, wind indicator, parking area, mixing area, personnel area, etc.

C. DAY OF BURN (following items done daily on multiple day projects)

1. Deliver all personnel and equipment to project helibase (see map for helibase location).
2. Burning boss to hold briefing on project explaining it in detail, i.e., specific duties of each person, escape routes, communication plan, map orientation, flight paths and patterns, emergency procedures, etc. All flight hazards will be reviewed and hazard map discussed.
3. Address all safety aspects in conjunction with #2 above (fire shelter demonstration, hazard of contacting ignited alumagel, etc.).
4. Helitorch Manager conduct operational and safety procedures meeting with all personnel concerning helicopter and helitorch operations and safety.
5. At this point every person involved in the project will know exactly what, when, where, and why they are supposed to do and how they are supposed to do it.
6. Make an orientation flight with burning boss and other necessary project overhead (these people will be determined by Burning Boss, Helitorch Manager, and Pilot). On multiple day burns, orientation flight may be waived after first day's operation if there will be no significant changes. This decision will be made jointly by the Burn Boss, Helitorch Manager, and Pilot.

OPERATIONAL SEQUENCE (Cont.)

Orientation flight will include:

- a. Recon of burn site.
- b. Flight patterns (ignition patterns).
- c. Local hazards identification.
- d. Personnel and equipment locations during duration of burn.
- e. Locations of project helispots and landing areas (see maps and photos). Helispots must meet agency standards.
- f. Make landings at project helispots if Pilot feels it is necessary.
- g. Review size, shape, number, and location of burn areas.

7. Mixing of helitorch fuel and hookup of helitorch will be done and helitorch operation will be checked on ground.

8. Burning Boss will radio to helibase when he/she is ready for ignition to begin. All radio communication will be re-checked.

9. Helitorch operation will begin under close direction of Burning Boss who will be in a position for clear viewing of the firing operation. If no adequate vantage points are available at the project area(s), it may be necessary to use another aircraft as a vantage point. Burning Boss will be in direct radio contact with Pilot and ground forces at all times (see communication plan).

10. When ignition is completed, helicopter will return to helibase and shut down. Helitorch will be disconnected and helicopter readied for support or demobe operation.

11. Demobe of personnel and equipment from project will begin when Burning Boss determines it to be safe.

12. Post operational safety briefing will be conducted by Burning Boss and Helitorch Manager.

HELITORCH BASE OPERATION

All mandatory positions at the helibase will be filled by qualified personnel. All air operations will be in compliance with R-4 standards.

The helitorch fuel mixing operation will be done at the helibase in accordance with Aerial Ignition Guide standards regarding handling, mixing, transportation, and storage of the fuel.

Helibase Operational Procedures

1. Fuel truck and mix area will be outside of safety circle - truck and tanks, etc., 50 feet or more from helicopter landing area.
2. Position foam-equipped engines away from fuel truck, mixing area, and clear of helicopter approach/departure path. Engines must be equipped with foam approved for extinguishing petroleum fires.
3. Helicopter will not take off or land unless landing area is clear of all personnel. **ONCE THE HELICOPTER IS OFF THE GROUND, PERSONNEL SHALL NOT MOVE UNDER THE HELICOPTER.**
4. Helicopter takeoffs and landings will be directed by the Parking Tender who will be in direct radio contact with the Pilot on a discrete frequency (see Communication Plan.)
5. Unloading/loading crew will clear landing area perimeter immediately after completion of loading and will not enter landing area except when signaled to do so by the Parking Tender who will be in constant radio contact with the Pilot.
 - a. The helitorch shall be positioned in front of the helicopter, at right angles to the long axis of the helicopter with the nozzle end on the Pilot's side, for hookup and liftoff.
 - b. If cables tangle or other problems occur requiring adjustment of the helitorch or its suspension system, the helicopter Pilot shall be instructed to land or jettison the helitorch. The helitorch shall not be flown over persons on the ground at any time.
 - c. All mix barrels being used will be grounded at all times except when being transported.

- d. Fuel truck driver will pump all gasoline and record quantity used in each barrel or other type of tank used.
 - e. Spare barrels will be stored away from the mixing area and outside of safety circle.
 - f. Fire extinguishers will be manned at all times during mixing and loading of fuel.
6. No one is allowed in the mixing or landing area except those authorized by the Helitorch Manager.
7. Except when actually involved in firing operations, the helicopter is under the control of the Helitorch Manager. As always, the Pilot has the final say and shall not be pressured in any way to do something that he/she is not comfortable with.

Mixing Safety

1. Mixmaster Manager is in direct control of mixing operations. This position is directly supervised by the Helitorch Manager.
2. The Mixmaster sees that:
 - a. Tanks are grounded at all times except when being transported.
 - b. Gasoline-gel quantities are exact.
 - c. Gasoline nozzle is completely shut off before removal from tank being filled.
 - d. Fire extinguisher and operator are properly placed and on standby at all times.
3. Mix Crew - Only the number of people necessary to conduct mixing and transporting functions will be in the mixing and helitorch area.
4. Helitorch Manager - Individual designated for the purpose of doing work (maintenance) on the helitorch. This position will be filled by the person from the module with the most expertise in this area. No more than two people shall work on the helitorch at one time with the exception of the R.O. Helicopter Specialist who will assist with any helitorch work as needed.

5. General

- a. All members of the mixing-transporting job will wear safety clothing consisting of hardhat with chin strap, cotton coveralls, hearing protectors, safety goggles, dust mask, gloves, and field boots at all times while engaged in the mixing-transporting operation. No nylon or synthetic fabric will be worn by the mixing crew due to the possibility of static electricity discharge.
- b. The engine will be placed in a location that provides quick access to both the mixing area and the helicopter-helitorch area. Pre-laid hose may be used where appropriate.
- c. Escape routes will be established by the Helitorch Manager and all helibase personnel will know where to go and what to do in the event of an emergency.
- d. In the event that an accident/incident occurs, procedures outlined in the Crash Rescue Plan will be followed.

Helibase Safety

1. Helitorch Manager

- a. The Helitorch Manager is directly responsible for helipad safety. This includes:
 - (1) All personnel clear of the landing area during all takeoffs and landings.
 - (2) Mix crew is in the helitorch area only as long as required for loading and unloading torch.
 - (3) Through the mixmaster manager, the mixing operation is conducted safely.
 - (4) Assures that parking tender is equipped with a radio with headset, boom, or equivalent microphone, and remote key switch channeled to a discrete frequency guarded by the helicopter Pilot, the Burn Boss, the Helitorch Manager and no one else.
 - (5) Engine properly positioned to provide emergency service to both mixing and helicopter-helitorch functions.

(6) All helibase mixing crews are properly equipped with prescribed safety clothing. This includes:

- (a) Helmet (SP-4) or hardhats with chin straps
- (b) Hearing protection
- (c) Safety goggles
- (d) Dust masks
- (e) Cotton coveralls
- (f) Field boots
- (g) Gloves - Rubber coated cotton

(7) Fire extinguishers, evacuation kit and burn kit are positioned for immediate access and use.

(8) No nylon or other synthetic fabrics, due to static electricity, will be worn by helibase personnel involved in mixing operation.

EQUIPMENT AND PERSONNEL LIST

HELITORCH MODULE

UNITS WILL PROVIDE:

- | | |
|---|--|
| -All aerial ignition equipment | -Engine with Foam capabilities |
| -All PPE for Helitorch Module | -Personnel to support mixing operation, including personnel PPE |
| -Gelling Agent | -Bulk gasoline truck (if needed) |
| -Radios for flight following & helitorch operation. | -Maps showing helibase & helispot locations |
| -Batch Mixer | -Completed burn plan with attached aerial ignition operations/safety plan. |
| -Core Helitorch Module personnel | -Hazard map showing local aerial hazards. |
| -Module transportation | |
| -Crash rescue equipment | |
| -All helibase equipment | |
| -Three course Bar-B-Que'd lunch. | |

CRASH RESCUE PLAN

In the event of an accident during the project, the Helitorch Manager will supervise and coordinate the crash rescue activities. Specific crash rescue duties will be assigned to helibase personnel each morning before flights of any kind. Crash rescue and first-aid equipment will be located on or near the engine and the equipment's location made known to all helibase personnel. The standard Forest procedure will be used. The Forest Dispatch Office, who will be notified by the Helitorch Manager, will coordinate any additional support needed. In the event that an air evacuation is needed, assistance can be requested for Life Flight in Boise, phone number 1-800-521-2444 or through the state emergency communication center at phone number 1-800-632-8000.

COMMUNICATION PLAN

- * There will be a separate discrete frequency used for communication between the Pilot, Burn Boss, Parking Tender, and Helitorch Manger during helitorch operation. In the event of multiple helitorch operations, additional discrete frequencies will need to be assigned.
- * Flight following will be done on-site during helitorch operation.
- * NF Dispatch will be staffed during entire operation.
- * Communication will be established between Burn Boss, helibase, and Dispatch prior to start of operation (Freq.).
- * The discrete frequency used between the Pilot, Parking Tender and Burn Boss will be .
- * All communications will be checked prior to start of operation and rechecked just prior to start of helitorch operation.
- * Helibase and Burn Boss will monitor both frequencies.
- * There will be no other radio traffic on the discrete frequency used on the project.

Discrete Frequency _____ _____	Dispatch
Burn Boss _____ Boss _____	Burn
Parking Tender _____ Crew _____	Ground Holding
Pilot _____ Operator _____	Helibase Radio
* Helibase Radio Operator _____ _____	Holding Boss
* Helitorch Manager _____	

* Monitors Both Frequencies

HELICOPTER OPERATIONS

The helicopter operations undertaken on this project will require the use of the check lists contained in the Aerial Ignition Guide, formerly FSH 5709.12 (sec. 45 32c, 45 35a)

If any box on the right-hand column is unchecked (item not accomplished) the entire flying operation will be aborted.

A check mark inside the box on the right-hand column means all facets of the required statement are accomplished.

The check list shall be updated daily as necessary.

HELITORCH OPERATIONS CHECK LIST

A Helitorch Operations Check list shall be completed prior to each day's operation.

A. Organization

1. Helitack organization chart has been prepared and posted showing responsibility for functions by name.....| |
2. All Helitack positions are filled by qualified personnel.....| |
3. Pilot and aircraft agency approval cards checked.....| |
4. Helitorch module certified by Regional Helicopter Specialist....| |

B. Helibase Operations

1. Helibase Manger.....| |
 - a. Has established separate radio frequencies as designated on Communications Plan.....| |
 - b. Communications tested and operational.....| |
 - c. Briefings - to include as a minimum all required helitack personnel, key firing personnel, and helitorch Pilot.....| |
 - (1) Overhead responsibilities and authorities.....| |
 - (2) Flight routes-include jettisoning torch considerations | |
 - (3) Area flight hazards.....| |
 - (4) Radio frequency assignments.....| |
 - (5) Personnel assignments.....| |
 - (6) Emergency procedures with torch, man extinguisher.....| |
 - (7) Helibase emergency fire suppression procedures, medivac, foam/extinguisher..... | |

* NOTE: All personnel will be briefed on the adherency of alumagel and the hazards from coming into contact with it.....| |

C. Mixing Area

1. Separate from other helibase activities.....||
2. Traffic control.....||
 - (a) Ground Vehicles, (b) Personnel, (c) Aircraft
3. Helitorch fuel supply. Available and properly located, static grounding measures.....|
4. Fire suppression equipment available..... ||
 - Equipment operational.....||
 - Personnel available and briefed.....||
5. Personnel assignments.....|
6. Emergency procedures with helitorch, manning extinguishers.....||
7. Emergency fire suppression procedures, medivac, foam/ extinguisher.....|

D. Landing Area

1. Located where safe approach and departure paths exist, and separate from other helibase activities.....||
2. Free from flight hazards within the landing area.....||
3. Traffic control of (1) ground vehicles, (2) personnel, and (3) aircraft.....||
4. Dust abatement measures taken.....|
5. Helicopter fuel truck security - parking area and driving route designated, located away from flight routes, landing areas, and personnel. Static grounding measures required.....||
6. Helitorch loading procedures-briefed and personnel assignments. ||
7. Fire suppression equipment available and operational.....|
8. Fire suppression personnel available and briefed.....|

E. Crash Rescue Plan

- 1. Follows Crash Rescue Plan.....| |
- 2. Base helibase crash rescue personnel assigned.....| |
- 3. Posted at helibase and Dispatch Office.....| |
- 4. Map showing flight routes, helitorch area, flight hazards, and ground access routes - posted on a bulletin board.....| |

F. Orientation flight completed.....| |

G. Go/No-Go check list completed.....| |

CERTIFICATION - All items of the Helitorch Operations Check list have been accomplished.

Helibase Manger _____

Burn Boss

Date:_____

Date:_____

HELITORCH DATA SHEET

Agency	Project Acres	
Region/State	No.	Acres to be treated
Forest/District	No.	Total Tons/Acre
District/Area	No.	Tons to be Consumed
Project/Sale Name	NFDRS Fuel Type	

FUELS AND WEATHER DESCRIPTION

Slash age (yrs)	Aspect	Slope
Veg. Type % Green	Elevation	Cloud Cover(%)
Timber Species	Wind Speed	Direction
Relative Humidity	Fuel Moisture	Temperature

Activity (Circle One)

Broadcast Machine Pile Hand Pile Wind Row Burn Out (Wildfire)

AERIAL INFORMATION

Flight time, helibase to project (min) Lbs. of Fuel Thickener Used

Flight time, round trip (min) Gals. of Gasoline Used

Total Flight Time (Project) Mixing Ratio (lbs per gallon)

Airspeed mph Results: Poor Fair Excellent

Drop Height

Remarks:

FIRETROL FIREGEL

1. Explosive only as dust in high concentrations in presence of spark or open flame.
2. Releases carbon dioxide and carbon monoxide when burned
3. May react to strong acids and oxidizers

AVOID:

1. Skin and eye contact - WEAR GOGGLES AND RUBBER GLOVES
2. Inhalation - WEAR OSHA APPROVED DUST MASK
3. Ingestion

FIRST AID:

1. Eye contact - Flush with water for 15 minutes- call physician
2. Skin contact - Wash with soap and water
3. Inhalation - Move to fresh air
4. Ingestion - Call physician immediately

GASOLINE

1. Extremely flammable
2. May be ignited by static electricity
3. Contact with oxidizing agents such as chlorine, permanganates, and dichromates may cause fire or explosion.
4. Some ingredients are known carcinogens and gasoline itself is suspect.

AVOID:

1. Contact on skin or eyes
2. Inhalation of vapors
3. Ingestion

FIRST AID:

1. Eye contact - move to fresh air, flush with clean water
2. Skin contact - remove contaminated clothing, wash with soap and water.
3. Inhalation - move to fresh air, support breathing as needed.
Oxygen should be administered by qualified personnel.
4. Ingestion - Do not induce vomiting or give anything by mouth.
If victim is drowsy or unconscious, place on left side with head down. Physician should call (800)356-3129 - Los Angeles Poison Information Center.

PROPANE

1. Highly flammable - boils at -44 F
2. If container is exposed to high heat source, cool with water.
If no water available, evacuate area.

AVOID:

1. Direct contact with skin or eyes

