9. TIMBER HARVESTING

In the past, the timber harvesting industry has been responsible for many forest fires including some of the most devastating and costly in American history. Over the years, through the school of hard knocks, the record has been significantly improved. Considering the fact that the timber industry is operating continuously in a highly vulnerable environment, timber harvesting operations cause remarkably few wildfires. Industry personnel suppress most of those fires before the public agency forces arrive. This kind of record cannot, however, be maintained without continuous effort on the part of both the industry and the fire agencies.

With few exceptions, fires caused by timber harvesting operations are the result of ignorance or carelessness. The fully informed and conscientious operator or employee will not willfully risk a fire. Too much is at stake. On the other hand, new or poorly trained employees can unknowingly cause fires. This section also confronts the possibility that veterans in the industry can fall prey to the old saying, “familiarity breeds contempt”, or can be distracted by personal problems or outside influences.

This chapter will present some of the more important fire safety information for the timber harvesting industry. Included is material on machinery, procedure, personal habits, and special areas.

9.1 Chain Saws

- ***PRC §4431 (Gasoline powersaw clearance and tools required).***
- ***PRC §4442 (Spark arresters required).***
- ***36CFR §261.52 (Spark arresters required on National Forest land).***

In the past, chain saws were among the most dangerous machinery in the woods. A modern saw in the hands of a skilled operator will seldom cause a fire. Many older saws were poorly designed and under-powered. Unfortunately, some of them are still around. Design features included discharging the exhaust into the saw cut, or sawdust, fuel filler cap directly above the exhaust system, lack of or poorly designed spark arresters, etc. Under powering led to overheating. In the past, saw operators were either not trained or not required to refuel in cleared areas, keep spark arresters clean and in place, or carry firefighting tools and equipment.

The time of greatest fire danger with regard to a chain saw is during refueling. The saw should always be set firmly in position within an area cleared of all flammables down to mineral soil for a radius of 10 feet. The engine should be stopped and allowed to cool while chain oil is being replenished. The required fire tools (i.e., shovel and fire extinguisher) should be placed nearby. Care should be exercised to avoid spilling any fuel on the engine, especially on or near the exhaust port.

Photograph 9-1.
Refueling Chain Saw in Properly Cleared Area

The next most dangerous operation with a chain saw is cutting dead wood. Unless decomposition has started, the wood is harder than green wood; therefore, the saw has to work harder and both the chain and the engine can overheat. In addition, the sawdust is a highly flammable fine-sized fuel. It can quickly blow onto the engine and ignite. It will not necessarily stay there. Before the operator can notice it, glowing embers can fall off into sawdust or duff below.

The sharper the operator keeps his chain, the easier it will cut; therefore, less heating of both chain and motor will result. If the surface wood is punky the exhaust gases can ignite it. A careful fire watch should be kept on such an area for at least one hour following cutting.

The spark arrester should be checked for holes each time the saw is refueled. If the mesh is fine enough to meet legal standards (.023 in.), screen arresters work quite well when they and the engine are new. Worn engines produce more carbon than new ones, therefore, they tend to clog the screen rapidly.

The wire used to make the screen, though usually a high carbon steel, is necessarily fine. Thus it will burn out under continuous heavy use. In order to avoid excessive back pressure or the escape of carbon particles, these screen arresters require frequent inspection and servicing. They should be inspected for holes at each refueling and cleaned daily. Most professional sawyers carry a spare spark arrester screen to avoid costly shutdown during the day should the installed screen fail.

Photograph 9-2.
Burned Out Chainsaw Spark Arrester Screen

Photograph 9-3.
Chain Saw With Properly Attached Bumper Spike and Heat Shield

9.2 Choker Setting

Although they seldom use machinery, choker setters, like fallers, limbers and buckers, often work alone. Since they are more or less isolated they may be difficult to supervise. They work in areas where fires are most difficult to fight, away from roads with logs and slash on the ground. In addition,

they are generally less skilled and often younger than other wood workers. Some do not realize the fire risk they represent. This is cause for increased concern.

Self-discipline becomes paramount in such situations. Though most companies prohibit smoking in operating areas, and while various laws impose penalties for smoking at inappropriate times and places, (even for the improper discarding of tobacco products and matches), the risk will remain high unless self discipline can be emphasized.

9.3 Tractors, Skidders, Loaders, Etc.

- ***PRC §4428 (Fire tools required)***
- ***PRC §4442 (Spark arresters required)***

The heavy power equipment used in timber harvesting is fundamentally no different from that used by the construction and surface mining industries. Generally speaking, however, the hazards are greater since the logging machines are operating almost continuously over and through flammable forest fuels. Construction and mining equipment, on the other hand, is usually working in this hazardous environment only during the pioneering stages of a project or operation. Consequently manufacturers, distributors, owners and agency inspectors have devoted a great deal of attention to the reduction of the fire-starting potential of logging machines.

Photograph 9-4.
Log Skidder

Exhaust sparks may be a fire risk from logging machinery. This explains the requirement by state law and in most timber sale contracts for spark arresters on all exhaust stacks. This includes the main engine, starting, and other auxiliary internal combustion engines as well. Because the rapidly turning drive blades of a turbocharger tend to chew carbon particles into dust and thus act as an attrition spark arrester such turbochargers are usually accepted in lieu of spark arresters.

This practice should not be followed automatically. The exhaust systems on some older makes and models of engines may be designed so that only a portion of the exhaust gases pass through the turbocharger. The remainder is bypassed directly into the exhaust stack receiving no spark arresting treatment. These machines, even though turbocharged, must be equipped with spark arresters.

Photograph 9-5.
Turbocharger on Equipment

An adequate spark arrester is one which effectively removes carbon particles (sparks) large enough to ignite light fuels (e.g., dry grass, pine needles, or oak leaves) from the exhaust stream. It will only do this if it is the proper size and is properly installed (i.e., vertical or horizontal). Most arresters in use are of the retention type. This means they trap and retain carbon particles. When the trap becomes full, they completely lose their arresting capabilities, and no longer comply with legal or contract requirements. Therefore, the trap should be emptied regularly and often.

The spark arrester on a finely tuned engine should be cleaned every 30-40 operating hours. The proper way of doing this is to park the machine on a landing or other large cleared area. Next, remove the band or plug, start the engine and rev it up to blow out the carbon, shut down the engine, and replace the band or plug. It should be noted some units may require two spark arresters: one for the diesel engine and one for the gasoline starter engine.

Photograph 9-6.
Spark Arrester with Band Removed

OSHA regulations require most new equipment to be fitted with mufflers or silencers. Many older operators and owners are convinced an internal combustion engine cannot operate efficiently with both a muffler and a spark arrester affixed to the exhaust stack. They feel it may create too much back pressure. This is not necessarily so, provided the proper model and size of both is utilized. Many new machines come factory equipped this way. Older machines can be successfully retrofitted if properly engineered.

Photograph 9-7.
Machine Equipped with Both a Muffler and Spark Arrester

Another fire risk, particularly with log skidding equipment (e.g., tractors, chippers and rubber-tired skidders), is the collection of flammable trash inside the engine compartment, particularly on the exhaust manifold or in the belly pan. The danger of the former location is obvious.

Trash in the belly pan restricts cooling of crankcase oil, hydraulic fluid and engine cooling water. It also causes engine overheating. Additionally, it forms a fuel bed to which access for extinguishment of a fire ignited from any source is almost impossible. Such sources could include exhaust sparks, flaming or glowing material falling from the exhaust manifold, or electric short. For these reasons, machines designed for use in the logging industry by all manufacturers in recent years have had the engine compartments enclosed by plates and/or screens. These should always be kept in place while the machine is being operated.

Some operators and mechanics fail to replace said plates and/or screens after servicing or repairing equipment. This creates rather than solves problems. In fact, it would be a good practice to retrofit older machines with these screens.

Those machines which are not so equipped should have all trash removed from the engine compartment, especially the belly pan, regularly and often. Once a day or at every refueling is recommended.

Leakage in the exhaust system is another potential source of ignition of flammable material located either on or off the machine. Since no exhaust system is designed with leaks, this problem is primarily one of inadequate maintenance and repair. Leaks can develop from cracks, missing bolts, burned-out or rusted-out spots, etc.

Some exhaust systems include sections of flexible tubing. These are vulnerable to vibration and burning out. They should be checked regularly for leaks. Any exhaust system which leaks is in violation of the spark arrester laws and regulations.

Photograph 9-8.
Leaking Exhaust System

A source of fire ignition can be an electrical short. All such equipment has an electrical system, either for ignition on a gasoline-starter engine or for power supply to an electric-starter motor. The cables are subject to abrasion, vibration and corrosion and thus to shorts. The resulting arcing will most often ignite a fire on the machine itself, particularly if it has been allowed to accumulate flammable debris and/or oil or grease.

Once the machine catches fire, it becomes a threat to the surrounding forest. Therefore, electrical systems should be checked frequently for any signs of worn insulation, loose connections or corrosion. Also, the entire machine, not just the belly pan, should be kept clean of flammable debris.

As an additional safeguard, it has been suggested that a quick-operating master switch for opening the circuit be located within easy reach of the driver for use in an emergency. Similar protection could be provided by an automatic overload circuit breaker.

Less frequent, but not unknown, causes of fires in logging machinery include: overheated brakes on wheeled equipment, slipping belts, overheated bearings and bushings, sparks struck by track growzers or blades against stones, etc. Most of these, except the latter, can be avoided by good preventive maintenance programs. This will not only make the equipment more fire safe but also improve its efficiency and longevity. Blade and track sparks are difficult to prevent, thus require vigilance and rapid suppression action.

Every piece of mobile equipment used for yarding and loading logs should be equipped with a readily accessible fire extinguisher and is required to have a long-handle, round-point shovel for fire suppression. The extinguisher should be at least a 10-pound multipurpose (ABC) dry-powder type.

9.3a Feller/Hydro Bunchers

Timber harvesting methods of operation are rapidly changing. More and more portable processing equipment is being used to process the forest products at the site where obtained. This has created new fire risks and problems that there are no defined laws to handle.

One such process is the use of machinery that cuts and bunches smaller trees for processing into wood chips either for pulp or hog fuel. These machines are normally referred to as “feller/bunchers”. Although all of the machines pose the same risks of fires from the exhaust system, these type of machines bring their own unique fire risk problems.

Numerous fires have been documented from these types of machines with a saw, instead of a snipper. The saw causes a fire either through friction of cutting the tree off or the saw’s teeth hitting a rock unseen by the operator. Due to the high hydraulic pressure these machines operate under, fires can readily ignite when a leak occurs in the hydraulic system and comes into contact with the hot exhaust or engine. Some timber companies in northern California and Oregon have adopted conditions under which this type of machinery will be voluntarily shut down. (See Appendix E)

Because the weight of most mechanized harvesting equipment is less than some conventional types of equipment, they can pivot and turn more quickly than a bulldozer, creating sparks from the cleats when contacting rocks. When these sparks land in a receptive fuel bed, an ignition can occur.

Photograph 9-9.
Feller Buncher

Another risk which has been created is the process of chipping the material at the location obtained. If the operation is for clean chips for pulp, large piles of byproduct will be generated. These piles have been left behind for other processors to come in and further chip the remains for hog fuel. These piles left behind, which can exceed 10 feet in height and 100 feet in length, can ignite through spontaneous combustion. The Oregon Department of Forestry has done a study on this process. (See Appendix F) The Public Resources Code addresses fire prevention measures for mill wood waste, but the piles left over in the woods are still a wood by-product which the laws do not cover.

9.3b Manual/Automatic Fire Suppression Systems

Many models of heavy equipment have dry chemical fire suppression systems which are mounted inside the engine compartment. It is of significant importance that these models be inspected. There are three parts to the system: the firing mechanism, extinguisher, and the distribution system.

The firing mechanism consists of a nitrogen cartridge which can be visually checked for a manufacturing date stamped on the neck. If the date is over ten years old, the cartridge needs to be replaced. Also, it is necessary to check wiring to the cartridge for any frays as well as for tight mounting brackets.

When inspecting the extinguisher, the top lid can be removed and the dry chemical stirred to check for wetness or clumping. The chemical must be dry and loose to be effective. In accordance with NFPA Standard 17, the chemical must be replaced every six years. Also inspect brackets for tightness.

The distribution network begins at the extinguisher outlet and ends at the nozzles. The following are items to check:

- Check for hoses routed out of the way of all engine compartment parts. The hoses should be secured with connectors and hose tie wraps.
- Look for hose kinks and damaged hose.
- Where hose or pipe runs through metal there must be a rubber grommet in the hole.
- All nozzles must be aimed at hazard areas and the hinge on the cone nozzle cap must be mounted away from the hazard areas.
- There must be spring tension in nozzle caps (not all models have caps), and no debris accumulations on cone caps.
- The battery wiring to the extinguishing system should be checked for flaws.

These systems do not replace the requirements for portable fire extinguishers and are not required by law.

Photograph 9-10.
Fire Suppression System

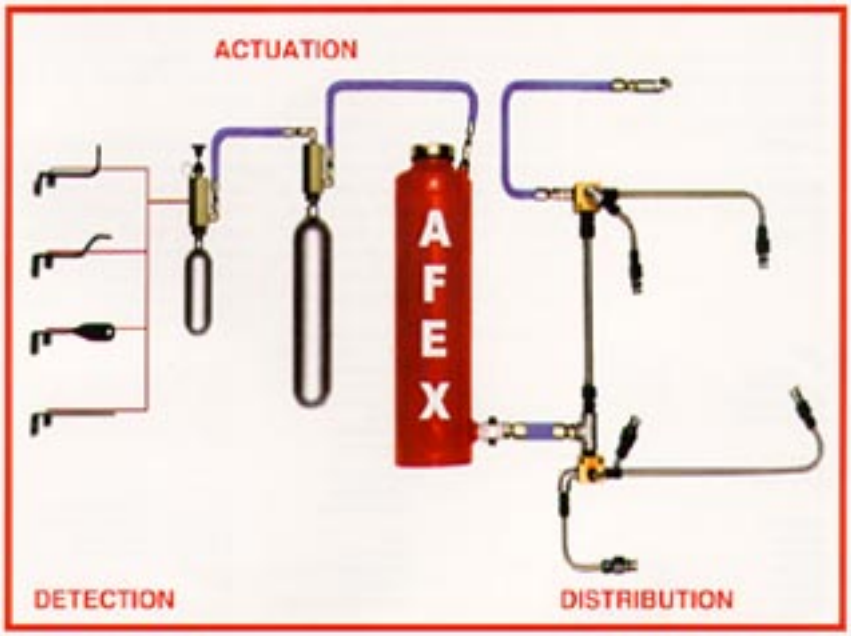

Figure 9-11.
Diagram of Fire Suppression System

9.4 Cable Systems

- ***14CCR §918.10 (Cable block requirements)***

Cable logging systems are composed of yarders, cables, and blocks. They are rigged in three basic configurations (ground lead, high lead and skyline) with many variations of each. Their primary use is for logging country which is too steep for skidder or tractor logging. This means they are found in topography wherein fire suppression is difficult and expensive. Therefore, fire prevention is of utmost importance.

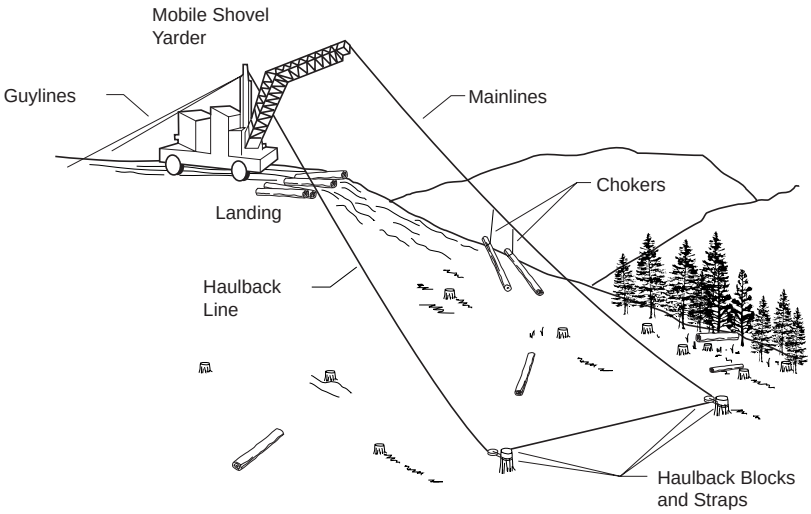

Figure 9-12.
Ground Lead Cable System

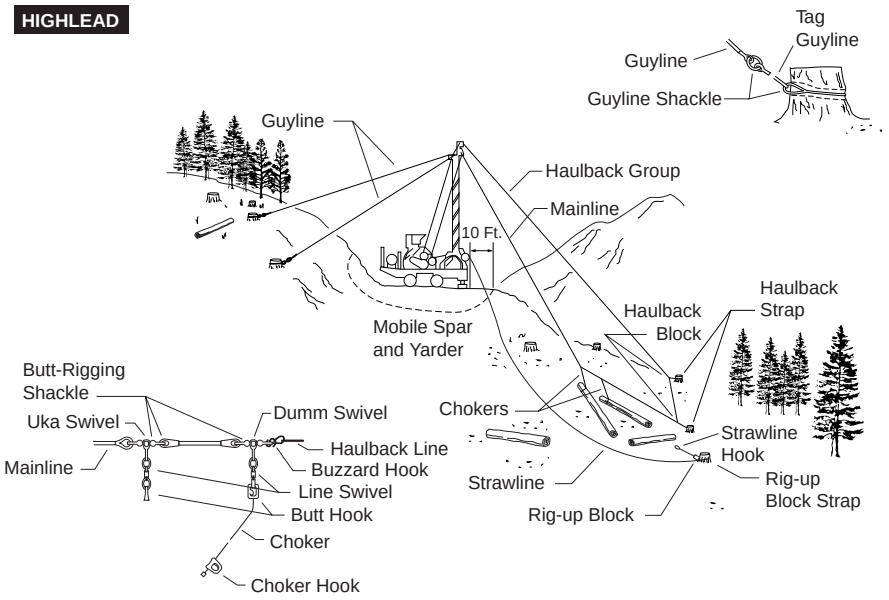

Figure 9-13.
High Lead Cable System

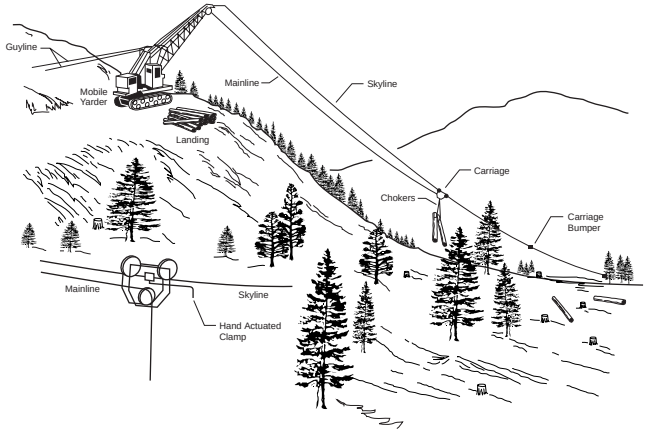

Figure 9-14.
Skyline Cable System

The yarder is, generally speaking, the least dangerous part of a cable logging system from a fire risk standpoint. However, it cannot be ignored. A yarder is composed of an internal combustion engine providing power to a winch with one to four drums and a boom or tower. In some systems the tower is separate. Even though the yarder normally operates in a semi-permanent location (e.g., a landing) which is relatively free of flammable vegetation, the exhaust system is dangerous and is required to be spark arrester equipped. The same recommendations for cleanliness and preventive maintenance apply to this piece of mechanical equipment as to any other. Some special areas where excessive friction can cause fires are the cable drum brakes and the blocks or sheaves on the boom or tower. Fire extinguishers and firefighting tools are required on or close to the yarder.

Photograph 9-15.
Cable Yarder

The cable, being made of steel and, except for a standing skyline, traveling at high rates of speed, can create high frictional heat in anything it rubs against. On live green vegetation this will normally not cause a fire. However, many wildfires have been observed to have been started by cables rubbing against dead woody material, including standing snags, down logs or trees, stumps, dead branches on live trees, etc. Therefore, it is of the utmost importance that all moving cables be laid out and rigged in such a way as to avoid contact with dead woody material at all times during set up and use.

Photograph 9-16.
Cable Rub Marks on Tree

A special problem is presented by skylines and, to a lesser extent, high leads. This is not from a potential for starting fires standpoint. It is from flying hazards to firefighting aircraft.

There have been several near misses by both fixed wing planes and helicopters. Therefore, whenever a fire is known to be in progress on the operating area or nearby, skylines should be lowered to the ground and high lead systems allowed to go slack. Telescoping or hinged towers and booms should also be lowered until it is certain that low-flying aircraft will no longer be in the area.

Skyline cable systems having motorized carriages must be inspected for spark arresters. There is not a great fire risk here, but as with any internal combustion engine, it will require an arrester. Some carriages may be equipped with manual/automatic fire suppression systems in the event of a malfunction which causes the carriage to strike the ground. Since these carriages will have a fuel supply (although not large) and a battery, the intent of the fire suppression system is to activate upon impact and extinguish a fire caused by sparks and fuel. These extinguishing systems are not 100% dependable in carriage or sky cars, but are an attempt by industry to prevent fires. When inspecting carriages, the fire suppression systems are the same as are found in heavy ground equipment.

Photograph 9-17.
Mechanized Carriage

The most fire-hazardous parts of a cable logging system are the blocks. Depending on their position and purpose, these may be known as tail blocks, haul-back blocks, corner blocks, etc. Since fires have started at blocks all protection agencies have special regulations regarding them and many timberland owners have special timber sale contract clauses about them. Common causes of fires at cable blocks are frozen bearings, dead wood jammed between the cable and the block and the block resting on flammables.

Tail and side block requirements:

- Located in the center of an area that is cleared to mineral soil and is at least 15 feet in diameter.
- Placing of firefighting equipment: shovel and an operational full 5 gallon backpack pump or a 4A fire extinguisher within 25 feet of such blocks prior to yarding.

Photograph 9-18.
Tools at Tail Block Site

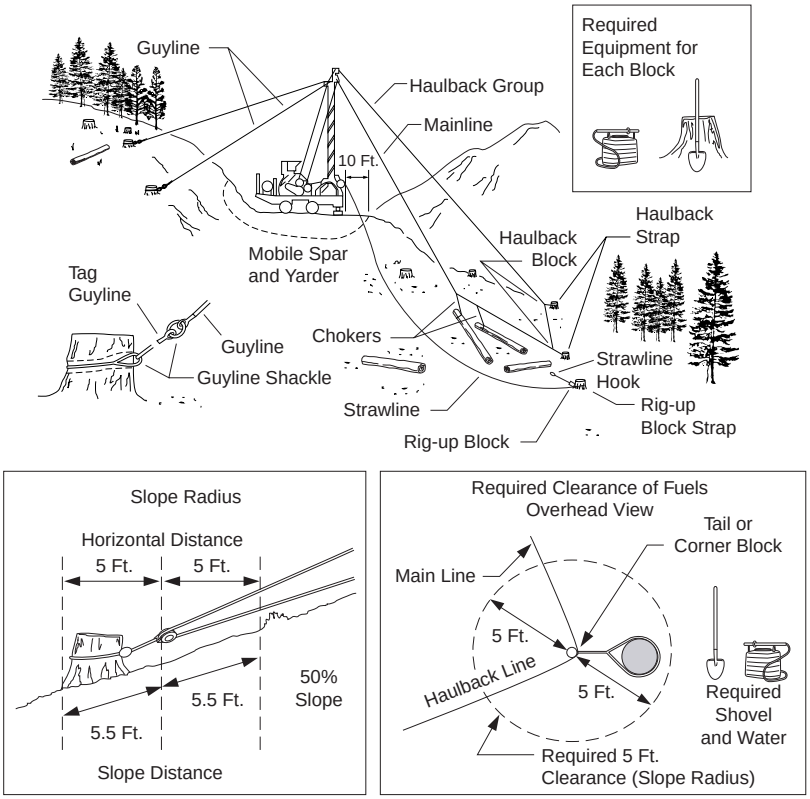

Figure 9-19.
Clearance Required for Cable Block

9.5 HELICOPTER LOGGING

The equipment used in helicopter logging is not inherently any more dangerous from a fire stand point than that used in any other logging system (and less than some). There are however, two matters of some concern: refueling and accessibility for fire suppression.

Photograph 9-20.
Helicopter Logging

Very large helicopters needed to lift loads are powered by turbine engines and thus use much less volatile fuel (Jet A) than gasoline engines. Still, large quantities of the fuel must be stored and transported to heliports on or near the operating area. Special precautions must be taken to contain spills and to combat petroleum fires. This is accomplished by burying or blocking tanks and building dikes around tanks.

Fire Extinguisher requirements for helicopter refueling:

Aircraft refuelers:

- Must be equipped with at least two fire extinguishers having a minimum rating of 20-B:C (U.F.C. Standard No. 10-1)
- A fire extinguisher must be readily accessible from either side of vehicle.

- Portable fire extinguishers at aircraft motor vehicle fuel dispensing stations shall be located such that pumps and dispensers are not more than 75 feet from one such extinguisher.

Open hose discharge capacity for fueling system less than 200 gallons per minute:

- At least two fire extinguishers minimum rating of 20-B:C (U.F.C. Standard No. 10-1)

Open hose discharge capacity for fueling system more than 200 gallons per minute but not over 350 gallons per minute:

- At least one wheeled extinguisher having a minimum rating of 80-B:C (U.F.C. Standard No. 10-1) and having a minimum capacity of 125 lbs. of agent shall be provided.

Open hose discharge capacity for fueling system more than 350 gallons per minute:

- At least two wheeled extinguishers having a minimum rating of 80-B:C (U.F.C. Standard No. 10-1) and having a minimum capacity of 125 lbs. of agent shall be provided.

Because of the economics involved, helicopter logging is seldom used where cable, tractor, or skidder yarding can be done. Therefore, large portions of the operating area are accessible only by air or on foot where the rugged terrain promotes rapid spread and difficult control of fires. Fallers, limbers, buckers, choker setters, or rigging slingers are working in semi-isolation and with minimum supervision and communications. Their capacity for initial attack is limited. The only feasible means of fire response by protection agencies is by helicopter. Foot travel is much too slow. On National Forest Land and some private timber sales the operator is required to have a water tank and a drop bucket, or helitank available at the landing.

Extreme caution must be taken when approaching fires by helicopter to avoid scattering the fire with the downdraft of the rotor blades.

9.6 Landings

It would be easy to consider log landings as fireproof as they are often carved out of a hillside and/or located on bare soil. They are, however, seldom any larger than necessary to perform the yarding and loading operations and thus are closely surrounded by forest vegetation. In addition, they have a tendency to quickly accumulate trash and debris including bark, limbs, paper, oil, etc. It is, therefore, necessary to maintain suitable fire prevention and suppression defenses which include:

- properly serviced spark arresters on all internal combustion engines,
- clearance of flammables,
- fire tools,
- fire extinguishers,
- horn (or other alarm system),
- smoking rules, etc.

Photograph 9-21.
Log Landing

9.7 Timber Cooperators

In some areas of California large timber landowners and operators have formed fire protection cooperatives. The purpose of these cooperatives is to implement and coordinate the use of industrial manpower and equipment to fight wildland fire and to provide liaison between industrial and public control forces. These groups provide a service of great value to both their members and the public agencies at a very nominal cost (usually of a few cents per acre or per thousand board feet of timber harvested per year). The only expense is salary, transportation and communications for a seasonal employee. In both cases, they hire a forester-firefighter. This individual collects copies of all timber operator fire plans in his/her area, attends industry-agency meetings, assists in training and physical testing, assists agency dispatch in ordering, assigning and demobilizing industry forces during fires, etc.

The following is a typical duty statement for an industry-agency liaison position:

I. Pre-season Activities

A. Attend annual spring industry-agency and air patrol meetings.

B. Promote and help conduct employee fire training and physical testing.

II. Inventories

A. Prepare and maintain records of available equipment and manpower.

B. Coordinate pre-season equipment qualifying inspections.

C. Keep current on changes in operating areas.

D. Coordinate private aerial fire patrol with agency patrols.

III. Ordering Forces

A. Function as an integral part of agency dispatching system when industry manpower and equipment are required for emergency firefighting.

IV. During Fire Operations

A. Fills Industry Liaison position in fire line organization.

B. Coordinates relief, equipment use, welfare, etc., for industry forces.

C. Assists agency in rotating forces, obtaining replacements and attempting to share the burden of the fire equally among operators.

D. Inform or alert the agency and/or operator as to any potential problems developing.

V. Demobilization

A. Assists agency in establishing priorities of release of industry manpower and equipment.

B. Assists in coordinating transportation of industry personnel and equipment.

9.8 Firefighting Equipment

- ***PRC §4427 (Tools required for welding/cutting/grinding)***
- ***PRC §4428 (Fire tools required on industrial operations)***
- ***PRC §4431 (Gasoline powersaw and power tool–tool requirements)***
- ***14CCR §918.10 (Cable block requirements)***

As set forth in the chapter on Fire Plans, a rather comprehensive set of standards for provision of firefighting equipment on timber operating areas has been worked out over a period of years. Although minor differences exist between regulations of various agencies and between different timber sale contracts, the following chart of locations and corresponding equipment will be found to satisfy most requirements.

Location	Required Tool(s)
Motor, torch, grinder, etc.	Shovel and 5-gallon backpack pump.
Log landing, construction field office or service area, mine headquarters, etc.	Fire toolbox with enough tools to equip each employee, plus chain saw and tractor headlights.
Motor vehicle, tractor, skidder, scraper, etc.	Shovel, axe, 4BC fire extinguisher or larger.
Portable power tools (including chain saw, tamper etc.)	Shovel and approved fire extinguisher.
Cable block	Shovel and 5-gallon backpack pump or 4A fire extinguisher.
Yarder, loader, crane, service truck, etc.	4 ABC fire extinguisher or larger
Helicopter refueling area.	20 ABC fire extinguisher or larger
Choker setter.	Shovel.
USFS ONLY - Mechanized-harvesting equipment with hydraulic systems powered by internal combustion engines (chipper, feller/buncher, harvester, forwarder, etc.), except tractors and skidders.	**USFS ONLY** - At least two 10 lb. 4A/60 B:C fire extinguishers or equivalent. Concentrations of wood dust shall be removed daily from equipment.