10. CONSTRUCTION AND SURFACE MINING

Construction and surface mining are treated together. Each has certain operations and equipment unique to itself. Likewise, they generally involve similar operations (e.g., earth moving, drilling, and blasting) and equipment (e.g., bulldozers, loaders, and air compressors). Construction includes building dams, highways, railroads, pipelines, powerlines, etc., as well as grading for real estate developments, realigning or widening highways, etc. Surface mining includes rock and stone quarries, sand and gravel pits, cement quarries as well as mines for specific ores such as iron, coal, borax, diatomaceous earth, etc.

The time of greatest fire danger in any of these activities occurs during the pioneering or right-of-way clearing phase. At this time, people and machines are working in and among vegetative fuels which are highly flammable during a major portion of the year.

Later, as earth is moved much of the operation takes place on bare mineral soil or rock. However, fire prevention activities and fire suppression readiness cannot be ignored. There is always a fringe or border zone where vegetation meets the working area, and there are always access routes. The latter are particularly important since a major portion of wildland fires associated with construction and mining start along such access routes from motor vehicles and/or their operators.

10.1 Earth Moving Equipment

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

Earth moving equipment (e.g., bulldozers, scrapers, end loaders, and trenchers) comprises the majority of construction and surface mining equipment. It is the bulk of the fire risk in these activities.

This section applies equally, however, to all other mobile equipment used in these industries (e.g., pavement spreaders and rollers, forklifts, sidebooms, and compactors). These types of equipment are powered by internal combustion engines and therefore required to be fitted with a properly functioning spark arrester when operating on forest, brush or grass-covered land.

“Operating on” has been interpreted as meaning either actually on and over these vegetative fuels or in proximity thereof. Nearly anywhere on a highway, powerline or pipeline right-of-way would be included, as would all areas within 50 to 100 feet inside the perimeter of open pit mines, quarries, dam site clearings, or anywhere outside such perimeters.

A “properly functioning spark arrester” normally includes a turbocharger, providing none of the exhaust gases are allowed to bypass the impeller blades. If the arrester is of the common retention type, it is “properly functioning” only if the carbon trap is empty enough to actually retain carbon particles. The frequency of cleaning the trap to meet this standard will vary with type and condition of engines, and type and amount of use. Generally, however, spark arrester traps should be emptied no less often than once a week. A well-tuned engine operating continuously at, or near, full power will usually produce the fewest exhaust carbon particles. An engine that is in poor condition, and is allowed to idle for an appreciable time will, when revved up, produce large quantities of carbon particles. Most equipment is operated and maintained somewhere between these two extremes.
The escape of carbon particles out the top of the stack is the most frequent source of wildland fire from the use of these machines. Other parts of the exhaust system can, and sometimes do, provide ignition sources. These primarily include leaks and accumulations of flammable debris. During any routine maintenance, the entire exhaust system, from manifold to end of stack, should be inspected for cracks, burned out holes, missing bolts, broken gaskets, etc., and for accumulations of debris. Appropriate corrections must be made. A leaking exhaust system is in violation of spark arrester laws and regulations.

Other sources of ignition from these machines include sparks from blades or tracks scraping against rocks, overheated brakes on wheeled equipment, friction from worn or unaligned belts and drive chains, and burned out bearings or bushings. The first of these is difficult to prevent. Operators should be aware that sparks can, and do, fly from rock/metal contact. They should be prepared and equipped to take immediate suppression action. The other hazards result primarily from inadequate maintenance. The prevention indicated is obvious.

A common fuel bed, which presents a fire hazard to both the machine and the surrounding vegetation, is accumulated debris in the belly pan. Such debris, which may include soil, is usually soaked with oil and therefore more flammable than in its natural state. It also restricts air flow around the crankcase and causes overheating of lubricating oil.

Two remedies are available: 1) screening the debris out of the engine compartment, and 2) washing or blowing the debris out during servicing and maintenance. This trash problem has been so serious in the logging industry that all major manufacturers now equip their new logging machines with screens or grates to completely enclose the engine compartment. In the interest of fire safety, all owners and operators in any type of service should have their machines similarly equipped.
All such equipment has an electrical system, either for direct starting or for ignition on a gasoline starting motor. These electrical systems occasionally develop shorts and electric arcing which often ignites a fire. It has been suggested that all machines, both new and old, be equipped with a conveniently located master switch by which the operator can instantly open the circuit to stop any arcing. An alternative would be an automatic overload circuit breaker.

All construction equipment, whether tracked or wheeled, and whether for highway or non-highway use, should be equipped with a shovel and axe. Both should be mounted so as to be readily available to the operator in case of fire, not locked away in a compartment or trunk. The shovel should be long-handled and round-pointed. Some of the large and expensive machines may be equipped with manual/automatic fire suppression systems.

10.2 Stationary and Portable Equipment

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

This section covers equipment which may be mounted on wheels, tracks or skids, is usually not self-propelled, and is normally operated in a given location for an appreciable time, from a few hours to several months. Such equipment can be highly varied but is typified by: air compressors, chippers, generators, derricks or cranes (other than electric), etc. This machinery would usually be in the way if placed directly in the operating area.

As with all internal combustion engine-powered equipment, the greatest fire danger comes from the exhaust system. The problems and their solutions for this type of equipment are different than for mobile equipment. This type of equipment is often governed to run at a steady speed, but not necessarily at a
steady load. Being in a fixed location, grass can grow up under and around it. Leaves and needles can blow against it even though it may have been placed on bare ground at the outset.

Over the years, various laws, ordinances, and regulations have been adopted regarding such equipment. They require the same type of exhaust spark arresters as for mobile equipment, a clearance of all flammable materials of at least 10 feet in all directions from the machine and the provision of a shovel and a backpack pump water fire extinguisher in the immediate area. It is good firesafe practice to inspect the exhaust system on these machines periodically for leaks as discussed in “Earth Moving Equipment.”

10.3 Trenching Equipment

A modern piece of equipment being used to trench through rock is a rock saw. This piece of equipment requires a 10-foot clearance like any other grinding equipment. Due to the terrain that this equipment is used in, a 10-foot clearance is often unattainable. In this case, a water tender of 2000 gallons may be required to be on site and saturate the area prior to operating.
10.4 Small Multi-position Engines

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

These engines power all types of hand-held power equipment, including chain or rotary saws, posthole diggers, weed cutters, compactors, etc. They must be equipped with spark arresters like all other internal combustion engines used on forest, brush, or grass-covered land. The retention spark arresters and turbochargers commonly used on larger engines are too bulky and heavy for these hand-held engines. Therefore, they are commonly fitted with attrition screen-type spark arresters.

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 rather rapidly. The wire used to make the screen, though usually high carbon steel, is necessarily so fine that it will burn out under continuous heavy use. Thus, in order to avoid either 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.

 Probably the most hazardous time in the use of these small engines is during refueling. They are built compactly and most use gasoline for fuel. The proximity of the gas tank filler opening to the exhaust outlet and other very hot engine parts makes it easy to spill gasoline in a place where it will burst into flame. Therefore, the same laws and rules are applicable to all these machines as to chain saws discussed under “Timber Harvesting.”

Basically, these laws and rules include:

- having fire fighting equipment readily at hand,
- refueling only in an area cleared to mineral earth at least 10 feet in all directions,
• when restarting engines, move the equipment away from any fumes, turning it so the exhaust points away from the refueling location.

Photograph 10-5.
Refueling a Chainsaw

Since July 1, 1978, all the Pacific Coast states have required new multi position small engines to be equipped with exhaust systems or spark arresters which meet SAE (Society of Automotive Engineers) Standard J335 (b). Some older equipment met this standard. All operators in wildland areas should make sure all their small engines meet this standard for surface and exhaust gas temperatures, debris accumulation, durability and serviceability.

Another source of fire from these machines is the cutting edge, or other rapidly moving metal part, striking a rock and causing a spark. This has been a frequent occurrence with rotary mowers used to clear dry grass and weeds. It can happen with any of the types of machines discussed here. Whether a fire starts from this cause, from exhaust sparks or from fuel spillage during refueling, it is imperative that the operator be prepared to immediately shut down the machine and commence fighting the fire. This is why California law, and that of several other states, requires that a long-handled, round-point shovel, or a fire extinguisher be kept within 25 feet at all times during operation and refueling.
10.5 Crushers and Pavement Plants

These plants are usually erected on large areas of bare soil, sand or rock and are thus not, in themselves, wildland fire risks. The greatest source of fire danger around the plants is people and machines that work in and around them. The most frequent location of fire starts is along the access routes. People smoke and sometimes build lunch or warming fires. Motor vehicles and other mobile equipment emit exhaust sparks, have electric shorts, develop fuel leaks, etc. Thus, even though the plants themselves are not great fire risks, their mere existence creates an increased fire risk in the area. This warrants extra fire prevention effort.

10.6 Servicing and Maintenance of Equipment

For a more complete treatment of this subject, please refer to the chapter on “Maintenance, Repair and Servicing.” The most important points to remember are:

- whenever possible, bring equipment to a service area which is free of flammables;
- if the machine cannot be moved, clear all flammables to mineral soil for at least 10 feet in all directions from it;
- in any case, always have firefighting equipment available nearby (i.e., within 25 feet); and
- have spark arresters on all internal combustion engines.

10.7 Training

Construction and mining employees are less likely to have had previous training and experience in fighting wildland fire than loggers. Therefore, for their own protection, as well as their employer’s, it is important they be given training in wildland fire control.