Fire and explosion risks on hydraulic excavators

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The versatility and manoeuvrability of hydraulic excavators has made them indispensable to the mining industry and they are used in open cut mines throughout Australia.

Fundamental to the design of these machines are the numerous hydraulic hoses, some of considerable length, supplying high pressure hydraulic fluid from hydrostatic pumps to hydraulic cylinders and motors that provide linear or rotary motion at the various machine functions.

Some of the high pressure hydraulic hoses are subject to flexing and are exposed to mechanical damage. A hose failure can result in hydraulic oil being sprayed around the machine creating a fire risk and in some cases an explosion risk. Hot spots such as the turbo chargers on the diesel engines are capable of igniting hydrocarbons increasing the fire and explosion danger. A number of major fires have occurred on excavators while the machines were operating. A common mechanism has been oil spray or mist from a damaged hose coming into contact with a hot spot on the diesel engine or exhaust.

There have been other incidents that have been associated with maintenance work on the machines. In one incident a battery was being charged in its battery box allowing the accumulation of hydrogen which was then ignited as the charger was disconnected. In another instance hydrogen from a battery was ignited while still in position on the machine creating a major fire. In this incident there was also suspicion that acetone used as a degreaser was ignited during maintenance work on the machine. Particular care has to be taken with cleaning fluids because the vapours are heavier than air and migrate to low parts of the machine where they may be ignited by sparks from hot work.

Managing safety risk involves: first taking every reasonable action to prevent a fire occurring; second minimising risks to safety if there is a fire and third manage risk to safety associated with activities such as battery charging, maintenance, servicing and emergency egress.

Actions taken should include regular checking of hoses and connections for damage; where possible hoses should be protected from mechanical damage. Hot spots on diesels, for example turbo chargers, should be shielded. Coal dust or rags that can become saturated with oil must not be allowed to accumulate. Maintenance staff should be made aware of the fire risks associated with maintenance activities from hydrogen originating from battery charging and from cleaning fluids. It is also extremely important that there is a safe exit for personnel on the machine in the event of a fire.

Fire suppression systems often fail to operate when not properly maintained. There are components that may fail, preventing the suppression system from operating successfully. Analysis of equipment fires where fire suppression systems were fitted indicated that up to 20% of non-maintained fire suppression systems failed to operate when fired in anger compared with less than 3% of maintained systems. There have also been systems installed where the capacity (volume), number of nozzles or the discharge time is inadequate for the fire area to be covered. Fire suppression systems to be of any use must be adequately sized, properly maintained and regularly tested.

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