Fire on an underground loader

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Mine type

Coal mine - underground

Incident

A fire occurred on an underground loader being operated in an Explosion Risk Zone 1 (a zone in an underground coal mine where methane levels from 0.5–2% might be encountered). The seat of the fire was on and around the main hydraulic pump, which had oil soaked coal packed beneath it. A piece of engine cover insulation foam beside the pump ignited, creating a small fire.

The loader was being used to provide hydraulic power to a pipe trailer, although for 45 minutes prior to the fire it had simply been manoeuvring the pipe trailer into a different position. At the time of the fire the loader was idling and the operator was in the process of connecting the quick-detach power take-off (QDS/PTO) hydraulic hoses so that the pipe trailer could again be operated.

Within 5 minutes of the fire being extinguished, temperatures as high as 200°C were still being observed.

Equipment

Underground load haul dump front end loader.

Hazard

Fire in an Explosion Risk Zone in an underground coal mine.

Cause

The hydraulic pump and relief valve had overheated because they had been operating in a closed hydraulic circuit..

Comments

Investigations revealed that a chain fashioned from multiple safety clips was being used to hold the self centring QDS/PTO hydraulic lever in the engaged position. This had the effect of supplying constant hydraulic pressure and flow to the QDS/PTO circuit. When the hoses were disconnected from the pipe trailer, valves in the circuit automatically closed. A closed circuit was created, leaving the pump operating against a closed valve, effectively 'dead heading' the pump. The only path for the oil back to the tank was over the 138 bar relief valve. The loader had been operated in this condition for the entire time it was manoeuvring the pipe trailer.

Subsequent testing of the circuit in this configuration found a rapid and significant temperature rise at both the pump and relief valve. Self centering hydraulic controls are safety devices and must not be overridden. Most hydraulic circuits can overheat if the system is subjected to prolonged dead heading or stall conditions. Overheating of circuits and components such as hoses, pumps and valves can lead to early failure of components and injury to personnel. In this incident, it resulted in a fire in an Explosion Risk Zone in an underground coal mine, which may have had catastrophic consequences.

Recommendations

Hydraulic oil temperature monitoring must be considered for all machines where a risk assessment shows it is possible to overheat a circuit and its components to above 150°C. The monitoring system should activate the machine's shut down system where the requirements of the Coal Mining Safety and Health Regulation 2001, Section 152 'Limit to external surface temperature of equipment used underground' are not met.

It is also recommended that the mine:

- develop a training program for equipment operators on the hazards created when safety devices such as self centring controls for hydraulics are overridden
- incorporate training on hydraulic hazards in operator training packages.

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