



Dangerous Goods Significant Incident Report No. 03-16 and Petroleum Safety Significant Incident Report No. 02/2016

Switchboard fire caused by arc flash

Summary of incident

Note: The Department of Mines and Petroleum's investigation is ongoing. The information contained in this significant incident report is based on materials received, knowledge and understanding at the time of writing.

During normal operations at a gas processing facility, an early smoke detection and alarm system was activated in a substation's switchroom. After workers confirmed the presence of fire, the electrical supply to the substation was manually isolated. The 6.6 kV upstream feeder protection (part of the power supply feeding the switchboard) did not activate.

Production was shut down and the emergency response team were unsuccessful in their attempts to manually fight the fire. The fire was finally extinguished when the switchroom was blanketed with an inert gas.

There had been a phase-to-phase arc fault on the line-side cables within a 185 kW 415 LV withdrawable motor starter in the switchboard's motor control centre (MCC). The fault escalated to the main bus on the same switchboard, almost completely destroying the 415 V MCC in the switchroom, damaging adjacent equipment.

The subsequent investigation found that the switchboard's MCC modules were heat damaged due to a high resistance connection to the main bus. These modules were used for both electrical and mechanical isolations over an extended timeframe. This is thought to have caused a high resistance connection which generated sufficient heat to escalate into an arc fault. The upstream 6.6 kV feeder protection failed due to a seized tripping mechanism in the contactor. The possibility for the latch roller to seize and fail was a known contactor vulnerability.



Damaged MCC modules

Direct factors

- The MCC modules were subject to a high resistance connection.

Contributory factors

- A maintenance regime to address the known vulnerability of the 6.6 kV contactor, was not established.
- Lack of substation building electrical supply isolation and pre-incident (switchboard fire) plans.

- Incorrect identification and prioritisation of MCC modules for refurbishment or replacement.
- Fire protection and suppression design and arrangements for the substation were inefficient.

Actions required

The following actions are recommended to ensure the appropriate measures and systems are in place to manage the risks posed by arc flash events and substation fires.

Engineering measures

- Identify, risk assess and prioritise electrical equipment for refurbishment or replacement as necessary. Implement mitigation plans to address any residual risk.
- Periodically risk assess and address any issue in relation to electrical protection settings.
- A power system protection scheme needs to incorporate:
 - local back-up protection; or
 - remote back-up protection.

AS 2067 outlines the requirements for protection, control and auxiliary systems.

Note: It may also be beneficial to consult the Protective relays applications guide, which is applicable to the age of the installation. For example, refer to the 1985 edition for circa 1980 installations.

Maintenance and operational measures

- Operate and maintain MCC modules in accordance with the original equipment manufacturer's (OEM's) specifications.
- Review the suitability of fire protection and suppression systems and change where necessary.

Administrative measures

- Conduct, complete and record all maintenance and testing strategies and requirements.
- Complete periodic, close visual inspections of module line-side cabling where withdrawable MCC modules are used for both mechanical and electrical isolation purposes.
- Keep and make available, clear and easily understood electrical isolation and switchboard plans for all substation buildings.

Further information

- Department of Mines and Petroleum, Asset integrity management systems
Evaluation of asset integrity management system (AIMS) – guide
www.dmp.wa.gov.au/Safety/Guides-and-procedures-16202.aspx
Asset integrity management system (AIMS) evaluation checklist
www.dmp.wa.gov.au/Safety/Templates-and-checklists-16206.aspx
- Standards Australia, www.standards.org.au
AS 2067 Substations and high voltage installations exceeding 1 kV a.c.
- GEC Management (editors), 1985. *Protective relays application guide.*

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