RECENT ELECTRICAL ACCIDENTS IN THE EKURHULENI METROPOLITAN MUNICIPALITY

THE PADSTOW STREET ACCIDENT

On 17 March 2003 an electrician and his handyman was working on a 33kV outdoor isolator in the switchyard of the Padstow Street substation in the Alberton Service Delivery Centre. The foreman was also present on site. All procedures were followed and a permit was issued. The purpose of the exercise was to repair a hot connection where the blue phase busbar connects onto the stationary contact of the horizontal rotary action isolator. All that was needed was to remove, clean the contact surfaces and replace the u-clamp holding the connection. The triple pole isolator was mounted on its own structure and the busbars were isolated at the circuit breaker on the next structure. The other side of the isolator was left live, presumably because there was no intention to climb onto the structure or to work near the live parts and switching it off would have entailed driving to another substation about two kilometres away. There was no misunderstanding about the fact that the other end of the isolator was live as more than one witness saw the electrician demonstrating to his handyman that this was the case by bringing a link stick close to the live parts. Both the electrician and the handyman had many years experience in this type of work.

After satisfying himself that the work was well under way the foreman retired into his vehicle to fill in the logbook. The next moment there was a loud bang. When he looked up both the electrician and his handyman was lying on the ground in the vicinity of the isolator. He called for help and they were rushed off to hospital where they both later died. There were flash marks on all three phases of the "live" part of the isolator and the supply was tripped at the other substation. Indications are that the handyman had possibly climbed onto the isolator structure causing the flash over. No reason for him or the electrician wanting to do so could be found.

The Department of Labour was informed and an inspector visited the site a few days later. He issued a "Prohibition Notice" in terms of General Machinery Regulation 5(1), prohibiting the Ekurhuleni Metropolitan Municipality *"to work on or near electrically live distribution networks where the voltage exceeds 6,6 kV, including a competent person".* This has left the staff of the Electricity Division in a difficult position, as it is not entirely clear what the legal position is. How near is "near"? How do you operate and maintain an electrical reticulation system when not even your legally competent people are allowed to work near live equipment?

THE LANGAVILLE ACCIDENT

On 3 April 2002 an electrician and his handyman was busy replacing a blown 11 kV fuse in an outdoor ring main unit in Langaville in the Brakpan Service Delivery Centre. One or more of the fuses in this fuse switch had blown several times before as the circuit it supplied was overloaded, inter alia due to illegal connections made by members of the community and the excessive consumption of the resultant free

electricity. While they were removing one of the fuses an explosion occurred inside the fuse switch causing it to spew burning oil over both the electrician and his handyman. They were rushed to hospital where they both eventually died. It was later found that the explosion was caused by a loose piece of metal, possibly the end cap of a blown fuse, causing a short circuit between two of the busbars that was positioned underneath the fuse carriage. It was also established that fuses had, on several occasions, been found to have disintegrated inside the fuse carriage.

It seems that the accident was caused by the inappropriate application of the fuse protected ring main unit in a situation where overloads regularly occurred. The “back up” type fuses that was used is not suitable for protecting electrical loads against light overload conditions. Under such conditions this type of fuse will overheat and ultimately fall apart when the porcelain breaks. The fuse will, however, blow correctly under heavy overloads. Under medium overload conditions the fuse will start blowing in a reasonable time thus setting off the striker pin mechanism. This will, in turn, trip the switch and thus protect the fuse from further damage due to overheating. The peculiar behaviour of a medium voltage fuse lies in the fact that such a fuse is, in effect, made up of a large number of series connected fuse elements that need to be blown simultaneously by a heavy overcurrent. If there is not enough current the fuse may only melt in one place and with the voltage available to sustain the resultant arc the fuse will be turned into an arc furnace.

A contributing factor in this case was the design of the particular fuse switch. The placement of the busbars underneath the fuse carriage, combined with the fact that there was no physical barrier between the fuse compartment and the busbar section was most unfortunate. Such a barrier could possibly have prevented the remains of the fuse from falling onto the busbars. It could also possibly have prevented the arc and burning oil from being expelled through the opened fuse compartment.

Japie de Villiers
Interim Director: Electricity (Operations and Maintenance)
Municipal Infrastructure Department
Ekurhuleni Metropolitan Municipality

ACCIDENT / INCIDENT: ESKOM DISTRIBUTION – CENTRAL REGION. INCIDENT OCCURRED ON 20 MARCH 2003.

DESCRIPTION OF EVENTS.
An incident occurred whereby a power transformer failed causing a PCB contaminated oil spill. A 20 MVA 88/33 kV faulted in the region.

This transformer (situated in the number two bay and is one of three transformers at this substation) faulted on the 20th March 2003, causing approximately 5000 litres to spill. A bundwall was in existence around the transformer, with a drainage system into an oil pit.

On arrival at the substation on the day of the failure, standard operating procedures were followed to isolate, earth and barricade the area. The operator inspected the faulted transformer and discovered that a RED warning label was affixed to the tank. The label showed that the transformer contained more than 500 ppm of PCB.

The operator didn't know what the label actually meant and what procedures were to be followed, although the procedure number and title was stipulated on the label. He contacted the supervisor who in turn contacted the risk department (environmental management) to clarify what actions they should follow regarding the warning label.

The approved contractor for oil spill clean-up and remediation was informed about the PCB contaminated oil spill. Safety clothing and other precautionary equipment was used to dismantle and remove the unit to an isolated storage area.

The crusher stone around the transformer was contaminated as well. This stone was sealed in a bin and send away for safe disposal. Disposal of all waste and clothes had to be done at an approved "Hazardous Waste Disposal" site. A similar process was followed to de-chlorinate or incinerate the PCB oil.

Upon inspection of the substation civil drawings it was discovered that the areas around the transformers were connected through the underground pipes to a soak pit (French drain). This meant that all its contents and surrounding soil had to be removed and disposed of in the correct manner.

CONCLUSIONS AND SOLUTIONS TO PREVENT A RE-OCCURRENCE:

- Identify all power transformers containing PCB
- Inform operating staff of such locations
- Label the substation area and fences with warning signboards regarding PCB contamination
- Do an environmental risk assessment on the substation and surrounds
- Label all power transformers to indicate their status
- Consider insurance premiums as at present most insurance policies do not cover PCB clean-up and incineration / de-chlorination of contaminated products.

Presented by: Egmont Dennyschen