

# ON LINE PARTIAL DISCHARGE MAPPING

*If diagnostic insulation testing had been included in the preventive maintenance program it may have been possible to plan maintenance or replacement of these cables at a time when the line was inactive thereby minimizing costs.*

*By Peter Rhodes, High Voltage Solution, New Zealand*

**W**ith recent world wide turmoil in the financial market, new electrical upgrades may go on hold. This has the effect of having to rely on existing aged networks. International demand for Coal, Oil & Petrol, Iron ore, Gold, Alumina, Aluminum, Nickel, LNG, Copper, Iron & Steel, Dairy products, all rely on HV systems that had a design life of 25 years, 25 years ago!

## PERIODIC TESTING PROGRAM

Without maintaining a periodic testing program all failures will come as a surprise, unplanned, inconvenient and quite possibly very expensive in time and resources.

Using 'On Line Partial Discharge Mapping', means testing high voltage assets such as underground cables, through joint, switch boards and terminations while the circuit is still live and in-service, with no interruption to the operation.

By undertaking an annual inspection program it is now possible to predict when to switch out a HV cable before it fails and arrange alternative supply in advance is obviously a smart move, especially when a mine is working beneath the natural water table and relies on pumping water to keep their mine operationally and dry!

## THE ANNUAL TESTING PROGRAM

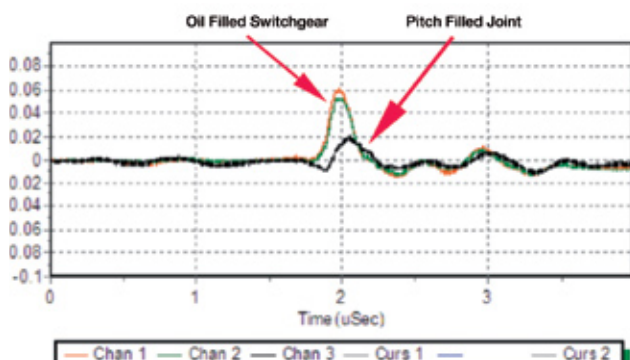
- A. A yearly program of On Line Partial Discharge surveys / mapping is carried out on all substations.
- B. In the second year a sample of the previously surveyed 6.6 / 11 / 33kV cables and switchgear should be resurveyed to maintain confidence of results of previous tests. This will provide on going trending and build a case history of the particular cable and it's ageing characteristics. Critical cables whose failure is costly to production deadlines and plant down time should be tested more often (yearly).

## CASE STUDY

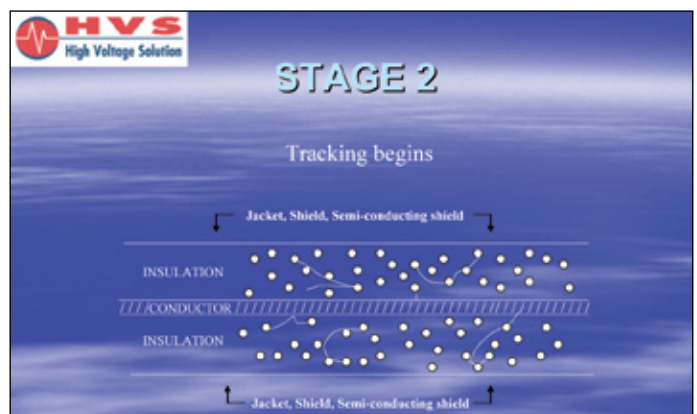
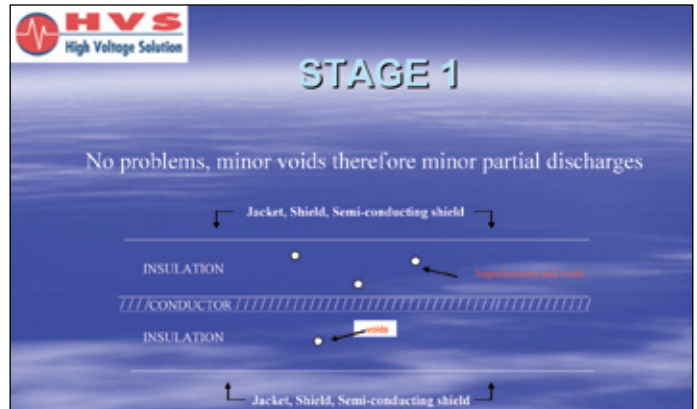
A recent On Line Partial Discharge Survey of a coal mine operation (Australia) showed an 11kV feeder with two locations of high partial discharge. By using PD detection and mapping of cables it was possible to locate the source of this discharge:

1. One source was a pitch filled joint
2. The second source was a pending termination switchgear failure.

We advised the client that the termination in the switchgear had a higher probability of failure compared to the paper lead pitch filled in-line joint. A planned outage occurred and the suspect termination was replaced. A second PD survey carried out showed the levels of Partial Discharge had reduced.



## A BRIEF SUMMARY OF 'CABLE FAILURE MECHANISM'



This allowed rescheduling of repairs to the joint until suitable access / loading had dropped (It was not possible to cut off the load to the cable).

## SUMMARY

Operations were then advised of the pending power failure. This allowed operations to off load the feeder concerned, and back supply the load via a healthy electricity supply, leaving electrical maintenance crews to attend to defects identified in the Partial Discharge report.

### Shift Rosters Superintendent comments:

*Having a planned shift roster, without an unplanned electrical outage! Is a shift bosses dream!*

