Safety Advice 01-2005 (NZ)

FATAL INJURIES DURING 66kV LINE WORK (FURTHER REPORT)

This further Safety Advice supplements the original Safety Advice 01-2005, providing additional information about the event itself, the causes and the conclusions drawn.

The Event

A Lineman received a fatal electric shock while carrying out the task of transferring a conductor from an old angle strain single pole to a newly installed angle strain single pole some five metres away on a double-circuit 66 kV wood pole line.

The double circuit line in which the pole replacement work was being done predominantly comprises pairs of single poles each supporting one circuit of the double circuit line. But interspersed among these along the line are double crossarm Pi structure configurations with phases from both circuits supported by the two crossarms. This arrangement means that circuit separations change back and forth progressively along the double circuit line between clear vertical separation space for the single pole parts of the line (each pole carrying one circuit) and horizontal separation between the Pi Pole crossarm mounted conductors. Additionally, in the case of this line, each of the Pi Pole mounted crossarms carried conductors of both circuits, meaning that at least one of the phase conductors from both circuits would be vertically in line at each Pi Pole. (See diagram below "Unusual Conductor Positioning"). In this event, Pi structure arrangements (Structures 421 and 420 - see photos) as described above were the next along the line from the single circuit angle strain pole (structure 422) being replaced. The live blue phase of the in-service circuit of this line was attached to the middle of the Pi structure top crossarm, vertically above one of the out-of-service conductors (also the blue phase) of the out-of-service line for which pole replacement work was being done.

On the day of the accident the armless angle strain pole 422 was being replaced, and the de-energised conductors transferred from the old to the new pole. The new angle strain pole was offset from the centre line of the old pole line, and was also higher; therefore the conductors had to be swung over onto the new pole and then lifted up for attachment.

Comprehensive hazard identification was carried out before work commenced, which adequately covered the immediate work site and work proceedings. However the hazard ID did not fully consider the impact of changing the conductor heights in terms of the additional tensioning on the affected conductor. It did not identify the implications of this for the next Pi-Pole span nor did it identify the hazard posed by the live blue phase situated directly above the dead blue phase being tensioned during transfer to the new single strain pole.

The de-energised blue phase conductor being transferred was being hoisted into its final higher position on the new angle strain single pole and tensioned using a chain winch. The line mechanic operating the winch applied excessive tension to the conductor. This pulled the insulator strings on the nearby double-Pi structure to a near horizontal position, reducing the sag between the Pi structures but raising the conductor so that it contacted the live blue phase

conductor vertically above it at a mid-span position. The line mechanic received a fatal electric shock from the winch handle through his body.

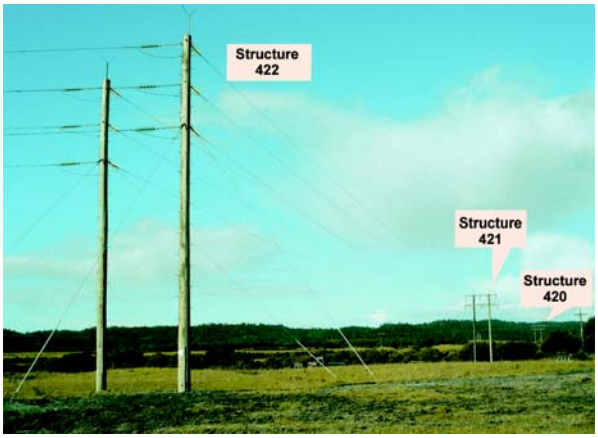
Causes and Conclusions

The full accident report found that the key factor underlying the accident was "*Failure to recognise the possibility of … a conductor clash during the planning and hazard identification stage of the work or during the progress of the work …"*

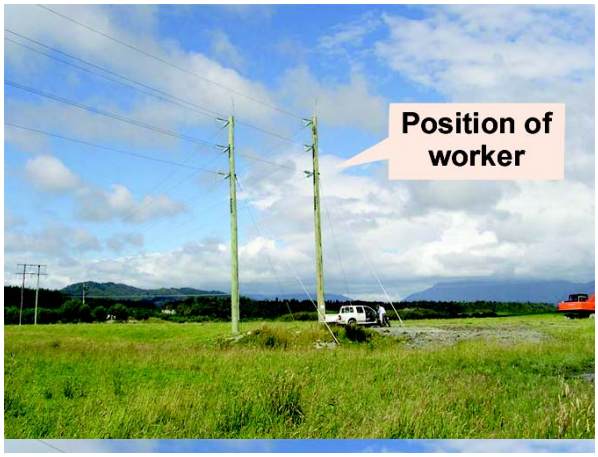
Key conclusions arising from the investigation included the following:

- More attention must be given to worksite safety assessment and hazard identification.
- Line workers must understand the effect of small changes in tension on the amount of conductor sag, even several spans away. (See Item 15 of the Safety Rules Newsletter Issue 8 - December 2005).
- Workers must stand back from the detail of the immediate work site and consider the wider area.
- Beware of a false sense of security because you have 'done it before'. (On the day of the accident similar work had been carried out on the red and yellow phase conductors and in June 2004 the other single angle pole at structure 422 had been successfully replaced using the same techniques).
- Consider the effect of unusual conductor positioning (the combined vertical/horizontal configuration of the 420-421 span introduced a significant hazard that was not identified in the original work scope proposed by the contractor).
- Ensure that protective earthing and bonding arrangements create an equipotential zone around workers on dead line work.
- Site Supervisors in control of complex and/or difficult jobs must work in a position of supervision and not be an integral part of the actual 'hands on' work.

The investigation recommended that more attention be given to correct earthing and equipotential bonding procedures. In this instance preventive measures included review and improvement of specifications for the establishment of equipotential zones and portable earthing of the lines, and a roadshow promoting the above matters and the basic principle for electrical safety *("Live unless proven dead … establish effective equipotential earthing and bonding"),* all aimed at ensuring that this fatality is never repeated.

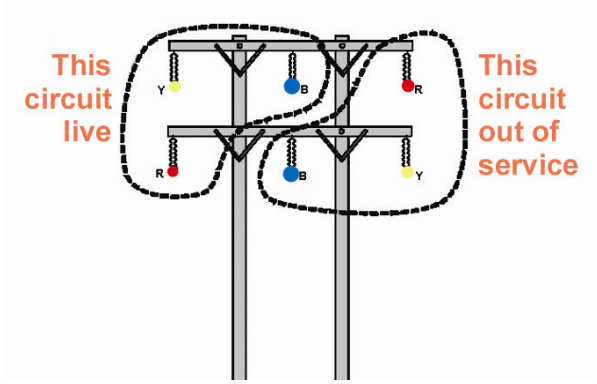


The scene: the deceased was working on the angle strain pole nearest the camera.



The accident scene: the deceased was straining up the bottom, blue phase, conductor at this angle pole.

The blue phase conductors are in the same vertical plane at the point of crossing the River, as shown in …



…the unusual conductor positioning.