

DETERMINATION
of
Sheriff K McLernan
in
FATAL ACCIDENT INQUIRY
Into the circumstances of the death of
ALEXANDER WILLIAM RIDDOCH

The Sheriff, having resumed consideration of the cause, Makes the following findings:-

Part I. [Section 6(1)a,b.]

(1) That the late Alexander William Riddoch was working as an employee of Maxwell Farms Limited at Nether Tocher Field of the home farm at Meikle Wartle Inverurie on 22nd January 2008 when at 13.38 the trailer, attached to the tractor under his control, came into contact with one of the conductors of an 11 kilovolt overhead power line which traversed that field at Nether Tocher.

The power line was owned by Scottish Hydro-electric Power Distribution Limited (referred to hereafter as SHEPDL)

(2) As a result of the contact between the trailer and the power line, which was carrying 6,350 volts, power was cut off by the operation of a circuit breaker. Power was restored and cut off in a series of automated sequences applied to the circuit-breaker until the sequence ended with power cut off 31 seconds later.

(3) Power to said line remained cut off for a further 11½ minutes during which time Alexander William Riddoch carried out greasing to the braking system of said

trailer with a grease gun which he applied to grease nipples on the chassis of the trailer.

- (4) At 13.50 hours on 22nd January 2008, the power line was re-energised by a further closure of the circuit breaker by means of a signal sent from the system controller employed by SHEPDL based in Inveralmond House, Perth which allowed current to flow from the overhead line to the trailer. Alexander William Riddoch, who was at that time kneeling on the ground under the trailer and in contact with it was as a result electrocuted and died.

Part II.[Section 6(1)c]

(5) The court requires to consider whether the death and any accident which gave rise to the death might have been avoided by any reasonable precautions. In order to comment further it is necessary to narrate the evidence of circumstances in more detail.

(6) Prior to 22nd January 2008, Alexander William Riddoch had been engaged in the harvesting of swedes (turnip) from a field at Nether Tocher. He was employed by Maxwell Farms who had a contract to recover swedes from that field.

(7) Alexander William Riddoch was a highly experienced worker, energetic, conscientious and reliable, highly regarded by his employers and was generally regarded as second in command to the farm manager. On 22nd January 2008, there remained an estimated eight to ten trailer loads to be taken from the field to the home farm. The system employed was the same as had been used before, namely that one employee operated a machine known as the swede harvester to lift the swedes from the ground, elevate them onboard the harvester and discharge them into a trailer which was drawn by a tractor driven by another employee parallel to the track of the harvester.

(8) In order to keep the harvesting continuous, a fleet of tractors and trailers was used whereby each tractor driver took it in turns to fill his trailer from the harvester and thereafter return to the home farm, discharge his cargo, and then return to the field. While each tractor was away its place in a track parallel to the harvester would be taken by one of the other tractors.

(9) Four tractors were used for this purpose.

(10) Alexander William Riddoch, who had organised the whole operation, had completed one run and was awaiting his turn again at the field. He had stopped his tractor and trailer at the bottom of the field parallel to a stob and wire fence which separated that field from its neighbouring field until the time came for him to take up his place alongside the harvester.

(11) Overhead power lines supported by wooden poles ran across the fields at right angles to that fence. Pole No. 9 supporting the overhead power lines is situated at the fence.

Alexander William Riddoch's tractor had been driven past pole number 9 and came to a stop with the trailer approximately one third past the pole.

(12) The tractor operated by Alexander William Riddoch had an on-board computer which stored a record of the operations of the tractor. The trailer was a tipping trailer the tipping function of which was controlled by a hydraulic system controlled by a computer in the cab of the tractor. Analysis of the information in that computer disclosed that the trailer had been raised by the driver activating the lifting programme from inside the cab.

(13) During the process of tipping the trailer from a horizontal position to its near maximum elevation at 48 degrees it came into contact with one of the two high voltage overhead lines which traversed the field.

(14) When the trailer was tipped the highest edge missed the line closest to the tractor but caught on the line furthest from the tractor. As the trailer came into close proximity of that second cable which it touched it is probable that arcing would have

occurred between the cable and the nearest point of the trailer to the cable. That arcing would be accompanied by a sparking and probably a loud noise.

(15) From his position in the cab with the engine running the driver would be unable to see the sparking or hear the noise.

(16) When that arcing and touching occurred there would be a voltage drop in the supply system. The cable touched would have been transmitting 6,350 kilovolts at the time.

(17) The distribution of electrical power is provided by numerous organisations across the United Kingdom. The generic title for such organisations is Distributor Network Organisations (DNO). The DNO responsible for these lines was the Scottish Hydro Electric Power Distribution Limited (SHEPDL).

(18) Regulations have been issued by Statutory Instrument to provide minimum standards of safety for overhead lines c.f. Electricity Safety Quality and Continuity Regulations 2002 S.I. 2665 (2002).

(19) At that time the minimum height prescribed for such overhead lines crossing a field was 5.2 metres. The actual line height at the point where contact occurred was 6.63 metres.

(20) In terms of Section 3(1) of said Regulations,
 “Distributors ... shall ensure that their equipment is a)b) so constructed, installed, protected, used and maintained as to prevent danger, interference with or interruption of supply so far as is reasonably practicable.

In terms of Section 3(2) ... distributors shall a) for each of their overhead lines assess the foreseeable risk of danger from interference, vandalism or unauthorised access having regard both to the nature of the equipment and use of the surrounding land and classify the degree of the risk. b)(c) ... shall take measures to safeguard the equipment commensurate with the nature and class of risk to which it gives rise. “

(21) Electrical distribution by DNOs is done by a series of circuits. All circuits are protected against damage caused by excess of current arising from faults or overloads. The line involved in this incident was part of a circuit known as the Warthill House Spur. That circuit was protected by a circuit breaker known as a Loanhead North PMR. The type of circuit breaker used was type GVR gas-filled vacuum recloser.

(22) The operation of the recloser was controlled by a device known as a Polarr Protection Relay which was linked by radio signals to a control room of the DNO situated in Inveralmond House, Perth.

(23) The Polarr Protection Relay is an electronic device which can be programmed to respond automatically to certain specific changes in the current flowing through the circuit.

(24) When the specific changes are detected by the device an electronic signal will cause the circuit breaker to “trip” and open. The effect of the opening – a trip – is to cut off supply to the whole system downstream of that circuit breaker.

(25) At the material time the device was programmed to respond to the following changes

- (a) A current in excess of 160 amps (overload protection);
- (b) A current in excess of 20 amps flowing to earth (earth fault);
- (c) A current less than 20 amps but greater than 4 amps flowing to earth (Sensitive Earth Fault).

(26) The speed at which the trip was triggered varied with the amount of current flowing to earth detected.

(27) Changes in current flow are not uncommon and are usually caused by transient conditions. Examples of transient conditions are lightning strikes, airborne objects such as debris of certain kinds, branches of trees, and bird activity which may cause bridging between a live line and a leak to earth.

(28) In order to avoid loss of supply throughout the circuit when one of these transient conditions applied, the Polarr device provides for an immediate or delayed opening of the circuit breaker but also for automatic closure. The automatic closure facility, however, is restricted to a limited number of operations. It ceases to be available if there are four “over-current” incidents within a set period of time or four earth faults or two sensitive earth faults. In that condition the circuit –breaker is said to be” locked out”

(29) Once the automatic closure facility is unavailable the circuit is open and no power flows past the circuit - breaker.

(30) All the information on the activity of this automatic system is relayed back to Perth by radio signals. The system controller at Perth has the power to reactivate the reclosure by sending a signal from Perth. The effect of a reclosure from Perth is that the line becomes re-energised. The system controller is deemed by the DNO to be the person responsible for a decision to re-energise the line.

(31) SHEPDL have provided a procedure to guide the system controller in his decision. The procedure is set down in writing and is declared to be “The business processes to deliver consistent and swift restoration of supplies to customers while considering the safety of staff and members of the public and the integrity of the distribution system”.

(32) The guidance given to the system controller allows the system controller discretion to take into account time of day and weather conditions. For example, in abnormal conditions such as during lightning storms or gales (from which one infers that windborne items may be touching or bridging between lines), the system controller is authorised to attempt to reclose the circuit breaker from Perth immediately after” lock out”. In non-abnormal conditions he is authorised to attempt to reclose the circuit breaker after a wait of 5 minutes if the incident occurs after 10 pm but before 6 am and after 10 minutes if after 6 am but before 10 pm but only if there are no reports received of accident, damage, or contact.

(33) On 22nd January 2008, the system controller in Perth in accordance with the company procedures reclosed the circuit by sending the signal from Perth. This signal was sent approximately 12 minutes after the first trip. Seven minutes after reclosing the circuit-breaker a call was received from the public to indicate that an accident had occurred.

(34) The record of the operation of the automatic reclosures discloses that after the first contact between the trailer and the overhead line the series of reclosing and reopening took 31 seconds. The line in contact with the trailer was thereafter not energised for a period of 11½ minutes until the remote reactivation from Perth occurred. The circuit breaker after five seconds delay tripped again and the line thereafter remained dead until the DNO's operatives attended at the site of the accident.

(35) During that period of 11½ minutes, it is beyond doubt that Alexander William Riddoch would have come out his tractor cab, collected the tools he required from his tool box and commenced the greasing operation. While he was still engaged in that operation kneeling on the ground and in contact with the tractor body the line was re-energised and the current then leaked from the line through the trailer and flowed to earth through him.

(36) It is inconceivable that Alexander William Riddoch was unaware of the potential danger from overhead lines. He was vastly experienced and would have worked under such power lines many many times. Pole number 9 carrying the overhead lines was at the fence alongside of which the tractor had been driven. The pole past which he stopped was marked with a hazard warning sign of the approved type. His trailer bore a similar hazard warning sign.

(37) There was no discernible reason for Alexander William Riddoch to have stopped at the point at which he stopped. There is no evidence from which there can be inferred his state of knowledge at the material time.

(38) The raising of a trailer in a field was an unusual and unexpected event.

Alexander William Riddoch was not involved in an activity that would normally be expected or anticipated to have been undertaken by the side of a field.

(39) In considering therefore what reasonable precautions, if any, could have been taken whereby this accident might have been avoided, consideration has to focus on three separate areas.

1. Precautions which might have been taken by the deceased.
2. Precautions which might have been taken by his employers, namely Maxwell Farms.
3. Precautions which might have been taken by the owners of the power lines.

(40) In respect of the deceased I was urged to find that a reasonable precaution would have been not to park under the line. I see no value in restating the obvious. Beyond that I do not find that there has been shown to be any precaution to be taken by the deceased which might have prevented the accident. While some precautions may make mistake or faulty judgment less likely, I do not find that there is any reasonable precaution to be desiderated of an operator of the skill and experience of the deceased.

(41) Turning to the precautions that may have been taken by Maxwell Farms, it is possible that if there had been an established system of making a risk assessment for every field where employees were working in the presence of power lines the need for caution and awareness would have been enhanced and that would have made it less likely that the deceased would have parked in close proximity to the overhead line. While that is possible I do not consider that the evidence shows that such a system would have had any effect on the actions of this deceased. It seems far more probable that the incident which exposed him to danger was more the product of misjudgement than lack of awareness.

It is inconceivable he was not aware of the potential dangers. He had driven past a pole which was suitably marked to warn him of danger and stopped his tractor

beyond the pole so that he was not stopping under the line. Unfortunately, part of his trailer lay under the line. It would seem to me more likely that he simply misjudged the distance he would have to drive past the pole to ensure that his trailer was clear of the overhead line. Greater awareness would be unlikely to affect that kind of misjudgement. I do not therefore consider on the evidence before me that Maxwell Farms failed to take any reasonable precautions which might have avoided the accident.

(42) I do not consider that there was any defect in the system of work which contributed to the accident. The system of work being applied did not include the actions of Alexander William Riddoch. The situation of danger that arose, arose not from the implement of a system of working but from the actions of a particularly zealous and enthusiastic worker who used legitimate waiting time for an unusual and unexpected purpose.

(43) The consideration of whether there were any reasonable precautions taken by the DNO or system of work operated by them to comply with their statutory responsibilities which might have avoided the accident raises quite different issues.

Part III

(44) National supply of electricity depends on a network of high voltage overhead line transmitters. Overhead lines are far cheaper to install than buried lines which use insulated cable.

(45) Given that overhead lines are visible, the emphasis for protecting the public has been on increasing public awareness of the presence of, and extent of, danger.

(46) Loss of supply can have very significant consequences for all customers on a supply circuit. Customers with electrically powered machines can find that the machinery can cease to work at perhaps crucial times. Essential lighting or essential heating may fail. Continuity of supply is very important to society as a whole in a developed country which is much dependent on electrically powered machinery and equipment and services.

(47) The performance of DNOs in the United Kingdom in maintaining continuity of supply to customers is assessed nationally by two principal measures, namely a record of the number of minutes lost and the numbers of interruptions of supply that occur.

(48) DNOs have an obligation in terms of regulations to notify the Secretary of State of specified interruptions of supply. In addition there is a financial incentive to minimise periods of loss of power supply.

(49) The physical examination of every incident of trip of a circuit breaker and thus loss of supply has been deemed by the supply industry to be not reasonably practicable in that the cause of many trips clears without other intervention and the cause becomes undetectable by physical examination at the locus of the trip. Accordingly, a system was devised whereby there could be automatic reclosure of the circuit- breaker whenever there is a fault where power runs to earth.

The automatic re-closure system is said to be a satisfactory way of limiting interruption of supply in that it has operated for many years with very few fatal accidents.

(50) Any power leak to earth is a potential source of danger. Leakage of even milliamps can cause harm to humans.

(51) A fault where power runs to earth is sometimes termed a high resistance fault. That description indicates that the amount of power actually flowing into earth is low at the time of detection. The automatic system provides for a time lag in the tripping operation based on the amount of current leakage. Momentary transient conditions and non-transient conditions both give rise to leakage. The time lag set for the Loanhead PMR was five seconds.

(52) The only reasonable conclusion from a circuit-breaker having gone through a series of automatic reclosures and then ceasing to reclose (locking out) is that there is a continuing contact with a line which is creating a leakage of current. Faults when "lock out" occurs are seldom transient in nature.

Had the tractor and trailer moved on and away from the line within the 11½ minutes from the locking out the cause of the trip might never have been known as there would have been no leakage when the line was re-energised. Thus, such an incident might have been regarded as a transient condition of unknown duration.

(53) On the evidence before me it is clear that there is no universally accepted definition of what would constitute a transient condition.

The recording of the existence of a SEF does not allow any conclusion to be drawn on whether the fault is caused by a transient condition of short duration or a transient condition of unknown duration or a non- transient condition.

The existence of a non-transient event could indicate that a dangerous condition for the public is persisting.

(54) In the absence of a means of determining whether the fault is caused by a transient condition or a non transient condition some DNOs do not allow lines which have tripped to be re-energised at all until the line has been physically inspected. On the other hand some DNOs allow for re-energising without line inspections. Of these there is wide variation in the lapse of time to be allowed before re-energising without line inspection. Throughout the country the number of incidents of trip arising from a continuing contact with an overhead line is a very small proportion of the total number of trips.

(55) In determining whether or not to manually re-energise a line which has been locked out a balance has to be struck between the need to restore supplies to those served by the tripped out circuit and the need to protect the public from the potential danger of a non transient condition persisting.

(56) Supply circuits by overhead line traverse a wide variety of terrain, some are close to heavily populated areas, some are remote from habitation of any kind. Some lines are easily accessible throughout their length, others are far less so.

(57) Some circuits will have going on under them frequent agricultural, horticultural or forestry activity. Others will seldom have any such activity. Accordingly, what might be a reasonable balance in one area may not be so in another area. The

likelihood of danger to the public is higher if there is constant work in the fields below than where there is little or no activity in the fields below

(58) A generalised policy applicable throughout the area served by the DNO may not be a reasonable approach to finding a balance between reasonable protection of the public from an abnormal condition and maintenance of supply to all users of that circuit. A DNO has a duty is to protect the supply and supply equipment as well as a duty to minimise risk to the public.

(59) It would appear to me that there is a duty on DNOs to make risk assessments in respect of all overhead lines over which they have control and to assess the variety of risks which may arise in the differing locations over which their overhead lines traverse and take that into account before deciding to re-energise a line which has locked out.

(60) The system controller who operates a control system similar to that operated by SHEPDL will be aware of the de-energisation of the circuit from their control devices. The likelihood, however, of receiving in addition an accident or incident report will vary depending on the remoteness of the location of the indicated fault, the time of the day, the visibility of the lines and the weather conditions prevailing at the material time. In accordance with the procedures laid down by the DNO the system controller in charge of the Meikle Wartle spur chose to allow more than the permitted 10 minutes to elapse before energising the line. At the time of re-energising the line he had received no reports of any incident having been reported.

(61) In the absence of line examination the only way the DNO can know if there has been an accident or continuing source of danger to the public is by report from the public or public service providers of emergency services. By re-energising a line which has become accessible or is linked to equipment which has become accessible to the public there is a significant rise in the likelihood of the occurrence of serious harm.

(62) It would appear that across the United Kingdom supply industry there is no agreed system for assessing the likelihood of the existence of a situation of continuing potential harm before manually re-energising a locked out line .

(63) The HSE representatives involved in this enquiry were unanimously of the view that the ten minute interval before re-energising as required by SHEPDL procedures was too short. The basis for that conclusion was however far from clear. Their enquiries among other DNO appear to indicate that there exists no common rational criteria for determining what is an appropriate time to wait before re-energising.

(64) In my view, this Inquiry has drawn attention to a state of matters affecting the supply of electrical power across the country which does require to be examined more closely. The evidence indicated that 10 to 15 deaths occur per annum from contact of all kinds with electrical supply apparatus.

(65) There would appear to be no system short of physical examination to allow a DNO to ascertain whether there exists a continuing interference with an overhead line other than re-energising and seeing if the circuit locks out again.

It would appear that each company has a discretion as to what factors it takes into account before they exercise their discretion to re-energise a line. There is no agreed national set of criteria for that decision.

(66) One cannot eliminate misfortune and personal danger from human affairs.

The re-energising of a line without knowledge of the cause of a repeated fault is an action which may create a situation of danger. Whether that danger results in catastrophe or not can be a matter of luck

(67) While the public have accepted that the only economic means of supply of power across the country is by overhead lines, and have accepted the risk thus posed, when an incident occurs which indicates a change in the level of risk then it is reasonable that there be a well recognised set of criteria rationally based to achieve a balance between the necessity for maintaining public supply and the necessity to take reasonable measures to safeguard the public from higher risk.

In view of the variety of social and economic conflicting interests involved it may be that there will require to be a multi- agency nationally based systematic enquiry and analysis with a view to establishing the reasonably practicable and safe means of informing system controllers of the existence of a non-transient condition and to arriving at an agreed set of rational criteria to be applied before a line which has been locked out is re-energised.

(68) The Court would wish to express thanks to all those who participated in this enquiry so sensitively and efficiently. The Court would also wish to repeat herethe expression of sympathy with the widow and family who sat through the whole enquiry with fortitude.