Interface Analysis
Centre
University of Bristol

18th May 2000

Dear Mr. Pratt,

In response to your inquiry about electric shock from 25 KV power lines, I can report that experiments over many decades in many countries have resulted in a body of universally accepted knowledge on the effects of electric current on humans and animals. Essentially the same information can be found in documents published by the various national and international standards organizations and I base my statements primarily on document PD 6519 (1988) published by the British Standards Institute. I shall attempt to summarize the information relevant to your specific inquiry, thus all the values given below relate to Alternating Current in the range of frequencies used for power distribution (15Hz to 100Hz) and to adult men. For women the figures should be reduced by approximately 50% and for children, they should be halved.

In all but the most extreme cases of electric shock, the important parameter is the electric current that flows through the body and in particular, through the heart. The smallest current that can be felt varies with individuals from approximately 0.4 mA to 2.0 mA. For currents greater than this threshold, but less than approximately 40 mA, there will be no organic damage even if the current persists, while a current of 500 mA which lasts for less than a tenth of a second will do no organic damage. Currents greater than a few mA cause muscles to contract which usually breaks the electrical circuit in less than a tenth of a second but if the source of the current is being gripped and the current exceeds approximately 10 mA, the subject may not be able to let go. As currents increase beyond 40 mA long term or 500 mA short term there is increasing risk of cardiac arrest or fibrillation, resulting in death if prompt medical attention is not available.

The electrical resistance of the body in dry conditions is of the order of 1,000 ohms and 25 KV is sufficient to arc across the insulation of working boots. Even if the insulating effect of dry ground is considered, contact with a conductor at 25 KV will result in electric current through the body of Amperes in dry conditions and tens of Amperes in wet conditions. In this range, severe burns and possible damage to internal organs are to be expected. Death is probable.

If there is an electrical insulator, which does not arc over, in the circuit between the 25 KV supply, the body and ground, the electric current flow through the body will be determined by the insulator and its condition and not by the wet or dry conditions of the body or ground. It should be noted that even if an electrical insulator is perfect in the sense that it passes no direct current when measured on a high voltage DC apparatus, it will inevitably pass some current from an AC source because of its electrical capacitance. As an example, if 25 KV, 60 Hz supply is applied to a perfect insulator with an electrical capacitance of 1 nF, a current slightly less than 10 mA will flow which would give a significant but not lethal electric shock. While it would be desirable to design protective insulators with an electrical capacitance significantly less than 1 nF, there appears to be little point in attempting to eliminate all

current flow, even if this were possible, because the shock from a current of one or two milliamperes provides a useful warning that all is not well.

I trust that the above information meets your needs. Please let me know if further information or clarification is necessary.

Yours sincerely
P. S. Aplin M. Sc., Ph. D