Lecture NO. 03

Corona

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Compiled By
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What Is Corona?

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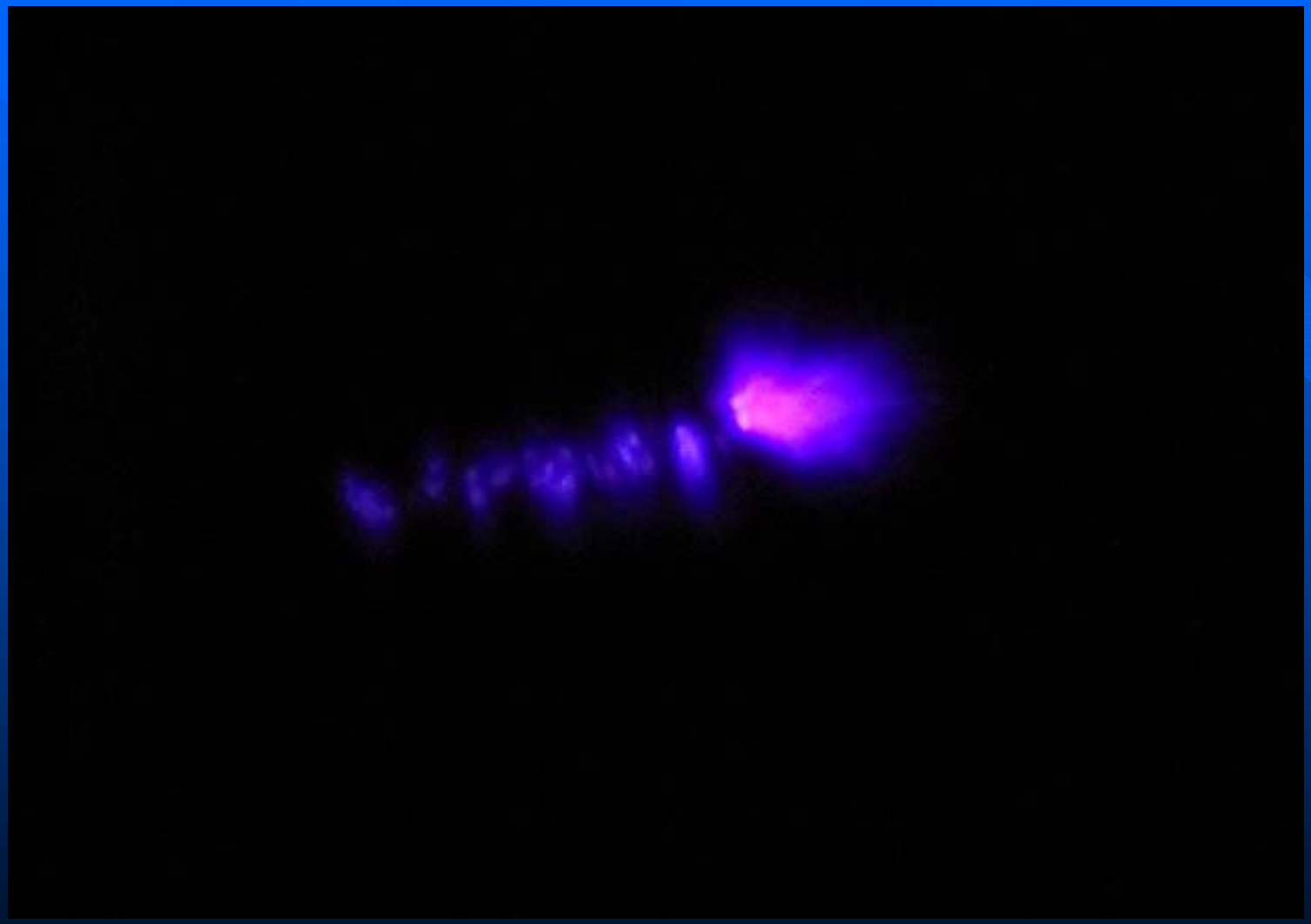
Corona is a luminous discharge due to ionization of the air surrounding an electrode, caused by a voltage gradient exceeding a certain critical value.

Example of Conductor Corona



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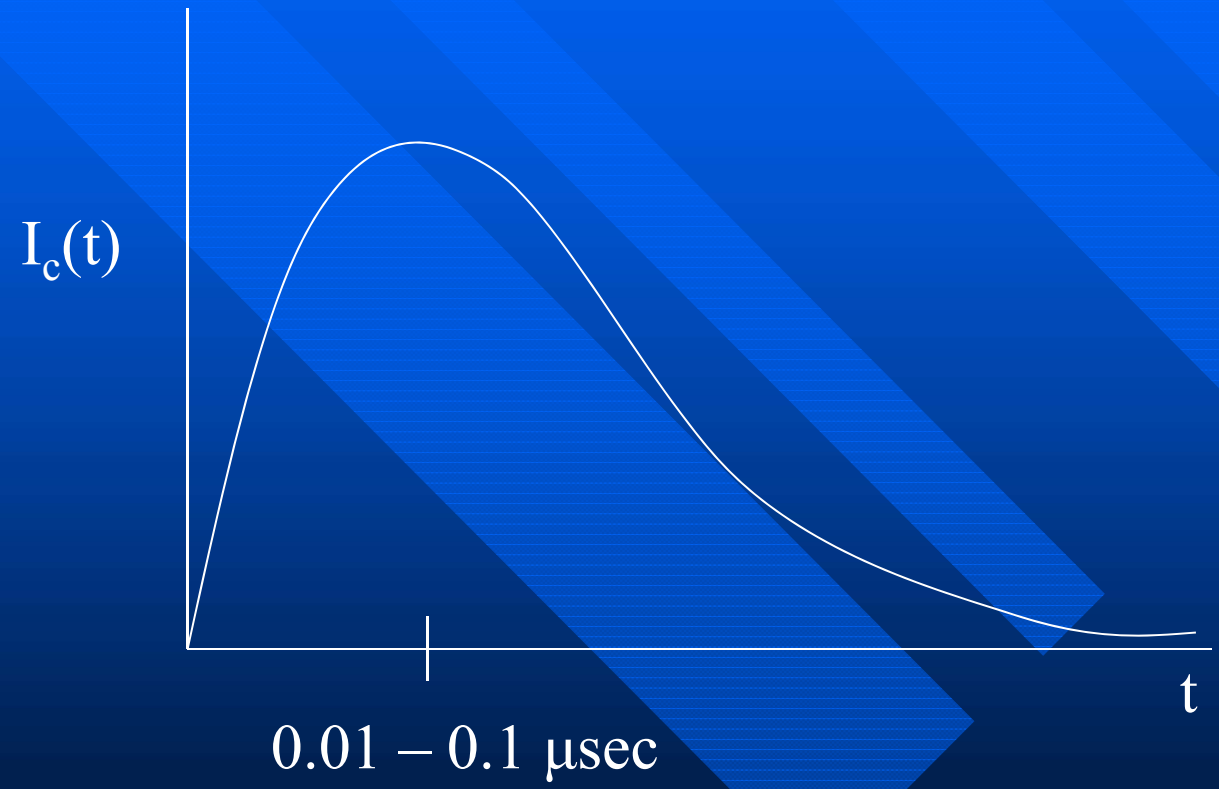
- Corona can cause possible damage to polymeric insulators

Corona Discharge Currents are Impulsive



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- Corona onset is a function of relative humidity

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- Corona is also a function of the rate of decay of the electric field away from the electrode (conductor)

Corona and the Electric Field

For the preceding reasons, selecting the conductor with the smallest electric field at its surface is not correct.

One utility found out (the hard way) that simply choosing large diameter conductors did not work well because the electric field decayed slowly away from the surface

Corona and the Relative Air Density

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- Standard line designs that perform well at sea level, may have significant corona issues if used on lines that are installed over mountainous areas

Corona and the Humidity

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- Fair weather corona is more prevalent in low humidity environments

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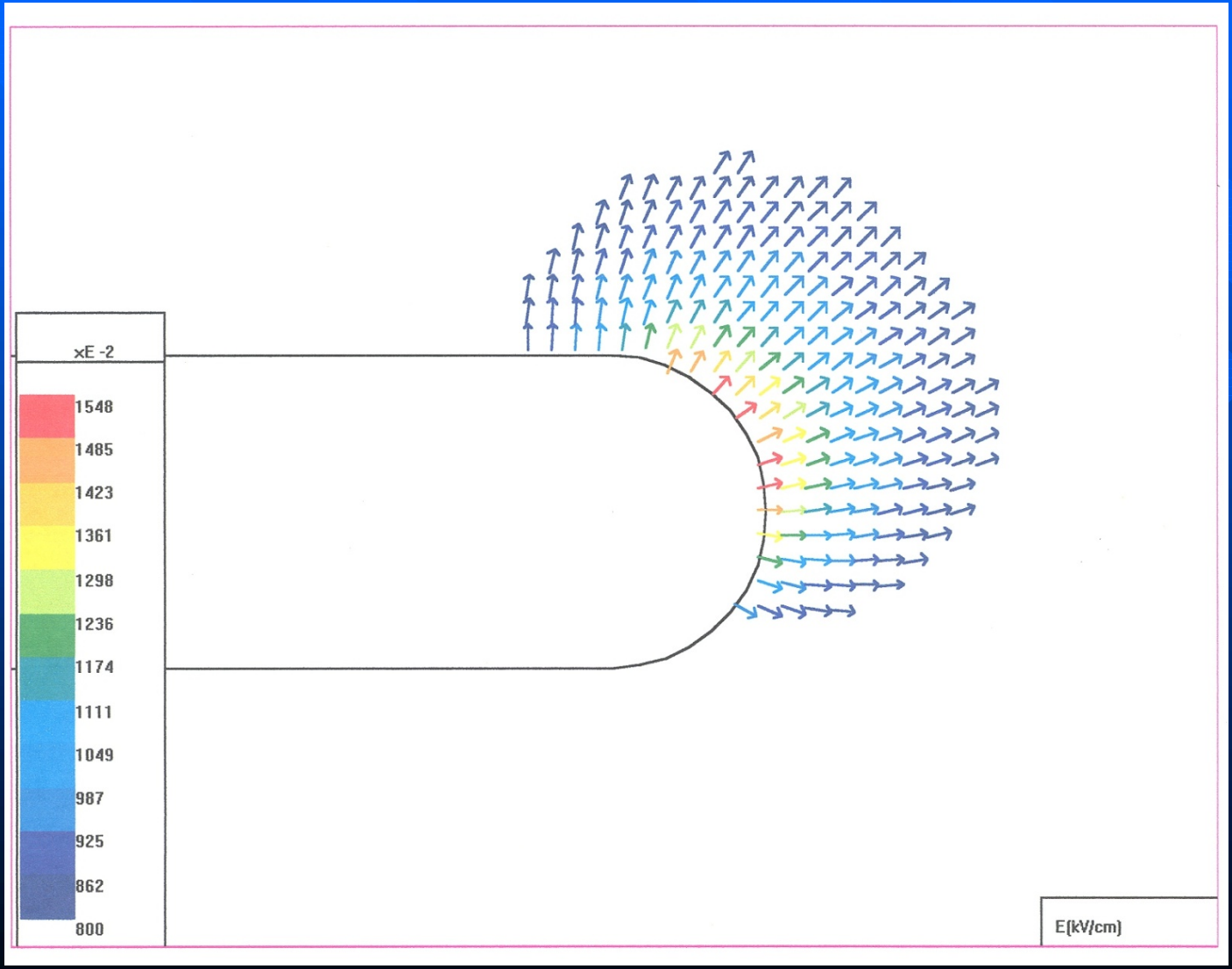
- Corona is significantly increased in foul weather.

Corona Is Dependent On Local Electrode Geometry



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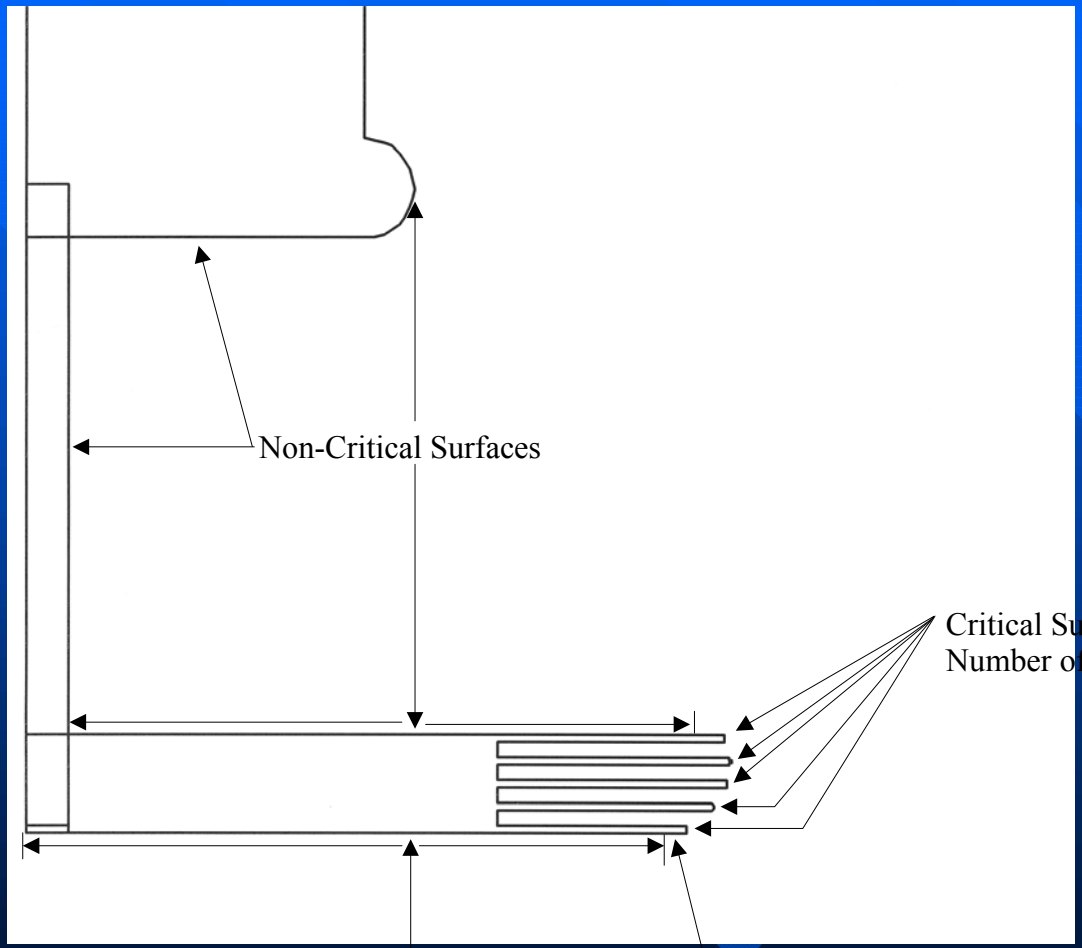

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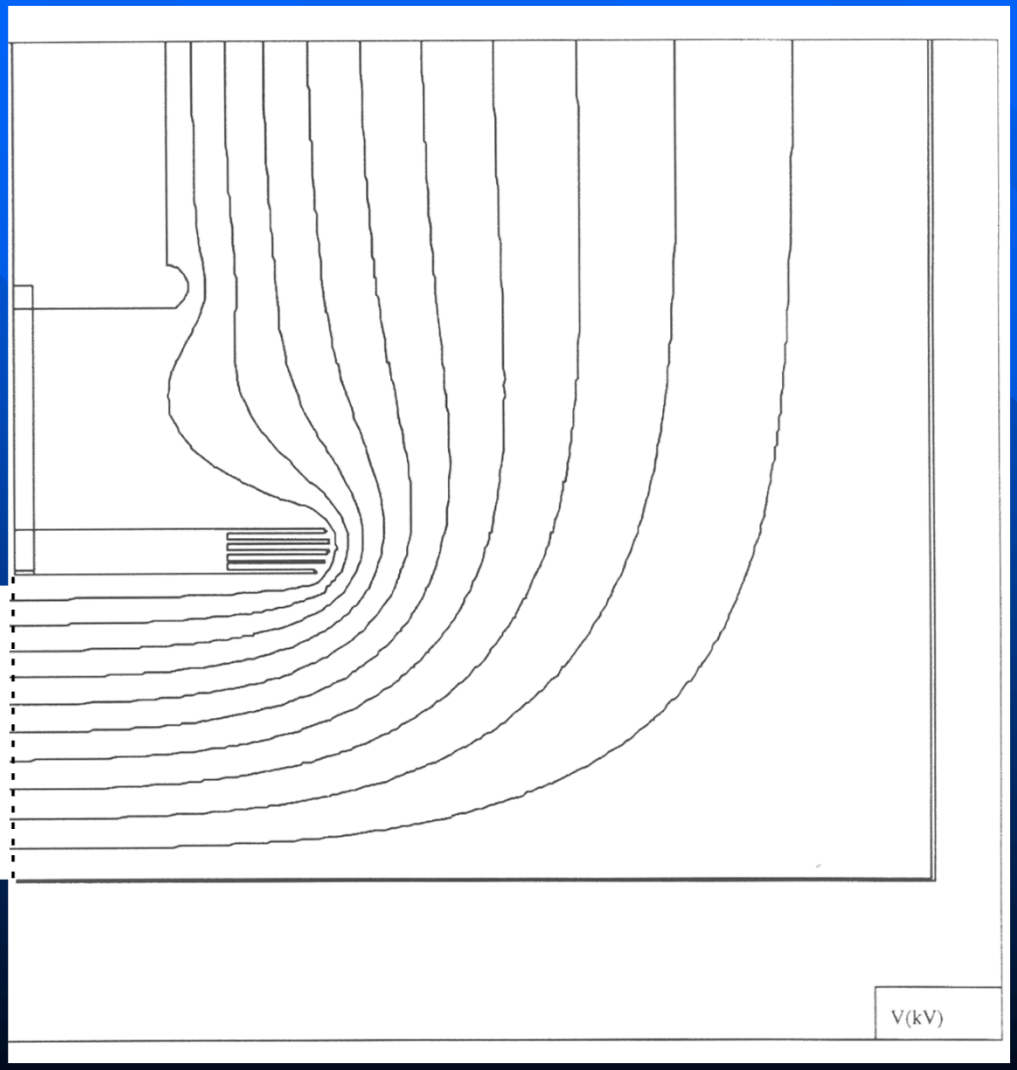

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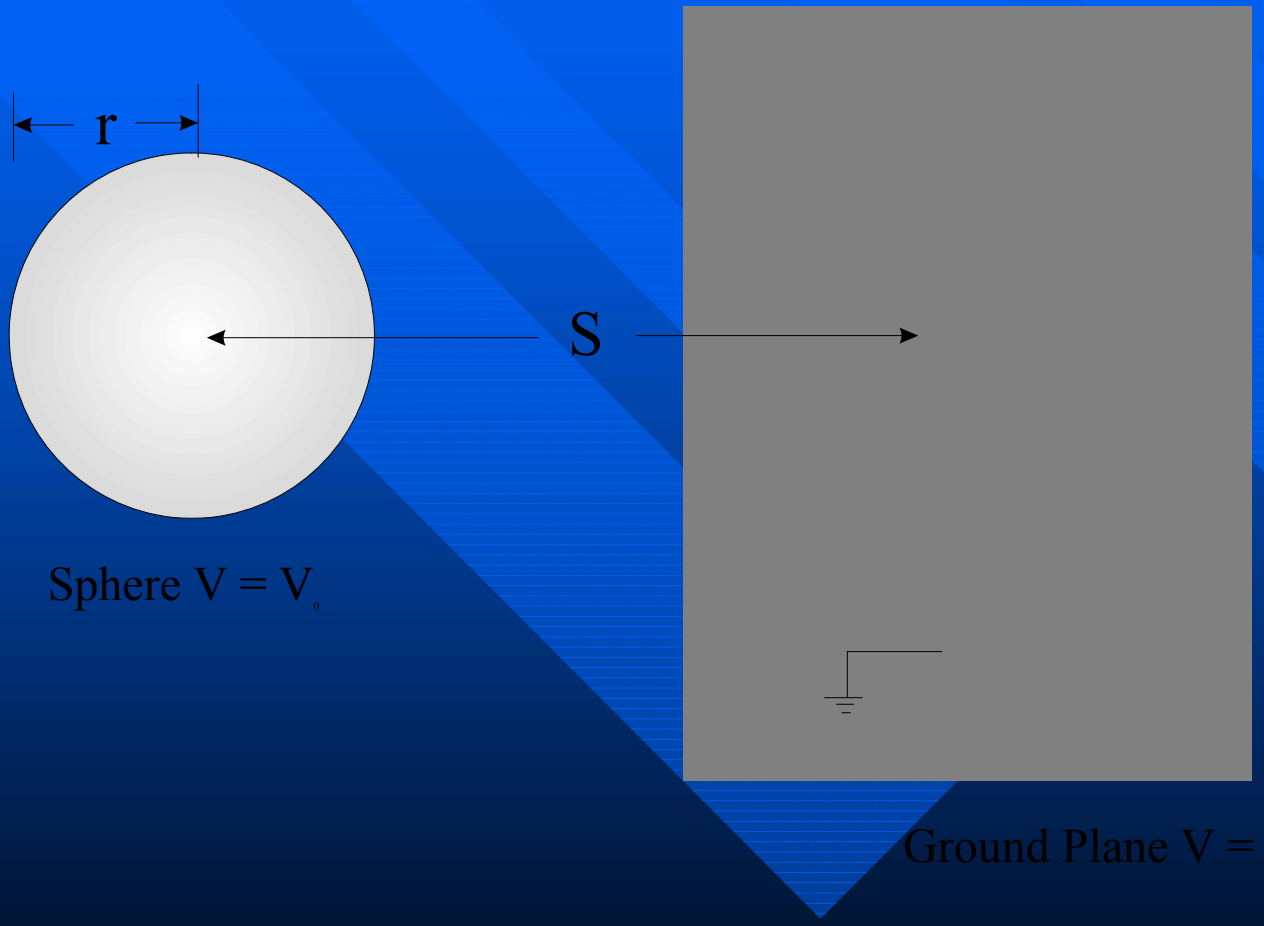

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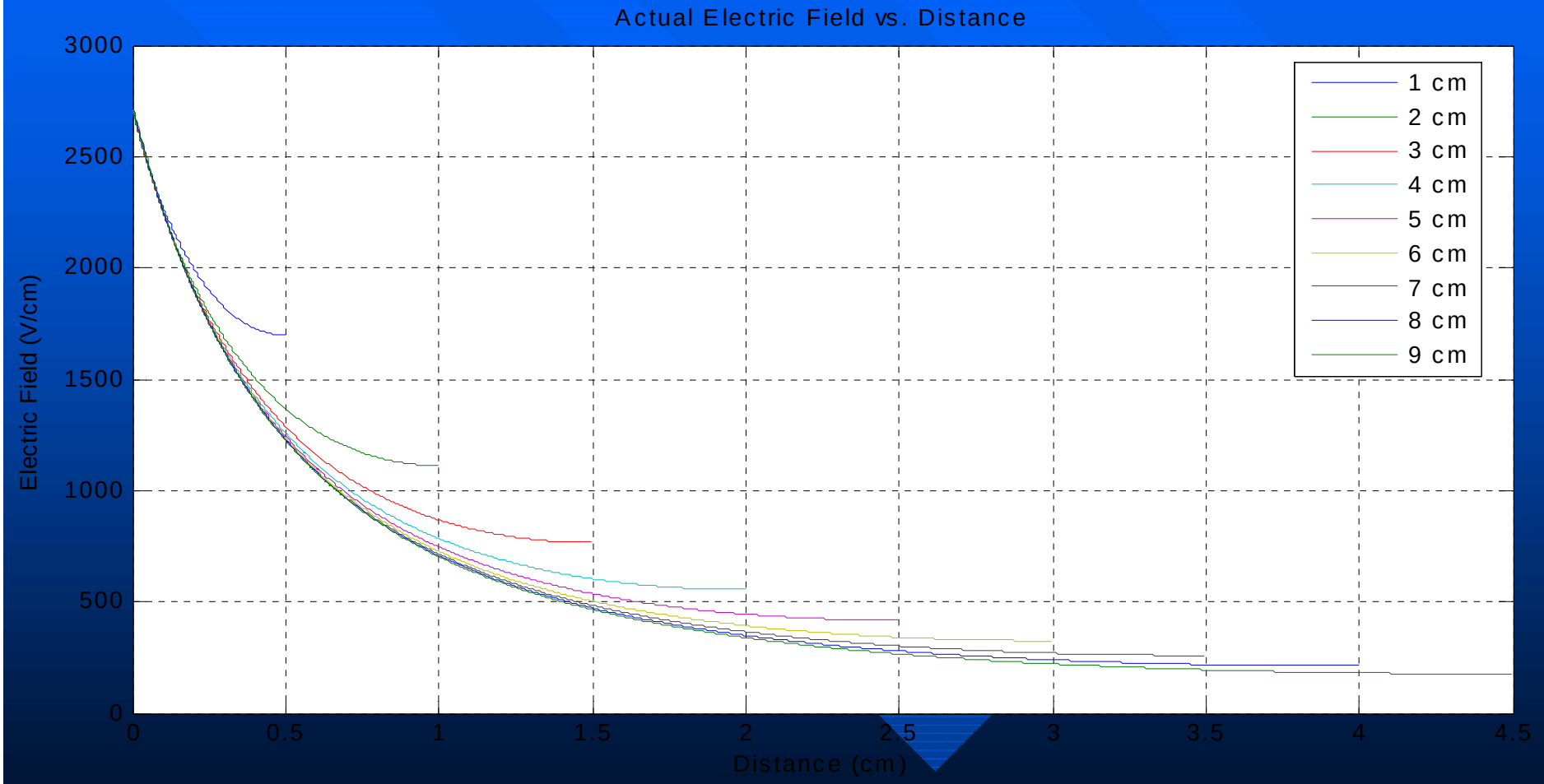

Why is it a special problem for voltage upgrades?

If the voltage of a transmission line is increased without changing the line design, the electric field at the surface of the line conductors (and hardware) will increase. This increase will cause additional Corona

Practical Consequences

1. Larger conductors better – to a point
2. Use conductor bundles to reduce corona
3. Corona phenomena much worse in foul weather, high altitude
4. Compact lines more susceptible
5. New conductors can lead to poor corona performance for a while

Cautions Regarding Radio Noise

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- High frequency complaints are almost always due to sparks
- Causes of spark discharges can be located and repaired
- Corona is a DESIGN ISSUE

Cautions Regarding Radio Noise

- Radio noise caused by corona cannot be reduced by changing the line configuration near where the noise problem is occuring. The source of the problem can be several miles away

Audible Noise

Can get “broadband noise” and “hum”

Load can affect audible noise

For measurement see:

ANSI/IEEE Standard 656-1992 – “IEEE Standard For Measurement of Audible Noise from Overhead Transmission Lines

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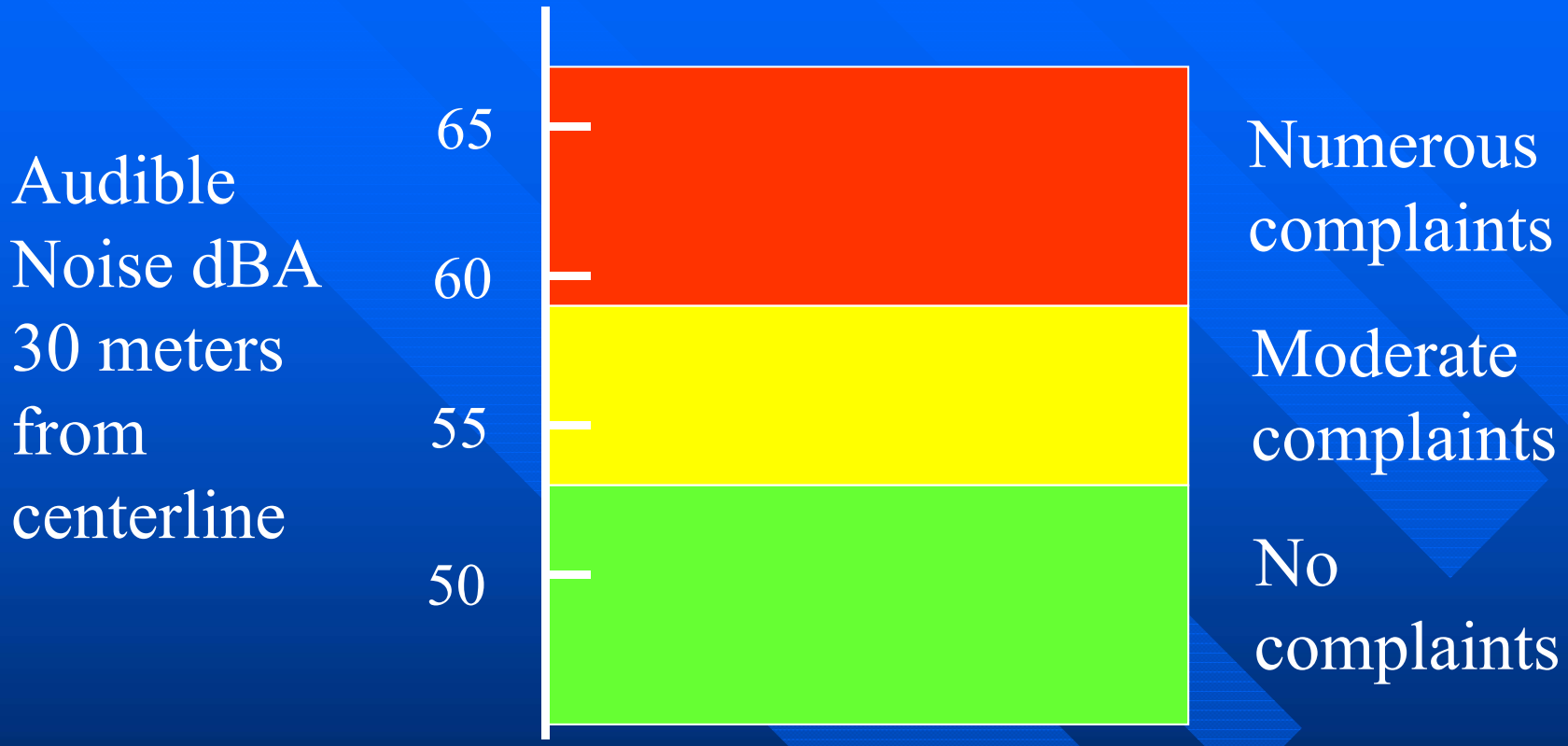
Audible Noise in Context



Common design limit – 53 dBA

Source: BPA study

Corona Loss

What is it?

Whenever corona occurs on a transmission line, there is a corresponding loss of energy called “corona loss.” This loss is one of the reasons why the transmission of electric energy between two points is not perfect.

When can it be a problem?

Generally, corona loss is significantly less than resistive loss. However, at higher voltages, high altitudes and during foul weather, corona loss can actually exceed resistive loss.

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Example Losses (sea level)

Line Voltage (kV)	Bundle n x 2a	Load MVA	I^2R Loss kW/km	Corona Loss (kW/km)	
				Average	Maximum
362	2 x 3.16	400	41	2	26
550	3 x 3.3	900	52	4	78
800	4 x 3.3	2000	93	8	208

Corona On Hardware

Transmission line hardware is usually tested in the laboratory prior to being selected to determine whether is corona free. This test is often done on a single phase system in order to conserve laboratory space.

It has been found that the traditional method of energizing the system to 110% of the rated line to ground voltage is not sufficient, especially for lines of more compact design. Apparently, the hardware is exposed to higher gradients in the field than those to which the hardware was tested.

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