### Description of RG®

- RG<sup>®</sup> Stands for Resistive Graded Porcelain
- The Glaze is a Permanent Semiconductor
- This Allows for a Controlled Continuous Current to Flow Across the Surface of the Insulator (1mA  $\pm$ .50)
- Linear Voltage Distribution
- The Current Prevents Dry Band Arcing
- The Current Creates a Heating Effect





### How Does RG<sup>®</sup> Work?

- The glaze of the insulator acts as a semi-conductor
- When voltage is applied to the glaze a controlled current flows through the glaze
- This provides a continuous current on the surface of the insulator
- The protected leakage areas of the insulator cannot have dry band arcing during wetting, or ever





### Contamination

- Contamination Exists in Many Forms...
  - Salt Spray (i.e. Coastal Locations, Seasonal Maintenance, etc.)
  - Roadway, Railway & Airport Contamination
  - Dirt, Dust, Debris & Open Fields
  - Industrial Emissions & Pollution
    - Steel, Paper & Cement Mills
    - Petrochemical Plants, Oil Refineries & Coal Processing
    - Mining & Metal/Mineral Ore Processing
  - Agricultural Material & Processing
    - Crop Dusting
    - Fertilizer
    - Mulch
- Cost of Routine Cleaning
- Unpredicted Flashovers & Potential Damage
- Service Outages





### **Common Contamination Mitigation Practices**

- Routine Washing (Hot Line Washing, Hand Washing)
- Over Insulation
- Greasing
- Increase Creep / Leak
- Silicone Coatings NOT a Permanent Solution
- RG<sup>®</sup> Solution (Maintenance-Free & Long Term)





# **RG®** Glaze Insulators

### History

- RG<sup>®</sup> In-Service Since 1970!
- It was Developed to Solve Performance Issues that Utilities were Facing Due to Heavy Contamination
- The Target Areas for RG<sup>®</sup> are Heavy Contamination Locations, Coastal, Desert, Heavy Industry & Road Ways
- Over 1 Million Units in Service!
- <u>Last 10 Years Total Sales of RG<sup>®</sup> > \$40</u> Million!







### **RG<sup>®</sup> Glaze Benefits**

- RG<sup>®</sup> Out-Performs Standard Glaze
- RG<sup>®</sup> Can be Offered in Standard, High Leakage or Extra High Leakage Profiles
- RG<sup>®</sup> is a Long Term Solution to Contamination Issues
- RG<sup>®</sup> Prevents Ice Bridging
- RG<sup>®</sup> Cost of Ownership is Less than Maintenance
- Fully Vitrified Glaze is Permanent for the Life of the Insulator Chemically Bonded to the Porcelain
- RG<sup>®</sup> Glaze <u>DOES NOT</u> Wear Off
- Withstands Pressure Washing





# **RG®** Glaze vs Silicone Coating

#### RG<sup>®</sup> Glaze:

- Offers superior contamination performance compared to standard glaze
- <u>Long term</u> solution to contamination application
- Fully vitrified glaze is permanent for life of insulator- chemically bonded to porcelain
- RG<sup>®</sup> glaze does not wear off
- Withstands pressure washing
- Conductivity is 100% tested and verified at factory



#### Silicone Coated Post:

- Offers contamination performance enhancement to standard glaze
- Short term solution to contamination application
- RTV silicone has potential to wear away- mechanical bond to porcelain, much weaker bonding than glaze
- Does not withstand pressure washing as well as actual glaze
- Quality control is questionable and can vary between applications
- Silicone coatings can cover critical core flaws and cosmetic concerns
- Can be applied to existing insulators in the field
- RTV silicone can lose hydrophobicity via UV radiation, leaving it partially or completely ineffective



### **RG®** Glaze Insulators

### Common Misconceptions About RG®

- RG<sup>®</sup> Glaze has High Power Losses
  - As was shown, RG<sup>®</sup> may be the most efficient option for contamination performance
- RG<sup>®</sup> Glaze can have Thermal Runaways
  - It is impossible for RG<sup>®</sup> to have a Thermal Run-Away, between 200-250C the Glaze will become stable and cease to be a semiconductor
- RG<sup>®</sup> Glaze can Degrade Over Time
  - New information calls into question this long held belief
  - Extended field returns show the conductivity within specification





### **Recommended Practices**

- DO's
  - Bonding/Grounding is Required
  - Cleaning the Insulators <u>is NOT</u> Necessary, But Can Be Performed
  - Inspect the Insulators for Damage, Upon Installation

- Dont's
  - <u>DO NOT</u> Clean Insulators with Hot Water in Sub-Zero Temperatures
  - <u>DO NOT</u> Use in DC Applications
  - <u>DO NOT</u> Use in Extremely High Temperature Applications Without First Consulting LAPP



### Industry Experience

- Hydro One Networks (Ontario, Canada)
- Pacific Gas & Electric (West Coast)
- Florida Power & Light (East Coast)
- S&C Electric
- LADWP (West Coast)
- Ameren (Missouri)
- Con Edison (New York City)





### **Customer Testimonials**

- PG&E
- FP&L
- Hydro One

# Technical / Industry Studies & Papers

- Kinetrics
- EPRI
- ESKOM





### Service Life

- New test data indicates that RG<sup>®</sup> glaze material does not decrease in conductivity over time
- It was previously thought that RG<sup>®</sup> conductivity degraded over time due to dry aging
- The chart to the right represents 50 years of extended lifecycle testing
- Multiple units returned from FP&L extended service have conductivity within normal specifications





# **RG®** Glaze Insulators

### Service Life Cont: RG<sup>®</sup> Insulators have Less Leakage Current than Regular Insulators

• A report written by ESKOM<sup>1</sup> in 2005 (Practical Guide to Outdoor High Voltage insulators) shows that RG<sup>®</sup> Insulators are SIGNIFICANTLY more efficient than all other current market options for contamination performance.



Time Of Day

