

Submerged / Flooded Cables

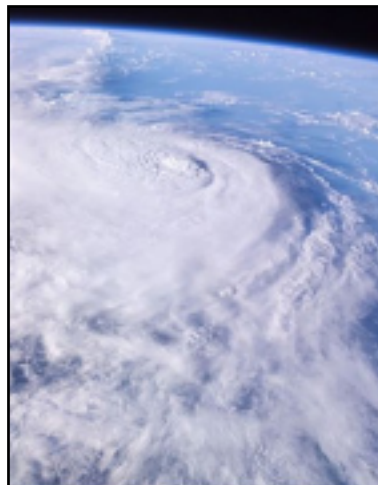
Expert advice and information links from the cable professionals



The devastation in the U.S. Gulf Coast region from Hurricanes Katrina and Rita is one of the greatest natural disasters our country has faced. One of the keys to recovery will be the restoration of businesses and industries that have been submerged by rain, tidal surges and post-storm flooding.

As a leading cable manufacturer/supplier to the oil and gas industry, AmerCable undertook a proactive research and ongoing evaluation program to identify cable performance and safety concerns relative to prolonged submersion of power, control, and instrumentation cables in water.

This article was assembled by AmerCable's oil and gas cable engineering staff. We hope this information and the associated links will be useful in your decision making process as you are attempting to restore/rebuild electrical equipment.



"Future operational safety of the electrical system and the safety of people working near it should be the number one priority."

– Rudy Bright
AmerCable

Offshore Rig and Platform Cable Issues

Especially vulnerable was the Gulf's oil and gas industry. Katrina and Rita cut through the heart of the offshore oil patch, damaging a large number of offshore rigs, including many that are likely to be scrapped. Additionally, damage to at least 30 offshore platforms has been confirmed, with 18 platforms declared a total loss. And that number may increase after further evaluation.

Water that has entered electrical cabling on offshore rigs and platforms will have a higher salinity and cause the most problems. The higher salt content of ocean water accelerates corrosion of copper conductors and accelerates the reduction of the conductor insulation's

break down voltage. An IEEE technical paper AmerCable recommends is titled "Aging Performance of EPR Compound Under the Influence of Thermal Stress and Saltwater." This informative paper can be purchased through the IEEE website at www.ieee.org.

Hidden Danger / Fire Hazard

Electrical wiring and equipment exposed to flood waters can be extremely dangerous if reenergized without replacement or professional reconditioning. Initially, it may not be apparent that the integrity of the electrical system has been compromised as a result of contaminants and sediment lodged in the equipment (eg. initial megger and hi-pot testing will not predict premature failure of electrical wiring).

However, exposure to moisture will result in corrosion of the exposed metallic parts and an increase in the resistance between electric contacts. As corrosion builds, increased resistance may cause overheating of the metallic parts. This in turn, can result in the overheating and burning of the wire insulation.

This progressive burning can bring about combustion of flammable materials and an ensuing fire.

continued

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Handling Water Damaged Electrical Equipment

The National Electrical Manufacturers Association (NEMA) publishes a document titled "*Guidelines for Handling Water Damaged Electrical Equipment*". The cable engineering staff at AmerCable highly recommends reading this brief document, which provides advice on the safe handling of electrical equipment that has been exposed to water through flooding, fire fighting activities, hurricanes, etc.

It is written for suppliers, installers, inspectors, and users of electrical products. The brochure outlines which items will require complete replacement or can be reconditioned by a trained professional. Equipment covered includes electrical distribution equipment, motor circuits, power equipment, transformers, wire, cable and flexible cords, wiring devices, GFCIs and surge protectors, lighting fixtures and ballasts, motors, electronic products including signaling, protection, communication systems, and industrial controls, and cable trays. This document can be downloaded free of charge at www.nema.org/stds/water-damaged.cfm.

Recovery Lessons From Hurricane Georges

The level of damage on the Gulf Coast oil and gas infrastructure is extensive, and it will be a long, difficult process to repair the problems that will arise in the wake of Hurricanes Katrina and Rita. To aid in the restoration of onshore industrial and business operations, the Institute of Electrical and Electronics Engineers (IEEE) has made available (at no charge) the technical paper, "*Disaster Recovery Project Management*" which provides a case history and lessons learned from the restoration of a large oil refinery following severe damage from Hurricane Georges in 1998. It may be useful as a reference in planning and organizing recovery and restoration of petrochemical and other industrial facilities. This document can be downloaded at www.ieee-pcic.org.

Accelerated Deterioration

Another IEEE technical paper AmerCable recommends is "*The Behaviour of Water in XLPE and EPR Cables and its Influence on the Electric Characteristics of Insulation*." This paper demonstrates what happens if water is allowed to remain in the cable during operation. The paper shows that the combined effects of water or water vapor, pressure, moisture, electric field and temperature will greatly accelerate deterioration of XLPE and EPR cable insulation materials. Pressure within medium voltage cables (rated 5kV and greater) is especially of concern. Separation of semi-conducting and insulating layers will cause partial discharge and premature failure. This paper can be purchased through the IEEE website at www.ieee.org.

Recommendations

In conclusion, AmerCable recommends all water-damaged electrical equipment be completely evaluated. Some equipment might be repaired through professional rebuilders, but most of any electrical system that has been submerged will require replacement. Future operational safety of the electrical system and the people working within its proximity should be the number one priority.

AmerCable's experienced cable engineering staff is available to provide expert information and a professional evaluation of your damaged equipment and cabling.

REFERENCES

NEMA Staff: "*Guidelines for Handling Water-damaged Electrical Equipment*", undated.

Hayes, Phillip; Hammons, Aubrey: "*Disaster Recovery Project Management*", IEEE Paper No. PCIC-2000-6.

S. V. Nikolajevic: "*The Behaviour of Water in XLPE and EPR Cables and Its Influence on the Electric Characteristics of Insulation*", IEEE Transactions on Power Delivery, Vol. 14, No. 1, January 1999.

Kaltenborn, Uwe; Hackam, Reuben; Kindersberger, Josef: "*Aging Performance of EPR-Compound Under the Influence of Thermal Stress and Salt-Water*", High Voltage Engineering Symposium, 22-27 August 1999 Conference Publication No. 467, IEE, 1999.



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