The SorbWeb™ Plus Solution

Secondary Oil Containment System

RESPONSE UNDER SEVERE WINTER CONDITIONS

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1. Introduction and description of the problem:

Conventional secondary containment systems for oil filled transformers, such as concrete pits, can be negatively affected in winter weather due to accumulation of snow and ice and/or the freezing of standing water in containment sumps and oil-water separators. The effects can result in:

- The containment volume originally designed to contain the spilled oil could be occupied by the standing snow/ice or water.
- The freezing pipes can prevent the flow through the system, flooding the containment area, causing the oil to spill into the surrounding area.
- Frozen pumps and other mechanical devices in the oil-water separator system will fail to operate, causing the sump to overflow and discharge oil into the environment.

The potential problems inherent to the conventional secondary systems are not present in the **Sorbweb™Plus** system. **Sorbweb™Plus** is a passive oil containment system solution that offers continuous protection against oil spills from transformers. The **Sorbweb™Plus** secondary containment system is an engineered "smart" solution that allows water from rainfall and/or melted snow to drain through the composite, retaining oil that might leak or spill from the transformer. **Sorbweb™Plus** has been installed in various North American weather conditions.

As the **Sorbweb™Plus** secondary containment system is free draining, where water freely drains out, there is minimal ice formation in the interstices of the stones and therefore the void fraction of fire quenching stone layer remains virtually empty. It is expected that fresh snow would cover a small fraction of the top layer of fire quenching stones and not penetrate to any depth of the fire quenching stone layer.

It is also expected that an area around the energized transformers remain free or relatively free of snow due to the radiant heat from the transformer and the melting of the falling snow on the surface of the transformer. As snow falls down on the transformer surface, the snow is converted into liquefied water on the transformer wall. As the temperature of an energized transformer is in the order of 80 degrees Celsius and higher, the conduction of heat from the transformer to liquefied water will make the temperature of the water increase well above the freezing point. This warm liquid water would add to the radiant heat of the transformer and increase the snow free area around the transformer. The liquefied water would subsequently drain through the **Sorbweb™Plus** composite.

Based on the relative densities between the spilled oil [920 kg/m^3] and the fresh snow [160 kg/m^3], it would be expected that oil would go through the fresh snow into the fire quenching stones. In addition, the heat carried by the hot oil will allow the melted snow and ice and the melted water to travel with the oil into the stones. As indicated earlier, the fire quenching stone's void area will remain virtually empty, as only a small fraction of the top layer will be filled with snow. As snow is typically $1/10^{th}$ the volume of water, 1 m of snow would be about 10 cm of liquefied water. The system can be designed for a 24hour/ 25 year rainfall event; therefore, the volume area within the fire quenching stone void will meet the capacity required for the snow melt that exists.

In the event of a decommissioned transformer, based on the relative densities between the spilled oil [920 kg/m^3] and the fresh snow [160 kg/m^3], it is expected that the spilled oil from the transformer would pass through the fresh snow into the fire quenching stones. The much lower temperature of the oil makes the oil viscosity to be much higher therefore the mobility of the oil would be much slower.

As the oil and the snow would be at the same temperature, no thermal effects are expected.

With an energized transformer spill, the spilled oil would be able to migrate through the empty fire quenching stones. When water from the melting snow, reaches the oil-absorbing mat, before it is sealed with oil, would be able to permeate the system.

With a de-energized transformer the spilled oil would be at a relatively high viscosity and would slowly sink through the fresh snow into the empty voids of the fire quenching stones. The void volume of the stone layer is capable of holding oil from the transformer.

Sorbweb™Plus will provide a reliable and effective containment system in the event of a catastrophic transformer failure, even under various Canadian winter conditions.