Albarrie Canada

SORBWEB PLUS with SAM OIL CONTAINMENT PILOT TEST

3 June 2015

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SORBWEB PLUS WITH SAM
OIL CONTAINMENT PILOT TEST

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Executive Summary

ARCADIS Canada Inc. (ARCADIS, formerly Decommissioning Consulting Services) was contracted by Albarrie Canada Limited (Albarrie) to provide third party oversight of the Sorbweb Plus with SAM Secondary Oil Containment System pilot test. Albarrie's objective for the pilot test program was to obtain verification of the hydrocarbon spill performance of the Sorbweb Plus with SAM system for a 72-hour time period when subjected to a major transformer oil spill (e.g. the rupture of a transformer oil tank).

The methodology involved constructing a scaled down pilot unit. The pilot unit was installed according to the procedures documented in the Sorbweb Plus with SAM Installation Manual (Appendix D). The unit received a simulated 'spill' of 150 litres of transformer oil (Hyvolt II C50B), and was left for 72 hours. There was no visual evidence of oil penetration through the oilmat. This was further confirmed when the petroleum hydrocarbon test results for sand samples collected from below the oilmat and sent to an accredited commercial testing laboratory were below the laboratory's Reportable Detection Limits (RDL), which are below regulatory standards.

Thus the Sorbweb Plus with SAM pilot testing program demonstrated that the units successfully met Albarrie's objective and contained the 'spilled' transformer oil for a period of 72 hours.
1. Introduction

Albarrie Canada Limited (Albarrie) manufactures and markets the Sorbweb Plus with SAM Secondary Oil Containment system for installation at electrical transformer sites to protect against oil spills and leaks. The Sorbweb Plus with SAM system is specifically tailored to absorb small leaks or drips without requiring replacement, while still being able to contain a major spill.

In full scale installations the containment system is designed to allow water to flow through under normal conditions (e.g. such that rainwater or snow melt does not overflow the containment area) and absorb small amounts of oil in the upper absorbent layer, but if there is a major oil spill, the sealing layer forms an impermeable gel with the oil and prevents any liquid discharge. The containment area volume is generally tailored to contain both the entire oil volume and a major storm event in the case of a major spill. The oil and water are then pumped out and the entire system decommissioned and replaced. In the case of chronic leaks, the sealing layer will not be impacted and will not impede drainage.

ARCADIS Canada Inc. (formerly Decommissioning Consulting Services) was requested by Albarrie to peer review the installation and performance of a pilot test Sorbweb Plus with SAM secondary oil containment system. Albarrie’s objective for the pilot test was to obtain verification of the hydrocarbon spill performance of the Sorbweb Plus with SAM system for a 72-hour time period when subjected to a major transformer oil spill.

The results of the peer review are provided in this report.
2. Methodology

At the Albarrie facility, bench scale testing using 10 and 15 cm diameter columns has generally been used to investigate the performance of the oilmat and absorbent system for various transformer oils, and to assess components and design characteristics of the system such as oilmat materials, thickness and different types of oilmats. The need for a two-tier system was identified in order to avoid replacement of an entire containment system due to a small spill or chronic leak causing the containment system to seal.

The resulting system is Sorbweb Plus with SAM, which has a top layer of absorbent polymer (the absorbent layer) and a bottom layer of sealing polymer (the sealing layer). The absorbent layer will absorb up to 20 L/m² of oil, though 15 L/m² is used as a conservative estimate for design purposes. Only once this saturation point is reached will oil penetrate through the absorbent layer and react with the sealing layer. The system remains permeable to water until the sealing layer is impacted.

Albarrie manufactures both the absorbent and sealing layers by placing a known quantity of polymer between two layers of geotextile. These mats are packaged in different colours for ease of installation.

In full scale installations, polypropylene sheets seal the sides of the excavation and redirect flow to a central drainage area.

The pilot project was performed in a box, 46.5 inches (118 cm) wide by 43.5 inches (110 cm) long and 24 inches (61 cm) deep. This provided sufficient space to include all the layers placed in full scale installations. The pilot unit was installed according to the procedures documented in the Albarrie Sorbweb Plus with SAM Installation Manual (Appendix D). A detailed outline of the pilot installation procedure along with associated photographs is provided in Appendix A.

The pilot test bed was constructed with all components of the full-scale unit – sealing and absorbent layers, sand layers, nonwoven geotextiles, polypropylene sheets and a layer of washed crushed stone as shown in Figure 1. The depths of the layers were representative of full-scale field units, though the depth of crushed stone can be adapted to transformer volume. The sidewalls are sealed with polypropylene sheets and drainage is redirected to the central drainage area cut through these sheets. The sealing layer is sealed to the top and bottom polypropylene sheets using Dymonic 100, which is left to cure for 24 hours.
The oil spill simulation was carried out using 150 L of transformer oil (Hyvolt II C50B) in the pilot test bed. The oil was limited to this volume to minimize the quantity of waste oil requiring disposal upon completion of the pilot test.

The pilot bed was assembled on 27 February, 2015 and the sealant allowed to cure over the weekend (though the Dymonic 100 only requires 24 hours). The system was then saturated with water on 2 March, 2015 until the water level was above the crushed stone layer. Water started to drain through the bottom of the system within 5 minutes and was draining heavily within 10 minutes. Within less than two hours, no water remained in the crushed stone layer and water only dripped slowly from the bottom of the bed.

Once the water had drained, a total of 150 L of transformer oil (Hyvolt II C50B) was ‘spilled’ onto the stone on the top of the bed on 2 March, 2015 at 11:00 am and the bed was deconstructed and inspected 72 hours later on 5 March at 11:00 am. Details of the deconstruction of the beds and inspection of the layers and associated photographs are provided in Appendix B.

A profile drawing showing the structure of the pilot bed is provided in Figure 1 at the end of this report.
3. Observations and Results

Albarrie's objective for the pilot test was to obtain verification of the performance of the Sorweb Plus with SAM system for a 72-hour time period when subjected to a major transformer oil spill.

During the deconstruction of the pilot bed, visual observations indicated that there were no leaks through the sealing layer, and the oil was completely contained. As indicated in the deconstruction log (Appendix B), the absorbent layer was saturated with oil, a thin layer (1 mm thick) of blue gel had formed at the surface of the sealing layer and none of the blue dyed oil had penetrated past that layer. A white absorbent layer was used below the sealing layer and there was no evidence of blue dye on this absorbent. Two samples from the sand layer below the olimat, within the drainage area, were sent to Maxxam Analytics Inc., a Canadian Association for Laboratory Accreditation (CALA)-accredited commercial laboratory, for analysis of oil content (petroleum hydrocarbon fractions F1 through F4 and BTEX) before and after the pilot test to confirm these observations. Sample SAND-0 was taken during the construction of the pilot system while sample SAND-72 was taken during the deconstruction phase.

The laboratory Certificate of Analysis providing the results of the petroleum hydrocarbon testing of the sand samples collected from below the olims before and after the pilot test is provided in Appendix C. All results were below the laboratory's Reportable Detection Limit (RDL) for each of the fractions tested. Table 3.1 shows the laboratory's RDL in comparison with the Ministry of the Environment and Climate Change (MOECC) Ontario Regulation (O.Reg.) 153/04 Table 1, Full Depth Background Site Condition Standard for a Non-Agricultural Property Use and Table 2 Full Depth Generic Site Condition Standards in a Potable Ground Water Condition for Industrial/Commercial Property Use.

These results confirm the visual observations that there were no leaks through the absorbent layer of the pilot Sorweb Plus with SAM unit.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>RDL for All Samples</th>
<th>Standard (Table 1)</th>
<th>Standard (Table 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>0.020</td>
<td>0.02</td>
<td>0.32</td>
</tr>
<tr>
<td>Toluene</td>
<td>0.020</td>
<td>0.2</td>
<td>6.4</td>
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<tr>
<td>Ethylbenzene</td>
<td>0.020</td>
<td>0.05</td>
<td>1.1</td>
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<tr>
<td>Xylenes</td>
<td>0.040</td>
<td>0.05</td>
<td>26</td>
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<tr>
<td>PHC-F1 (C10-C16)</td>
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<td>55</td>
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<tr>
<td>PHC-F2 (C16-C34)</td>
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<td>10</td>
<td>230</td>
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<tr>
<td>PHC-F3 (C34-C50)</td>
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<td>240</td>
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<tr>
<td>PHC-F4 (C34-C50)</td>
<td>50</td>
<td>120</td>
<td>3300</td>
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</table>

All concentrations in µg/g
RDL - Reportable Detection Limit
* All results were below RDL.
** MOECC O.Reg. 153/04 Table 1 Full Depth Background Site Condition Standard, Non-Agricultural Property Use (in µg/g).
*** MOECC O.Reg. 153-04 Table 2 Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, Industrial/Commercial Property Use (in µg/g).
4. Conclusions

Albarrie’s objective for the pilot test was to obtain verification of the performance of the Sorbweb Plus with SAM system for a 72-hour time period when subjected to a major transformer oil spill.

The results of the pilot test program demonstrate that the Sorbweb Plus with SAM system successfully met Albarrie’s objective and contained a 150 litre transformer oil ‘spill’ for a 72-hour time period. No oil passed through the oilmat barrier.