VEOLIA
ENVIRONMENTAL SERVICES

SPECIAL SERVICES

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Re: 2010 Straits of Mackinac Pipeline Inspection & Repair Project

Dear Jake,

Attached you will find the job overview report. This report will contain detailed information from the Enbridge Energy, Straits of Mackinac pipeline inspection and repair project. Included with the report are the Remotely Operated Vehicle (ROV) inspection logs and the construction logs.

ROV inspection and survey services took place September 17, 2010 – October 11, 2010 for Enbridge Energy's Straits of Mackinac pipelines, both the east and west legs, while diving services took place September 22, 2010–October 8, 2010. ROV inspections were conducted following each of the pipelines looking for pipeline condition and spans.

Thank you for allowing Veolia ES Special Services, Inc. to perform survey and diving services. If there are any questions, please don't hesitate to call or email me.

Sincerely,

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Project Overview

Veolia ES Special Services, Inc was retained by Enbridge Energy Inc. to inspect and repair the east and west, 24 inch diameter steel pipelines which cross the Straits of Mackinac in Michigan. These lines run parallel to each other and are separated by approximately 1200 feet along the 4.6-mile length of the crossing and are situated in water depths ranging from 0 to 260ffw. Both lines are buried at the shoreline out to water depths of approximately 50 feet and then lie primarily uncovered on the bottom.

The focus of this project was to inspect, identify existing conditions and repair areas which could potentially compromise the safety of the pipelines. Examples of these conditions could include exposed or unsupported areas of pipe, items such as fish traps or cable lying on or next to the pipeline or damage caused by an impact. In past surveys it was determined that the exposed pipelines are now unsupported in many areas along the crossing.



ROV inspection and diving services mobilized to Mackinaw City on September 17, 2010 and were de-mobilized to Cheboygan on October 8, 2010. The inspection services were conducted with an (ROV), acoustical tracking system and video recording devices indicating that there were numerous spans exceeding Enbridge Energy's tolerances for unsupported span length. As such, Veolia was mobilized to place designed supports within these problem spans. This report includes data on this repair operation as well as the initial inspection.

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Operations

Veolia ES Special Services, Inc. and Durocher Marine completed mobilization of the inspection barge/tug at Durocher Marine's Cheboygan yard and mobilized to the Mackinaw City Dock on September 17, 2010. From the Mackinaw City dock, the inspection barge would mobilize to the work site where Veolia and Durocher Marine went through a series of equipment calibration procedures.

Enbridge Energy's pipeline inspections started September 17, 2010 on the East pipeline leg. The diving operations barge and equipment mobilization began at Durocher Marine's yard on September 17, 2010. On September 22, 2010, mobilization of the primary tug and diving operations barge to the Mackinaw City dock occurred, where the vessels would dock for the entire job. From Mackinaw City, the inspection barge, diving operations barge, equipment and personnel would mobilize to repair affected areas along Enbridge Energy's east and west crude oil pipelines crossing the Straits of Mackinac. Veolia ES Special Services, Inc. provided the navigation, positioning, remotely operated vehicles (ROV) support and diving operations while Durocher Marine provided the tug boats, inspection and diving barges, anchors and a crane.

In planning the repair operations of the pipelines, the east pipeline would first be filled with NGL and then be shutdown for the entire survey and dive repair work. As the ROV survey proceeded, affected areas of concern were determined by Enbridge Energy management viewing documentation from data previously collected in 2007. The ROV inspection was working ahead of the diving operations. Spans of pipeline that were over 140' in length, which require the pipeline to be shut down, and spans over 100' in length, would be repaired. The west pipeline would then follow the same procedure as the east. Please note that the dates below represent the days the repairs took place. The reason for gaps in the dates is due to weather and equipment down time.

Diving operations for the west line repairs began on September 26th, 2010 and went through September 30, 2010. Spans on the west pipeline that were repaired:

- West Line–W-18A, W-34B, W70, W-58A

Diving operations for the east line repairs began on October 4th, 2010 and went through October 6th, 2010. Spans on the east pipeline that were repaired:

- East Line–E-13C, E-13B, E-74B

Diving operations for miscellaneous repairs and debris removal began on October 7th, 2010 and went through October 8th, 2010. Miscellaneous repairs and debris removal that was preformed:

- Fish trap like structure removed from W-59B.
- Bolt and rubber repaired to anchor W-58A
- Removed cable laying on top of and near pipeline

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Summary of Methods / Equipment Limitations

Remotely Operated Vehicle – Seaeye "Tiger"



The 'Tiger', a Remotely Operated Vehicle (ROV) system, is extremely versatile and can be employed to carry out a variety of tasks including surveying, searching and inspections. A pilot on the surface controls the vehicle remotely by sending commands to the vehicle via an umbilical and tether. The vehicle can be moved in any direction or by using the autopilot facility remain accurately on course and depth to provide a stable platform. The pilot can also control the vehicle's video system, lighting and any other equipment fitted to the unit.



For this inspection, the vehicle was fitted with a Linkquest USBL tracking system in concert with an RTK GPS system and Hypack software. In use, the ROV was fitted with a Linkquest acoustic transponder, which sends out a sound signal to be picked up by a hydrophone mounted on the front of the surface support barge. The offset of the vehicle (calculated by Hypack) is fed to the navigation computer that plots a corresponding XY position based on Real Time Kinematics (RTK) information. Video from the on-board camera is recorded in a digital format, with the surveyor following position information from the Hypack navigational software. Once data has been gathered as acoustic records, video documentation is encouraged in order to provide definitive ground truthing of the indications on the sonar record.

In operation, the tug and barge is positioned over the pipeline using a live boat operation for the survey. With evidence of a strong fixed RTK lock as well as a solid return from the vehicle tracking system, the vehicle is launched from the surface to begin its descent to the bottom. Once on bottom, the operator utilizes the navigation system to guide the vehicle to the pipeline. With the pilot free to fly the vehicle, the survey supervisor takes notes with further direction given by the client representative on site. 'Parking' the vehicle at the desired location attains accurate location of anomalies, while the Linkquest tracking and RTK stabilize and update the position. This position is noted in the inspection log for future reference. After taking a fix on the span location, the ROV, tug and barge would proceed along the pipeline to the next span. With the survey running a live boat operation, Veolia was able to survey more efficiently.



The main limitations to this equipment are related to water clarity (visibility), water current, surface weather and wave conditions. In highly turbid water conditions, an acceptable video record is impossible to generate. Fortunately water clarity for this project was exceptional, allowing for a very clear video record. Higher water velocities (current) can pose difficulties in keeping the vehicle on station, or even getting it to the target. Currents of 1 to 2 knots were encountered during this project, which did pose challenges.

The most prevalent limitation of this equipment is imposed by weather conditions. High winds/waves make for difficulties in launch and recovery of the remotely operated vehicle. Throughout the survey period we encountered periodic weather delays and equipment set-backs.

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Equipment Overview (Inspection Operations)

Veolia mobilized the Remotely Operated Vehicle (ROV), a vessel and additional equipment from Cheboygan, MI to Mackinaw City, MI for the inspection. This package consisted of the following:

- 140' x 40' Barge
- Tug boat
- ROV LARS–Launch and Recovery System
- Seaeye Tiger - Remotely Operated Vehicle with all associated equipment
  - Typhoon Camera
  - Tilt Unit
  - Lighting
  - Compass
  - Depth Sensor
- Comprehensive field spares kit
- Linkquest tracking, Ultra short base line acoustic tracking system
- CSI Vector Sensor for Heading
- Motion Reference Unit (MRU)
- Trimble R5-R6 GPS System - Real Time Kinematics (RTK) (centimeter accuracy)
- Computer navigation system
- Computerized and digital video recording equipment
- Offshore safety package

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Diving Operation and Equipment

The project superintendent is in contact with immediate personnel on treatment gas stores, equipment and equipment start-up. In turn, the tug boat captain is in contact with the USCG for shipping traffic concerns, weather reports and will report this information to the project superintendent. At this point, the project superintendent and client representative will make the determination of project location and a decision to sail.



Span coordinates identified from the 2007 ROV survey were used to plot anchor and mooring locations. The barge was than positioned over anchor locations identified by the Hypack navigation system. The Hypack navigation program, located on the dive barge, brings in information provided from the RTK GPS, Vector Sensor, Motion Reference Unit (MRU) and Link-quest tracking, which is then relayed to a monitor on the tug for the tug captain to follow. The anchors are then dropped approximately 750' from the pipeline and 1000' apart. Once both anchors are in position (2 anchor spread off the stern of the barge) the barge was towed into position and held in place with a constant speed and heading from the tugboat.

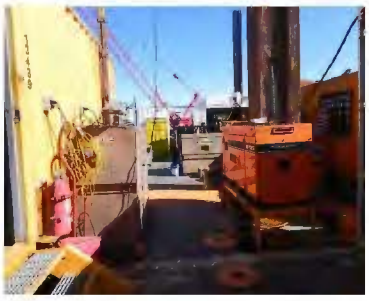


The VideoRay Pro 3 XE GTO ROV was launched so that a specific repair procedure and location can be selected. Locations were selected based on their proximity to the center of the span or as determined by Enbridge's on site representative, type of bottom encountered (smooth or irregular, hardness) and span height.



The dive bell was then lowered to the work site, guided by the ROV. Adjustments were then made for barge positioning.

When positioning of the barge was finished, guided by the remotely operated vehicle, the hydraulic drilling tool was then lowered to the work area and held by the crane approximately 25' away from the pipeline.



The screw anchor and saddle support, which is a prefabricated design, is designed to drill along both sides of the pipeline. Extensions can be added, for adjustment with sub-bottom material or span height. When drilling into the sub-bottom, a specified hydraulic pressure must be met. At that time, the upper and lower saddle supports were installed. Placing the support over and under the pipeline and then all-thread bolts bring all the support saddles together.

Dive operation begins and bottom time starts when the diver leaves the surface. Once on bottom, the diver brings the drilling tool over the pipeline and lowers the drilling tool into place. Once in place, drilling proceeded. The Diver monitored the drilling process until completion. When drilling is complete, the 3-pin assembly is disconnected and the hydraulic tool is lifted off the screw assembly and safely placed off the East Side of the pipeline to prevent dragging back into the pipe. The Diver then assembled the anchor and saddle into place. A repair (as detailed in above) is completed.



The final inspection and position of the pipeline repair was recorded from the ROV and the diver was brought to the surface and decompressed. This process usually entailed multiple dives to complete.

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Diving Barge Remotely Operated Vehicle

The VideoRay Pro 3 XE GTO is mainly used for diver observation from the barge diving operations and is equipped with a remote pan and tilt video camera with auto focus controls, as well as lighting. The ROV is a free-swimming vehicle tethered to a surface support vessel and controlled by personnel on-board. Navigation was provided by the Link Quest tracking system in concert with Trimble R5 GPS RTK system and a stand-alone computer with Hypack software. In use, the ROV is fitted with an acoustic transponder, which sends out a sound signal to be picked up by a hydrophone mounted on the side of the surface support barge. The offset of the vehicle (calculated by Link Quest) is fed to the navigation computer that plots a corresponding XY position based on GPS information. Video from the on-board camera is recorded in a computerized and digital format, with the operator entering position information to the on-screen display. Once data has been gathered as acoustic records, video documentation is encouraged in order to provide definitive ground truthing of the indications on the sonar record.

The main limitations of this equipment are related to water clarity (visibility), water current, surface weather and wave conditions. Obviously, in highly turbid water conditions, an acceptable video record is impossible to generate. Fortunately water clarity for this project was exceptional, allowing for a very clear video record. Higher water velocities (current) can pose difficulties in keeping the vehicle on station, or even getting it to the target. Currents of 1 to 2 knots were encountered during this project, which posed little challenges.

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Equipment Overview (Diving Operations)

The following equipment was mobilized to Durocher Marine's yard in Cheboygan, MI for setup on barges:

- Mixed gas control Trailer
- 2–54' deck decompression chambers
- 4–Hot water machines
- 2–Quincy 5120 diver's air compressors
- 150kw Multi-quip generator
- Class 2 diving bell and Man Rated Handling system
- Hydraulic drilling tool
- 2–Hydraulic hose reels
- 2–Underwater video and lighting systems
- VideoRay 'Pro 3 XE GTO' - Remotely Operated Vehicle with all equipment and spares (Inspection Class)
- Link Quest tracking Plus tracking system with 4 beacons
- 2 - Hypack navigation computers
- Hemisphere GPS VS110 System
- 2–600' Diver's umbilicals
- Mixed gas stores
    - 100% Oxygen (Decompression gas)
    - 8416 HeO2 (Bottom mix)
    - 8614 HeO2 (Bottom mix, emergency gas)
    - 6040 HeO2 (Decompression gas)
    - 6040 Nitrox (Treatment gas)
- Miscellaneous diving and construction equipment (Hoses, extension cords, tools, etc.)
- Helical Screw Anchors and Supports

    - Due to space and weather considerations, the above equipment was setup in storage containers and sea fastened to the barge. The Hypack navigation equipment was centralized in the dive container, tracking the barge heading and position, ROV position, bell position and anchor drilling tool position. With the primary navigation being controlled from the dive container, a monitor was installed in the tug boat for navigation.

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Findings

The Remotely Operating Vehicle (ROV) survey inspection took place September 17, 2010–October 11, 2010 on the east and west pipelines. The diving operations followed 4 to 5 days behind the ROV inspections. Data obtained by the ROV survey inspection closely followed past findings and data obtained in the 2007 survey. During this time, Enbridge Energy made the determination that the east pipeline would be surveyed and repaired. The pipeline would have NGL placed in the line and then be locked out of service. When the inspection and repair work was concluded, the pipeline would then be placed back into service. The same procedure would be done to the west pipeline. Both the east and west pipelines show intermittent suspension over their entire length. Previous grout bag repairs were noted on the east and west lines where the pipeline no longer rested on the bag. The exposed portion of the pipeline is heavily covered in zebra mussel growth, making a detailed analysis of the coating and actual pipe condition impossible. Additionally, areas of debris encroachment as well as cables lying over the pipeline were noted.

The attached span logs identify repaired spans, location of all spans, with northing / easting coordinates to each. Also included with this report is a CD with a very detailed informational spreadsheet of each span. Some of the information included in this spreadsheet: 2005 / 2004 span numbers, length, height, video tape number, DVD copy number, northing, easting, longitude, latitude and description.



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