



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

August 31, 2011

Enbridge Energy, Limited Partnership
c/o Mr. Rich Adams
Vice President, Operations
Superior City Centre
Second Floor
1409 Hammond Ave.
Superior, Wisconsin 54880

Re: U.S. EPA Directive for Additional Hydrodynamic Assessment Pursuant to the Administrative Order issued by U.S. EPA on July 27, 2010, pursuant to §311(c) of the Clean Water Act (Docket No. CWA 1321-5-10-001) and Supplement to the Administrative Order issued by U.S. EPA on September 23, 2010

Dear Mr. Adams:

The United States Environmental Protection Agency ("U.S. EPA") directs Enbridge Energy, Limited Partnership, Enbridge Pipelines (Lakehead) L.L.C., Enbridge Pipelines (Wisconsin), and Enbridge Energy Partners, L.P. (herein collectively referred to as "Enbridge") to: (1) prepare a work plan addendum, and (2) perform hydrodynamic assessment activities described herein.

The U.S. EPA directs these actions pursuant to the Administrative Order ("Order") issued by the U.S. EPA on July 27, 2010 and a Supplement to Order for Compliance under Section 311(c) of the Clean Water Act issued ("Supplement") by the U.S. EPA on September 23, 2010 (Docket No. CWA 1321-5-10-001).

Enbridge shall prepare an addendum to incorporate assessment activities described below or otherwise modify the following document:

*Enbridge Line 6B MP 608, Marshall, MI Pipeline Release, Addendum to Response Plan for Downstream Impacted Areas and the Work Plan for Permanent Recovery of Submerged Oil and Oil-Contaminated Sediments at Priority locations and Ceresco Dam Dredging; as an Attachment to the supplemental modification of the **Response Plan for downstream Impact Area and the Source Area response Plan, Strategy, and Tactics for Permanent Recovery of Submerged Oil and Oil-Contaminated Sediment (Commonly referred to as the "2011 Summer Strategic Work Plan")** Prepared for United States Environmental Protection Agency, Enbridge Energy, Limited Partnership; Submitted: June 29, 2011, Resubmitted July 30, 2011.*

The primary objectives of the assessment described herein are presented below:

- A) To develop an understanding of the riverine system (i.e., Talmadge Creek, Kalamazoo River, Morrow Lake Delta and Morrow Lake) physical chemistry associated with the migration, mobilization and recovery of submerged oil, including, but not limited to, the effects of temperature, barometric pressure and river velocity on the migration of submerged oil.
- B) To identify physical patterns and migration rates of submerged oil along channel bars, impoundments, and delta/fan environments caused by the following river conditions: high flow, low flow, seasonal/diurnal variation, and during oil recovery/assessment activities.
- C) To provide support for quantification of submerged oil in riverine deposits.

The following components shall be included in the work plan:

- 1. **Velocity Profiling:** Existing hydrodynamic data consists of current-meter point measurements at discrete poling locations, and qualitative estimations at various locations throughout the river system. Multi-dimensional understanding of velocity distributions and profiles for adequately describing bed shear stresses under different flow conditions is needed. Data shall be used directly to understand migration/transport rates and for calibration/verification of the hydrodynamic model. Velocity data shall be collected at the following locations and times:
 - a. Collection Locations
 - i. Horizontal and vertical velocities at cross-sections (at varying river stages) in specific geomorphic areas including, but not limited to:
 - 1. Morrow Lake Fan (at least 5 latitudinal profiles and 5 longitudinal profiles) along each representative geomorphic features;
 - 2. Each side of existing containment location E4.5;
 - 3. Delta channels;
 - 4. 35th Street bridge;
 - 5. Neck of delta; and
 - 6. Upstream river reaches of concern.
 - ii. Horizontal and vertical velocities at longitudinal locations including, but not limited to:
 - 1. Morrow Lake Fan to 35th Street;
 - 2. Mill Ponds;
 - 3. Ceresco dam; and
 - 4. Other reaches of concern.

- b. Collection Times
 - i. During mean-flow conditions
 - ii. During low-flow conditions
 - iii. During high-flow conditions (e.g., various flows above median values)
- 2. **Surficial streambed sediment characteristics**: Existing data consist of pre- and post-recovery cores linked with poling data from various river locations and the Morrow Lake Delta/fan area. Additional data is needed to characterize submerged oil transport rates and depositional patterns. Enbridge shall collect the additional sediment data including, but not be limited to, the following characteristics, locations and other specified parameters:
 - a. Core samples
 - i. Stratigraphic logging using the Unified Soil Classification System (USCS) and United States Department of Agriculture (USDA) classification system.
 - ii. Color assessment using Munsell Color System.
 - iii. Identification of pre-dam (e.g., before the Morrow Lake Dam was constructed) surface mapping in the Morrow Lake Delta/impounded areas to calculate sedimentation rates.
 - iv. In the Morrow Lake Delta, the cores should penetrate into pre-dam floodplain/channel deposits.
 - b. Laboratory analyses
 - i. Total Petroleum Hydrocarbons (TPH)
 - ii. Oil and grease
 - iii. Bulk density
 - iv. Particle size
 - v. Organic matter content (loss on ignition method)

- c. Locations
 - i. Locate the sample locations with poling and velocity transects/longitudinal profiles
 - ii. Morrow Lake Fan: along a contour from north/south and east/west along the channel reported to pass through the Morrow Lake Fan (at least 5 latitudinal profiles and 5 longitudinal profiles)
 - iii. Morrow Lake Fan to 35th Street Bridge and within the Morrow Lake Delta channels
 - iv. Other locations in key reaches (to be determined in consultation with the U.S. EPA and the USGS) such as Millpond/Ceresco Dam
 - d. Temporal
 - i. At least once a season (Winter, Spring, Summer, Fall);
 - ii. Pre- and post- flood events
 - iii. Downstream of work areas
 - e. Temperature:
 - i. During varying temperatures (winter freeze and summer heat)
 - f. Coring devices shall:
 - i. Record depth penetration and recovery ratios; and
 - ii. Recover high water-content sediment and water interface that likely contains submerged oil.
 - g. Equipment:
 - i. Hand/push style (given shallow depths) that allow a direct feel of the contact and preservation of the sediment/water interface.
 - ii. Careful sub-sampling methods that retain in-situ bulk densities.
3. **Sediment transport**: Existing data consist of turbidity measurements and other field parameter data collected over the course of the project to date. Anecdotal evidence

suggests that submerged oil migrates in association with fine-grained bedload and/or suspended sediment. This evidence also suggests that the migration is dependent on flow conditions, temperature, possibly atmospheric pressure, and agitation from oil recovery operations. Increased sediment transport also takes place during runoff events (e.g., rain events) and low-flow conditions. More information is needed on how submerged oil is transported in various geomorphic settings, and on the mass of submerged oil transported in suspended and/or bed-load components. Enbridge shall collect the data including, but limited to:

- a. Time-integrated suspended sediment sampling, which shall occur downstream of agitation/recovery areas and silt curtains. Enbridge shall use Walling suspended sediment traps (Phillips et al., 2000) at the following locations and in accordance with the following parameters:

- i. Locations:

1. Morrow Lake Fan: downstream of E4.5 control point.
 2. The Kalamazoo River at Battle Creek stream gage: 1 location, along bank in flow (e.g., 3-5 meters offshore) but not impeding navigation or safety.
 3. Ceresco impoundment: immediately downstream of active recovery areas and booms, in areas that have known turbidity downstream of the booms (2-3 locations, equally spaced along a transverse transect).

- ii. Configuration

1. Traps shall be placed with minimum 8 feet long T- or U-shaped channel posts, driven into the soil bed along with a buoy markers along the transect. The traps shall be spaced at approximately 100 meter spacing along a roughly north-south transect in at least 10 locations.

- iii. Sampling

1. During oil recovery, Enbridge shall check and sample the traps weekly, after storm events, immediately following oil recovery operations and at other times as directed by the U.S. EPA.

2. After oil recovery operations are complete, Enbridge shall check and sample the traps twice a week bi-weekly after recovery operations into September, monthly in October and November, and at other times as directed by the U.S. EPA.
4. **Hydrodynamic Modeling:** Hydrodynamic modeling shall be used to simulate and evaluate a range of flow conditions using various existing data sets, and additional data as discussed herein.
5. **Poling in Morrow Lake downstream of fan (in addition to ongoing poling activities):** Qualitative assessment via poling shall be performed at the quantity and locations similar to 2010 pre-recovery and Spring 2011 reassessment activities. Enbridge shall perform poling as specified below.
 - a. Poling Frequency upstream of Morrow Lake Dam
 - i. At least daily during recovery;
 - ii. Immediately following recovery;
 - iii. At least once a season (Winter, Spring, Summer, Fall); and
 - iv. After large flood events (2-yr or higher)
 - b. Poling locations downstream of Morrow Lake dam (e.g., next likely depositional areas)
 - i. Immediately downstream of the Morrow Lake Dam, in a backwater area at MP 39.75
 - ii. Margin of a bend on the left descending bank at MP 40.25
 - iii. Downstream side mid-channel island at approximately MP 40.85
 - iv. North side channel margin, just downstream of MP 41 and upstream of River St. bridge
 - v. Upstream end of an oxbow at approximately MP 41.25 (downstream of River St. and upstream of King Hwy)

- 6. Bench Test for sub-oil transport/behavior:** Enbridge shall provide details for and perform a bench test to observe and determine characteristics of released oil in the riverine system.

The bench test equipment shall include a graduated rectangular channel (plexiglass or other compatible invisible material); unimpacted soft sediment; river water; weathered oil identical to that resulting from the Enbridge Line 6B release; thermal controls for the fluid (i.e., chiller/heater); and variable speed pump having the ability to mimic river flow speeds. The channel shall have interior dimensions of at least 20 feet long, 2 feet wide and 3 feet tall.

The bench test shall propose means and methods to evaluate, by observation and measurement, submerged oil and sediment flow to mimic the various geomorphologic conditions and flow conditions encountered in the riverine system.

In addition to a written report, the bench test shall include a narrated video record of the bench test setup and test implementation.

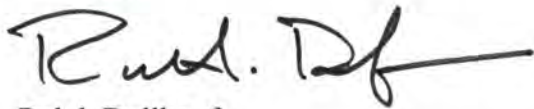
- 7. Acquisition of existing data sets and data derived from the scope of work describe herein, in usable (interactive) formats:** Enbridge shall provide results of all data in usable interactive formats (e.g., spreadsheets, word processing, etc.). This includes, but is not limited to, data for the following parameters/items: water temperature; turbidity; sediment temperature; water velocity; surface water elevation; depth to soft sediment; soft sediment thickness; depth to hardpan; core logging information; all other surface water field parameter data collected to date; 2011 analytical data including TPH, oil and grease and total suspended solids (TSS); river discharge rates; river stage; and sediment curtain configurations from project inception (Geographical Information System format). Enbridge shall also provide location information (e.g., Global Positioning System-GPS data, latitude/longitude).

Enbridge shall submit the addendum described above by 17:00 Eastern on September 9, 2011. Upon Enbridge's receipt of U.S. EPA approval of the work plan addendum, Enbridge shall perform the assessment described herein and in the approved work plan. Enbridge shall submit a report documenting the results of the assessment and modeling to the U.S. EPA within 30 calendar days of receipt of U.S. EPA approval of the work plan addendum.

Preparation of the addendum to the work plan and implementation of the approved assessment shall not impede or otherwise affect the progress of active and/or planned oil recovery operations.

If you have any questions regarding this letter, please contact me immediately at (231) 301-0559.

Sincerely,

A handwritten signature in black ink, appearing to read "R. Dollhopf". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

Ralph Dollhopf
Federal On-Scene Coordinator and Incident Commander
U.S. EPA, Region 5

cc: L. Kirby-Miles, U.S. EPA, ORC
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