UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

March 26, 2012

Isaac Aboulafia
MEC^X, LP
3203 Audley Street
Houston, TX 77098

Re: Effects of Sediment Agitation during Oil Recovery in Kalamazoo River
Prepared by the Scientific Support Coordination Group (SSCG)
Eco-toxicity / Agitation Subgroup
Enbridge Line 6B MP608 Release, Marshall, MI

Dear Isaac:

I have reviewed the attached memo regarding potential ecological impacts of agitation techniques for submerged oil liberation that was prepared in response to Charge No. 4 submitted to the SCCG:

4. Identify viable procedures to assess the potential for adverse ecological effects resulting from further oil recovery using sediment agitation ("toolbox") techniques.

I hereby accept the group's recommendations to initiate Tier I and Tier II tasks immediately given the need to expedite schedule. I understand that the Tier I data/literature review is already underway by the SSCG, and a draft work plan is in preparation by the SSCG to address Tier II bench/field tasks. I have requested our SSCG staff to coordinate with Enbridge in implementing these tasks I have approved today.

We must remember that, just as many of the tools used for recovering oil were created on this project, we now also need to invent methods to assess the impacts of using those tools. I thank you and the group for working to meet these new challenges.

Sincerely,

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

cc: L. Kirby-Miles, U.S. EPA, ORC
Sonia Vega, U.S. EPA, Deputy Incident Commander

John Sobojinski, Enbridge
Mike Alexander, MDEQ
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March 21, 2012

Mr. Ralph Dollhopf
Federal OSC and Incident Commander
U.S. EPA, Region 5
Emergency Response Branch
801 Garfield Avenue, #229
Traverse City, MI 49686

Subject: Effects of Sediment Agitation during Oil Recovery in Kalamazoo River Sediments
Enbridge Line 6B MP 608, Marshall, MI Pipeline Release

Dear Mr. Dollhopf,

The Effects of Agitation Subgroup (a subgroup of the Ecological Risk and Toxicity Subgroup) of the Scientific Support Coordination Group (SSCG) presents the attached response to the Federal On-Scene Coordinator's (FOSC) Charge No. 4:

> Identify viable procedures to assess the potential for adverse ecological effects resulting from further oil recovery using sediment agitation ("toolbox") techniques.

Recommendations herein describe a three-tier approach to assessing the potential effects of agitation. Given the expedited schedule for 2012 activities resulting from warm weather, the subgroup recommends performing Tier I and II tasks simultaneously. A summary of the three ties is presented below.

- Tier I: review of existing project data (chemistry, toxicity, etc.) and other published literature regarding the potential effects of sediment agitation;
- Tier II: perform bench-scale and field applications of agitation techniques while simultaneously water quality measurements and collecting samples for analyses.
- Tier III: develop an understanding of the concentration-space-time relationships associated with agitation activities to develop an gradient of expected exposure scenarios following agitation activities. This would include expanded analyses of substrates and organisms.

Based on subgroup members' experience in addressing issues related to oil spill recovery and potential effects of recovery, we recommend adoption of this technical approach to further develop the understanding of potential effects of sediment agitation for the purposes of oil recovery from the Kalamazoo River.

On behalf of the SSCG Effects of Agitation Subgroup,

Isaac Aboulafia
Sr. Vice President, MEC^{X}, LP, a Weston Solutions Region 5 S.T.A.R.T. Subcontractor

RECOMMENDATIONS TO THE FOSC
POTENTIAL ECOLOGICAL IMPACTS OF AGITATION TECHNIQUES FOR SUBMERGED OIL LIBERATION

ENBRIDGE LINE 6B MP 608 MARSHALL, MI PIPELINE RELEASE
MARCH 21, 2012

SSCG ECOLOGICAL IMPACTS OF AGITATION SUB-SUBGROUP

Background and FOSC Charge

Spring 2012 cleanup activities for the Kalamazoo River in response to the Enbridge Line 6B Pipeline Release are expected to be based on several ongoing investigations, including the assessment of potential ecological impacts associated with agitation techniques. The Scientific Support Coordination Group (SSCG) Ecological Impacts of Agitation Sub-Subgroup examined and discussed different tests and studies, and made recommendations in response to the Federal On-Scene Coordinator's (FOSC) Charge No. 4 to the SSCG, which was to i*dentify viable procedures to assess the potential for adverse ecological effects resulting from further oil recovery using sediment agitation ("toolbox") techniques.*

The Sub-Subgroup acknowledges direct and indirect disturbances of the benthic environment from agitation techniques associated with liberation of submerged oil from depositional settings. Agitation has negative impacts on aquatic vegetation, benthic invertebrates, periphyton, and on mussels, amphibians, reptiles, and fish spawning, particularly smallmouth bass spawning and nesting. The greatest impacts within the agitation footprint would likely occur among non-motile receptors. However, additional indirect effects outside of the depositional area from boat traffic-induced erosion and sediment resuspension affect a wide range of motile and non-motile aquatic organisms. In addition to direct impacts, fish and wildlife may also be disturbed by noise and heavy boat traffic near the site(s) of operations.

Some of the anticipated direct and indirect negative potential impacts from these techniques include the enumerated items below. In each case the potential impacts become significant when extensive areas are agitated, and/or when agitation is conducted for an extended period of time in a particular location.

1) Direct damage of the benthic habitat.
2) Resuspension of buried residual oil and other potentially toxic/harmful chemicals.
3) Localized reduction of dissolved oxygen in the water-column as the reduced sediments are resuspended.
4) Creation of a turbidity plume that extends for an unknown distance downstream of the agitation footprint.
5) Localized increased of suspended solids and turbidity.
6) Increased sedimentation downstream from the agitation site.
7) Smothering of organisms in various life stages.
8) Smothering of fish and invertebrate eggs and larvae if agitation occurs directly on spawning beds/vegetation.

9) Destabilization of the sediments making them prone to resuspension during high flow events and transport downstream.
10) Redistribution of settled oil from the surficial layers into deeper layers that are more reducing and may have slower biodegradation rates.
11) Removal of important habitat (e.g., woody debris) and vegetation to provide a clear area for agitation.
12) Bank and bed erosion from airboat wakes and scraping.
13) Increased habitat disturbance, potential loss of habitat use (e.g., by fish and wildlife) from increased boat traffic and noise, and injuries and fatalities of turtles and other receptors from collisions with boats and equipment.

Some of the anticipated direct and indirect positive outcomes from agitation may include the following.

1) Removal of potentially toxic submerged oil and increased aeration and weathering of submerged oil.
2) Increased biodegradation of submerged oil (currently unknown but possible).
3) Dilution of remaining submerged oil.

Based on the potential impacts identified above, the key question that needs answer is-
Do agitation techniques pose unacceptable risks (e.g., chemical, physical, toxicological, large impacts on habitats, changes in habitat quality, loss of habitat use) to aquatic resources and benthic habitats as compared to the benefits of oil removal?

The Sub-Subgroup recognizes that several pieces of information are currently under collection for FOSC Charges 1-3, which may provide additional knowledge that could be used in assessing the direct and indirect potential ecological impacts of agitation. The initial information gathered for Charge 4 will be used in the Net Environmental Benefits Analysis (NEBA). Recommendations herein are in detail for immediate action (March/April 2012). Considerations for additional follow-up studies that may take place during summer 2012 and post 2012 are presented as preliminary ideas that need further discussion and development.

Recommended Approach

The Sub-Subgroup recommends a tiered approach that evaluates available information and data sources currently under collection by ongoing investigations (Charges 1-3), followed by carefully designed studies that answer specific questions and concerns not fully addressed with the available data. The tiered approach is described below.

Tier I

- Tier I Execution timeline: March 26, 2012- April 6, 2012.
- Conduct a literature review on the ecological impacts and biological recoveries associated with suspended solids and dredging (e.g., Kaplan, et al. 1974 on biological recovery; Rosenberg 1977 on recruitment and reproduction impacted of sedimentation near dredge disposal areas; Wilber and Clarke, 2001, on the biological impacts of suspended solids).
- Evaluate available data collected by operations during agitation (e.g., areal extent of plumes, areal extent of agitation operations, traffic volume, changes in sediment depth,

on site and aerial photos taken during agitation) to aid in the assessment of potential impacts on habitats and loss of habitat use.

- Evaluate available turbidity and suspended sediment concentrations collected before/during/after agitation activities, and compare values to potential levels of concern (see Wilber and Clarke, 2001).
- Evaluate available sedimentation information from sediment traps placed at agitation sites, and compare values to typical sedimentation rates (average and maximum) within this riverine system, or to similar data collected during the response.
- Evaluate available quantitative/qualitative data on the impacts of these activities (or similar) on fish and benthic invertebrate communities.
- Evaluate available chemistry data (sediment and water) collected near agitation sites, and compare analyte concentrations to agreed or recommended benchmarks. Specifically, potential adverse effects to benthos from PAHs can be evaluated using the Equilibrium Sediment Benchmark Toxic Unit approach (USEPA, 2003).
- Evaluate available chemistry data (sediment and water) collected near agitation sites, and compare analyte concentrations to those concentrations associated with acute toxicity effects based on ongoing investigations for Charge 2.
- If the information above is insufficient to assess potential adverse effects from agitation (refer to key question above), Tier II is recommended.

Tier II

- Tier II execution timeline: Given the desire to provide value-added information to the FOSC in time to potentially affect Spring/Summer 2012 recovery operations, the Sub-Subgroup recommends performing Tier II activities concurrently with Tier I activities. Therefore, Tier II would be conducted between March 26, 2012 and April 30, 2012.
- Perform a bench-scale "Demonstration Agitation test" with typical agitation tool equipment to help characterize the scale (spatial and temporal) of the potential physical impacts associated with agitation. The results of this test can be scaled to actual agitation operations. Sources of information from this test may include:
    - Turbidity and suspended solid at various time intervals (pre-, during- and post-agitation) and distances (upstream, downstream) from agitation test.
    - Characterization of chemical constituents in water, suspended and settling sediment, and sheen and surfacing oil globules via analytical chemistry protocols (USEPA, 2012).
    - Documentation of the spatial and temporal extent of the suspended sediment plume.
    - Data generated from this test can be compared to recommended sediment/water benchmarks and thresholds of concern derived from the literature synthesis to determine if potential adverse effects may occur from contaminant resuspension or sediment disturbance following agitation.
- Perform an *in-situ* agitation test (finer scale than above) followed by the collection of quantitative data (e.g., suspended solids), water and sediment sampling for chemical characterization (USEPA, 2012), collection of settled sediments for standard sediment

toxicity testing with benthic organisms (*Hyalella* and *Chironomus*) (SSCG Ecological Risk and Toxicity Subgroup, 2012). A laboratory controlled agitation experiment may also be performed followed by sample collection for chemical analysis (USEPA, 2012).

- Collect data (e.g., traffic volume, changes in sediment depth, temporal and spatial extent of plumes, sediment erosion of banks from increased traffic volume) prior, during and post 2012 agitation operations to help characterize the temporal and spatial scale of potential physical impacts resulting from these activities. This activity will depend on Spring 2012 recovery operations and may not be completed within the timeframe of this tier.
- Based on the above, develop an understanding of the concentration-space-time relationships associated with agitation activities (scale and magnitude of potential impacts), and determine if these exposure conditions may cause unacceptable risks (e.g., exposures to unacceptable levels for more than 48 hours). Use all lines of evidence (e.g., chemistry analysis, acute toxicity testing, spatial and temporal characterization of impacts) to make these assessments (e.g., spatial and temporal duration of sediment plume(s) vs. duration and concentration of oil constituents following agitation vs. results from sediment toxicity testing at comparable oil constituent concentrations)
- If the information above is insufficient to assess potential adverse effects from agitation (refer to key question above), Tier III is recommended

Tier III

- Estimated timeline: to be determined
- Based on the findings of Tier I and II evaluations, develop the understanding of the concentration-space-time relationships associated with agitation activities, design a water/sediment sampling strategy that would encompass a gradient of expected exposure scenarios following agitation activities
- Perform aqueous and sediment acute toxicity testing following a modified version of the "Toxicity Testing Design 02162012," and conduct a chemical characterization of the exposure media. Specific studies may include:
    - Deployment of sediment traps upstream and downstream of agitation operations, followed by standard sediment toxicity testing with benthic organisms (*Hyalella* and *Chironomus*). *Note*: the traps would not be Walling samplers, but rather samples collected using vertical cylinders placed just above the sediment surface.
    - Sediment plume water could also be collected and used under laboratory exposures with aquatic organisms.
    - *Note:* Since there are no approved toxicity tests for "agitation scenarios" all assumptions will have to be clearly stated (e.g., assume that exposure duration in the field would be equivalent to a 48 h static exposure under laboratory conditions).

- Perform *in-situ* quantitative assessments considering a wide range of options for assessing impacts from agitation. These options may include:
    - Leaf pack collection of detritus and/or multiple-plate artificial substrate sampler deployed upstream and downstream of the operations, may also be used to characterize invertebrate occupancy in these traps and to assess changes in stream quality.
    - Caged organisms (fishes or mussels), deployed downstream of the operations, may also be used to characterize effects to aquatic organisms.
- Based on Tier I-III results, characterize risk to aquatic resources from agitation activities.

References

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