ATTACHMENT 5

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Technical Review
NEBA and Spatial/Temporal Evaluation of 10/1/2012

Background and Purpose of NEBA Generally

NEBA is a methodology for comparing and ranking the net environmental benefit associated with multiple management alternatives that compares the environmental harm posed by residual contaminants that would be removed by remediation or recovery to the environmental injuries caused by those actions (Efroymson et. al 2003, Rayburn et. al 2004, Aurand et. al 2004).

Human health risks are typically external to NEBA. That is, the NEBA analysis is applied after human health and safety factors are addressed in order to determine ecological benefits for recovery actions and identify cleanup endpoints (Efroymson et. al 2003, 8/8/12 NEBA, p.1).

A complete NEBA includes three steps:

1. A scoring of potential response actions by habitat in order to quantify (at least categorically) the relative damage each action would cause to those habitats and associated biota.
2. A scoring of each area containing residual material in order to quantify (again at least categorically) the environmental harm or risk of harm posed by conditions existing at that location.
3. An evaluation of the various possible combinations of responses and levels of harm or risk of harm to determine the net benefit of the different potential responses available.

The resulting document can then be used to develop appropriate endpoints for different affected areas and guide response activities.

The NEBA process is intended to be iterative in applied situations where updated data is being collected over time (Efroymson et. al 2003, 8/8/12 NEBA, p.13). The general development path is from general to specific where the data and analysis becomes focused on site specific conditions in an area or areas of concern in order to minimize the risk that a selected remedial alternative will provide no net environmental benefit. As Efroymson et. al (2003) state, an alternative may provide no net environmental benefit because:

1. The remedial or ecological restoration action is ineffective (the action does not substantially change the risk), or
2. The remediation alternative causes environmental injuries greater than the damage associated with the contamination because –
    a. The need for remediation has been driven by human health risk, not ecological risk;

b. The ecological injury from contamination has been overestimated because of conservative assumptions; or
c. Injuries associated with remediation were not properly addressed.

Within the NEBA context, monitoring does not simply involve evaluating residual oil. Rather, it involves collection and incorporation of additional data addressing all conditions relating to development of risk and damages.

Charge, Purpose, Scope, and Status of the Line 6b NEBA (8/8/12)

The EPA charged the SSCG with developing "recommendations and guidance to the U.S. Environmental Protection Agency's (EPA) Federal On-Scene Coordinator for Spring 2012 cleanup strategies and endpoints for the remaining submerged oil and oil-containing sediment in the Kalamazoo River associated with the July 2010 Enbridge Line 6B oil spill" (8/8/12 NEBA, p.1).

The SSCG settled on development of a NEBA in order to weigh the environmental risks associated leaving residual submerged oil in place and allowing for natural attenuation as opposed to varying levels of physical habitat disturbance associated with recovery actions such as agitation and dredging.

The resulting document provided a ranking of the "potential impacts from specific submerged oil recovery actions (monitored natural attenuation, enhanced deposition, agitation toolbox, sweep/push collection, dredging/vacuum truck, dewater/excavate, scraping, and sheen collection) on ecological resources present within eight distinct habitats of the Kalamazoo River" (8/8/12 NEBA, p.2). The included response activity risk rankings show a positive net environmental benefit for the less invasive techniques and a negative net environmental benefit from use of the more invasive techniques when compared to each other. An example for "Impounded Waters and Associated Deltas" is shown in Attachment A. Dredging and vacuuming in particular have a large negative net environmental benefit as compared to sheen management.

Recognizing that the NEBA process is iterative, and considering the four charges it was given, the SSCG identified four main information gaps (8/8/12 NEBA, p.51):

1. Additional acute and chronic sediment toxicity data,
2. Toxicity and physical smothering associated with agitation toolbox techniques,
3. Oil biodegradation rates, and
4. Quantification of volume of remaining oil.

As of October 25, 2012, studies addressing the above information gaps remain uncompleted and the SSCG's recommendation to subsequently review and update the relative risk rankings as more data are generated has not been carried out.

Connection between the 10/1 letter, the NEBA, and the Proposed Order

The October 1 letter is presented as "(a)n evaluation of the spatial/temporal patterns and migration potential of submerged oil in three impounded sections of the Kalamazoo River affected by the Enbridge Line 6B oil discharge."

As such, the letter simply revisits the recommendations made in the August 8 NEBA update in terms of Summer 2012 poling data and hydrodynamic model results and updates the oil conditions. The document makes no claim to NEBA being applied. It simply refers to the earlier "NEBA/Tactical Area" as a means of identifying tactical areas.

The key points indicating that the letter is not intended as a NEBA document are:

1. The letter claims to synthesize (1) 2012 submerged oil data, (2) hydrodynamic model, and (3) integrated NEBA/Tactical Areas. While this is largely the case, the additional data needs identified by the SSCG in the Conceptual Design was not collected, nor evaluated. Nor does the letter suggest why the data is no longer relevant to the evaluation of net environmental benefit.

2. The letter (with attachments) is presented as the synthesis of opinions and recommendations by Faith Fitzpatrick (USGS) and not a work product of the Scientific Support Coordination Group (SSCG) nor any team working on a NEBA. The document states that it "*does not necessarily represent consensus among the individuals of the group.*"

3. The document consistently references the NEBA integrated with tactical areas (July 8 NEBA Update), not the NEBA Conceptual Design. It further makes clear that the NEBA/Tactical Area Integration is based on eight factors, of which the NEBA risk ranking is one (the others are: oil recovery history, poling results, proximity to sensitive receptors, oil mobilization potential, distance to traps, aquatic toxicity results, and sheen incidents). From this it is clear that the majority of the recommendations in the October 1 Letter flow from the presence of submerged oil, not the quantified effects of submerged oil on the environment or the threat of harm it may pose to humans or biota. No new toxicology results are presented or discussed nor are the risk matrices updated.

4. The October 1 Letter provides updated information on the patterns of observations of oil ("Evaluation of Spatial Temporal Patterns…") and bases its discussion entirely on an integration of sheen and poling observations and interpretation of hydrodynamic model results on the focus areas around the impoundments (without explaining why). That is, the letter speaks largely to sediment mobility and its assumed relationship to mobility of any oil remaining in the system. Mobility (in suspended and bed loads) is a known factor in a fluvial setting. The issue at hand is not mobility however. The issue is whether sediment mobility and the concentrations of oil present in the mobile sediment would change the relative risk matrix such that the threat of harm that would be removed now out-weighs the damages caused by dredging. There is no additional evaluation of environmental benefit, much less net environmental benefit in this document.

5. The Proposed Order looks to the October 1 letter for support. However, it goes well beyond the conclusions and assertions of that letter. The October 1 Fitzpatrick Letter, even though it focuses on the impoundments, does not actually recommend dredging, instead phrasing it in terms of a contribution to the "consideration for recovery of sub oil".

Overall, the October 1, 2012 letter from Faith Fitzpatrick to Ralph Dollhopf has only an indirect and incomplete connection to the August 8, 2012 NEBA and the Proposed Order. The October 1 letter does not constitute a completion of the SSCG-identified studies needed to address data gaps, nor does it constitute a complete monitoring report incorporating that data that is necessary to properly update the NEBA risk matrix tables to correspond to present river conditions.

There are additional data that should be compiled or collected in the field to strengthen the scoring of the NEBA.

1. Update the environmental "costs" of the existing condition in the relevant portions of the river, including locations where sheen can be caused by the agitation of sediments, by
    a. Complete additional toxicity testing in impoundments.
    b. Incorporate the P51 data, mussel observation data, turtle population data. This will allow fine tuning of the "cost" of the existing conditions (implicit in the "MNA" alternative.)
    c. Review and incorporate fingerprinting and biodegradation data into scoring
    d. The current score for MNA is 15 harm units. These evaluations could reduce harm units from anywhere between 15 and 0 (i.e. full recovery to baseline)

    These data serve to fine tune the scoring for the option named "MNA", i.e. the current baseline and a measure of the harm to be mitigated.

2. Review the environmental costs of actions.
    a. Implement the data gaps identified by the NEBA group
    b. Develop scoring for the reduction in harm points each action achieves.

    These data serve to fine tune the scoring for the environmental cost of the individual actions.

Following these steps, a refined NEBA can be developed based on the existing relative risk ranking, but with additional modifiers and data:

1. Update the risk matrix by quantifying the risk rankings, accepting, for now, the scoring assigned by the SSCG to each variable. This updating should:
    a. Allocate numerical scores for the letter codes, and calculate numerical values for the "cost" of each action.
    b. Consider the MNA option as the "harm" that is intended to be mitigated and do a proper net benefit analysis for each area and action.
    c. Consider how much of the "harm" is actually mitigated by each option
    d. Provide under the given assumptions, a relative ranking of potential removal activities in terms of comparable net benefit (positive and negative).

2. Fill the data gaps underlying the scores. The NEBA Conceptual Design identifies key data gaps needed to fine tune the model. These data must be collected to make the conclusions accurate.

3. Use toxicity data to clarify the role of the"presence of submerged oil and sheens" in the scoring.

Conclusion

Through direction to the Science Support Coordination Group (SSCG), the US EPA established completion of a Net Environmental Benefits Analysis (NEBA) as a central element in evaluating the necessity and appropriateness of different response techniques for addressing conditions in the Kalamazoo River relating to the Line 6b release.

Harm or risk of harm to human health, safety, and welfare has been addressed by prior response activities on the Kalamazoo River. The river is now open to all forms of human activity and there are no release-related restrictions on uses of the river or its water. Therefore, it is appropriate to use a NEBA in determining whether to carry out additional potential response actions and if so, which ones may be most appropriate.

The coarse-scale *Evaluation of Spatial/Temporal Patterns of Submerged Oil at Ceresco, Mill Ponds and the Morrow Lake Delta* presented to the EPA on October 1, 2012 does not take the place of completing necessary studies identified by the SSCG, nor does it provide the updated quantification of harm or net benefit comparison necessary for making the NEBA current with existing conditions.

Absent any indication of immediate risk to human health, safety, and welfare, there is no need to rush into a particular action, particularly since the existing NEBA indicates a negative net benefit from dredging and agitation as compared to other less invasive techniques. Therefore, the NEBA process should be updated with detailed site-specific data before final decisions regarding additional active recovery are made (as compared to continuing the present plan). Further, the NEBA document should also be modified to include net effects (a comparison of the relative damage levels for different removal options such as presented in Attachment A).

Without clear indication of a change in the threat of harm and/or the relative risks and damages of different removal options, ordering a radical departure from the present approach to managing the residual oil is premature.

References

Efroymson, R.A., Nicolette, J.P., Suter, II, G.W., 2003, *A framework for Net Environmental Benefit Analysis for remediation or restoration of petroleum-contaminated sites.* Report ORNL/TM-2003/17. Oakridge National Laboratory Environmental Sciences Division: Oak Ridge TN. 51 pages.

Fitzpatrick, F, compiler. 2012. *Net Environmental Benefit Analysis (NEBA) Relative Risk Ranking Conceptual Design*. Line 6b Science Support Coordination Group: Marshall, MI. August 8, 2012. 52 pages plus attachments.

Rayburn, T., Whelan, A., Jaster, M., Wingrove, R., 2004, *Net Environmental Benefit Analysis for Isle Royale National Park, Final Report: Proceedings from the workshop held January 6-8, 2004, Duluth, MN*. Great Lakes Commission: Ann Arbor, MI. 32 pages plus attachments.

Aurand, D. and G. Coelho (Compilers). 2004. Net Environmental Benefit (Ecological Risk) Assessment: Consensus Workshop. Environmental Tradeoffs Associated With Oil Spill Response Technologies. Upper Mississippi River, Pools & and 19. A report to USCG District 8 and US EPA Region 5. Ecosystem Management & Associates, Inc., Lusby, MD 20657. Technical Report 04-02, 48 pages.

Risk Ranking Matrix Table from NEBA

	Very Short-Term (1)	Short-Term (2)	Intermediate-Term (3)	Long-Term (4)
Low (1)	4D	3D	2D	1D
Moderate (2)	4C	3C	2C	1C
High (3)	4B	3B	2B	1B
Very High (4)	4A	3A	2A	1A

Risk Ranking Matrix Table from NEBA Converted to Numerical Values

	Very Short-Term (1)	Short-Term (2)	Intermediate-Term (3)	Long-Term (4)
Low (1)	1	2	3	4
Moderate (2)	2	4	6	8
High (3)	3	6	9	12
Very High (4)	4	8	12	16

NEBA Matrix Scores for Impounded Waters and Associated Deltas

	Mon. Nat. Atten.	Enhanced Dep.	Agitation Toolbox	Dredge/Vacuum	Sweep/Push	Scrape	Sheen Mgt.
Plants	4D	3B	3B	3B	3B	4C	4D
Mammals	4D	4D	4D	4D	4D	4D	4D
Birds	4D	4D	4D	4D	4D	4D	4D
Amph/Repts	3C	2B	2B	2B	2B	4C	4D
Fish	3C	2B	2B	2B	2B	4D	4D
Inverts	3C	2B	2B	2B	2B	4C	4D

NEBA Matrix Scores for Impounded Waters and Associated Deltas (converted to numerical values)

	Mon. Nat. Atten.	Enhanced Dep.	Agitation Toolbox	Dredge/Vacuum	Sweep/Push	Scrape	Sheen Mgt.
Plants	1	6	6	6	6	2	1
Mammals	1	1	1	1	1	1	1
Birds	1	1	1	1	1	1	1
Amph/Repts	4	9	9	9	9	2	1
Fish	4	9	9	9	9	1	1
Inverts	4	9	9	9	9	2	1
Sum	15	35	35	35	35	9	6

Relative Environmental Cost Matrix for Impounded Waters and Associated Deltas (using numerical conversion)

		Proposed Response Activity					
	Mon. Nat. Atten.	Enhanced Dep.	Agitation Toolbox	Dredge/Vacuum	Sweep/Push	Scrape	Sheen Mgt.
Comparison **Mon. Nat. Atten.**		**-20**	**-20**	**-20**	**-20**	**6**	**9**
Enhanced Dep.	20		0	0	0	26	29
Agitation Toolbox	20	0		0	0	26	29
Dredge/Vacuum	20	0	0		0	26	29
Sweep/Push	20	0	0	0		26	29
Scrape	-6	-26	-26	-26	-26		3
Sheen Mgt.	-9	-29	-29	-29	-29	-3	

NEBA Matrix Scores for Impounded Waters and Associated Deltas (using numerical conversion)
Comparison for dredging and sheen management

	Dredge/Vac	Sheen Mgt.	Resource Total
Plants	6	1	-5
Mammals	1	1	0
Birds	1	1	0
Amph/Repts	9	1	-8
Fish	9	1	-8
Inverts	9	1	-8
	Relative Environmental Cost		-29