ENCLOSURE 3

RESPONSE TO VARIOUS CONCERNS EXPRESSED BY STATE OF OHIO REGARDING OPEN-LAKE PLACEMENT OF SEDIMENTS DREDGED FROM THE CLEVELAND HARBOR UPPER CUYAHOGA RIVER CHANNEL

This responds to various Ohio Environmental Protection Agency (OEPA) concerns with respect to the open-lake placement of Cleveland Harbor Upper Cuyahoga River Channel sediments. It addresses several concerns raised by OEPA in letters dated December 20, 2014; January 10, 2015; February 20, 2015 and July 22, 2015; and Ohio Attorney General (AG) letter dated December 17, 2014.

1. Determination as to whether the channel sediments meet Clean Water Act Section 404(b)(1) Guidelines for open-lake placement with respect to bioaccumulation of PCBs (OEPA letter dated December 20, 2014 and Ohio AG letter dated December 17, 2014). USACE acknowledges the excerpted text from the 1998 U.S. Environmental Protection Agency (USEPA)/USACE Great Lakes Dredged Material and Evaluation Manual (GLTM) (USEPA/USACE 1998a), but strongly disagrees that the channel sediments do not meet bioaccumulation guidelines. This is based on the fact that the mean concentration of PCBs in test organisms exposed to the dredged sediments in the laboratory for two of the three dredged material management units (DMMUs) were not statistically greater than the mean concentration of polychlorinated biphenyls (PCBs) in test organisms exposed to disposal site sediments (CLA-1). For the remaining third DMMU, the observed increase in test organism laboratory bioaccumulation of PCBs relative to disposal site sediments was determined to not be ecologically meaningful. Formal guidance in the 1998 USEPA/USACE Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.—Testing Manual (ITM) (USEPA/USACE 1998b) cautions that statistically significant differences observed in the laboratory are not a quantitative prediction that an ecologically important impact would occur in the field. To that end, formal guidance discusses additional factors beyond statistically significant differences to be weighed in evaluating potential ecological impact of contaminant bioaccumulation, which was duly accomplished with respect to PCBs in the 2013 evaluation. USACE reiterates that neither the ITM nor GLTM is intended to be more or less protective than the other. While we understand that OEPA does not agree with this, we have more compelling outstanding concerns that OEPA largely misinterpreted this portion of the 2013 dredged sediment evaluation (see No. 4). For example, derivatives of 100% and 20% from bioaccumulation exposure factor (BEF) thresholds of 2 and 1.2 (respectively) were incorrectly used to imply that 50% and 10% increases in fish bioaccumulation of PCBs would be acceptable to USACE.

2. Application of the GLTM and ITM (OEPA letter dated December 20, 2014 and Ohio AG letter dated December 17, 2014). USACE is required to and has applied guidance from both manuals at various other Lake Erie and Great Lakes harbors. USACE points out that the two manuals serve as formal guidance to facilitate compliance with the Clean Water Act (CWA) Section 404(b)(1) Guidelines, and disagrees that it did not follow the guidance in the GLTM. The GLTM is not stand-alone and its connection to the ITM is inherent. USACE acknowledges that while OEPA consistently accepted use of disposal site sediments to determine acceptable PCB bioaccumulation from Ashtabula Harbor channel sediments up until 2013, it no longer agrees with that particular aspect of the GLTM. Also, as stated in our March 20 and 21, 2014 e-mails in response to OEPA inquiries, the draft guidance used in USACE (2013) (as well as the

2012 Duluth-Superior Harbor dredged sediment evaluation) simply added rigor to existing ITM guidance at Tier 3 which provides for an assessment of several factors beyond statistically significant increases in bioaccumulation.

3. Use of CLA-1 sediments to make a dredged sediment open-lake placement determination (OEPA letter dated December 20, 2014 and Ohio AG letter dated December 17, 2014). USACE disagrees that the existing bottom sediments at CLA-1 do not constitute an accurate representation of background conditions in the lake. In addition, it appears that OEPA was not receptive to Enclosure 5 of USACE letter dated November 17, 2014 which shows why sediments sampled from CLA-1 are acceptable for reference area purposes. While most of the bulk concentrations of total PCBs in the sediments are consistent with lake bottom sediments offshore of Cleveland (not previously used for the discharge of dredged sediment), USACE acknowledges that the benthic bioaccumulation of PCBs from CLA-1 reference sediments is within the higher end of the range of "ambient" bioaccumulation from sediments offshore of Cleveland. USACE disagrees that the purpose of the "GLTM process is to ensure that the dredged sediment is of the same or better quality than the placement area, which must be representative of the regional background conditions." The GLTM and ITM provide formal guidance as to whether the discharge of dredged sediment at a specified site would result in unacceptable adverse effects to the affected aquatic ecosystem. Also note that placement area sediments comprise a portion of regional background conditions. With one exception to date, existing bulk sediment concentration PCB data on CLA-1 sediments are consistent with ambient Lake Erie sediment concentrations. OEPA's reference that USACE encountered contaminated sediments at CLA-1 during the 2014 sampling is accurate; however, it also failed to consider the four other samples as well as other sites sampled from CLA-1 in 2012. Moreover, most of the evidently contaminated sites were impacted by bioavailable polycyclic aromatic hydrocarbons (PAHs) and usually did not evidence PCB concentrations above ambient conditions. While formal guidance provides for the use of disposal sites sediments to make a determination, this information collectively shows that there are ample sediments within the CLA-1 "box" that are chemically and toxicologically consistent with the adjacent Lake Erie sediments.

4. OEPA's assessment of bioaccumulation of PCBs in Upper Cuyahoga River Channel sediments in Lake Erie fish (OEPA letter dated December 20, 2014 and Ohio AG letter dated December 17, 2014). USACE has major concerns with respect to the Figure 1 graphic intended to portray the bioaccumulation of PCBs in fish resulting from the open-lake placement of these channel sediments, and concludes that the graphic provides a misrepresentation of information provided by USACE and general misunderstanding of the bioaccumulation process. Of particular concern is the inappropriate use of information to construct the graphic despite previous explanations provided by USACE to clarify the bioaccumulation exposure concept (e.g., USACE letter to USEPA Great Lakes National Program Office [GLNPO] dated February 5, 2014 and USACE e-mail to OEPA dated March 20, 2024).

There are several reasons why open-lake placement of these channel sediments could not measurably or substantially increase existing total PCB concentrations in Lake Erie fish:

a. Many of the fish species portrayed as bioaccumulating unacceptable levels of PCBs from the Upper River Cuyahoga Channel sediments have little to no food web connection to fine-grain, deep-water Lake Erie sediments because they and the species they prey upon reside in the other aquatic environments such as nearshore areas and tributaries. Therefore,

bioaccumulation of PCBs from deep-water Lake Erie sediments, regardless of their source, does not typically occur in those species.

b. The PCB bioaccumulation predictions for fish involving a 50% increase evolved from a misinterpretation of the American Society of Testing and Materials (ASTM) (2010) recommended 2-fold minimum detectable difference among benthic bioaccumulation from test and reference sediments. The PCB bioaccumulation predictions for fish involving a 10% increase were derived from BEF model output that is intended for screening potential changes in benthic exposure, and provides no quantitative information regarding changes in net uptake by fish. The BEF model is very conservative, and it is limited to predicting bioaccumulation exposure through the benthic pathway; however, it was incorrectly applied to quantify bioaccumulation in fish.

c. The predictions cited values such as 10%, 20%, 50% and 100% which were explained as increases in PCB bioaccumulation determined to be acceptable by USACE. This was an invalid assumption and an incorrect use of information provided in USACE (2013).

(1) Fundamentally, the original 2-fold difference used by USACE was to show that a less than 2-fold increase in PCB bioaccumulation in benthic invertebrate species from channel sediments as observed in a controlled, standard laboratory test (relative to reference sediments) would not translate into ecologically meaningful increases under dynamic field conditions, such as through the benthic pathway of a fish's diet and food web (USACE 2013). This is consistent with the ASTM (2010) recommended minimum detectable difference which suggests that such a difference in benthic bioaccumulation between test and reference sediments observed in the laboratory is not likely to warrant ecological and human concerns. This 2-fold difference was incorrectly assumed by OEPA to represent that an increase in PCB bioaccumulation in fish in the field of less than 100% was acceptable by USACE. Based on information obtained from USACE for an estimated 50% benthic/50% pelagic diet specific to yellow perch (USACE letter dated November 17, 2014), OEPA subsequently halved the 100% to 50% to incorrectly predict bioaccumulation from sediments for all fish species, and suggested that a 50% increase in PCB bioaccumulation in fish in the field is acceptable by USACE.

(2) USACE screening modeling showed that any increase in benthic exposure to yellow perch, as predicted through laboratory-derived data, would be less than a factor of 1.2 (USACE 2013). This benthic exposure factor, based on laboratory benthic bioaccumulation experiments, is less than a 2-fold difference and therefore not ecologically meaningful. Furthermore, since any estimated increase in benthic exposure was also within 20%, it would nevertheless not be measureable as it falls within the general range of analytical variability alone. Like the treatment of the 100% value, OEPA halved the 20% to 10% to incorrectly predict bioaccumulation from sediments for all fish species, and suggested that a 10% increase in PCB bioaccumulation in fish in the field is acceptable by USACE.

5. <u>Potential effect of open-lake placement of Upper Cuyahoga River Channel sediments on the existing fish consumption advisory (FCA) to consume no more than one meal/month of Lake Erie walleye (OEPA letter dated January 10, 2015)</u>. OEPA expressed new concerns with respect to the potential effect of open-lake placement of Upper Cuyahoga River Channel sediments on the existing FCA to consume no more than one meal/month of Lake Erie walleye. OEPA's preliminary analyses of the newer data suggested a potential increase in walleye tissue PCB

concentrations between 2011 and 2013. USACE responded to this new concern in a letter dated February 17, 2015, strongly disagreeing that open-lake placement of these channel sediments would have any measureable effect on the FCA. On an average lipid-normalized basis, the laboratory bioaccumulation of PCBs in the oligochaete *Lumbriculus variegatus* from the channel sediments is on the order of 5,500 µg/kg-lipid, and very comparable (or lower) to that which exists from CLA-1 reference sediments (USACE 2013; USACE 2015). Existing information indicates that this value is roughly about half the benthic bioaccumulation of PCBs (including by oligochaetes) from bottom sediments in the Western Lake Erie Basin (WLEB). Reasons for this difference in PCB bioaccumulation amongst the two basins vary, but the presence of higher PCB contamination in WLEB water and sediments certainly play a role. It is widely accepted by the scientific community that the major source of PCBs to Lake Erie is the Detroit River which empties into the lake in the northern portion of the WLEB, and that the trend in PCB contamination in Lake Erie progressively declines eastward to the Niagara River at Buffalo, New York. As OEPA is aware, the majority of walleye in Ohio's Lake Erie waters are spawned and tend to home toward WLEB and its watersheds for the majority of the year where total PCB concentrations in sediments are amongst the highest in Lake Erie.

6. <u>Vertical homogeneity of the Upper Cuyahoga River Channel sediments (OEPA letter dated February 20, 2015)</u>. OEPA reiterated the question whether sediments in the Upper Cuyahoga River Channel were vertically homogenous and provided selective evidence of vertical stratification in core samples collected by OEPA in 2014. OEPA's concern was that surface grab sediment samples were not sufficiently representative of the channel sediments. USACE responded to these concerns in letter dated March 2, 2015, noting issues with OEPA's location data on the core and surface grab sediment samples (i.e., inadequately co-located core and surface grab samples and vague core sample elevation information). The information provided to USACE to date suggests that many of the April/May 2014 core samples were collected from outside the actual channel dredging prism. In an effort to address OEPA's concerns with respect to heterogeneity of these channel sediments, USACE collected six core samples co-located with six surface grab samples. The cores sampled intervals consistent with the dredged prism, which was about 2.5 to 3.5 feet at the time of sampling. Total PAH concentrations in the core samples were consistent with those of the surface grab samples and the differences presented by OEPA were not reproduced. The average total PAH concentrations (normalized to TOC) across the co-located surface grab and core samples were 253 and 293 mg/kg-TOC, respectively, demonstrating PAH concentrations in two sediment sample groups to be quite comparable and not a consequence of sample type. This information indicates that surface grab samples are adequately representative of these maintenance-dredging sediments, which is consistent with the sample protocol provided in existing formal USEPA/USACE guidance.

With respect to PAH contamination in the channel sediments, USACE continues to be concerned about OEPA's focus on bulk concentrations (e.g., summation of 16 USEPA priority pollutants [PPs]) in these channel sediments to portray potential toxicity. In its February 20, 2015, OEPA referenced total PAH concentrations in surface grab and core sediment samples collected in 2014 that ranged from 4.4 to 26.7 mg/kg. Other than for preliminary screening purposes, using bulk concentration to characterize PAH-related toxicity can be quite problematic and lead to erroneous conclusions because many PAHs are pyrogenic in origin and adsorb to hard carbon, thereby reducing their bioavailability and potential for toxicity. Existing data show that PAHs mixtures in Upper Cuyahoga River Channel sediments are of predominantly pyrogenic origin

which is typical for most Great Lakes watershed sediments. As initially discussed in USACE (2013) December 20, 2013 USACE letter, a more accurate characterization of PAH-related toxicity in sediments is the quantification of sediment pore water concentrations of 34 PAHs (18 non-alkylated parent compounds and 16 groups of generic alkylated forms) to predict the potential for toxicity using hydrocarbon narcosis modeling (USEPA 2003). This testing/evaluation approach was used by USACE in 2012, 2014 and 2015 (along with measurements of the 16 PPs) but has not to our knowledge been employed by OEPA in this case. Use of this approach has not predicted the potential for PAH-elated toxicity in harbor sediments, which is consistent with the associated solid phase bioassay data.

7. Recent results of standard 10-day *Hyalella azteca* solid phase bioassays applied to these channel sediments in 2015 (OEPA letter dated July 22, 2015). As in 2012, USACE applied solid phase laboratory bioassays to the channel sediment samples in 2015. The results of this testing are contained in USACE (2015). It is important to note that ammonia in sediment pore water is often a confounding factor in the performance of bioassays, so it is critical that it be monitored to ensure that it does not mask the potential toxic effects of persistent contaminants. In 2015, in addition to following standard water renewal guidance to reduce sediment pore water ammonia concentrations (USEPA/USACE 1998b), the U.S. Army Engineer Research and Development Center (USAERDC) found that an abundance of native aquatic worms (likely tubificids) in some of the channel sediment samples significantly reduced the survival of *H. azteca*. The potential confounding effect of oligochaetes on *H. azteca* and other test species in laboratory bioassays is documented in the scientific literature and recognized by USEPA (Reynoldson *et al.* 1994; USEPA 2000). Using standard methodology (USEPA 2000; USEPA 2001; ASTM 2005), USAERDC sieved the sediment samples to remove the oligochaetes (which also likely served to concentrate sediment contaminant concentrations) and reran the bioassay. The results yielded high *H. azteca* survival while showing that the native worms produced an adverse, non-contaminant-related effect on this test species in the laboratory. Since USACE's 2015 *H. azteca* bioassay data substantially contrast with those generated by OEPA in 2015 and it appears that OEPA did not address sediment pore water ammonia and native organism-related factors in the laboratory test procedures, it is likely that ammonia and/or the presence of a significant number of indigenous worms influenced OEPA's 2015 bioassay data on Upper Cuyahoga River sediments.

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