TECHNICAL BRIEFING – LAKES FEASIBILITY STUDY – SITE 54/PICA 015, SITE 53/PICA 057, AND SITE 103/PICA 164 – APRIL 2012

The document reviewed was a final focused feasibility study (FS) for Lake Denmark (Site 54/PICA 015), Picatinny Lake (Site 53/PICA 057), and the Explosive Ordnance Demolition Pond (EOD Pond). The purpose of the FS was to determine the appropriate remedy for the lake sites. Surface water, sediment, and soil contamination were addressed for Lake Denmark whereas only surface water and sediment were addressed for Picatinny Lake and the EOD Pond. Soil for these areas is being considered separately as part of other individual sites located in those areas. The basis for the FS was numerous environmental investigations completed in each of the areas and a Human Health Risk Assessment (HHRA) and Screening-Level Ecological Risk Assessment (SLERA). In addition another site-wide study was completed in 2004 to examine the potential risks and hazards associated with fish consumption from Picatinny water bodies. Fish were collected from individual water bodies but risk assessments were performed for groups of water bodies with related characteristics. For example, Lake Denmark, Green Pond Brook, and Picatinny Lake were considered as a single group. The fish ingestion evaluation is a key factor in the need for remedial action at the three water bodies as discussed in the following sections.

A track-changed version of the FS had previously been approved by the U.S. Environmental Protection Agency (USEPA) in November 2010. The version contained in the April 2012 FS was necessary as a result of several factors as follows:

- Additional sampling performed in 2011 needed to be incorporated and addressed (results contained in new Appendix D – Results of November 2011 Sampling Event);
- A revised risk assessment was completed (results contained in Appendix E – Risk Assessment Memorandum);
- Fishing restrictions were included as part of a land use control (LUC) provision; and
- the alternative for sediment removal in Picatinny Lake was deleted since there was found to be acceptable risk at that site.

For soil the New Jersey Department of Environmental Protection (NJDEP) Non-Residential Soil Remediation Standard (NRSR) was used as the level of concern (LOC). If no state criteria was available, the USEPA Industrial Regional Screening Levels (IRSLs) were used as the basis for comparison. For

sediment, the LOC was the lower of the Interim Sediment Quality Guideline, New York Sediment Criteria, or the Sediment Quality Benchmark. In the absence of those criterion then NJDEP Effects Range- Low (ER-L) values were used and if none of those values were available, then the lower of the IRSL and the NRSR were used. For surface water the New Jersey Surface Water Quality Criteria were used. In the absence of those values USEPA Water Quality Criteria were used. In the absence of those value the USEPA Tap Water Regional Screening Level (RSL) values were used. If the Picatinny background values was higher than the selected guidance criteria, the background value was used.

HHRA

The recreational visitor was considered for all water bodies. Only a hypothetical resident was considered for Lake Denmark where soil was part of the environmental media in the FS. Soil for Picatinny Lake and the EOD Pond was considered as part of other sites surrounding the water bodies. For all water bodies the current/future on-site youth visitor (i.e., recreational) and current/future industrial/research worker were evaluated.

SLERA

As part of the SLERA ecological risks were evaluated by comparing detected concentrations in environmental media at a given site to applicable screening levels. Aquatic biota, benthic biota, and semi-aquatic wildlife (Great Blue heron, mink, and Indiana bat) were considered. In some cases where detected concentrations far exceed screening levels there is justification that "effects only occur at much higher concentrations." The utility of the SLERA is questionable given that any potential for adverse effects appears to be discounted. As a further example, the population of warm water fish in Lake Denmark is observed to be poor. This is potentially attributed to competition with other species or significant vegetation providing cover to forage fish.

Lake Denmark

Lake Denmark is a man-made lake that was created by damming a marsh in the early 1900s. The lake is approximately 174 acres in extent. A fill/excavation area was in use near the lake between approximately 1951 and 1987. Storage magazines were located at the southern end of the lake for more than 70 years. A 20 mm rifle testing range was located across the lake with the impact area

approximately 5300 feet away across the lake. The 1926 explosion was responsible for scattering unexploded ordnance (UXO) in the lake and around the surrounding area. Furthermore the lake had historically been used as an impact area for experimental mortar rounds and other explosive or pyrotechnic munitions. Like the other lakes that are the focus of the FS, Lake Denmark is managed as a "recreational resource" with fishing from shore, by boat, or on the ice but no swimming, wading, or sail boarding is permitted.

Lake Denmark is the only one of the three water bodies in which soil was also considered as part of the FS. As such the consideration of future land-use scenarios includes both military/industrial, residential, and recreational. Other risk assessments did not focus on the residential scenario since only the water body was included. No constituents at concentrations greater than LOCs were detected in surface soil. Volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and pesticides were detected at concentrations over the respective LOC in sediment whereas only metals and pesticides were detected above the LOC in surface water. A munitions and explosives of concern (MEC) survey was completed and the potential MEC identified as a result of that survey will be dealt with under the Military Munitions Response Program (MMRP) initiative.

As part of the HHRA, scenarios were considered for the following exposures: current and future industrial/research worker, current and future on-site youth visitor (recreational), current and future adult resident, and current and future child resident. Calculated risk values were all with the 10^{-6} to 10^{-4} range for carcinogens and for non-carcinogens the hazard index (HI) was less than 1.

Despite Lake Denmark fish tissue concentrations being the lowest of all the water bodies considered, there were some hazard indices greater than 1 for non-carcinogens. For current use receptors this was due to mercury presence with some contribution from PCBs in yellow perch. The FS does note that mercury seems to be a ubiquitous compound in the environment in New Jersey and that its widespread occurrence is the reason for a statewide ban on consumption of certain types of fish. For the hypothetical future resident PCBs in large mouth bass and yellow perch contribute to the hazard index exceeding 1.

Picatinny Lake

The lake is surrounded by active, inactive, and demolished buildings. Buildings are or were in use for research and development, production, and storage. In addition there were chemical labs, steam and electric generation in one building, and a betatron and x-ray lab situated in another building. The water in the lake was historically used for drinking. In addition the water was used for industrial and fire fighting purposes and non-contact cooling water. All industrial discharges that had gone into the lake now go to a sanitary sewer. In the past the permited discharges were for wastewater from cleanup of explosives (1985 to 1988), stormwater, cooling water, and unspecified discharges from two buildings. Other non-permitted discharges were debris from the 1926 explosion, solid waste, photo processing chemical, a 1981 fuel oil spill, sump discharges, untreated explosive wash down, other washdown, and backup from a sewer manhole. The lake may have been used as an impact area, for underwater storage, and for disposal. Furthermore an island in the lake, Flare Island, was used for pyrotechnic testing. As a result burned material may have been deposited in the lake by the wind and there is the potential for MEC.

Compounds exceeding the LOCs were detected in sediment samples as follows: VOCs, SVOCs, pesticides, PCBs, and metals. One VOC, attributed to laboratory contamination, exceeded the LOCs in surface water samples as did another SVOC, also a common laboratory contaminant, in surface water. A pesticide, explosives (2,4-DNT, nitroglycerine, RDX, and TNT), metals, and cyanide exceeded the LOC in surface water samples. Despite these detections the FS notes “the overall water quality of Picatinny Lake is good.” It is difficult to comprehend the basis for the conclusion given the detections reported. The NJDEP had requested collection and analysis of samples for silver and Radium-226, neither of which were detected.

A magnetic survey identified several small anomalies that could be MEC. Several linear magnetic anomalies were also detected and could be pipelines. These anomalies will be investigated as part of the MMRP RI.

The original risk assessment looked at surface water as a whole but sediment and some surface water scenarios were evaluated on a site by site basis. The supplemental risk evaluation was designed to look

at exposures to the lake as a whole which could be considered more representative. The supplemental evaluation was for an on-site youth visitor. Only sediment results from within 100 feet of the shoreline were utilized rather than deeper sediments which said visitor would not likely encounter. Calculated risks were within the acceptable range and the HI was less than one.

Ecological risks to aquatic biota, benthic biota, and semi-aquatic wildlife were evaluated by comparing detected constituent concentrations in environmental media to screening levels. Aquatic biota were determined to have no "widespread or substantial risks", this despite the detection of barium and boron exceeding screening values toxicity reference values (TRV) by more than a factor of 10. The FS states that TRVs are considered to be conservative screening values at which effects could occur but are unlikely to. Organic and inorganic constituents were found to pose a risk to benthic invertebrates in isolated areas but not to the "community overall." The report states that "based on the weight of evidence constituents in sediment do not appear to pose widespread risks to the Picatinny Lake benthic invertebrate community." A food chain analysis was performed to examine risks to semi-aquatic wildlife. Fish tissue was analyzed for a number of compounds including SVOCs, pesticides, PCBs, explosives, and metals. Pesticides, metals, and one PCB were detected. The fish tissue concentrations were used to estimate exposure concentrations which were then compared to TRVs for dietary exposure.

<u>EOD Pond</u>

The EOD Pond is approximately 9 acres in extent. The pond was constructed between 1945 and 1953 in what had been a marsh area. Currently the pond is inactive. In the past pesticides, flammable materials, and PCBs were stored in nearby buildings. Ordnance from the 1926 explosion may have been dumped in the pond. As with Lake Denmark and Picatinny Lake the pond is considered a recreational resource. Fishing is allowed from the shore, boats, or the ice in winter. Only non-motor boats are permitted and as with the two other water bodies discussed herein, swimming (and wading) is not permitted.

Pesticides, metals, and PCBs were detected at concentrations above LOCs in sediment samples. A single surface water sample was found with LOC exceedances for metals. The sample was in the outfall north

of the pond. Based on this single exceedance (outside the water body) the report concludes that "no constituents are detected in surface water from the EOD Pond in concentrations greater than the LOCs. The overall water quality of the EOD Pond is good."

Several anomalies were identified from a geophysical survey. No unacceptable risks were identified for the current/future on-site youth visitor for exposure to sediment or surface water (both cases for which arsenic was the risk driver). A lead blood model was done as part of the 2005 remedial investigation (RI). Lead was not a COPC in surface water. For lead in sediment there was no concern for either the current on-site youth visitor or the current adult resident.

Several pesticides, PCBs, and some metals were identified as chemicals of potential ecological concern (COPECs) in sediment. The highest concentrations were found at the inlet and the outlet of the pond. The conclusion of a benthic community assessment was that there did not appear to be any significant risk.

Remedial Action Objectives (RAO)

Based on the HHRA constituents found in soil, sediment, and surface water were not deemed to pose an unacceptable risk or hazard to human health under the current and planned future land-use scenarios. However, elevated contaminant concentrations in fish tissue were deemed to pose a potential health risk for ingestion. As part of this phase of the FS several steps are completed as follows:

- Identify ARARs
- Formulate RAO(s)
- Identify chemicals of concern
- Identify cleanup goals
- Delineate the area of attainment

The stated RAO was to "control consumption of fish with concentrations of chemicals driving unacceptable risk or hazard. The chemicals of concern (COC) are those that accumulate at unacceptable concentrations in edible fish and those are mercury and PCBs.

Process of Identifying and Selecting Alternatives

Once the RAOs have been formulated and the attainment areas identified, the final steps in the FS are as follows:

- Identify response actions
- Perform initial screening: effectiveness, implementability, and cost
- Perform technology screening
- Develop response action alternatives
- Detailed evaluation of response actions
- Individual analysis of alternatives
- Comparative analysis of alternatives

During the detailed evaluation of response actions the remedial action is evaluated against nine criteria as follows:

1. Protectiveness of human health and environment
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance

The first two criteria are the threshold criteria and "the preferred remedial alternative will be the one that satisfies the first two criteria and achieves the best combination of the remaining seven criteria." The second five criteria are considered balancing criteria and the last two are modifying criteria that do not enter consideration until the final stages of remedy selection.

Two alternatives were considered as follows: Alternative 1 – No Action and Alternative 2 – Land Use Controls. No Action was retained as a baseline for comparison to the other alternative even though it is not a viable alternative; the alternative would not address the potential for exposure due to fish consumption which is a potential health risk. Alternative 2 satisfies the balancing criteria and has

relative ratings of adequate to excellent for the balancing criteria. The total present worth of capital and annual costs for the LUC alternative is $188,000. By default Alternative 2 is the only suitable option.