Supplemental Responses to Additional NRC Requests Regarding the Honeywell Metropolis Works License Amendment Request Report Volume 2: Closure Plan for Surface Impoundments B, C, D, & E

PREPARED FOR: Nuclear Regulatory Commission

PREPARED BY: CH2M HILL on behalf of Honeywell

COPIES: ENERCON, Andrews Engineering

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The Nuclear Regulatory Commission (NRC) has sent additional requests regarding the License Amendment Request Report (LARR) Volume 2 to Honeywell. Communications between NRC and Honeywell related to the original LARR Volume 2 Requests for Additional Information (RAIs) occurred in May and June, followed by additional questions and requests received from and discussed with NRC in July. On August 6, NRC sent a letter summarizing the July 30 conference call and requesting additional responses.

Responses to the additional NRC requests regarding the LARR Volume 2 RAIs 1, 2, 3, 4.1, 4.2, and 4.7 were submitted in a memorandum dated September 7, 2012. As noted in that response and discussed with NRC, the additional NRC requests on RAIs 4.3 through 4.6 would be addressed by a supplemental response. This memorandum serves as that supplement.

Attachment 1 to this memorandum is the updated site stormwater management calculation package (Calculation CALC-388996-SW-01, Revision 4). This version now includes the latest sedimentation evaluation (pages 190-198), top cover vegetation evaluation (pages 199-202), and wind erosion evaluation (pages 203-241), plus narrative descriptions of these evaluations (pages 16-19). This revision also contains updates to previously presented stormwater flow and riprap calculations, which now include the top covers and minor updates to cover/drainage areas (various pages 1-189).

Attachment 2 to this memorandum is the Ohio River probable maximum flood (PMF) calculation package (Calculation CALC-388996-SW-03, Revision 0).

The contents and results in Attachments 1 and 2 relative to NRCs additional RAIs are summarized herein.

Responses to Additional NRC RAIs

Additional Request 4.3:

Was a sediment accumulation analysis performed at the site, based on different storm events and flow velocity (flush of sediments?) to support Honeywell's conclusions? Will there be sediment accumulation on top of the rock (after all the voids are filled)?

4.3 Response:

The perimeter ditches are designed to manage runoff from the closed pond system. Based on surrounding topography, significant run-on from other areas of the facility will not occur. Therefore, sediments that will discharge to the ditches will generate from the vegetated top covers (four percent slopes) and from the riprap armored sideslopes (approximately 33 percent slopes). Since only durable riprap will be used in sideslope construction, significant sediment generation from the riprap is not expected.

A sediment accumulation analysis was performed per Appendix E of NUREG 1623. The total soil loss from the top four percent sloped covers was calculated to be 1.34 tons/year (see Attachment 1, pages 190-198). The riprapped sideslopes will consist of durable riprap sized to resist the PMF flowrates, which should result in minimal, if any, sediment loss. Based on a void ratio of 0.33, the riprap has a total void capacity to accumulate over 5000 tons of sediment. Based on the soil loss rate of 1.34 tons/year, the riprap voids would not be filled for over 3,800 years (see Attachment A). After this time, sediment may temporarily accumulate on top of the riprap, but would be flushed away past the discharge points during subsequent large storm events.

Additional Request 4.4:

It appears that V-shape slopes may be too steep and sediment accumulation may occur. The licensee should demonstrate that it has accounted for the proper slopes in its design. Please refer to comments in response to 4.3.

4.4 Response:

Based on the calculations described in the response to comment 4.3, riprap voids would not be filled with sediment for over 3800 years. Sediments that accumulate over the riprap thereafter would be flushed from the ditches during subsequent storm events. The V-shaped ditch will result in higher flow velocities at low flow depths relative to a flat-bottom channel, which would help to resuspend and remove any sediment that does collect in the bottom of the channel.

Additional Request 4.5:

Provide the technical basis/analysis for selecting 4%? Will rock be required? Refer to Section 2.2.2 in Appendix A of NUREG-1623 for guidance on how to design vegetated soil covers.

Was a wind erosion analysis performed? The Chepil Equation mentioned in NUREG-1623, Page 18, is an approved method.

4.5 Response:

Based on the evaluation method in NUREG 1623 Appendix A, the calculated maximum permissible velocity (MPV) over the four percent slope vegetated top covers is 1.50 ft/s. The calculated top cover flow velocities during the 100-year storm in each sub-area range from 1.03 ft/s to 1.42 ft/s (see Attachment 1, pages 199-202). These are below the maximum permissible velocity, and therefore the vegetated cover is expected to withstand the 100-year storm flow velocities without damage.

However, the calculated top cover flow velocities during the PMF event range from 2.57 to 3.64 ft/s, which would exceed the calculated MPV over the vegetated top cover. Therefore, it is possible that some damage to the vegetated top cover could occur during a PMF event. The long-term behavior of the top cover after such a PMF event (i.e., extent of actual damage to vegetation, time to re-establish full vegetation, etc.) is uncertain.

To mitigate this uncertainty, we propose to incorporate a riprap layer within the top cover system. A 4-inch thick layer of riprap with D_{50} of 1 inch would be sufficient to resist the top cover flow velocities during the PMF event (see Attachment 1, pages 117 through 138). We propose to construct the 4-inch thick riprap layer between the 12-inch thick granular filter/drainage layer and the overlying 18-inch thick vegetative support layer. This configuration will allow establishment of a vegetated top cover, while also protecting against uncontrolled erosion down into the solidified pond materials if the vegetation is significantly damaged by a PMF-level event (and for some reason does not re-establish) after the cover maintenance period ends. The granular filter/drainage layer can serve as the riprap bedding layer.

The Wind Erosion Equation (WEQ), as developed by W.S. Chepil, was published in 1965. It is an empirical model that represented the most accurate science at the time and was used by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) for many years to estimate wind erosion on cropland. The Wind Erosion Prediction System (WEPS) is a wind erosion simulation model developed by the NRCS to replace the WEQ. The WEQ is no longer supported by NRCS. Although developed for cropland, the WEPS is well suited to evaluate wind erosion from other disturbed lands such as construction sites and landfills.

Based on both the WEQ model and the WEPS model, wind erosion from the four percent slope top covers is calculated to be essentially zero tons/year (see Attachment 1, pages 203-241)

Additional Request 4.6:

What is the drainage area of the Ohio River assumed for the Honeywell site? How were the 4,000,000 cfs and PMF elevation of 365ft taken into consideration in your design? The licensee can follow the same procedure used for the PGDP facility (RG1.59) and apply it at the Honeywell site to calculate the PMF.

4.6 Response:

The drainage area of the Ohio River upstream of Metropolis, IL is approximately 203,000 square miles, as reported for USGS Station # 03611500 (Metropolis, IL).

The Ohio River PMF peak discharge and elevation were calculated based on the above drainage area (see Attachment 2). The PMF discharge was calculated using the stepwise procedure outlined in Section B.3.2.2 of NRC Regulatory Guide (RG) 1.59. The corresponding PMF discharges for six different drainage areas (100, 500, 1000, 5000, 10,000, and 20,000 square miles) were plotted on a log-log chart. The peak discharge for a drainage area of 203,000 square miles was calculated by straight-line interpolation. The resulting PMF discharge is 4,240,000 cfs. This is slightly higher than the calculated PMF of 4,000,000 cfs reported in the SAR for the Paducah Gaseous Diffusion Plant (PGDP, 1995).

The corresponding PMF elevation at Metropolis was estimated based on extrapolation of the historic flood discharges and associated gage elevations measured at Metropolis. A regression analysis was performed to calculate the relationship between elevation and peak discharge. The corresponding equation relating elevation and peak discharge is as follows:

$$\text{PMF Elevation, ft NGVD29} = 26.56 \times \ln [\text{ PMF Discharge, cfs}] - 37.64$$

Based on this analysis, the estimated PMF elevation at Metropolis corresponding to a discharge rate of 4,240,000 cfs is 367.6 feet NGVD29.

The calculated relationship is consistent with the reported PMF elevation for the PGDP. For the PGDP calculated PMF discharge of 4,000,000 cfs, the elevation calculated by the above equation is 366.1 feet NGVD29, which is only approximately one foot higher than the PGDP reported elevation of 365 feet NGVD29. This demonstrates that the above equation results in a reasonable, if slightly conservative, estimate of elevation.

The PMF elevation of 367.6 feet NGVD29 would flood the perimeter ditch around the closed ponds and would only rise a few feet up along the sideslopes at the lowest locations. The ditches and sideslopes will be armored with riprap.

The cross-sectional area of the Ohio River at the Honeywell site from the river bottom to elevation 367.6 ft is approximately 640,000 ft^2 (see Attachment 1, page 18). The average PMF river velocity is calculated by dividing the PMF flow rate of 4,240,000 cfs by the cross-sectional area. This results in an average PMF river velocity of less than 7 ft/s. However, due to the drainage pattern and topography adjacent to and south of the ponds, PMF flow velocities near the ponds will be much lower than the average PMF river velocity. The flood waters will need to back up into the drainage ditches to reach the ponds, which will limit flow velocities. The higher velocities will be restricted to within the banks of the river bluffs located several hundred feet south of the ponds.

Based on the above, the PMF peak discharge and elevation, if they were to occur, are not expected to adversely impact the closed pond erosion protection system.