Agenda

• Introduction
• Overview of MTW Ponds and Closure Project
• Closure Design Concept and Criteria
• NRC Decommissioning/MARSSIM Strategy
• Pond Characterization Data
• Dose Modeling – Key Assumptions
• Preliminary Modeling Results
• Next Steps
• Discussion/Feedback
• Concluding Remarks
Overview of Ponds at MTW

- Surface impoundments permitted under RCRA
  - Calcium Fluoride (CaF$_2$) ponds
  - RCRA sampling verified the materials in the ponds as non-hazardous
  - Contain some residual radioactivity

<table>
<thead>
<tr>
<th>Pond ID</th>
<th>Volume (cubic yards)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B Pond</td>
<td>13,000</td>
</tr>
<tr>
<td>C Pond</td>
<td>13,600</td>
</tr>
<tr>
<td>D Pond</td>
<td>9,500</td>
</tr>
<tr>
<td>E Pond</td>
<td>52,000</td>
</tr>
</tbody>
</table>
Overview of Pond Closure Project

- Three ponds no longer in use, fourth to be removed from use prior to closure
- Must be closed in timely fashion per NRC and IEPA regulations
- Pond closure must comply with both NRC and IEPA requirements
  - 10 CFR Part 20, Subpart E regulations
  - RCRA Part B regulations
- Closure approach
  - Stabilize/solidify CaF$_2$ material in-situ within existing pond footprints using a pozzolanic material (e.g., Portland cement)
  - Construct RCRA cover over each pond

Agency Coordination is Essential
Closure Design Criteria

• Leave existing ethylene propylene diene monomer (EPDM) liner in place

• Stabilize materials in-situ with pozzolanic material above existing EPDM liner

• Add a minimum of 4 feet of clean cover soil above stabilized material (cover subgrade slopes at 4%), from top to bottom:
  - 2 feet of cover soil including vegetated topsoil,
  - 1-foot granular drainage layer,
  - Textured geomembrane (GM),
  - Geosynthetic clay liner (GCL) and;
  - 1-foot minimum of clean cover soil.

• Armor berm side-slopes and drainage ditches with riprap for long-term erosion protection

Closure Design Based on Pertinent NRC and RCRA Guidance
Closure Design Criteria – Seismic

- Based overall design on IEPA and USEPA Guidance
  - 475-year Earthquake (IEPA):
    - Pseudo static slope stability factor of safety (FS) of 1.3 or greater
  - 2,475-year Earthquake (USEPA):
    - Seismic slope deformations no greater than 6 to 12 inches

- Considered pertinent sections of NUREGs 1620 and 1623, and RG 3.13
  - Slope stability, slope displacement, and settlement analytical methods
  - Effects of soil liquefaction

Design Criteria Addresses Credible Natural Events
Based surface water and erosion control features on IEPA and USEPA design guidance (for landfills and surface impoundments)
- Top cover hydraulic conductivity less than existing bottom liner
- Designed drainage feature sizes based on the 100-year, 24-hour storm

Considered pertinent sections of NUREGs 1757, 1620, 1623, and 6697 (e.g., erosion protection)
- Riprap on all berm sideslopes and ditches
- Considered erosion protection performance during precipitation intensity events greater than the 100-year, 24-hour storm
- Cover erosion rate assumed to be 0.00018 m/yr
NRC Decommissioning Strategy

• Partial site decommissioning
  - Ponds cover an approximately 6-acre combined area
  - Closed area will be released from NRC license (approximately 10 acres total)
  - Necessary to ensure consistency among EPA, IEPA, and NRC
  - Consistent with 10 CFR 40.42 (the “Timeliness Rule”)

• Selected approach is **unrestricted** release from license
  - Dose is As Low As Reasonably Achievable (ALARA)
  - Total Effective Dose Equivalent (TEDE) to average member of critical group less than 25 mrem
  - No institutional controls
  - Accounts for dose contribution from balance of site

Consistent with License Termination Rule and NUREG-1757
MARSSIM Methodology

• License termination strategy for the ponds
  - Document existing extensive pond characterization data
  - Develop site-specific radiological computer dose model using available site-specific parameters
  - Select appropriate end user scenario (e.g., industrial worker)
  - Verify that dose exposure criteria will be met when RCRA closure design (or more conservative) is implemented
  - Recognize that dose exposure used by partial release of the closed ponds from the license reduces the dose release criteria for the remainder of the site at eventual site decommissioning

• Approach shows that post-closure exposure levels achieve 10 CFR Part 20 requirements

• Methodology is consistent with using derived concentration guideline levels (DCGLs) to demonstrate 10 CFR Part 20 compliance

Consistent with License Termination Rule and NUREG-1757
Pond Characterization

• Pond Characterization Investigation
  - Pond characterization data collected in 2009 by Andrews Engineering
  - Used to calculate mean uranium concentrations for each pond

<table>
<thead>
<tr>
<th>Location</th>
<th>Grid Composite Mean Uranium Concentration (as is basis)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(pCi/g) (ppm)</td>
<td></td>
</tr>
<tr>
<td>Pond B</td>
<td>160 (240)</td>
<td>26</td>
</tr>
<tr>
<td>Pond C</td>
<td>191 (287)</td>
<td>36</td>
</tr>
<tr>
<td>Pond D</td>
<td>163 (245)</td>
<td>34</td>
</tr>
<tr>
<td>Pond E</td>
<td>135 (203)</td>
<td>105</td>
</tr>
</tbody>
</table>

Uranium is Present at Levels Less Than Source Material (500 ppm)
Dose Modeling – Key Assumptions

• Critical Group – Industrial Worker
  - Industrial use consistent with nearby land uses
  - Area surrounding closed ponds (i.e., balance of MTW operations area) is expected to remain an industrial facility under NRC license
  - IEPA RCRA closure restrictions will proscribe certain uses/activities

• Exposure Pathways
  - Conservatively includes drinking water pathway
  - Suppresses plant, meat, milk, and aquatic food ingestion pathways
  - Occupancy factors (40-hour work week; 2,000 work hours/year)

Consistent with License Termination Rule and NUREG-1757
Dose Modeling – Key Assumptions

• Size, thickness, and hydrogeologic properties of contaminated zone, cover materials, unsaturated zones, and saturated zones are defined

• Engineered cover required by RCRA and IEPA regulations
  - Minimum 4’ cover
  - Severely restricts water infiltration and potential migration of waste materials
  - Evaluations based on reasonably conservative average cover thickness at each pond

• Engineered cover only credited for passive performance
  - Assumes no maintenance or monitoring
  - Modeling will consider range of failure mechanisms
    ◆ Erosion
    ◆ Flood
    ◆ Earthquake

Consistent with License Termination Rule and NUREG-1757
Dose Modeling – Additional Conservatism

• Industrial worker alternative modeling evaluated a range of parameters:
  - Impact of cover thickness and erosion
  - Impact of unsaturated zone hydraulic conductivity
  - Impact of stabilization volume increase and concentration decrease
  - Impact of saturated zone porosity
  - Impact of no sub-pond liner

• Maintenance and monitoring of engineered cover will be required by IEPA

• Conservatively modeled Resident Farmer scenario as a check

Model Yields Conservative Results
Dose Modeling – Preliminary Results

• RESRAD dose model (probabilistic mode)
  - Conceptual site model
  - Preliminary cover design
  - Site-specific geologic and hydrologic parameters

• Maximum industrial worker dose values for conservative average cover thickness was approximately $2 \times 10^{-7}$ mrem/year at 1,000 years

• Resident farmer scenario, evaluated as a conservative comparison, resulted in an estimated dose value of $6 \times 10^{-7}$ mrem/year at 1,000 years

Doses Far Below Part 20 Limits
Next Steps…

• Submit License Amendment Request and Decommissioning Plan to NRC (November 2010)
• Submit Class 3 Permit Modification Request and Closure Plan to IEPA (November 2010)
• Begin Pond Closure (March 2013)
• Complete Pond Closure (May 2016)
Questions/Comments