**Title and Subtitle:**
Verifications Studies on Solidification of Basin F Wastes

**Author(s):**

**Performing Organization Name(s) and Address(es):**
Army Engineer Waterways Experiment Station, Environmental Laboratory, Vicksburg, MS

**Performing Organization Report Number:**
83228R02

**Sponsoring/Monitoring Agency Name(s) and Address(es):**
Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD

**Sponsoring/Monitoring Agency Report Number:**
94-34876

**Abstract:**
Objectives of this study:
1) Verify solidification concepts developed in previous studies,
2) Identify test procedures needed to monitor solidification processing,
3) Develop performance criteria for solidified basin F wastes.

**Distribution/Availability Statement:**
Approved for public release; distribution is unlimited.

**Security Classification of Report:**
Unclassified
VERIFICATION STUDIES ON SOLIDIFICATION OF BASIN F WASTES

BY

ENVIRONMENTAL LABORATORY
U.S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION
VICKSBURG, MS 39180

FOR

U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY
ABERDEEN PROVING GROUND, MD 21010

Rocky Mountain Arsenal
Information Center
Commerce City, Colorado

FILE COPY
OBJECTIVES

- VERIFY SOLIDIFICATION CONCEPTS DEVELOPED IN PREVIOUS STUDIES

- IDENTIFY TEST PROCEDURES NEEDED TO MONITOR SOLIDIFICATION PROCESSING

- DEVELOP PERFORMANCE CRITERIA FOR SOLIDIFIED BASIN F WASTES
RESULTS FROM PREVIOUS STUDY

- SOLIDIFICATION IS A FEASIBLE TECHNIQUE FOR CONVERTING BASIN F LIQUID TO A SOLID FORM.
- LARGE QUANTITIES OF AMMONIA GAS ARE RELEASED WHEN VARIOUS SOLIDIFICATION REAGENTS ARE ADDED TO BASIN F LIQUID.
CHEMISTRY OF AMMONIA RELEASE

I. IONIZATION EQ

\[ NH_4^+ + OH^- \rightleftharpoons NH_3 + H_2O \]

II. CHANGE OF PHASE EQ

\[ NH_3(aq) \rightleftharpoons NH_3(g) \uparrow \]

[Eq (1)]

![Graph showing mole fraction vs pH]

\[ \text{Mole Fraction} \]

\[ \log \]
SEQUESTERING OF AMMONIA RELEASE BY MgNH₄PO₄·6H₂O PRECIPITATION

\[
\frac{\text{NH}_3 \text{ Released}}{\text{NH}_3 \text{ Present}} = \left( \frac{\text{Amt. Sec. By Used}}{\text{Stoichiometric Amt.}} \right)
\]

\[SR^2\]

Time (hrs) →

\[SR=0.0\]
\[SR=1.0\]
\[SR=1.15\]
\[SR=1.5\]
\[SR=2.0\]
SEQUESTERING OF AMM IA RELEASE RATE BY MgNH₄F₄·6H₂O PRECIPITATION

Graph showing the release rate of NH₃ over time. The graph has a logarithmic scale on the y-axis and a linear scale on the x-axis, labeled "TIME (days)". The y-axis ranges from 0 to 10, and the x-axis ranges from 0 to 30 days. Two curves are shown, one labeled "SR = 1.15" and the other labeled "SR = 2.0". The curves show a decrease in NH₃ release rate with time.
ACCEPtANCE TESTING OF SOLIDIFIED WASTE

RAPID FIELD TESTS → SAMPLES → 24 HOUR TESTS → SAMPLES → INTERIM FINAL TESTS

CONDITIONAL ACCEPTANCE OF PROCESSING

CONDITIONAL ACCEPTANCE OF LANDFILLED MATERIAL

CONFIRMED ACCEPTANCE OF LANDFILLED MATERIAL
## PERFORMANCE TESTING OF FRESH SOLIDIFIED WASTE

<table>
<thead>
<tr>
<th>Process</th>
<th>Cure Time (HR)</th>
<th>NP (MM)</th>
<th>PP (psi)</th>
<th>CP (psi)</th>
<th>UCS (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEAK</td>
<td>¼</td>
<td>&gt;50</td>
<td>&lt;60</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>&gt;50</td>
<td>&lt;60</td>
<td>20</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>&lt;0.1</td>
<td>502</td>
<td>246</td>
<td>7.0</td>
</tr>
<tr>
<td>MEDIUM</td>
<td>¼</td>
<td>&gt;50</td>
<td>&lt;60</td>
<td>23</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>37</td>
<td>107</td>
<td>67</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>&lt;0.1</td>
<td>653</td>
<td>310</td>
<td>9.4</td>
</tr>
<tr>
<td>STRONG</td>
<td>¼</td>
<td>32</td>
<td>-</td>
<td>213</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>8.5</td>
<td>450</td>
<td>256</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>&lt;0.1</td>
<td>&gt;700</td>
<td>503</td>
<td>21</td>
</tr>
</tbody>
</table>

NP: NEEDLE PENETROMETER  
PP: POCKET PENETROMETER  
CP: Cone Penetrometer  
UCS: UNCONFINED COMPRESSIVE STRENGTH

PROCESS:  
SOIL 0.8  
FLYASH 0.8  
LIME X (0.5 - 0.7)  
SEQ REG 1.1  
BF LIQ 1.0

---

Notes:
- Weak: 0.5 - 0.7  
- Strong: > 0.7

- UCS: Unconfined Compressive Strength
1. AMMONIA FLUX EXPERIMENTS

2. VERIFICATION OF ADDITIVE DOSAGE RATES

3. EVALUATION OF TEST PROCEDURES

4. DATA REDUCTION

5. REPORT PREPARATION

SCHEDULE AND STATUS

| MAY | JUN | JUL | AUG | SEP |

- ▼
- △

COMPLETE