

JUN 18 1991

MEMORANDUM FOR: Paul Lohaus, Branch Chief  
Low-Level Waste Management Branch  
Division of Low-Level Waste Management  
and Decommissioning

FROM: Michael Tokar, Section Leader  
Technical and Special Issues Section  
Division of Low-Level Waste Management  
and Decommissioning

SUBJECT: TOPICAL REPORT TRACKING SYSTEM

Enclosed is the June, 1991 issue of the monthly Topical Report (TR) tracking system. The report is composed of three sections:

1. A single page summary listing all active and non-active TR's and their dispositions.
2. A disposition/status summary showing submittal and completion dates, past and current reviewers, and the last steps and next steps to be performed per review procedures.
3. Summary sheets for each TR including a brief correspondence history, conditions for approval (if applicable), major issues which arose from the TR review, and reason for withdrawal, non-approval, or discontinuance, as appropriate.

The report will be updated monthly, and will include new or revised summary sheets only when changes occur. Jennifer Woodey will be responsible for maintaining the tracking system and issuing the updated reports.

(Original Signed by \_\_\_\_\_)

Michael Tokar, Section Leader  
Technical and Special Issues Section  
Division of Low-Level Waste Management  
and Decommissioning

Enclosures: As stated

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PDR WASTE PDR  
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Distribution: Central File # NMS r/f JWoodey MAdams  
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 PDR Y/S X CDefino JKane MTokar  
 PDR NO    Category: Proprietary or CF Only  
 ACNW YES X NO    *MT 6/18/91*

SUBJECT ABSTRACT: TOPICAL REPORT TRACKING SYSTEM

OFC :LLWM *sw* :LLWM *MT*

NAME: JWoodey/sw :MTokar

DATE: 6/18/91 :6/18/91

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TOPICAL REPORT REVIEW STATUS SUMMARY  
SOLIDIFIED WASTE FORMS AND HIGH INTEGRITY CONTAINERS (HIC's)

Office of Nuclear Material Safety and Safeguards

June 1, 1991

VENDOR	DOCKET NO	TOPICAL REPORT	DISPOSITION
Nuclear Packaging	WM-45	HIC (Ferralium/FL-50)	APPROVED
Chichibu	WM-81 Rev 2.1	HIC (Concrete/Poly)	APPROVED
DOW Chemical	WM-82	Solidification (Polymer)	APPROVED
Nuclear Packaging	WM-85	HIC (Ferralium/Enviralloy)	APPROVED
General Electric	WM-88	Solidification (Polymer)	APPROVED
WasteChem	WM-90	Solidification (Bitumen)	APPROVED
LN Technologies	WM-93	HIC (Stainless/Poly)	APPROVED
LN Technologies	WM-93 Rev 1	HIC (Stainless/Poly)	APPROVED
Chem-Nuclear	WM-18	HIC (HDPE)	NOT APPROVED
Pacific Nuclear	WM-51	Solid (Envirostone)	NOT APPROVED
TFC Nuclear	WM-76	HIC (HDPE)	NOT APPROVED
Westinghouse	WM-80	HIC (HDPE)	NOT APPROVED
VIKEM	WM-13	Solid (Oil/Cement)	DISCONTINUED
U.S. Ecology	WM-91	Solidification (Bitumen)	DISCONTINUED
Stock	WM-92	Solidification (Cement)	DISCONTINUED
U.S. Ecology	WM-100	Solid (NS1 Bitumen)	DISCONTINUED
Chem-Nuclear	WM-19	Solidification (Cement)	WITHDRAWN
Chem-Nuclear	WM-47	HIC (Fiberglass/Poly)	WITHDRAWN
LN Technologies	WM-57	HIC (HDPE)	WITHDRAWN
Nuclear Packaging	WM-71	Solid/Encap (Cement/Gypsum)	WITHDRAWN
Westinghouse	WM-79	Solidification (SG-95)	WITHDRAWN
Nuclear Packaging	WM-87	HIC (Stainless/SDS)	WITHDRAWN
Chem-Nuclear	WM-96	Solidification (Cement)	WITHDRAWN
SEG (LN Tech)	WM-20	Solidification (Cement)	UNDER REVIEW
SEG (W'house)	WM-46	Solidification (Cement)	UNDER REVIEW
Bondico	WM-94	HIC (Fiberglass/Poly)	UNDER REVIEW
Avancer (B&W)	WM-95	HIC (Coated Carbon Steel)	UNDER REVIEW
Chem-Nuclear	WM-97	Solidification (Cement #2)	UNDER REVIEW
Chem-Nuclear	WM-98	Solidification (Cement #3)	UNDER REVIEW
SEG (LN Tech)	WM-99	Solid (Cement/Decon)	UNDER REVIEW
Chem-Nuclear	WM-101	Solidification (Cement #1)	UNDER REVIEW
U.S. Ecology	WM-102	Solidification (Bitumen)	UNDER REVIEW
Pacific Nuclear	WM-103	H C (Enviroglass)	UNDER REVIEW
JGC Corp.	WM-104	Solidification (Cement)	UNDER REVIEW
Diversified Tech.	WM-105	Solidification (VERI)	UNDER REVIEW

TOPICAL REPORT REVIEW STATUS/DISPOSITION LISTING  
SOLIDIFIED WASTE FORMS AND HIGH INTEGRITY CONTAINERS (HICs)  
JUNE 1991

VENDOR	TOPICAL REPORT	DOCKET NUMBER	STATUS/DISPOSITION	REVIEWER Past/Future	SUBMITTAL COMPLETION
1. VIKEM	Solidification (Oil/Cement)	WM-13	DISCONTINUED	T. Johnson ** (M. Adams)	12/13/82 09/30/86
2. Chem-Nuclear	HIC (HDPE)	WM-18	NOT APPROVED	K. McDaniel (J. Woodey)	12/23/83 12/27/88
3. Chem-Nuclear	Solidification (Cement)	WM-19	WITHDRAWN	L. Person	11/30/83 05/27/88
4. Scientific Ecology Group (LN Tech)	Solidification (Cement)	WM-20	LAST: Meeting between SEG and NRC regarding schedule and remaining issues. (08/17/89) NEXT: SEG to submit revised TR. Originally due: 12/90 Now expected: Mid-June '91	K. McDaniel M. Adams J. Woodey	08/85
5. Nuclear Packaging	HIC (Ferralium/FL-50)	WM-45	APPROVED	M. Tokar	02/13/84 11/07/85
6. Scientific Ecology Group (Westinghouse)	Solidification (Cement)	WM-46	LAST: Vendor submitted responses to RAI #2. (03/01/91 and 03/11/91) NEXT: NRC sends RAI #3 to SEG, due 06/21/91.	J. Kane J. Woodey	04/13/89
7. Chem-Nuclear	HIC (Fiberglass/Poly)	WM-47	WITHDRAWN	D. Tiktinsky (J. Woodey)	04/30/84 05/02/86
8. Pacific Nuclear Systems	Solidification (Envirostone)	WM-51	NOT APPROVED	J. Kane	05/29/84 03/03/88
9. LN Technologies	HIC (HDPE)	WM-57	WITHDRAWN	T. Jungling (J. Woodey)	06/21/84 05/13/85
10. Nuclear Packaging	Solid/Encap (Cement/Gypsum)	WM-71	WITHDRAWN	T. Johnson (J. Woodey)	10/22/84 11/21/85
11. TFC Nuclear	HIC (HDPE)	WM-76	NOT APPROVED	K. McDaniel (J. Woodey)	06/26/84 12/27/88
12. Westinghouse	Solidification (SG-95)	WM-79	WITHDRAWN	E. Wick	06/26/84 06/10/88

\* For more information on any of these Topical Report Reviews, see attached summary sheets.

\*\* Names in parentheses indicate custodian of TR archives if different from reviewer.

VENDOR	TOPICAL REPORT	DOCKET NUMBER	STATUS/DISPOSITION	REVIEWER Past/Future	SUBMITTAL COMPLETION
13. Westinghouse	HIC (HDPE)	WM-80	NOT APPROVED	D. Widmayer ** (J. Woodey)	06/28/84 12/27/88
14. Chichibu	HIC (Concrete/Poly)	WM-81 REV 2.1	APPROVED	K. McDaniel	06/29/84 06/25/86
15. DOW Chemical	Solidification (Polymer)	WM-82	APPROVED	E. Wick	06/29/84 06/01/88
16. Nuclear Packaging	HIC (Ferralium/ Enviralloy family)	WM-85	APPROVED	K. McDaniel (E. Wick)	06/29/84 04/20/88
17. Nuclear Packaging	HIC (Stainless/SDS)	WM-87	WITHDRAWN	E. Wick	08/84 10/25/88
18. General Electric	Solidification (Polymer/AZTECH)	WM-88	APPROVED	E. Wick	02/13/85 09/29/87
19. WasteChem	Solidification (Bitumen)	WM-90	APPROVED	K. Chang (M. Adams)	05/30/86 01/22/88
20. U.S. Ecology	Solidification (Bitumen)	WM-91	DISCONTINUED	M. Tokar	01/03/86 03/04/88
21. Stock	Solidification (Cement)	WM-92	DISCONTINUED	J. Kane	12/05/86 06/24/88
22. LN Technologies	HIC (Stainless/Poly)	WM-93	APPROVED	E. Wick	09/11/87 11/25/88
23. LN Technologies	HIC (Stainless/Poly)	WM-93 REV 1	APPROVED	E. Wick	03/23/89 04/89
24. Bondico	HIC (Fiberglass/Poly)	WM-94	LAST: Telecon from Bondico to NRC indicating that they intend to withdraw the TR. (06/11/91) NEXT: Formal withdrawal of TR from Bondico.	E. Wick	02/25/88
25. Avancer Technologies (Babcock & Wilcox)	HIC (Coated Carbon Steel)	WM-95	LAST: Vendor submitted responses to RAI #1 marked "Confidential". (04/15/91) NEXT: Vendor submits responses to RAI #1 marked "Proprietary".	R. Shewmaker J. Woodey	04/21/88
26. Chem-Nuclear	Solidification (Cement)	WM-96	WITHDRAWN	L. Person (J. Woodey)	03/01/88 05/27/88

\* For more information on any of these Topical Report Reviews, see attached summary sheets.

\*\* Names in parentheses indicate custodian of TR archives if different from reviewer.

VENDOR	TOPICAL REPORT	DOCKET NUMBER	STATUS	REVIEWER Past/Future	SUBMITTAL COMPLETION
27. Chem-Nuclear	Solidification (Cement #2)	WM-97	LAST: NRC sent comments on draft TER to BNL on 06/04/91. NEXT: BNL revises draft TER in accordance with comments. Due 06/14/91.	M. Adams	06/03/88
28. Chem-Nuclear	Solidification (Cement #3)	WM-98	LAST: Vendor responded informally to RAI #4 on 04/15/91. NEXT: BNL revises draft TER in accordance with NRC comments on TER for WM-97. Due 06/14/91.	M. Adams	06/10/88
29. Scientific Ecology Group (LN Tech)	Solidification (Cement/Decon)	WM-99	LAST: Vendor submitted REV 1 to NRC on 04/19/89. NEXT: SEG to submit revised TR. Originally due: 09/01/89 Now expected: Mid-July '91	M. Adams J. Woodey	07/22/88
30. U.S. Ecology	Solidification (NSI Bitumen)	WM-100	DISCONTINUED	B. Jagganath ** (M. Adams)	07/15/88 09/13/90
31. Chem-Nuclear	Solidification (Cement #1)	WM-101	LAST: Vendor responded informally to RAI #4 on 04/15/91. NEXT: NRC revises draft TER in accordance with vendor responses. Due 06/21/91.	M. Adams	06/01/88
32. U.S. Ecology	Solidification (LLW Bitumen)	WM-102	LAST: Meeting (05/08/91) between NRC and USE resulted in decision to interim approve one waste form. NEXT: TER due to the Sited States on 06/28/91.	R. Shewmaker	07/13/89
33. Pacific Nuclear	HIC (Enviroglass)	WM-103	LAST: NRC sent RAI #1 to vendor on 06/29/90. NEXT: Vendor submits responses to RAI #1. Due: 06/15/91	R. Shewmaker	06/30/89
34. JGC Corp.	Solidification (Cement)	WM-104	LAST: TR submitted on 04/16/90. NEXT: NRC to send RAI #1 to vendor. Due: 06/28/91.	R. Shewmaker	04/16/90
35. Diversified Technologies	Solidification (VERI)	WM-105	LAST: NRC sent RAI #1 to vendor on 02/08/91. NEXT: DTI will submit a revised TR and test results on 09/01/91.	E. Wick	08/26/90

\* For more information on any of these Topical Report Reviews, see attached summary sheets.

\*\* Names in parentheses indicate custodian of TR archives if different from reviewer.



Continuation Sheet for WM-13

5. Not all waste loadings, or even a comprehensive range, have been tested for qualification.
6. The PCP does not include any verification testing requirements, or specifics regarding mixer operation.



Continuation Sheet for WM-18

3. General design problems:

A complete analysis was performed on only one of the 16 designs submitted.

The non-linear behavior of polyethylene was not considered in the analysis.

The buckling analysis was flawed.

Credit was given for waste within HIC to support against buckling, however the vendor did not characterize the mechanical properties of the waste, did not specify that the HIC's must be filled with the exact waste characterized, did not test HIC's with specific waste, etc.

The structural analysis did not properly consider the vertical and lateral loads from the soil surrounding the buried HIC. Soil arching, which could lead to increased lateral loads on buried HIC's, was not addressed at all.

Although the material was tested for creep, no mention was made of how to relate creep data to actual field conditions.

4. General material (HDPE) problems:

Polyethylene is susceptible to a ductile to brittle transition over time which leads to crack growth. (Silling report)

Polyethylene is susceptible to creep and creep leading to buckling. (Silling)

Irradiation of polyethylene tends to cause embrittlement. (Silling)

Long term creep properties are not well known.

SUMMARY SHEET

DOCKET NO: WM-19  
VENDOR: Chem-Nuclear  
TYPE: Solidification (Cement)  
DISPOSITION: Withdrawn  
PROJECT MANAGER: T. Jungling, then L. Person

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DATE TOPICAL REPORT SUBMITTED: 11/30/83, 2/12/85 (Rev 1)

REQUEST FOR ADDITIONAL  
INFORMATION (RAI) #1

DUE:  
ACTUAL: 9/5/84

VENDOR RESPONSE TO RAI #1

DUE:  
ACTUAL: 2/12/85 (with revised TR),  
2/19/85

Letter from CNSI withdrew this TR and WM-96 from consideration on 5/27/88, with the intent that they reorganize the two TR's into three, based on solidification media. (See WM-97, 98, and 101).

TECHNICAL EVALUATION REPORT

DUE: N/A  
ACTUAL:

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CONDITIONS FOR APPROVAL: N/A  
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SUMMARY OF MAJOR ISSUES:

1. Waste characterization is inadequate, especially with regard to the composition of the demineralization slurry and resin A waste streams, and with regard to the meaning/composition of the waste forms PWR-73, BWR-65, BWR-73, PWR-96 etc.
2. The in-situ encapsulation method is not defined, and it is unclear what wastes are intended to be solidified.
3. Qualification testing is incomplete; there is no irradiation data for the diatomaceous earth or powdex waste streams, and there are no indications of what formulations were subjected to leach testing. In addition, leach testing was only performed for 5 days, and only one radionuclide was used (Cs-137).
4. The TR is unclear regarding which cement(s) are used (Portland I, II, or III), and what the secret additives (P-14, M-5, N-24 etc.) consist of.
5. The revised TR (2/12/85) includes new formulations.
6. Most of the immersion samples showed various degrees of surface degradation.

SUMMARY SHEET

DOCKET NO: WM-20  
VENDOR: Scientific Ecology Group (Formerly LN Technologies,  
after London Nuclear Svcs, Inc., after NUS Process  
Services Corp.)  
TYPE: Solidification (Cement)  
DISPOSITION: Under Review  
PROJECT MANAGER: Mary Adams

LAST: Meeting between SEG and NRC regarding schedule and  
remaining issues. (8/17/89)  
NEXT: Awaiting receipt of revised TR. Most recent telecon  
(5/28/91) informed NRC to expect the document in mid-  
June.

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DATE TOPICAL REPORT SUBMITTED: 8/85

REQUEST FOR ADDITIONAL DUE:  
INFORMATION (RAI) #1 ACTUAL: 8/86

VENDOR RESPONSE TO RAI #1 DUE:  
ACTUAL: 11/15/88, 3/23/89, 7/11/89

NRC held meeting with vendor on 8/17/89 to discuss remaining  
issues and schedule.

TECHNICAL EVALUATION REPORT DUE:  
ACTUAL:

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CONDITIONS FOR APPROVAL:  
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SUMMARY OF MAJOR ISSUES:

1. A complete set of test data (biodegradation, irradiation,  
thermal cycling, etc.) was not provided for all waste stream  
formulations proposed to be qualified.
2. Waste characterization is inadequate.
3. The limiting parameters (wt %, pH, density, etc.) for the  
waste streams to be solidified are not well defined, or  
possibly fully qualified.
4. PCP's are incomplete (mixing times, testing procedures etc.)  
and confusing.
5. Calculations and rationale for encapsulation design fail to  
demonstrate mechanical stability in the initial TR, however,  
a subsequent design analysis report has been submitted.

Continuation Sheet for WM-20

6. Mixing scale-up is not well demonstrated.
7. Only 3 of 13 waste forms appear to pass the revised Branch Technical Position on Waste Form.



SUMMARY SHEET

DOCKET NO: WM-46  
VENDOR: Scientific Ecology Group (nee Westinghouse Radiological Services, formerly Westinghouse Hittman Nuclear)  
TYPE: Solidification (Cement)  
DISPOSITION: Under Review  
PROJECT MANAGER: J. Kane, J. Woodey

LAST: Vendor submitted responses to RAI #2. (3/1/91 and 3/11/91).  
NEXT: NRC to send RAI #3 to SEG. Due 6/14/91.

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DATE TOPICAL REPORT SUBMITTED: 4/13/89 (Rev 4)

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1

DUE:  
ACTUAL: 9/28/89

VENDOR RESPONSE TO RAI #1

DUE:  
ACTUAL: 12/5/89

REQUEST FOR ADDITIONAL INFORMATION (RAI) #2

DUE:  
ACTUAL: 8/1/90

VENDOR RESPONSE TO RAI #2

DUE:  
ACTUAL: 3/1/91, 3/11/91

REQUEST FOR ADDITIONAL INFORMATION (RAI) #3

DUE: 5/24/91, 6/21/91  
ACTUAL:

VENDOR RESPONSE TO RAI #3

DUE:  
ACTUAL:

TECHNICAL EVALUATION REPORT

DUE: 7/19/91  
ACTUAL:

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CONDITIONS FOR APPROVAL:

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SUMMARY OF MAJOR ISSUES:

1. Weak correlation between qualification test samples described in the TR and the PCP verification samples.
2. Inadequate demonstration of correlation between the recipes used in qualification and waste parameters typically measured in the field.

Continuation Sheet for WM-46

3. Several of the waste forms fail various criteria in the revised Branch Technical Position on Waste Form:
  - High PE Mixed Bed Bead Resin - biodegradation, fungal, irradiation, asymptotic immersion
  - Low PE Powdered Resin - immersion
  - High PE Powdered Resin - initial, immersion, irradiation, leaching
  - 8% Boric Acid - all
  - 20% Boric Acid - initial, immersion, thermal, irradiation
  - Low PE Mixed Bed Bead Resin - thermal
  - 10% Sodium Sulfate - immersion
  - Oil - all
  - Grit - all
  - 20% Sodium Sulfate with 30% Mixed Solids - immersion
  - Blank - initial, thermal, irradiation, immersion
  
4. Full scale testing was limited to four compositions (of 17 submitted), and homogeneity was not substantiated by the full scale sample.

SUMMARY SHEET

DOCKET NO: WM-47  
VENDOR: Chem-Nuclear  
TYPE: HIC (Fiberglass/Poly)  
DISPOSITION: Withdrawn  
PROJECT MANAGER: D. Tiktinsky

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DATE TOPICAL REPORT SUBMITTED: 4/30/84

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1      DUE: 8/5/84  
ACTUAL: 4/19/85 (Draft), 10/18/85

VENDOR RESPONSE TO RAI #1      DUE: 12/18/85  
ACTUAL:

Comments from SC (5/31/85) and WA (10/17/85) were received.  
NRC sent a letter to CNSI on 3/3/86 requesting their responses.  
CNSI withdrew their TR from consideration on 5/2/86.

TECHNICAL EVALUATION REPORT      DUE: 1/4/85  
ACTUAL: N/A

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CONDITIONS FOR APPROVAL: N/A  
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SUMMARY OF MAJOR ISSUES:

1. The TR was very poorly organized. It lacked detailed information on the design of the container, the sealing and lifting devices, and the cap.
2. The possibility of material delamination, which seems especially important with respect to thermal cycling, vibration, and irradiation, was not considered.
3. Corrosion resistance and structural integrity analysis was based only on the individual components which comprised the laminate, and not on the entire HIC.
4. The TR lacked specific test results including biodegradation, thermal cycling, and drop-testing.

SUMMARY SHEET

DOCKET NO: WM-51  
VENDOR: Pacific Nuclear Systems, (nee U.S. Gypsum)  
TYPE: Solidification (Envirostone)  
DISPOSITION: Approved  
PROJECT MANA J. Kane

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DATE TOPICAL REPORT SUBMITTED: 5/29/84, 6/2/86 (REV 1)

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1 DUE:  
ACTUAL: 3/85

VENDOR RESPONSE TO RAI #1 DUE:  
ACTUAL: 11/8/85 (draft), 6/2/86

REQUEST FOR ADDITIONAL INFORMATION (RAI) #2 DUE:  
ACTUAL: 10/27/86

VENDOR RESPONSE TO RAI #2 DUE:  
ACTUAL: 7/17/87, 9/24/87, 10/8/87

TECHNICAL EVALUATION REPORT DUE:  
ACTUAL: 3/3/88

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CONDITIONS FOR APPROVAL:

1. Conditional one year approval for one of eight waste streams submitted. (Mixed Bed Ion Exchange Resin, 60% PE)
  2. The waste forms produced are limited to those made from the waste streams specifically identified in the topical report as those used to prepare the test specimens on which the data were obtained.
  3. The waste forms will be contained in 55 gallon drums.
  4. The process control program outlined in the topical report must be followed.
  5. A design for encapsulation of waste was not presented in the topical report and therefore no specific types of encapsulation can be approved.
  6. Conditional one year approval was given based on the uncertainties regarding softening of the waste form as discussed in section 2.3.11 of the TER.
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Continuation Sheet for WM-51

SUMMARY OF MAJOR ISSUES:

1. Several waste forms failed various criteria:

Mixed Bed Ion Exchange Bead Resin with 24% Boric Acid -  
thermal cycling  
Lubricating Oil - Biodegradation

Leach index < 6:

24% Boric Acid Solution (78% PE)  
Powdered Ion Exchange Resin (82% PE)  
Powdered Ion Exchange Resin with 24% Boric Acid (83% PE)  
EDTA Decontamination Fluid (50% PE)

2. The neat aqueous mix of cement for encapsulation of solid objects is satisfactory, however, no design for encapsulation was presented in the TR, and therefore no specific types of encapsulation can be approved.
3. Following the 90 days of immersion, the forms were no longer completely rigid, and there was a soft outer shell which could easily be removed. In addition, a small number of resin beads were lost from those samples which contained them. NRC is concerned that this softening could lead to a waste form that does not maintain its structural stability although softening is not specifically mentioned in the criteria.



SUMMARY SHEET

DOCKET NO: WM-71  
VENDOR: Nuclear Packaging (formerly Pacific Nuclear, Inc.)  
TYPE: Solidification/Encapsulation (Cement/Gypsum)  
DISPOSITION: Withdrawn  
PROJECT MANAGER: K. Chang, T. Johnson

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DATE TOPICAL REPORT SUBMITTED: 10/22/84

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1	DUE: 4/4/85 ACTUAL: 10/10/85
VENDOR RESPONSE TO RAI #1	DUE: 12/13/85 ACTUAL:

Vendor withdrew the TR from consideration on 11/21/85.

Received comments from SC on 12/30/85.

TECHNICAL EVALUATION REPORT	DUE: 9/18/85 ACTUAL: N/A
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CONDITIONS FOR APPROVAL: N/A  
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SUMMARY OF MAJOR ISSUES:

1. The TR is not clear whether the proposed method is for the encapsulation of filter elements only, or if it also includes encapsulation of other solid wastes and sludge and concentrate solidification. In addition, it was not apparent which waste forms were prepared using envirostone gypsum, and which were made with Portland cement.
2. Preparation of simulated wastes and test samples was not clearly described.
3. The TR does not show that the proposed solidification method meets the 300 year mechanical stability criteria.

SUMMARY SHEET

DOCKET NO: WM-76  
VENDOR: TFC Nuclear  
TYPE: HIC (HDPE)  
DISPOSITION: Not Approved  
PROJECT MANAGER: K. McDaniel

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DATE TOPICAL REPORT SUBMITTED: 6/26/84

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1      DUE:  
ACTUAL: 12/27/84

VENDOR RESPONSE TO RAI #1      DUE:  
ACTUAL: 6/26/85, 10/2/85

Brookhaven National Laboratory (BNL) submitted a study on the structural analysis of HDPE HIC designs to NRC in April 1987. The analysis indicated that HDPE HIC's were not likely to be as stable as TFC Nuclear indicated. (See below).

NRC sent a letter to TFC Nuclear on 10/15/87 regarding BNL's submittal.

TFC Nuclear responded to the NRC letter on 2/22/88.

Dr. Silling of Brown University submitted his findings on the structural stability of HDPE HIC's to the NRC on June 10, 1988. His findings were in agreement with the BNL study. (See below).

NRC sent a letter to TFC Nuclear regarding Dr. Silling's report on 6/14/88.

TECHNICAL EVALUATION REPORT      DUE:  
ACTUAL: 12/88

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CONDITIONS FOR APPROVAL: N/A

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SUMMARY OF MAJOR ISSUES: (See also WM-18, and WM-80)

1. HDPE HIC's are susceptible to excessive membrane stresses, buckling, and tertiary creep. (BNL study)
2. The TR did not limit the deformation of HIC's under expected loads. Gross shape changes could lead to redistribution of stresses in the HIC shell rendering the analysis and assumptions used to analyse the HIC's structural capability invalid.

Continuation Sheet for WM-76

3. General design problems:

A complete analysis was performed on only one of the two designs submitted.

The non-linear behavior of polyethylene was not considered in the analysis.

The buckling analysis was flawed.

The structural analysis did not properly consider the vertical and lateral loads from the soil surrounding the buried HIC. Soil arching, which could lead to increased lateral loads on buried HIC's, was not addressed at all.

Although the material was tested for creep, no mention was made of how to relate creep data to actual field conditions.

4. General material (HDPE) problems:

Polyethylene is susceptible to a ductile to brittle transition over time which leads to crack growth. (Silling report)

Polyethylene is susceptible to creep and creep leading to buckling. (Silling)

Irradiation of polyethylene tends to cause embrittlement. (Silling)

Long term creep properties are not well known.

SUMMARY SHEET

DOCKET NO: WM-79  
VENDOR: Westinghouse Radiological Services (nee Westinghouse  
Hittman Nuclear, Inc.)  
TYPE: Solidification (SG-95)  
DISPOSITION: Withdrawn  
PROJECT MANAGER: L. Person, E. Wick

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DATE TOPICAL REPORT SUBMITTED: 6/26/84

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1      DUE:  
ACTUAL: 5/86

VENDOR RESPONSE TO RAI #1      DUE:  
ACTUAL:

The vendor withdrew the subject TR on 6/10/88.

TECHNICAL EVALUATION REPORT      DUE:  
ACTUAL: N/A

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CONDITIONS FOR APPROVAL: N/A

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SUMMARY OF MAJOR ISSUES:

1. The proposed solidification agent (for solidification of boric acid wastes) is a silica gel which may not be stable over the long term.
2. The initial information indicated low compressive strengths and uncertainty as to the final stability of the product waste form.
3. In general, NRC was not satisfied with the history of absorbents in shallow land burial and was concerned that SG-95 appeared to be an absorbent.



Continuation Sheet for WM-80

3. General design problems:

A complete analysis was performed on only one of the three designs submitted.

The non-linear behavior of polyethylene was not considered in the analysis.

The buckling analysis was flawed.

Credit was given for waste within HIC to support against buckling, however the vendor did not characterize the mechanical properties of the waste, did not specify that the HIC's must be filled with the exact waste characterized, did not test HIC's with specific waste, etc.

The structural analysis did not properly consider the vertical and lateral loads from the soil surrounding the buried HIC. Soil arching, which could lead to increased lateral loads on buried HIC's, was not addressed at all.

Although the material was tested for creep, no mention was made of how to relate creep data to actual field conditions.

4. General material (HDPE) problems:

Polyethylene is susceptible to a ductile to brittle transition over time which leads to crack growth. (Silling report)

Polyethylene is susceptible to creep and creep leading to buckling. (Silling)

Irradiation of polyethylene tends to cause embrittlement. (Silling)

Long term creep properties are not well known.



Continuation Sheet for WM-81

SUMMARY OF MAJOR ISSUES:

1. There was initial concern regarding chemical resistance to both internal and external attack.
2. A passive vent system was incorporated for relief of pressure generated by gases.
3. The HIC's showed some cracking resulting from drop tests, but the integrity of the container was not compromised.
4. Some gas evolution from the HIC materials is only a concern now as related to flow rate of vent, however, if non-vented HIC's are used in the future, this will require further evaluation.
5. There was initial concern regarding the prevention of water retention on the lid of the container.
6. A means to perform inspection on the container contents without damaging the integrity of the container was not initially provided.

SUMMARY SHEET

DOCKET NO: WM-82  
VENDOR: DOW Chemical  
TYPE: Solidification (Polymer)  
DISPOSITION: Approved 6/1/88  
PROJECT MANAGER: E. Wick

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DATE TOPICAL REPORT SUBMITTED: 6/29/84, 11/26/86 (Rev 1)

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1      DUE:  
ACTUAL: 3/5/85 (Attachment 1, NRC Comments)

VENDOR RESPONSE TO RAI #1      DUE:  
ACTUAL: 1/10/86 (Amendment 1, Response to Attachment 1)

REQUEST FOR ADDITIONAL INFORMATION (RAI) #2      DUE:  
ACTUAL: 6/17/86 (Comments on Amendment 1)

VENDOR RESPONSE TO RAI #2      DUE:  
ACTUAL: 10/10/86 (Formal response to NRC Comments)

TECHNICAL EVALUATION REPORT      DUE:  
ACTUAL: 4/88

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CONDITIONS FOR APPROVAL:

1. The Dow waste solidification process shall be used in accordance with all restrictions and requirements specified by the burial site operators and governing state agencies.
2. Dow must notify users of the Dow waste solidification process that they shall certify that all restrictions and required procedures have been adhered to and that the waste forms do not contain proscribed chemicals or waste materials.
3. The waste forms shall be prepared in containers not larger than 50 cubic feet. For approval of larger waste forms, Dow should submit additional information on mixing parameters as discussed in Appendix A of the TER. This additional information could be submitted as a future revision to the TR.

Continuation Sheet for WM-82

4. The available evidence indicates that small amounts of unreacted materials may be present in the Dow waste forms that may be able to migrate out of the waste forms. This raises a question of whether hazardous wastes are involved; if this were the case, it would have to be referred to the Environmental Protection Agency, which has jurisdiction in this matter.
5. The Dow calculations confirm that the thermal cycling test specimens were not exposed to the recommended range of test temperatures. There is no way of predicting the effect of exposing the test specimens to the full range of temperatures recommended. The thermal cycling tests, therefore, should be repeated in accordance with Dow's letter of March 19, 1988 and NRC's reply of April 20, 1989. Dow should confirm that the test results meet the recommendations of the 1983 Technical Position on Waste Form. This confirmation must be submitted to NRC within 60 days after receipt of this letter (6/1/88) and approved by NRC prior to submittal of a final revised TR. The final revised TR must be submitted within 90 days after receipt of this letter.
6. Waste forms solidified from filter aid sludge are not approved. Approval of these waste forms is contingent on the submittal of additional information on cracking as discussed in Section 6.1.5 of the TER.
7. NRC's acceptance letter for the process TR (Ref. 5 of the TER) stipulated that the process control for BWR evaporator bottoms and PWR evaporator bottoms is based on tests performed with 7-12 percent solids. These solid concentrations are substantially lower than those of the corresponding waste forms. The process TR therefore should be amended and resubmitted to the Office of Nuclear Reactor Regulation (NRR) for review.
8. Dow must characterize the chemical nature of the ash used in the qualification tests so that users of the process can know what kind of ash can be solidified satisfactorily. This information must be clearly specified in the final revised TR and PCP.
9. Users must be made aware that relatively small amounts of particular materials such as copper and iron could interfere with satisfactory operation of the process. This must be made clear in the final revised TR, and in the Process Control Plan (PCP), and in any sales literature used by Dow. Upper limits on the amount of copper and iron should be specified in the PCP.

Continuation Sheet (#2) for WM-82

10. Maximum waste loadings should be those specified below, subject to a maximum process variability of 10%.

Waste Type Simulated	Principal Components	Permissible Volumetric Loadings	
		Waste/Binder	Waste, Vol %
BWR Concentrate	22.1 wt% sodium sulfate 25.5 wt% total solids	1.5/1.0	60.0
PWR Concentrate	9.0 wt % boric acid 1.5 wt % sodium borate 12 wt % total solids	1.65/1.0	62.3
IE Bead Resin Slurry	7.2 wt% Dowex MR-7	2.0/1.0	66.7
Powdered IE Resin Slurry	15.0 wt% each of Epicor anion and cation resins	1.5/1.0	60.0
Decontamination Waste	Dow formulation, NS-1 (contains chelating agents)	1.5/1.0	60.0
Volume Reduced Dry Salts	Sodium sulfate + 5% Ash	2.0/1.0	66.7

11. The waste forms produced are limited to those made from the reactants specifically identified in the TR as those used to prepare the test specimens on which the data were obtained.
12. The maximum total radionuclide loading in the waste forms shall be such that the cumulative dosage to the waste form shall not exceed 100 Mrd.
13. The waste forms shall be prepared in containers not larger than 50 cubic feet. Full-scale waste forms larger than 50 cubic feet cannot be approved at this time because correlation testing is incomplete.

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SUMMARY OF MAJOR ISSUES:

1. See above.
2. Biodegradation testing showed possible evidence of biological growth on filter sludge waste forms subjected to fungal attack.

SUMMARY SHEET

DOCKET NO: WM-85  
VENDOR: Nuclear Packaging  
TYPE: HIC (Ferralium/Enviralloy family)  
DISPOSITION: Approved 4/20/88  
PROJECT MANAGER: K. McDaniel

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DATE TOPICAL REPORT SUBMITTED: 6/29/84, 3/87 (Rev 1)

REQUEST FOR ADDITIONAL  
INFORMATION (RAI) #1

DUE:  
ACTUAL: 12/31/84

VENDOR RESPONSE TO RAI #1

DUE:  
ACTUAL: (Appear to be included in  
Rev 1 to the TR)

REQUEST FOR ADDITIONAL  
INFORMATION (RAI) #2

DUE:  
ACTUAL: 7/22/85

VENDOR RESPONSE TO RAI #2

DUE:  
ACTUAL: Included in Rev 1 to the  
TR

REQUEST FOR ADDITIONAL  
INFORMATION (RAI) #3

DUE:  
ACTUAL: 12/31/87

VENDOR RESPONSE TO RAI #3

DUE:  
ACTUAL: 2/4/88

TECHNICAL EVALUATION REPORT

DUE:  
ACTUAL: 4/88

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CONDITIONS FOR APPROVAL:

1. The Enviralloy family HIC's shall be used in accordance with the Operating Procedure restrictions outlined in the "NuPac Enviralloy HIC, TR-07-P Topical Report"; Section 5.12, "Waste Classification for Enviralloy HIC's" and Appendix H, "Operating Procedure for Enviralloy High Integrity Containers". Also, all additional restrictions and requirements specified by the burial site operators and governing state agencies must be adhered to.
2. Users of the Enviralloy HIC's shall certify that all restrictions and required procedures have been adhered to and that the HIC's do not contain proscribed chemicals or waste materials.

Continuation Sheet for WM-85

3. NuPac will provide appropriate material specimens for a surveillance program where corrosion samples are to be buried in an archival trench at each LLW burial site and retrieved and inspected at periodic intervals.

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SUMMARY OF MAJOR ISSUES:

1. The main issue was corrosion resistance of the HIC with respect to long-term underground exposure, and with respect to the specific waste streams expected to be contained. This included specific analyses of the corrosion performance of welds, crevice corrosion, and galvanic corrosion.



SUMMARY SHEET

DOCKET NO: WM-88  
VENDOR: General Electric  
TYPE: Solidification (Polymer/Aztech)  
DISPOSITION: Approved 9/29/87  
PROJECT MANAGER: C. Peterson, E. Wick

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DATE TOPICAL REPORT SUBMITTED: 2/13/85, Amended 6/85

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1	DUE: ACTUAL: 8/6/85
VENDOR RESPONSE TO RAI #1	DUE: ACTUAL: 1/28/87
REQUEST FOR ADDITIONAL INFORMATION (RAI) #2	DUE: ACTUAL: 12/16/86
VENDOR RESPONSE TO RAI #2	DUE: ACTUAL: 1/28/87
TECHNICAL EVALUATION REPORT	DUE: ACTUAL: 9/29/87

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CONDITIONS FOR APPROVAL:

1. The waste loadings are limited to those listed below:

<u>Waste</u>	<u>Maximum Permissible Loading Weight %</u>
Bead resins	40
Bead resins + 4% Sodium sulfate	30
Sodium sulfate	50
Powdered resins	40
Oxidized powdered resins	60
Boric acid	50
Decon solution	40

2. The waste forms produced are limited to those made from the reactants specifically identified in the LTR-2 as those used to prepare the test specimens on which the data were obtained.
  3. The maximum total radionuclide loading in the waste forms shall be such that the cumulative dosage to the waste form shall not exceed 100 Mrd.
  4. The waste forms shall be those made by a continuous fill into 55-gallon steel drums.
-

Continuation Sheet for WM-88

SUMMARY OF MAJOR ISSUES:

1. See above.
2. Specimens containing 60 weight% sodium sulfate failed fungal testing.
3. Specimens containing a combination of bead resin and 4% sodium sulfate failed immersion testing at 40 weight% concentration.

SUMMARY SHEET

DOCKET NO: WM-90  
VENDOR: WasteChem  
TYPE: Solidification (Bitumen)  
DISPOSITION: Approved 1/22/88  
PROJECT MANAGER: K. Chang

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DATE TOPICAL REPORT SUBMITTED: 5/30/86, 12/16/87 (REV 2)

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1      DUE:  
ACTUAL: 11/5/86

VENDOR RESPONSE TO RAI #1      DUE:  
ACTUAL: 9/25/87

TECHNICAL EVALUATION REPORT      DUE:  
ACTUAL: 1/22/88

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CONDITIONS FOR APPROVAL:

1. The waste forms produced are limited to those wastes prepared from the reactants from which the test specimens were prepared and tested and specifically identified in the Topical Report.
2. The maximum waste loadings are as follows:

Feed	Maximum Elevated Ratio of Waste-to-Asphalt in the End Product (by Weight)
1. Bead Resin (BWR/PWR)	50/50
2. Precoat Filter Cake with Powdered Resin (BWR)	25/75
3. Precoat Filter Cake with Diatomaceous Earth (BWR)	55/45
4. Evaporator Concentrates - Neutralization Waste (BWR)	60/40 - Class A waste only 25/75 - All waste classes
5. Evaporator Concentrates - Floor Drain Waste (BWR)	45/55
6. Evaporator Concentrates (PWR)	50/50
7. Decontamination Waste (BWR/PWR) *	30/70
8. Mixed Resin and Filter Cake Waste (BWR)	45/55

\* The Rad Clean-8 decontamination agent is the only approved one for use with the Waste Chem VRS system.

3. Bitumen can exhibit creep flow under an applied load, thereby increasing the potential for trench instability if not sufficiently confined. The NRC recommends an administrative backfill procedure to ensure adequate confinement and to prevent creepflow. However, if the bitumen waste form is housed in high integrity containers (HIC's) which by themselves can sustain the applied load in the disposal trench, the additional administrative backfill procedure will not be necessary.
4. The waste form shall be contained in 55 gallon steel drums (if not contained in approved HIC's).
5. The waste forms should be prepared using the procedures specified in the Process Control Program (PCP). With the above limitations, asphalt-encapsulated waste forms produced by WasteChem's VRS system should be capable of meeting the waste form requirements of 10 CFR Part 61. Because waste streams produced at various nuclear power facilities vary, the licensee employing the VRS system must demonstrate that it is capable of following waste elements PCP (above equivalent) and provide NRC with test results of solidified wastes which are representative of wastes produced by the system used.

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Continuation Sheet for WM-90

SUMMARY OF MAJOR ISSUES:

1. Waste form characterization.
2. Initial biodegradation tests show that bituminized waste forms are susceptible to fungal and bacterial growth. Further testing using the Bartha-Pramer biodegradation rate test show that these forms are acceptable for use.
3. See conditions for approval.

SUMMARY SHEET

DOCKET NO: WM-91  
VENDOR: U.S. Ecology (formerly Associated Technologies, Inc.  
(ATI))  
TYPE: Solidification (Bitumen)  
DISPOSITION: Discontinued  
PROJECT MANAGER: T. Jungling, M. Tokar

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DATE TOPICAL REPORT SUBMITTED: 1/3/86

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1      DUE:  
ACTUAL: 5/86 (informal)

VENDOR RESPONSE TO RAI #1      DUE:  
ACTUAL:

Vendor submitted a test plan on 3/2/87.

REQUEST FOR ADDITIONAL INFORMATION (RAI) #2      DUE:  
ACTUAL: 6/30/87 (Comments on the  
test plan)

VENDOR RESPONSE TO RAI #2      DUE:  
ACTUAL:

NRC sent the vendor a letter on 11/16/87 suggesting that they switch from distilled bitumen formulations to oxidized bitumen.

On 3/4/88, NRC discontinued the TR review.

On 3/21/88, the vendor proposed a new standardized test procedure for the compressive testing of bitumen solidified LLW.

TECHNICAL EVALUATION REPORT      DUE: 2nd QTR '88  
ACTUAL: N/A

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CONDITIONS FOR APPROVAL: N/A  
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SUMMARY OF MAJOR ISSUES:

1. Distilled bitumen does not meet the 60 psi compressive strength requirement for stabilized class B and C wastes.
2. Bitumenized LLW has a visco-elastic nature.

SUMMARY SHEET

DOCKET NO: WM-92  
VENDOR: Stock Equipment Company  
TYPE: Solidification (Cement)  
DISPOSITION: Discontinued 6/24/88  
PROJECT MANAGER: J. Kane

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DATE TOPICAL REPORT SUBMITTED: 12/5/86

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1      DUE:  
ACTUAL: 12/21/87, 3/1/88

VENDOR RESPONSE TO RAI #1      DUE: 5/30/87  
ACTUAL: 5/31/88 (incomplete)

This review was discontinued due to a lack of supporting data, by letter from NRC to Stock on 6/24/88. This letter also included the BNL comments that were submitted to NRC on 4/12/88. Note that NRC's letter of 12/21/87 read in part: "if we [NRC] do not receive the requested information by May 30, 1988, we will assume that Stock has no further interest in NRC approval of their topical report or waste solidification media, and we will discontinue our review".

TECHNICAL EVALUATION REPORT      DUE:  
ACTUAL: N/A

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CONDITIONS FOR APPROVAL: N/A  
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SUMMARY OF MAJOR ISSUES:

1. Of the seven solidified waste forms that Stock was seeking to qualify, the testing required by the May 1983 Branch Technical Position on Waste Form was fully completed for only three of the proposed formulations.
2. There was an absence of baseline compressive strength test results before subjecting the specimens to the various treatments (radiation, thermal cycling, immersion, etc.).
3. The specimen preparations and results in the leach testing appeared inadequate at best.
4. There were dramatic losses in the compressive strengths following biodegradation and immersion testing of the solidified cation bead resins and the mixed bed powdered resins, and cracking in the powdered resins following thermal cycling.



Continuation Sheet for WM-93

8. LN will provide appropriate materials, including a HIC, for a surveillance program if such a program is initiated. The material would be buried in an archival trench at a burial site, to be retrieved and inspected at periodic intervals.

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SUMMARY OF MAJOR ISSUES:

See conditions for approval.

SUMMARY SHEET

DOCKET NO: WM-93, REV 1  
VENDOR: LN Technologies  
TYPE: HIC (Stainless/Poly)  
DISPOSITION: Approved 4/89  
PROJECT MANAGER: E. Wick

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DATE TOPICAL REPORT SUBMITTED: 3/23/89 (REV 1)

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1      DUE:  
ACTUAL: 3/20/89

VENDOR RESPONSE TO RAI #1      DUE:  
ACTUAL: 3/20/89

TECHNICAL EVALUATION REPORT      DUE:  
ACTUAL: 4/89

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CONDITIONS FOR APPROVAL:

1. See information for WM-93 (Original).
2. LN Technologies shall require in its applicable purchasing documents proof that solidification shrinkage of the polyethylene liner during the rotomolding process does not exceed 2%.

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SUMMARY OF MAJOR ISSUES:

See conditions for approval.

SUMMARY SHEET

DOCKET NO: WM-94  
VENDOR: Bondico Nuclear  
TYPE: HIC (Fiberglass/Poly)  
DISPOSITION: Under Review  
PROJECT MANAGER: E. Wick

LAST: Telecon from Bondico to NRC indicating that they intend to withdraw the TR from consideration. (6/11/91)  
NEXT: Formal withdrawal of TR from Bondico.

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DATE TOPICAL REPORT SUBMITTED: 2/25/88

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1                    DUE:  
ACTUAL: 2/10/89

VENDOR RESPONSE TO RAI #1                    DUE: 10/31/89  
ACTUAL: 3/29/89 (NRC comments on 7/28/89), 8/28/89 (NRC comments on 10/4/89), 10/29/89

REQUEST FOR ADDITIONAL INFORMATION (RAI) #2                    DUE:  
ACTUAL: 2/10/90

VENDOR RESPONSE TO RAI #2                    DUE:  
ACTUAL:

Telecon from NRC to Bondico asking if they intend to withdraw their TR. (3/27/91)

TECHNICAL EVALUATION REPORT                    DUE:  
ACTUAL:

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CONDITIONS FOR APPROVAL:  
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SUMMARY OF MAJOR ISSUES:

1. It is possible that the fiberglass reinforced plastic (FRP) shell could lose its structural integrity as a result of environmental degradation and/or buckling.
  - Little information is available regarding FRP's resistance to environmental degradation.
  - Buckling is a likely mode of failure with the structural material in compression, especially when creep is taken into consideration.

Continuation Sheet for WM-94

2. Potential failure modes

- Actinetic degradation (sunlight)
- Ionizing radiation damage leading to embrittlement
- Thermal oxidative degradation
- Biodegradation
- Water absorption related degradation (embrittlement, swelling leading to cracking)
- Polymer/Glass debonding

3. Tension, compression and creep tests were not conducted under conditions that simulate a burial environment (i.e. moisture).
4. External hydrostatic pressure testing was not conducted at the pressure, temperature, and time durations sufficient to provide reasonable assurance of an adequate factor of safety over the projected burial conditions.
5. Hydrostatic pressure testing performed may not be relevant to actual loading conditions, for example, uneven loading on lids could lead to an initial deformation into a two lobe sidewall shape as a result of uneven soil compaction. Adjacent container contact, and HIC position in burial array were also not considered.
6. There are indications of an inadequate Quality Assurance program as relates to materials control.
7. The TR does not provide the chemical composition of the FRP.
8. The TR does not demonstrate that the FRP material can meet the long term structural stability requirements of 10 CFR Part 61. It does not demonstrate that the degradation mechanisms listed above will not occur, or that their potentially adverse effects will be insignificant, or adequately compensated for in some way.





SUMMARY SHEET

DOCKET NO: WM-97  
VENDOR: Chem-Nuclear  
TYPE: Solidification (Cement #2)  
DISPOSITION: Under review  
PROJECT MANAGER: M. Adams

LAST: NRC sent comments on the draft TER to BNL on 6/4/91.  
NEXT: BNL revises draft TER in accordance with comments. Due  
6/14/91.

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DATE TOPICAL REPORT SUBMITTED: 6/3/88, 2/9/89 (Rev 1)

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1	DUE: ACTUAL: 4/20/90
VENDOR RESPONSE TO RAI #1	DUE: 5/20/90 ACTUAL: 12/21/90
REQUEST FOR ADDITIONAL INFORMATION (RAI) #2	DUE: ACTUAL: N/A
VENDOR RESPONSE TO RAI #2	DUE: ACTUAL: N/A
REQUEST FOR ADDITIONAL INFORMATION (RAI) #3	DUE: ACTUAL: 11/20/89
VENDOR RESPONSE TO RAI #3	DUE: ACTUAL: 1/10/90
REQUEST FOR ADDITIONAL INFORMATION (RAI) #4	DUE: ACTUAL: 4/2/91
VENDOR RESPONSE TO RAI #4	DUE: ACTUAL: 4/15/91 (Informal)
TECHNICAL EVALUATION REPORT	DUE: 7/15/91 (Due to States 6/28/91) ACTUAL:

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CONDITIONS FOR APPROVAL:  
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SUMMARY OF MAJOR ISSUES: (See also WM-98 and WM-101)

1. Additional testing is required to meet the revised Branch Technical Position on Waste Form, primarily in the areas of sample cure time and quantity, and leachate selection.

Continuation Sheet for WM-97

2. Not all of the qualification formulations adequately simulate actual waste forms.
3. Anticipated actual waste streams are not fully characterized.
4. The PCP's are inadequate with respect to instructions for waste stream characterization, ranges and tolerances, and number and testing of verification specimens.
5. The waste formulations for full scale testing do not appear to be the same as those used for laboratory scale specimens.
6. The compressive strengths of the boric acid waste formulations are below 500 psi.
7. The selection of cure conditions for the full-scale forms is inadequate.
8. The mixing scale-up is inadequate.

SUMMARY SHEET

DOCKET NO: WM-98  
VENDOR: Chem-Nuclear  
TYPE: Solidification (Cement #3)  
DISTRIBUTION: Under review  
PROJECT MANAGER: M. Adams

LAST: Vendor responded informally to RAI #4 on 4/15/91.  
NEXT: BNL revises draft TER in accordance with NRC comments on  
TER for WM-97. Due 6/14/91.

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DATE TOPICAL REPORT SUBMITTED: 6/10/88

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1	DUE: ACTUAL: 12/15/88
VENDOR RESPONSE TO RAI #1	DUE: ACTUAL: 1/27/89
REQUEST FOR ADDITIONAL INFORMATION (RAI) #2	DUE: ACTUAL: 11/30/89
VENDOR RESPONSE TO RAI #2	DUE: 1/5/90 ACTUAL: 1/10/90
REQUEST FOR ADDITIONAL INFORMATION (RAI) #3	DUE: ACTUAL: 11/20/89
VENDOR RESPONSE TO RAI #3	DUE: ACTUAL: 1/10/90
REQUEST FOR ADDITIONAL INFORMATION (RAI) #4	DUE: ACTUAL: 4/2/91
VENDOR RESPONSE TO RAI #4	DUE: ACTUAL: 4/15/91 (Informal)
TECHNICAL EVALUATION REPORT	DUE: 7/15/91 (Due to States 6/28/91) ACTUAL:

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CONDITIONS FOR APPROVAL:  
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SUMMARY OF MAJOR ISSUES: (See also WM-97 and WM-101)

1. Additional testing is required to meet the revised Branch Technical Position on Waste Form, primarily in the areas of sample cure time and quantity, and leachate selection.

Continuation Sheet for WM-98

2. During the TR review, the "In-Situ" formulation use switched from encapsulation of various solid wastes to solidification media for miscellaneous aqueous wastes with no explanation from the vendor. In addition, no designs for encapsulation were ever provided.
3. Not all of the qualification formulations adequately simulate actual waste forms.
4. Anticipated actual waste streams are not fully characterized.
5. The PCP's are inadequate with respect to instructions for waste stream characterization, ranges and tolerances, and number and testing of verification specimens.
6. The waste formulations for full scale testing do not appear to be the same as those used for laboratory scale specimens.
7. The compressive strengths of the boric acid waste formulation are below 500 psi.
8. The selection of cure conditions for the full-scale forms is inadequate.
9. The mixing scale-up is inadequate.

SUMMARY SHEET

DOCKET NO: WM-99  
VENDOR: Scientific Ecology Group (formerly LN Technologies)  
TYPE: Solidification (Cement/Decon)  
DISPOSITION: Under Review  
PROJECT MANAGER: M. Adams

LAST: The vendor submitted revision 1 to the TR.  
NEXT: Awaiting receipt of revised TR. Most recent telecon  
(5/28/91) informed NRC to expect the document in mid-  
July. (Revision of TR for WM-20 has priority.)

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DATE TOPICAL REPORT SUBMITTED: 7/22/88, 4/19/88 (REV 1)

REQUEST FOR ADDITIONAL DUE:  
INFORMATION (RAI) #1 ACTUAL:

VENDOR RESPONSE TO RAI #1 DUE:  
ACTUAL:

BNL submitted review comments to NRC on 1/6/89.  
NIST submitted review comments to NRC on 12/15/88.

TECHNICAL EVALUATION REPORT DUE:  
ACTUAL:

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CONDITIONS FOR APPROVAL:  
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SUMMARY OF MAJOR ISSUES:

1. Neither of the two waste streams appear to pass the revised Branch Technical Position on Waste Form.
2. The vendor does not appear to have performed testing (thermal cycling, biodegradation, immersion, etc.) on duplicate specimens of any formulation as required.
3. Leach testing was performed using non-radioactive tracers, and there is no indication that this testing is analogous to testing using radio-isotopes.
4. Full scale correlation and acceptability is not definitively shown.

Continuation Sheet for WM-99

5. Cracking was reported for a number of waste forms, not all of which were identified specifically. The specimens which exhibited cracking were not all subsequently tested for their stability.
6. Control (as-cured) specimens were not provided for all formulations.

SUMMARY SHEET

DOCKET NO: WM-100  
VENDOR: U.S. Ecology  
TYPE: Solidification (NS1 Bitumen)  
DISPOSITION: Discontinued (Under B. Jagannath)  
PROJECT MANAGER: Working files with R. Shewmaker

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DATE TOPICAL REPORT SUBMITTED: 7/15/88

Consultant's comments were sent to vendor on 1/31/89.  
Vendor reply was received on 3/13/89.

REQUEST FOR ADDITIONAL  
INFORMATION (RAI) #1

DUE:  
ACTUAL: 9/18/89

VENDOR RESPONSE TO RAI #1

DUE: mid-Dec '89, 1/15/90,  
1/31/90, 2/15/90, 3/15/90, 5/20/90,  
8/31/90  
ACTUAL: N/A, see below

U.S. Ecology withdrew the TR per letter of 9/4/90.  
NRC letter of 9/13/90 terminates the review.

SUMMARY SHEET

DOCKET NO: WM-101  
VENDOR: Chem-Nuclear  
TYPE: Solidification (Cement #1)  
DISPOSITION: Under review  
PROJECT MANAGER: M. Adams

LAST: Vendor responded informally to RAI #4 on 4/15/91.  
NEXT: NRC revises draft TER in accordance with responses. Due  
6/21/91.

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DATE TOPICAL REPORT SUBMITTED: 6/1/88

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1	DUE: ACTUAL: 4/20/90
VENDOR RESPONSE TO RAI #1	DUE: 5/20/90 ACTUAL: 12/21/90
REQUEST FOR ADDITIONAL INFORMATION (RAI) #2	DUE: ACTUAL: N/A
VENDOR RESPONSE TO RAI #2	DUE: ACTUAL: N/A
REQUEST FOR ADDITIONAL INFORMATION (RAI) #3	DUE: ACTUAL: 11/20/89
VENDOR RESPONSE TO RAI #3	DUE: ACTUAL: 1/10/90
REQUEST FOR ADDITIONAL INFORMATION (RAI) #4	DUE: ACTUAL: 4/2/91
VENDOR RESPONSE TO RAI #4	DUE: ACTUAL: 4/15/91 (Informal)
TECHNICAL EVALUATION REPORT	DUE: 7/15/91 (Due to States 6/28/91) ACTUAL:

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CONDITIONS FOR APPROVAL:

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SUMMARY OF MAJOR ISSUES: (See also WM-97 and WM-98)

1. Additional testing is required to meet the revised Branch Technical Position on Waste Form, primarily in the areas of sample cure time and quantity, and leachate selection.

Continuation Sheet for WM-101

2. Not all of the qualification formulations adequately simulate actual waste forms.
3. Anticipated actual waste streams are not fully characterized.
4. The PCP's are inadequate with respect to instructions for waste stream characterization, ranges and tolerances, and number and testing of verification specimens.
5. The waste formulations for full scale testing do not appear to be the same as those used for laboratory scale specimens.
6. The selection of cure conditions for the full-scale forms is inadequate.
7. The mixing scale-up is inadequate.

SUMMARY SHEET

DOCKET NO: WM-102  
VENDOR: U.S. Ecology  
TYPE: Solidification (LLW Bitumen)  
DISPOSITION: Under Review  
PROJECT MANAGER: R. Shewmaker

LAST: Meeting of 5/8/91 between NRC, USE and JGC resulted in decision to interim approve boric acid waste stream with waste loading not to exceed 40% weight and a minimum pH of 9.0.

NEXT: NRC TER due 6/28/91 to the Sited States.

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DATE TOPICAL REPORT SUBMITTED: 7/13/89

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1      DUE: 2/28/90, 5/31/90  
ACTUAL: 9/18/90

VENDOR RESPONSE TO RAI #1      DUE: 3/30/90, 6/30/90  
ACTUAL: 12/14/90

NRC sent a letter to the vendor informing them of the unacceptability of the proposed three waste forms. (4/26/91)

Letter, P. Lohaus (NRC) to O. Wong (USE), May 17, 1991, confirming the agreement made in the 5/8/91 meeting.

On 5/24/91, NRC representatives visited the JGC Radwaste facility at Surry, Virginia.

REQUEST FOR ADDITIONAL INFORMATION (RAI) #2      DUE: 5/30/90, 7/14/90  
ACTUAL:

VENDOR RESPONSE TO RAI #2      DUE: 6/30/90, 8/15/90  
ACTUAL:

TECHNICAL EVALUATION REPORT      DUE: 8/31/90, 9/30/90, 6/28/91 (to States)  
ACTUAL:

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CONDITIONS FOR APPROVAL:  
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SUMMARY OF MAJOR ISSUES:

1. The original request on seven waste streams has been reduced to three.

Continuation Sheet for WM-102

2. The boric acid, and bead and powdered resin waste forms at proposed loading show large compressive strength losses after environmental tests (especially after contact with water); they show large volume expansion with water, especially the resins, and the boric acid waste form shows a large weight loss. Too high a degree of waste loading is a possible cause.
3. In the meeting between NRC, USE and JGC of 5/8/91, NRC agreed to develop guidance for bitumen solidified waste forms similar to Appendix A to the revised Technical Position on Waste Form regarding cement stabilization.



SUMMARY SHEET

DOCKET NO: WM-104  
VENDOR: JGC Corp.  
TYPE: Solidification (Cement)  
DISPOSITION: Under review  
PROJECT MANAGER: R. Shewmaker

LAST: Vendor submitted TR on 4/16/90.  
NEXT: NRC to send RAI #1 to vendor. Due 6/28/91.

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DATE TOPICAL REPORT SUBMITTED: 4/16/90

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1      DUE: 6/28/91  
ACTUAL:

VENDOR RESPONSE TO RAI #1      DUE: 6/3/91  
ACTUAL:

REQUEST FOR ADDITIONAL INFORMATION (RAI) #2      DUE: 8/30/91  
ACTUAL:

VENDOR RESPONSE TO RAI #2      DUE: 10/4/91  
ACTUAL:

REQUEST FOR ADDITIONAL INFORMATION (RAI) #3      DUE:  
ACTUAL:

VENDOR RESPONSE TO RAI #3      DUE:  
ACTUAL:

TECHNICAL EVALUATION REPORT      DUE: 12/20/91  
ACTUAL:

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CONDITIONS FOR APPROVAL:

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SUMMARY OF MAJOR ISSUES:

SUMMARY SHEET

DOCKET NO: WM-105  
VENDOR: Diversified Technologies, Inc.  
TYPE: Solidification (VERI)  
DISPOSITION: Under review  
PROJECT MANAGER: E. Wick

LAST: NRC sent RAI #1 to the vendor on 2/8/91.  
NEXT: DTI will submit a revised TR and additional test results  
on 9/1/91.

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DATE TOPICAL REPORT SUBMITTED: 8/26/90

REQUEST FOR ADDITIONAL INFORMATION (RAI) #1      DUE: 12/15/90  
ACTUAL: 2/8/91

VENDOR RESPONSE TO RAI #1      DUE: 3/10/91  
ACTUAL:

REQUEST FOR ADDITIONAL INFORMATION (RAI) #2      DUE:  
ACTUAL:

On 3/16/91 the vendor sent a letter to NRC acknowledging receipt of RAI #1 providing a proposed test regimen, and informing NRC that they intend to submit a revised TR.

NRC provided comments to the vendor on 3/21/91.

VENDOR RESPONSE TO RAI #2      DUE:  
ACTUAL:

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CONDITIONS FOR APPROVAL:  
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SUMMARY OF MAJOR ISSUES:

1. The TR is too broad. It includes processes for which no qualification test data has been submitted. The TR is based on a new process, but builds on Dow's approved TR (WM-82). To be a stand-alone TR (as required), it should discuss Dow work in summary, then describe only the solidification of dewatered resin beads into the 200 ft<sup>3</sup> monolith, and the supporting qualification test program.
2. DTI treats its PCP's as proprietary. If proprietary, this implies that the process differs from Dow's which is in the public domain. If the DTI formulation is different, it must undergo the complete test regimen as described in the Revised Branch Technical Position on Waste Forms.