

# West Valley Demonstration Project

Doc. Number WVNS-TP-063

Revision Number 0

Revision Date 03/03/94

Engineering Release #2873

## TEST PROCEDURE

### LONG-TERM COMPRESSIVE STRENGTH TESTING OF THE SLUDGE WASH LIQUID/PORTLAND TYPE V CEMENT WASTE FORM

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WV-1816, Rev. 1

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WVNS RECORD OF REVISION

DOCUMENT

If there are changes to the controlled document, the revision number increases by one. Indicate changes by one of the following:

- Placing an arrow at the beginning of the sentence or paragraph that was revised
- Placing a vertical black line in the margin adjacent to sentence or paragraph that was revised
- Placing the words GENERAL REVISION at the beginning of the text
- Placing either FC#> or PC#> at the beginning of a field/page change

Example:

The arrow in the margin indicates a change. >  
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<u>Rev. No.</u>	<u>Description of Changes</u>	<u>Revision On Page(s)</u>	<u>Dated</u>
0	Original Issue	All	05/03/94

WVNS RECORD OF REVISION CONTINUATION FORM

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Long-Term Compressive Strength Testing of the  
Sludge Wash Liquid/Portland Type V Cement Waste Form

WVNS-TP-063

Rev. 0

1.0 This work is to be performed to satisfy the NRC Branch Technical Position on Waste Form, Rev. 1, and a letter from the NRC (DW:93:0964). This procedure will include visual inspection and compressive strength testing of cement cores retrieved from product drums. Also included is a 14-day immersion test followed by a compressive strength test. These tests will be performed once every six months for a five-year period. After this time period, a report will be issued to the NRC with this information.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

CSS Product Drum - 71-gallon square drum of cement solidified waste from the decontaminated 8D-2 supernatant or sludge wash liquid.

Drum Cell - storage area for CSS 71-gallon square drums of cemented, low-level waste

Long-term Tests of Cemented Waste Form - applies to periodic confirmatory testing of WVNS cemented, low-level waste generated under actual production conditions to demonstrate long-term waste form stability.

Toxicity Characteristic Leaching Procedure (TCLP) - this program is required by the Code of Federal Regulations (40CFR261, "Identification and Listing of Hazardous Waste"). The sampling is performed to obtain verification that the cement product is, in fact, a nonhazardous waste.

2.2 Abbreviations

ANA - Analytical Aisle

CSRF - Contact Size Reduction Facility

CSS - Cement Solidification System

DC - Drum Cell

IIDS - Inspection Instructions Data Sheet

IRTS - Integrated Radwaste Treatment System

IWP - Industrial Work Permit

LWA - Lower Warm Aisle

QA - Quality Assurance

R&S - Radiation and Safety  
RWP - Radiation Work Permit  
SOP - Standard Operating Procedure  
TCLP - Toxicity Characteristic Leaching Procedure  
TRQ - Test Request (EP-11-003)  
TP - Test Procedure (EP-11-003)  
UWA - Upper Warm Aisle  
WMO - Waste Management Operations  
WRPA - Waste Reduction and Packaging Area  
WVDP - West Valley Demonstration Project

### 3.0 RESPONSIBILITIES

- 3.1 Operations Technical Support Engineering will provide engineering support in identifying drums, issuing the Test Summary Report, letters, and Test Exceptions per EP-11-003. The cognizant OTS engineer will serve as the test exception authority per EP-11-003.
- 3.2 Quality Assurance will provide compressive strength testing and visual examinations of waste form cores. Quality Assurance will also provide surveillance activities to assure the work performed agrees with work documents.
- 3.3 Waste Management Operations will provide support for drum movements, operation of core boring equipment, and storage of the core bored drum.
- 3.4 Radiation and Safety will provide support for work in the core boring and compressive strength testing tents, and release samples, cans and drums. Will also possibly provide storage space for immersion testing (i.e., UWA tent).
- 3.5 CSS Operations will dispose of immersion fluid from 5-gallon buckets to flush drums.
- 3.6 Analytical and Process Chemistry Laboratories will provide immersion bucket, and immersion fluid. May also supply storage space for immersion test if available.

4.0 TOOLS, EQUIPMENT, AND REFERENCES

4.1 Tools and Equipment

- 4.1.1 See SOP 70-44, section 4.1, for all tools and equipment required for core boring operations.
- 4.1.2 See ACM-6400 for all tools and equipment required to provide synthetic seawater solution.
- 4.1.3 Other tools and equipment

Table 4.1.3 Required Tools and Equipment

<u>Item</u>	<u>Description</u>
1	5-gallon immersion buckets
2	6-gallon immersion bucket for double containment

4.2 Components

4.2.1 List Of Drums For Use By This Test

Drum Number	Recipe Number	Date Processed	Time Processed
88073	9301870	09/01/93	13:23
88074	9301870	09/01/93	13:38
88075	9301870	09/01/93	14:06
88076	9301870	09/01/93	13:52
88089	9301870	09/01/93	08:25
88095	9301870	09/01/93	11:08
88106	9301870	09/01/93	08:10
88112	9301870	09/01/93	08:55
88114	9301870	09/01/93	14:36
88115	9301870	09/01/93	10:22
88116	9301870	09/01/93	14:21
88124	9301870	09/01/93	06:32
88125	9301870	09/01/93	08:40
88127	9301870	09/01/93	07:55
88132	9301870	09/01/93	09:39
88133	9301870	09/01/93	10:53
88134	9301870	09/01/93	09:53
88135	9301870	09/01/93	11:24
88136	9301870	09/01/93	10:07
88141	9301870	09/01/93	10:38



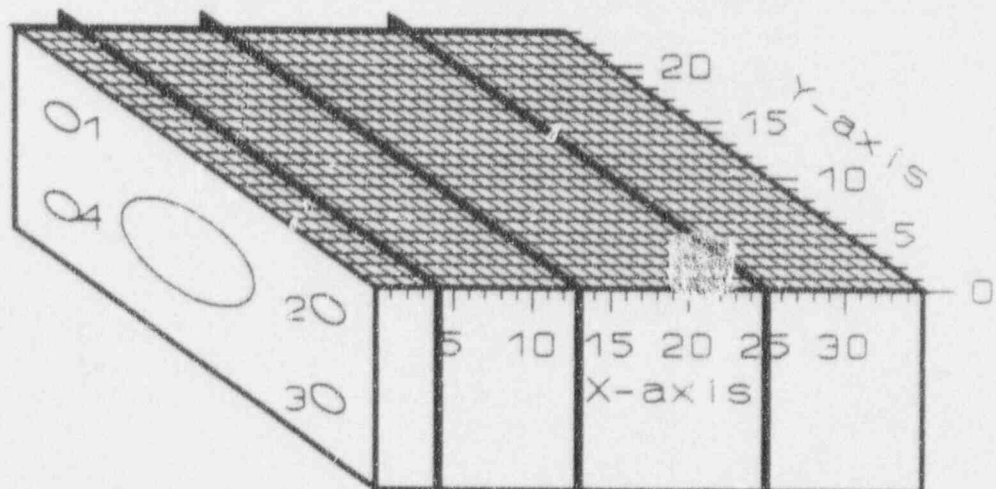
4.3 Test Apparatus

4.3.1 Approximately every six months, the following cores shall be taken from a single drum listed in section 4.2.1:

Core Location	Purpose
Top	Compressive Strength Testing
Top	Archive Sample
Middle	Compressive Strength Testing
Middle	Archive Sample
Bottom	Compressive Strength Testing
Bottom	Archive Sample
Top or Bottom	14-day Immersion

The locations described above are at the x-axis below:

Location	x-axis
Top	4" - 13"
Middle	13" - 25"
Bottom	25" - 35"



4.3.2 QA will perform visual inspection of archive cores taken in section 4.3.1 approximately every six months from the time of coring.



#### 4.4 References

USNRC Branch Technical Position on Low-level Waste Form, Rev. 1, dated January, 1991.

Letter AA:047:93-1457:93:10, DW:93:0964, "Official Nuclear Regulatory commission Letter of Support for the Production of Type V Cement Drums", Dated 07/20/93.

OSR-GP-3 - Building and Vessel Ventilation System Requirements

SOP 70-44 - Core Sampling of CSS Product Drums

SOP 73-02 - On-site Transport of CSS Cemented Waste Drums for Core Sampling

ACM-6400 - Immersion Testing, applicable sections: 5.0, 6.1, 7.1, 7.2, 10.1-10.8, 10.10, 10.12, 10.14, Attachment A.

ASTM C39 - Compressive Strength of Cylindrical Concrete Specimens

ASTM C617 - Standard Practice for Capping Cylindrical Concrete Specimens

WVNS-TR-70-023 - Waste Form Qualification Report; WVDP Stabilized Sludge Wash Cement-Waste with Type V Portland Cement

WVDP-130 - Quality Assurance Department Work Process Manual, section 2.4.1, General Inspection Reporting

#### 4.5 Safety

4.5.1 OSR-GP-3, Rev. 4

##### LIMITING CONDITIONS FOR OPERATION:

##### SITE-WIDE

"The applicable plant, process, and storage areas where there is a potential for loose radioactive surface contamination shall be ventilated through high efficiency filter (HEPA) systems of appropriate design at all times. HEPA filters used at the WVDP for radionuclide removal shall have been previously tested (prior to installation) to 99.97 percent efficiency."

4.5.2 Industrial hygiene practices shall be as described in the WVNS Hygiene and Safety Manual, WVDP-011.

4.5.3 Radiological work will be performed in accordance with the WVDP Radiological Controls Manual, WVDP-010.

4.5.4 ACP 7.5, "Laboratory Safety" must be complied with for all laboratory activity.

5.0 GENERAL INFORMATION

- 5.1 Twenty drums will be set aside for this five-year test. Ten (10) will be used by this Test Procedure. The remaining ten (10) will be set aside for possible future testing not identified at this time.
- 5.2 Three cores shall be obtained and compressive strength tested approximately once each six-months for a period of five-years. These cores will be compressive strength tested as soon as reasonably possible after extraction from the drum.
- 5.3 One core shall be obtained and subjected to a fourteen-day immersion followed by a compressive strength test approximately once every six-months for a five-year period.
- 5.4 Three cores shall be obtained and archived for visual examination approximately once each six-month period for five-years. These cores shall be visually examined approximately every six-months thereafter until the completion of the test.
- 5.5 At six and twelve months, tests described in sections 5.2 and 5.3 should meet the following requirements:
- 5.5.1 Cores should display a minimum mean compressive strength test of not more than two standard deviations below the mean of the as-cured strength values obtained with the qualification test specimens (NRC Branch Technical Position on Waste Form, Rev. 1, section VII of Appendix A). The qualification specimen information (reference WVNS-TR-70-023) is as follows:
- A. Average days cured: 104 days
  - B. Mean compressive strength = 1280 PSI
  - C. Sigma = 216 PSI
  - D. X bar minus two sigma = 848 PSI
- 5.5.2 If the cores do not pass the X-bar minus two-sigma, the NRC shall be notified in writing within 30-days of the condition per NRC Branch Technical Position on Waste Form section VII of Appendix A. Also, the disposal facility operator is to be notified if this test invalidates certification per 10 CFR 20.311.
- 5.6 WMO supervisor and A&PC manager will agree on location of immersion testing prior to each set of immersion tests.
- 5.7 Work under this Test Procedure will be Quality Level C.

6.0 PREREQUISITES AND START-UP

6.1 Prerequisites

- 6.1.1 Cognizant engineer fills out SOP 70-44, appendices B and D.
- 6.1.2 WMO supervisor conducts a pre-job brief with cognizant engineer, WMO personnel, representative from A&PC labs, and representative from QA.

6.2 Preparation of Simulated Seawater Solution

- 6.2.1 A&PC technician prepare solution as per International Standardization Organization, ISO 1691 1982(E). All chemicals should be reagent grade or equivalent. Deionized water should have an electrical conductivity of less than 5 $\mu$ mho/cm at 25°C and a total organic content (TOC) of less than 3 ppm. All measurements should be  $\pm 0.1\%$ .

<u>Compound</u>	<u>Grams</u>
NaCl	23.497
MgCl <sub>2</sub>	4.981
Na <sub>2</sub> SO <sub>4</sub>	3.917
CaCl <sub>2</sub>	1.102
KCl	0.664
NaHCO <sub>3</sub>	0.192
KBr	0.096
<hr/> SUBTOTAL	<hr/> 34.449
Deionized Water	965.551
<hr/> TOTAL	<hr/> 1000.000

- 6.2.2 A&PC technician place 14.0 $\pm$ 0.5 liters solution in a 5-gallon bucket.
- 6.2.3 A&PC technician place cover on 5-gallon bucket.

- 6.3 Calibration of Compressive Strength Test Equipment - is required once per year. QA to verify calibration is current prior to compressive strength testing. Record equipment serial number and calibration date on QA IIDS.

7.0 TEST INSTRUCTIONS

7.1 Coring and compressive strength testing

- 7.1.1 Cognizant engineer fills out SOP 70-44, appendix D, indicating all drums to be core drilled, locations of cores, and purpose of each core.
- 7.1.2 Perform core boring operations and destructively evaluate cores per SOP 70-44. Record all data on SOP 70-44 appendices.

7.2 Visual Inspection of Cores

- 7.2.1 Cognizant engineer fills out SOP 70-44, appendix B, sheet 2 of 5, indicating all archive cores to be retrieved from storage and visually inspected by Quality Assurance.
- 7.2.2 Perform visual examination operations per SOP 70-44 and WVDP-130, Quality Assurance Department Work Process Manual, section 2.4.1, General Inspection Reporting. Record visual examination per SOP 70-44.

7.3 Immersion of Cores

- 7.3.1 Cognizant engineer fills out SOP 70-44, appendix D, indicating drum to be core drilled and the location of core to be immersed. The core location will be either the top or bottom section of the drum.
- 7.3.2 A&PC prepares immersion fluids per section 6.1.
- 7.3.3 WMO perform core boring operation per SOP 70-44, including QA visual examination of core and bagging core for transportation to A&PC laboratories. Record all data per SOP 70-44.
- 7.3.4 WMO or A&PC place core in 5-gallon bucket containing simulated seawater. Immersion testing will be performed in a location that is normally between 60°F and 110°F. Record core identifier, start date and start time, and initial appendix A. Also record core identifier, start date and start time on 5-gallon bucket.
- 7.3.5 WMO or A&PC remove core from 5-gallon bucket after a minimum of fourteen days. Record end date, end time, and initial appendix A.
- 7.3.6 WMO or A&PC allow core to dry in fume hood at ambient temperature for a minimum of 48 hours. Record starting and ending dates and times on appendix A.

- 7.3.7 WMO or A&PC take 35mm high-resolution, black and white photograph of core. Give film to cognizant engineer to be processed and filed.
- 7.3.8 QA visually inspect core for cracking, spalling, or bulk disintegration. Record information on SOP 70-44, appendix B, sheet 2 of 5.
- 7.3.9 QA Destructively evaluate immersion core per SOP 70-44, section 6.5.

## 8.0 TEST COMPLETION

### 8.1 Disposal of Immersion Fluid

- 8.1.1 WMO place 5-gallon bucket in stainless steel hull cask or equivalent for double containment per R/S.
- 8.1.2 R/S survey out cask for transportation.
- 8.1.3 CSS transport 5-gallon bucket in cask to CSS process cell.
- 8.1.4 Place Herculite on floor of CSS process cell and drape up to fill nozzle of flush drum per appendix B.
- 8.1.5 CSS remove 5-gallon bucket from secondary containment.
- 8.1.6 CSS arrange pump and hosing for liquid transfer per appendix B.
- 8.1.7 Energize pump until liquid from 5-gallon bucket has been transferred to flush drum.
- 8.1.8 Use an absorbent wipe to dry off tubing as it is pulled out of the 5-gallon bucket and flush drum.
- 8.1.9 Either wipe inside of 5-gallon bucket dry or pour remaining contents into flush drum and allow to air dry.
- 8.1.10 If 5-gallon bucket has no precipitates in it, recycle it by using it in the CSS process cell for another job and/or send it back to A&PC for future immersion tests. If bucket has precipitates in it then discard it to a yellow drum. There must be no free liquids for disposal in a yellow drum.
- 8.1.11 R/S survey out bucket or cask secondary containment for future use.
- 8.1.12 CSS process immersion fluid per system 70 flush drum SOPs.



8.2 Disposition of Cored Drum and Crushed Cores

8.2.1 Store cored drum per SOP 70-44, section 6.7.

8.2.2 Dispose of crushed cores per SOP 70-44, section 6.9.5.

9.0 DATA ACQUISITION

9.1 Compressive Strength Data - will be obtained per WVDP-130, section 2.4.1, General Inspection Reporting and SOP 70-44, section 6.5.

9.2 Visual Examination of Archived Cores

9.2.1 Cognizant Engineer will plan visual examinations using SOP 70-44, Appendix B, sheet 2 of 5, section 6.8.3. The cognizant engineer will provide drum number and core identification information. Compressive Strength will be N/A. Archive will be checked Yes.

9.2.2 All QA visual examination results will be reported on SOP 70-44, Appendix B under Visual Examination Results.

9.3 Within ten (10) working days after compression testing of immersion cores, QA will issue a Surveillance Report (or similar Quality Record) stating the results of the compressive strength testing and visual examinations for incorporation into SOP 70-44 data sheets and fifteen-day summary report.

9.4 Fifteen-day Summary Report - to be provided by the cognizant engineer approximately once every six months. The report will be issued within fifteen working days after completion of step 9.3 with the following information:

9.4.1 QA Surveillance Report or equivalent type of Quality Record as an attachment (typically an IIDS).

9.4.2 SOP 70-44, attachment B and C, completed and signed.

9.4.3 A summary table of all pre and post immersion compressive strength data to date.

9.4.4 A line graph of the data in section 9.4.3 with time on the X-axis and compressive strength in PSI on the Y-axis.

9.4.5 References to Waste Management Operations and Analytical and Process Chemistry log books. References should include log book designator, page numbers, and dates.

9.4.6 Cognizant engineer and cognizant quality engineer signatures.

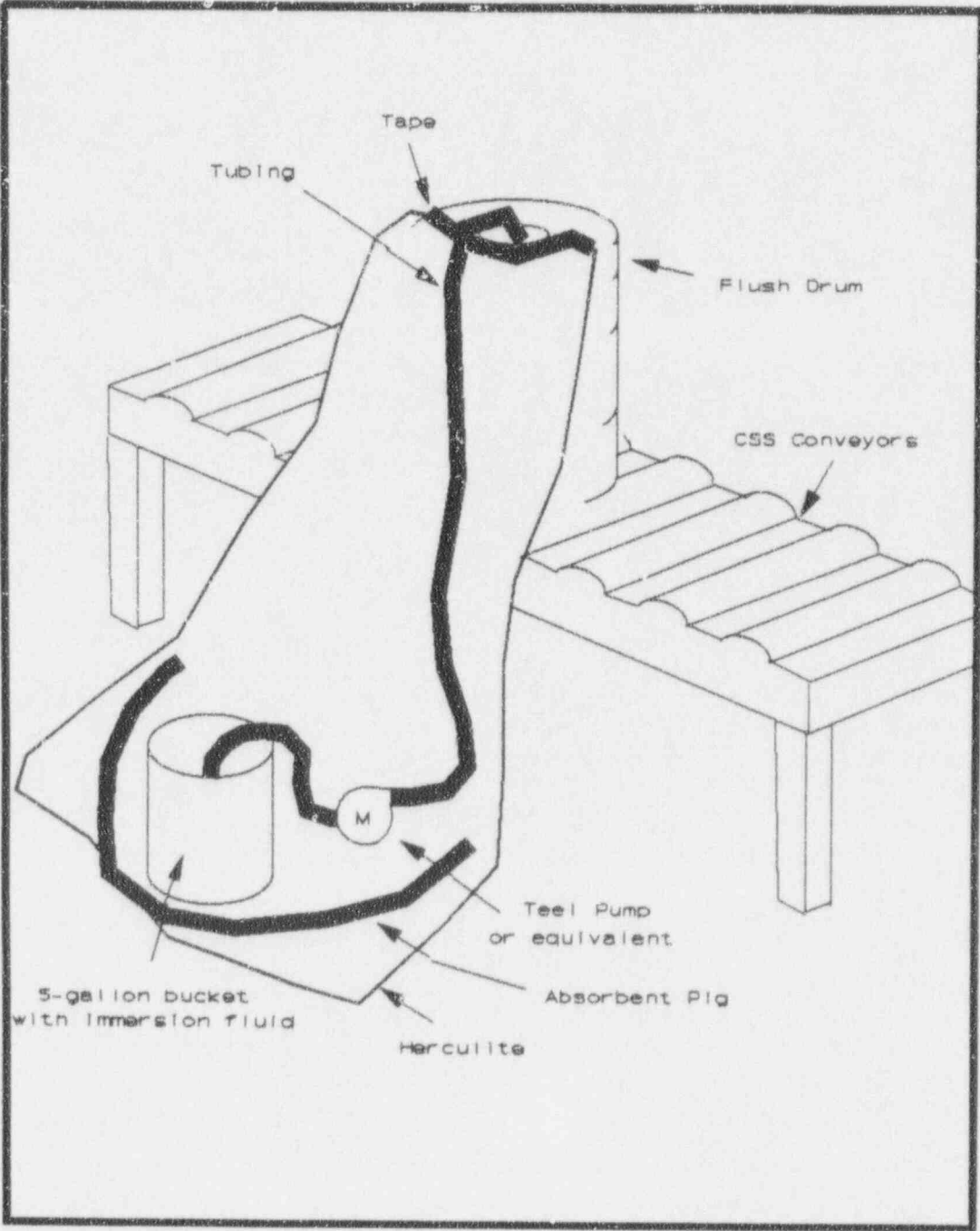
9.4.7 If this is the six-month or twelve-month test, additional data to be reported from section 5.5 will be included in the letter.





APPENDIX B

IMMERSION FLUID TRANSFER TO FLUSH DRUM



**Volume 3  
Waste Form Qualification Program  
For Solidification Of Sludge Wash Liquid With  
Type V Portland Cement**

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<u>Document No.</u>	<u>Title</u>	<u>Revision</u>	<u>Status</u>
N/A	Introduction to Volume 3	N/A	N/A
N/A	Transmittal Letters	N/A	N/A
WVNS-PCP-004	Process Control Plan For Cement Solidification Of Sludge Wash Liquid With Type V Portland Cement	1	Complete
TBD	Waste Form Qualification Report: WVDP Stabilized Sludge Wash Cement-Waste With Type V Portland Cement	A	Draft
N/A	WVNS Internal Letters	N/A	N/A
WVNS-TRQ-052	Test Request, Sludge Wash Cement-Waste Cores Windows of Composition Type V Cement	0	Complete
WVNS-TP-052	Test Procedure, Sludge Wash Type V Cement-Waste Cores: Windows Composition	1	Complete
WVNS-TRQ-057	Verification Cubes for Sludge Wash Cement-Waste With Type V Portland Cement	0	Complete
WVNS-TP-057	Verification Cubes Sludge Wash Cement-Waste With Type Portland Cement	0	Complete

**Volume 3**  
**Waste Form Qualification Program**  
**For Solidification Of Sludge Wash Liquid With**  
**Type V Portland Cement**

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WVNS-TRQ-063	Long Term Compressive Strength Testing of the Sludge Wash Liquid/Portland Type V Cement Waste Form	0	Complete
WVNS-TP-063	Long-Term Compressive Strength Testing of the Sludge Wash Liquid/Portland Type V Cement Waste Form	0	Complete