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|                  |   |                   |             | rating Proce            | ting Procedure        |                                 | 1104-281<br>sion No. |  |
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| Wast             | e Solidificatio   | on Process        | s Control F | rogram                  |                       | Decrear                         | 10<br>tole Office    |  |
| Applic           | ability/Scope   |                   |             |                         |                       | Respons                         | tore of the          |  |
|                  | 1 Division  |                   |             | <u> </u>                | 1.84                  | Plant C                         | ve Date              |  |
| This d<br>Safety | Reviews Requi   | nin QA pla<br>red | an scope .  | X Yes<br>X Yes<br>X Yes | - NO<br>NO            | Effecti                         | ve Date              |  |
| Import           | ant to Safety   |                   |             | X Yes _                 | No                    | 06                              | 5/08/88              |  |
| Enviro           | onmental Impact   | Related           | ١.          | X Yes                   | No                    |                                 |                      |  |
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## 1.0 DISCUSSION

The purpose of the Process Control Program (PCP) for incontainer solidification is to provide a program which will assure a solidified product with no free standing liquid prior to transportation for disposal and which meets the requirements of 10 CFR 61.56. Waste Characteristics.

The PCP's for each waste stream included in this procedure are based on laboratory testing, the results of which are included in "Topical Report Cement Solidified Waste to Meet the Stability Requirements of 10 CFR 61" prepared by Westinghouse - Hittman. These PCP's are valid for all liner types using electric or hydraulic mixing heads provided by Hittman.

The appropriate portions of this document shall be considered complete only when used with the operating procedures (OP 1104-28A for borated and oily wastes of OP 1104-28C for resin) for full scale solidification. This document describes the methodology for determining the acceptable ratio of waste, cement and additive that will result in an acceptable product for transportation and ultimately burial. The Solidification Data/Calculation Sheets convert these ratios into the recommended quantity of cement and additive that should be mixed with Class A unstable waste and the recommended quantity of cement and additive which must be mixed with Class A Stable and Class B or C wastes.

## 2.0 REFERENCES

- 2.1 Westinghouse Hittman F421-P-004, Process Control Program for Incontainer Solidification of 4 to 20 wt% Boric Acid
- 2.2 Westinghouse Hittman STD-P-05-002, Process Control Program for Incontainer Solidification of Oily Waste
- 2.3 Westinghouse Hittman F421-P-006, Process Control Program for Incontainer Solidification of Powdered Resins
- 2.4 Westinghouse 'ttman F421-P-005, Process Control Program for Incontainer Solidification o. Class A Unstable or Stable, Class B and C Resin at Maximum Packaging Efficiency
- 2.5 Westinghouse Hittman STD-R-05-007, Topical Report Cement Solidified Waste to Meet the Stability Requirements of 10 CFR 61
- 2.6 Westinghouse Hittman STD-R-05-011, Topical Report Mobile Incontainer Dewatering and Solidification System (MDSS)
- 2.7 NRC Letter from Charles E. Rossi, Assistant Director, Division of PWR Licensing-A to R.J. Leduc, Director of Engineering Westinghouse Hittman -"Acceptance of Referencing of Licensing Topical Report STD-R-05-011, Hittman Mobile Incontainer Dewatering and Solidification System (MDSS)", Dated Oct. 31, 1986.

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- 2.8 Tech. Spec. Section 3.22.3, Solid Radioactive Waste
- 2.9 GPUN Radiation Protection Plan

## 3.0 LIMITS AND PRECAUTIONS

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- 3.1 As required by Tech Spec 4.22.3.1.2, the PCP shall be used to verify the solidification of at least one representative test specimer from at least every tenth batch of each type of wet radioactive waste (e.g., evaporator bottoms, oily waste, resin and precoat sludge).
- 3.2 For the purpose of the PCP a batch is defined as that quantity of waste required to fill a disposable liner to the appropriate level on the waste level indicator.
- 3.3 If any test specimen fails to solidify, solidification of the batch under test shall be suspended until such time as additional test specimens can be obtained, alternative solidification parameters can be determined in accordance with the Process Control Program, and a subsequent test verifies solidification. Solidification of the batch may then be resumed using the alternate solidification parameters determined.
- 3.4 If the initial test specimen from a batch of waste fails to verify solidification then representative test specimens shall be collected from each consecutive batch of the same type of waste until the three (3) consecutive initial test specimens demonstrate solidification. The Process Control Program shall be modified as required to assure solidification of subsequent batches of waste.
- 3.5 For high activity wastes, such as spent resin or used precoat, where handling of samples could result in personnel radiation exposures which are inconsistent with the ALARA principle, representative non-radioactive samples will be tested. These samples should be as close to the actual waste physical and chemical properties as possible. Typical expended mixed bed resin shall be used to simulate the spent bead resin and the appropriate mix of anion to cation powdered resin shall be used to simulate used precoat.
- 3.6 All Chemicals used to condition or solidify waste or simulated waste in solidification tests shall be the actual chemicals used in full scale solidification.
- 3.7 A Test Sol Fication Data Sheet will be maintained for each test sample solidifie: uch Data Sheet will contain pertinent information of the test sample and the liner numbers solidified based on the test sample.

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- 3.8 Samples should be drawn at least six hours prior to the planned full scale waste solidification to allow adequate time to complete the required testing and verification of solidification for Class A unstable waste. 28 hours should be allowed, if practical, for Class A stable, Class B and C wastes.
- 3.9 The tank containing the waste to be solidified should be mixed by recirculating the tank contents for at least three volume changes prior to sampling to assure a representative sample.
- 3.10 If the contents of more than one tank are to be solidified in the same liner then representative samples of each tank should be drawn. These samples should be of such size that when mixed together they form samples of standard size. If the contents of a particular tank represents X percent of the total waste quantity to be solidified then the sample of that tank should be of such size to represent X percent of the composite samples.
- 3.11 An RWP must be obtained and used for performing test solidifications of radioactive samples.
- 4.0 TEST SOLIDIFICATION OF 4 TO 10 WT% BORIC ACID (CONCENTRATED WASTE)
  - 4.1 Prerequisites

NOTE: This PCP Test Solidification Procedure is applicable to Class A Unstable, Class A Stable, Class B and C Waste Forms.

- 4.1.1 A sufficient size sample of concentrated waste (approx. 1 liter) has been drawn and the following parameters analyzed for by Plant Chemistry:
  - Boron
  - pH
  - Total Solids
  - Gamma Scan

<u>NOTE</u>: The total solids and gamma scan are used for information purposes only to track waste characteristics and are not to be used in the Process Control Program calculations.

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| Waste          | Solidifica     | tion Process                                 | Control Program  |  | 9   |
|                |                |  |  | 34   |   |
|                | <u>NOTE</u> :  | uniess pr                                    | ntrated waste s<br>eviously neutra<br>ted waste is 7.  | 112eo. The acce  | ept heated (> 100°F)<br>ptable pH range for           |
|                | 4.1.2          | The Ops Qua<br>them of the<br>witness the    | pending lest S   | Group has been c<br>olidification to   | ontacted to inform<br>see if they care to             |
|                |                | OQA Mo                                       | nitor Contacted  | Support of the Advancement of the second sec |   |
|                |                |  |  | Name   | / Date / Time   |
|                | 4.1.3          | including w                                  | aste classifica  | f Attachment 1 h<br>tion, chemistry<br>equential sample  | ave been completed<br>information, balance<br>number. |
| 4.2            | Procedur       | e  |  |  |   |
|                |                |  |  |  |   |
|                | <u>NO7 E</u> : | obtained (                                   | nts of waste, co<br>during performan<br>to the nearest | nce of the follo   | , etc. should be<br>wing procedure.                   |
|                | 4.2.1          | Calculate th                                 | ne weight percer                                       | nt of Boric Acid   | on Attachment 1.                                      |
|                | 4.2.2          | MEASURE 500                                  | gms of untreate  | d concentrated w   | waste into a containe                                 |
|                | 4.2.3          | RECORD the .                                 | weight and volum                                       | ne on Attachment   | 1.  |
|                | 4.2.4          | ADD 50 wt% s<br>8.5 for Clas<br>tion.        | odium hydroxide<br>s A unstable, C                     | (NaOH) until th<br>Class A stable, B   | ne pH is between 8 10<br>8 and C solidifica-          |
|                | 4.2.5          | RECORD the w<br>Attachment 1                 | eight of NaOH u  | used and the adju  | sted pH on  |
|                | 4.2.6          | If large (i.<br>present, TRE<br>foam disappe | AT the sample w  | g) quantities of<br>ith an anti-foam   | detergents are<br>ling agent until the                |
|                | 4.2.7          | RECORD the w                                 | eight of anti-f  | oaming agent use   | d on Attachment 1.                                    |
|                | 4.2.8          | by volume, r<br>skimming. F                  | educe the quant<br>or unstable was                     | ity of oil to le   | sent and the volume                                   |
|                |                |  |  |  |   |

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| Waste Solidifica | tion Process                          | Control Program  | 9  |
| 1                | solidified                            | ig agent such as Maysol 776 ()<br>in concentrations > 12% by i<br>by this procedure. (Refer i<br>tion of Waste Qil). | volume may not be                              |
| : <u>3(0N</u>    | The dens<br>equal to                  | ity of Maysol 776 is 1.0 g/ml<br>the weight in grams.  | ; the volume in ml is                          |
| 4.2.9            | RECORD the<br>on Attachm              | % oil and the quantity of an ent 1.  | ny emulsifying agent used                      |
| 4.2.10           | Record the<br>on Attachm              | volume and calculate the wei<br>ent 1.   | ght of the treated Sampl                       |
| 4.2.11           | Calculate<br>(9), (10),               | the percent solids in the an<br>(11) and (12) in Section .I  | nple by completing items<br>of Attachment 1.   |
| 4.2.12           | For the te<br>into a mix              | st solidification of the conc<br>ing vessel 400 ml of pretreat   | entrated waste, measure<br>ed waste.           |
| <u>NOTE</u> :    | Test sol<br>disposab                  | idifications should be conduc<br>le beaker or similar size con   | ted using a 1.000 ml<br>tainer.                |
| 4.2.13           | RECORD the<br>Attachment              | volume AND weight of the tre   | ated sample on                                 |
| 4.2.14           | Calculate 1<br>and (17) in            | the water in the sample by co<br>n Section III of Attachment 1   | mpleting items (15), (16                       |
| 4.2.15           | tion Data S                           | re 1 and the percent solids f<br>Sheet, Item (12), DETERMINE t<br>LATE and WEIGH out the requir<br>ent.              | he water/coment ratio                          |
| 4.2.16           | RECORD the                            | weight of cement on Attachme   | nt 1.  |
| 4.2.17           | CALCULATE a<br>i.e., anhyd<br>vessel. | and WEIGH out the required qu<br>drous sodium metasilicate (AS   | antity of metso beads.<br>MS), into a separate |
| 4.2.15           | RECORD the                            | weight of ASMS on Attachment   | 1.   |
|                  |                                       |  |  |

| GPU Nuc           | lear                                       | TMI-1  | Number   |
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| Waste Solidificat | tion Proce                                 | ess Control Program  | 10   |
| 4.2 19            | Slowly A                                   | ADD the cement to the test sample w  | hile it is being mixed   |
| <u>NOTE</u>       | mixing                                     | g should be accomplished by stirring<br>motor with blade or manually with<br>a homogeneous mixture is obtained,<br>e.  | a rigid stirrer  |
| 4.2.20            |  | Il the cement is added, slowly ADD while it is being mixed.  | the ASMS to the test   |
| 4.2.21            | so that<br>CURE at                         | ufficient mixing (2 minutes after a a homogeneous mixture is obtained, $120 \pm 5^{\circ}$ F for 24 hours for Class A pom temperature for Class A unstable   | SEAL the sample and Stable, Class B or C                             |
| <u>NOTE</u> :     | the ac<br>proces                           | any time during the 24 hour cure,<br>cceptance criteria, the liner solid<br>ed. However, no test solidification<br>alified without at least 24 hours of  | ification may<br>n shall be  |
| 4.2.22            |  | the Acceptance Criteria (Section 10<br>d date Attachment 1.  | ) has been met and   |
| 4.2.23            | calcula<br>the ful<br>this was<br>ing) and | e Acceptance Criteria has been met p<br>te the required quantities of cemen<br>l scale solidification using a line<br>ste type (as determined by Radwaste<br>d the Solidification Calculation Shi<br>cid (Attachment 2). | t and additives for<br>r type applicable for<br>Operations Engineer- |
| NOTE :            |  | iner shall be solidified using OP 1<br>e Waste Solidification - Hittman.   | 104-28A, Radio   |
| 4.2.24            |  | e Section VII of Attachment 2 upon<br>loation if cement remains in the ho  |  |

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| Waste Solidif  | ication Process                           | Control Program   | 9  |
| .0 TEST SOLIDI | FICATION OF > 10                          | TO 20 WE% BORIC ACID (CONCENT   | TRATED WASTED                                  |
|                | quisites                                  |   |  |
| <u>NOT</u>     | E: This PCP<br>Class A U                  | Test Solidification Procedure<br>Instable, Class A Stable, Class                                  | is applicable to<br>s B and C Waste Forms.     |
| 5.1.1          | A sufficien<br>has been dr<br>Plant Chemi | t size sample of concentrated<br>awn and the following paramete<br>stry:                          | waste (approx. 1 liter)<br>ers analyzed for by |
|                | • Boron                                   |   |  |
|                | • рн                                      |   |  |
|                | • Total                                   | Solids  |  |
|                | • Gamma                                   | Scan  |  |
|                | purposes (                                | solids and gamma scan are use<br>only to track waste characteri<br>d in the Process Control Progr | stics and are not                              |
| NCT.           | unless pr                                 | ntrated waste sample shall be<br>viously neutralized. The acc<br>ted waste is 7.4 to 9.2.         | kept heated 130°F)<br>eptable pH ran, for      |
| 5.1.2          |   | lity Assurance Group has been<br>pending Test Solidification t<br>test.                           | contacted to inform<br>o see if they care to   |
|                | OQA Mor                                   | nitor Contacted   |  |
|                |   | Name  | / Date / Time                                  |
| 5.1.3          | including wa                              | iate portions of Attachment 3<br>aste classification, chemistry<br>data and the sequential sample | information, balance                           |

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| waste S | olidifica     | iction Process  | Control Program  | 9   |
| 5.2     | Procedur<br>: | e   |  |   |
|         | <u>NOTE</u> : | obtained  | ahts of waste, cement, addit<br>during performance of the f<br>to the nearest gram.  | ives, etc. should be<br>ollowing procedure.   |
|         | 5.2.1         | Calculate t   | the weight percent of Boric  | Acid on Attachment 3.   |
|         | 5.2.2         |   | gms of untreated concentra   |   |
|         | 5.2.3         |   | weight and volume on Attach  |   |
|         | 5.2.4         | ADD 50 wt% and 12.5.  | sodium hydroxide (NaOH) unt  | il the pH is between 12   |
|         | 5.2.5         | RECORD the 3.   | weight of NaOH used and the  | adjusted pH on Attachme   |
|         | 5.2.6         | If large (i<br>present, TR  | .e., foam causing) quantitin<br>EAT the sample with an anti  | es of detergents are<br>-foaming agent.   |
|         | 5.2.7         | RECORD the  | weight of anti-foaming agen  | t used on Attachment 3.   |
|         | 5.2.8         | skimming.<br>is between<br>emulsifying<br>oil). Oil<br>solidified t | resent in stable waste in a<br>reduce the quantity of oil is<br>For unstable waste if oil is<br>3 and 12% of the volume of a<br>agent such as Maysol 776 (2<br>in concentrations > 12% by v<br>by this procedure. (Refer t<br>ion of Waste Oil). | to less than 1% by<br>s present and the volume<br>waste, TREAT with an<br>20% of the volume of<br>volume may not be |
| -       | <u>NOTE</u> : | the densit<br>equal to t  | ty of Maysol 776 is 1.0 g/ml<br>the weight in grams.   | ; the volume in ml is   |
|         | 5.2.9         | RECORD the 1<br>on Attachmer  | oil and the quantity of an   |   |
|         | 5.2.10        | Record the v<br>on Attachmen  | volume and calculate the weint 3.  | ght of the treated sampl  |
|         | 5.2.11        | Calculate th  | ne percent solids in the sam<br>(11) and (12) in Section II  | ple by completing items   |

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| Maste Solidifica | tion Process               | Control Program  | 8   |
| 5.2.12           |                            | t solidification of the concent<br>ng vessel 400 ml of treated was   |   |
| <u>NOTE</u> :    |                            | difications should be conducted<br>e beaker or similar size conta  |   |
| 5.2.13           | RECORD the                 | volume AND weight of the sample  | e on Attachment 3.                              |
| 5.2.14           | Calculate t<br>and (17) in | he water in the sample by comp<br>Section III of Attachment 3.   | leting items (15), (16                          |
| 5.2.15           | tion Data S                | e 1 and the percent solids from<br>heet, Item (12), DETERMINE the<br>ATE and WEIGH out the required<br>nt.                       | water/cement ratio                              |
| 5.2.16           | RECORD the                 | weight of cement on Attachment   | 3.  |
| 5.2.17           | CALCULATE a<br>sodium meta | tity of anhydrous<br>e vessel.   |   |
| 5.2.18           | RECORD the                 | weight of ASMS on Attachment 3   |   |
| 5.2.19           | Slowly ADD                 | the cement to the test sample  | while it is being mixe                          |
| NOTE :           | mixing mo                  | ould be accomplished by stirri<br>tor with blade or manually wit<br>omogeneous mixture is obtained                               | h a rigid stirrer                               |
| 5.2.20           |                            | he cement is added, slowly ADD<br>e it is being mixed.   | the ASMS to the test                            |
| 5.2.21           | so that a h<br>CURE at 120 | cient mixing (2 minutes after<br>comogeneous mixture is obtained<br>5°F for 24 hours for Class<br>temperature for Class A Unstab | , SEAL the sample and<br>A Stable, Class B or C |
| NOTE :           | the accep<br>proceed.      | time during the 24 hour cure,<br>tance criteria, the liner soli<br>However, no test solidificati<br>without at least 24 hours of | dification may<br>on shall be dis-              |

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| GPL    | Nucl          | TMI-1   | Number   |
|--------|---------------|---|--|
| itle   |               | Operating Procedure   | Revision No.   |
| Waste  | Solidificat   | tion Process Control Program  | 10   |
| Haste  | Joi realized  |   |  |
|        | 5.2.22        | Verify the Acceptance Criteria (Section 10<br>sign and date Attachment 3.   | 0.0) has been met and  |
|        | 5.2.23        | When the Acceptance Criteria has been met<br>calculate the required quantities of cemer<br>the full scale solidification using a line<br>this waste type (as determined by Radwaste<br>ing) and the Solidification Calculation St<br>Boric Acid (Attachment 4). | nt and additives for<br>er type applicable for<br>e Operations Engineer- |
| Ī      | <u>NOTE</u> : | The liner shall be solidified using OP 1<br>Waste Solidification - Hittman.   | 1104-28A, Radioactive  |
|        | 5.2.24        | Complete Section VII of Attachment 4 upon solidification if cement remains in the ho  |  |
| 0 TEST | SOLIDIFIC     | TION OF WASTE OIL (12 - 40% 011)  |  |
| 6.1    | Prerequi      | iltes   |  |
| Ī      | <u>NOTE</u> : | This PCP Test Solidification Procedure i<br>Class A Unstable, Class A Stable, Class   |  |
|        | 6.1.1         | A sufficient size sample (approx. 500 ml.)<br>concentrated waste and waste oil have been<br>trated waste shall be within a pH range of  | n drawn. The concen-   |
| Ì      | <u>NOTE</u> : | The pH of the concentrated waste will be<br>tank before the test solidification.  | adjusted in the  |
|        | 6.1.2         | The Ops Quality Assurance Group has been of<br>them of the pending Test Solidification to<br>witness the test.  |  |
|        |               | OQA Monitor Contacted   |  |
|        |               | Name  | / Date / Time  |
|        | 6.1.3         | A sequential sample number has been assign<br>included on Attachment 5.   | ed to the test and   |
|        | 6.1.4         | A determination has been made as to the wa<br>pending full scale solidification by Radwa  |  |
|        |               |   |  |

| 95    | Nuc           | lear                                      | TMI-1  |   | Number                       |
|-------|---------------|---|--|---|------------------------------|
| 110   |               |   | Operating Procedu  | ire   | 1104 - 381                   |
|       |               |   |  |   | Revision No.                 |
| Waste | Solidifica    | tion Process                              | Control Program  |   | 9                            |
|       | 6.1.5         | The balance                               | e calibration data has t   | an Included                                     |                              |
|       |               |   | e carioración data nas t   | een included                                    | on Attachment 5.             |
| 6.2   | Procedur      | e   |  |   |                              |
| Ī     | <u>NOTE</u> : | obtained                                  | to the nearest gram.   | dditives, etc<br>he following                   | . should be<br>procedure.    |
| -     | ********      |   |  |   |                              |
|       | 6.2.)         | Measure int<br>140 ml oil.                | to a mixing vessel 210 m   | 1 of concentr                                   | ated waste and               |
| Ī     | <u>NQ7E</u> : | Test soli<br>disposabl                    | difications should be c<br>e beaker or similar siz   | onducted usir<br>e container.                   | ig a 1000 ml                 |
|       | 6.2.2         | Record the<br>volume on A                 | waste volumes added and<br>ttachment 5.  | calculate tr                                    | e percent oil by             |
|       | 6.2.3         | MEASURE out                               | 28.0 ml (28.0 gms) of  | Maysol 776.                                     |                              |
|       | 6.2.4         | RECORD the                                | quantity of the emulsif  | ier on Attach                                   | ment 5.                      |
|       | 6.2.5         | ADD the May mixture is                    | sol 776 to the waste an<br>obtained, at least five   | d mix until a<br>(5) minutes.                   | homogéneous                  |
|       | <u>NOTE</u> : | mixer wit<br>signs of<br>is breaki        | ould be accomplished by<br>h blade or manually wit<br>pure oil may be an indi<br>ng down. Should this o<br>nearing for further ins | h a rigid sti<br>cation that t<br>ccur. contact | rrer. Any                    |
|       | 6.2.6         | lf large (i<br>present, tr<br>foam disapp | .e., foam causing) quan<br>eat, the sample with an<br>ears.  | tities of det<br>ti-foaming ag                  | ergents are<br>ent until the |
|       | 6.2.7         | Record the                                | amount of anti-foaming   | agent used on                                   | Attachment 5.                |
|       | 6.2.8         | MEASURE out<br>anhydrous s                | 447.3 gms of Portland<br>odium metasilicate (ASM   | Type I cement<br>S).                            | and 51.8 gms of              |
|       | 6.2.9         | RECORD the                                | quantities of cement an  | d ASMS on Att                                   | achment 5.                   |

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| GRU Nuc           | lear                                   | TMI-1   | Number   |
|-------------------|--|---|--|
| Title             |  | Operating Procedure   | 1104-281   |
| iitie             |  |   | Revision No.   |
| Waste Solidifica  | tion Process                           | Control Program   | 9  |
| 6.2.10            | and mix un                             | the cement to the test sample<br>til a homogeneous mixture is ob<br>one (1) minute.   | while it is being mixed<br>tained but in no case                         |
| 6.2.11            | After all<br>sample whi                | the cement is added, slowly ADD<br>le it is being mixed.  | the ASMS to the test   |
| 6.2.12            | MIX for tw<br>geneous mi               | o (2) minutes after all the ASM<br>xture is obtained.   | IS is added and homo-  |
| 6.2.13            | Seal the s<br>Stable, Cl               | ample and cure at 120 ± 5°F for<br>ass B or C or at room temperatu  | 24 hours for Class A<br>re for Class A Unstable                          |
| <u>NOTE</u> :     | proceed.                               | ytime during the 24-Your cure t<br>e acceptance criteria, the line<br>However, no test solidificati<br>fied without at least 24 hours   | r solidification may<br>on shall be                                      |
| 6.2.14            | Verify the sign and d                  | Acceptance Criteria (Section 1)<br>ate Attachment 5.  | 0.0) has been met and  |
| 6.2.15            | calculate<br>the full so<br>this waste | cceptance Criteria has been met<br>the required quantities of ceme<br>cale solidification using a lin-<br>type (as determined by Radwast<br>he Solidification Calculation Si<br>t 6). | nt and additives for<br>er type applicable for<br>e Operations Engineer- |
| <u>NOTE</u> :     | The line<br>Waste Sol                  | r snall be solidified using OP<br>lidification - Hittman.   | 1104-28A, Radioactive  |
| C TEST SOLIDIFICA | TION OF USED                           | D PRECOAT   |  |
| 7.1 Prerequis     |  |   |  |
| <u>NOTE</u> :     | This PCP<br>Class A S                  | Test Solidification Procedure<br>Stable, Class B and C Waste Form   | is applicable to   |
| 7,1,1             | A sufficier<br>been drawn              | nt size sample of used precoat i<br>and the following parameters an   | (approx. 500 ml) has<br>nalyzed for by Plant                             |

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pH (of sluice water)

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|       | Nuc           | lear                                 | Op  | TMI-1<br>erating Pro                                     | cedure   |  | 104-281                      |
|-------|---------------|--------------------------------------|---|--|--|--|------------------------------|
|       |               |                                      |   |  |  | Revisi   | on No.                       |
| laste | Solidifica    | tion Proc                            | ess Control                                   | Program  |  |  | 9                            |
|       |               | • Gar                                | mma Scan                                      |  |  |  |                              |
|       | <u>NOTE</u> : | expens<br>expens<br>be sub<br>Operat | ded powdex w<br>bstituted.                    | when perfo<br>ith an appro<br>The ratio s<br>ering. A si | rming the<br>opriate an<br>hall be de<br>mall samp | test solidification ration/cation ration/cation ration rat | ation,<br>io shall<br>iwaste |
| Ī     | <u>NOTE</u> : | to tra                               | amma scan is<br>ack waste cha<br>alculations. | to be used<br>aracteristic                               | for infor<br>s and is                              | mation purposes<br>not to be used  | only<br>in the               |
|       | 7.1.2         | The samp                             | le has set t                                  | to verify <  | 1% 0:1 by  | volume.  |                              |
|       | 7.1.3         | them of                              | Quality Assu<br>the pending<br>the test.      | Test Solidi  | has been<br>ification                              | contacted to i<br>to see if they   | nform<br>care to             |
|       |               | OQA                                  | Monitor Cor                                   | tacted   |  |  |                              |
|       |               |                                      |   |  | Name   | / Date /   | Time                         |
|       | 7.1.4         | The appr<br>includin<br>number.      | opriate port<br>g the balanc                  | ions of Att<br>e calibrati                               | achme t 7<br>on data a                             | have been comp<br>nd the sequenti  | leted<br>al sampl            |
| 7.2   | Procedure     |                                      |   |  |  |  |                              |
|       | <u>NOTE</u> : | obtain                               | eights of wa<br>ed during pe<br>off to the n  | rformance o  | f the fol  | es, etc. should<br>lowing procedur   | be<br>e.                     |
|       |               |                                      | 2 JF 465.44                                   |  |  |  | *******                      |
|       | 7.2.1         | MEASURE<br>of water                  | out 381.1 gm<br>and place i                   | ns of dewate<br>nto separat                              | red powde<br>e contain                             | red resin and l<br>ers.  | 51.5 gms                     |
|       | *********     | Test s                               | and place 1                                   | nto separat  | e contain  | ers.<br>5 using a 1.000  |                              |

| ADT Nuc         | lear   | TMI-1<br>Operating Procedure   | Number<br>1104-281   |
|-----------------|--|--|--|
|                 |  |  | Revision No.   |
| laste Solidific | ation Proce                                  | ess Control Program  | 9  |
| 7.2.3           | water ac                                     | water to the powered resin and RECO<br>dded and the total volume of waste s<br>on Attachment 7.  | ORD the weight of<br>slurry (water plus                        |
| 7.2.4           | If any f<br>agent.                           | foam is present, TREAT the sample wi   | ith an anti-foaming  |
| 7.2.5           | RECORD t                                     | the quantity of anti-foaming agent u   | used on Attachment 7.  |
| 7.2.6           | If oil i<br>volume o<br>776 (20%<br>volume m | s present and the volume is between<br>of waste, TREAL with an emulsifying<br>of the volume of oil). Oil in con<br>may not be solidified by this proced<br>Operations Engineering for guidance | agent such as Maysol<br>acentrations > 12% by<br>fure. Contact |
| NOTE :          | The de<br>ml is                              | nsity of Maysol 776 is 1.0 gm/ml; t<br>equal to the weight in gms.   | the volume in  |
| 7.2.7           | RECORD t<br>added to                         | he quantity of oil present and the the sample on Attachment 7.   | amount of Maysol   |
| 7.2.8           | RECORD t                                     | he initial pH of the sample on Atta  | chment 7.  |
| 7.2.9           | MEASURE<br>Ca(OH)2.                          | out approximately 10 grams of calci<br>also known as hydrated lime.  | um hydroxide   |
| 7.2.10          | addition<br>three (3                         | DD the calcium hydroxide to the pow<br>grams at a time. MIX for three (3)<br>s until the pH is at least 11.5. A<br>) grams of calcium hydroxide. This<br>ot alter the pH of the slurry.        | DD an additional   |
| <u>NOTE</u> :   | mixing                                       | should be accomplished by stirring<br>motor with blade or manually with<br>a homogeneous mixture is obtained a<br>nute.  | a rigid stirrer  |
| 7.2.11          | RECORD t'<br>the final                       | ne quantity of calcium hydroxide add<br>1 pH on Attachment 7.  | ded to the slurry an   |
| 7.2.12          | MEASURE C                                    | out 444 gms of Portland Type 1 cemer   | nt.  |
| 7.2.13          | RECORD EP                                    | ne amount of cement on Attachment 7  |  |

| CIT Nuc           | lear                                  | TM!-1   | Number   |
|-------------------|---------------------------------------|---|--|
| Title             |                                       | Operating Procedure   | 1104-28I<br>Revision No.   |
| Waste Solidifica  | tion Process                          | s Control Program   | 9  |
|                   |                                       |   |  |
| 7.2.14            | Slowly ADD                            | D the cement to the test sample w   | hile it is being mixed.  |
| 7.2.15            | MIX for the a homogene                | wo (2) minutes after all the ceme<br>eous mixture.  | nt is added to obtain  |
| 7.2.16            | RECORD the                            | e final sample volume on Attachme   | nt 7.  |
| 7.2.17            | Seal and a                            | allow the sample to CURE for 24 h   | ours at 120 ± 5°F.   |
| <u>NOTE</u> :     | proceed.                              | nytime during the 24-hour cure time<br>ne acceptance criteria, the liner<br>However, no test solidification<br>ed without at least 24 hours of ci | solidification may<br>n shall be dis-                                  |
| 7.2.18            | Verify the<br>and date A              | acceptance criteria (Section 10<br>Attachment 7.  | .0) has been met, sign   |
| 7.2.19            | calculate<br>a liner ty<br>Radwaste O | the required quantities of cemen<br>pe applicable for this waste type<br>perations Engineering) and the So<br>for Used Precoat (Attachment 8)     | t and additives using<br>e (as determined by<br>olidification Calcula- |
| NOTE:             | The line<br>Resin an                  | r shall be solidified using OP 1<br>d Precoat Processing - Hittman.   | 104-280, Primary   |
| .0 TEST SOLIDIFIC | TION OF BEA                           | D RESIN   | ******************   |
| 8.1 Prerequir     |                                       |   |  |
| <u>NOTE</u> :     | This PCP<br>Class A                   | Test Solidification Procedure is<br>Stable, Class B and C Waste Forms   | s applicable to  |

- 8.1.1 A sufficient size sample of bead resin (approx. 500 ml) has been drawn and the following parameters analyzed for by Plant Chemistry:
  - pH (of sluice water)
  - Gamma Scan

| GPU (   | Nuc           | lear                             |                               | Oper                 | TMI-<br>ating F                          |                                     | re                                      |                                     | Number<br>1104-281   |
|---------|---------------|----------------------------------|-------------------------------|----------------------|--|-------------------------------------|---|-------------------------------------|--|
| le      |               |                                  |                               |                      |  |                                     |   |                                     | Revision No.   |
| ste Sol | idifica       | tion Proc                        | ess Cor                       | ntrol Pr             | ogram                                    |                                     |   |                                     | 9  |
|         |               |                                  |                               |                      |  |                                     |   |                                     |  |
| 1       | <u>NOTE</u> : | expension<br>source<br>Operation | ded nor<br>e of th<br>tions E | n-radioa<br>nis resi | then per<br>ictive r<br>n shall<br>ing A | formin<br>esin si<br>be de<br>small | g the f<br>hall be<br>termine<br>sample | test so<br>subst<br>d by R<br>of so | el radiation<br>Didification,<br>tituted. The<br>Radwasta<br>Dent resin<br>is. |
|         | <u>NOTE</u> : | to tra                           | amma sc<br>ack was<br>alculat | te char              | o be us<br>acteris                       | ed for<br>tics ar                   | inform<br>nd is n                       | nation<br>not to                    | purposes only<br>be used in the  |
| 8.      | 1.2           | The samp                         | ple has                       | set to               | verify                                   | ≤ 1% ;                              | bil by                                  | volume                              |  |
| 8.      | 1.3           | The Ops<br>them of<br>witness    | the pe                        | nding T              | ance Gr<br>est Sol                       | oup has<br>idifica                  | tion t                                  | contac<br>o see                     | ted to inform<br>if they care t  |
|         |               | 0QA                              | A Monit                       | or Cont              | acted                                    |                                     |   |                                     |  |
|         |               |                                  |                               |                      |  |                                     | Name                                    | 1                                   | Date / Time  |
| 8.      | 1.4           | The appr<br>includin<br>number.  | opriating the                 | e porti<br>balance   | ons of<br>calibr                         | Attachm<br>ation d                  | nent 9<br>lata an                       | have b<br>d sequ                    | een completed<br>ential sample   |
| 1.2 Fr  | ocedure       |                                  |                               |                      |  |                                     |   |                                     |  |
|         | NOTE :        | obtain                           | led dur                       | of wassing period    | formanci                                 | of th                               | ditive<br>e foll                        | s, etc<br>owing                     | . should be<br>procedure.  |
| 8.      | 2.1           | MEASURE                          | into a                        | mixing               | vessel                                   | 240 gm                              | of de                                   | watere                              | d resin.   |
|         | <u>NOTE</u> : | Test s<br>dispos                 | olidifi<br>able be            | ication<br>eaker or  | should<br>simila                         | be con<br>r size                    | ducted<br>conta                         | using<br>iner.                      | a 1,000 m1   |
| !       | NOTE :        | Tap *h                           | e beake                       | er gentl<br>e volume | y to co                                  | onsolid                             | at: th                                  | e resi                              | n prior to   |
|         |               | 116.0 201                        | 11.3 61.16                    | e a di unit          | A  |                                     |   |                                     |  |

| GRU Nuc         | lear                         | TMI-1<br>Operating Procedure  | Number<br>1104-281   |
|-----------------|------------------------------|---|--|
| Title           |                              |   | Revision No.   |
| Waste Solidific | ation Process                | Control Program   |  |
| 8.2.2           | RECORD the<br>Attachment     | weight and volume of the sample<br>9.   | (resin and water) on   |
| 8.2.3           | WEIGH out 2                  | .1 gms of EC-3 into a separate  | vessel.  |
| 8.2.4           | RECORD the                   | weight of EC-3 on Attachment 9.   |  |
| 8.2.5           | FEIGH out 8<br>Attachment    | 4.3 gms of water and record the<br>9.   | weight on  |
| 8.2.6           | ADD the wate<br>thoroughly.  | er to the vessel containing the   | EC-3 and mix   |
| 8.2.7           | ADD the wate                 | er/EC-3 mixture to the bead res   | in and mix thorougly.  |
| 8.2.8           | If any foam<br>agent.        | is present, TREAT the sample w  | ith an anti-foaming  |
| 8.2.9           | RECORD the c                 | quantity of anti-foaming agent i  | used on Attachment 9.  |
| 8.2.10          | 776 (20% of<br>volume may n  | resent and the volume is between<br>iste. TREAT with an emulsifying<br>the volume of oil). Oil in con<br>not be solidified by this process<br>rations Engineering for guidant | agent such as Maysol<br>ncentrations > 12% by<br>dure. Contact |
| <u>NOTE</u> :   | The densit<br>is equal t     | y of Maysol 776 is 1.0 gm/ml; 1<br>o the weight in gms.   | the volume in ml   |
| 8.2.11          | RECORD the q<br>Attachment 9 | uantity of oil and the volume o   | of emulsifier used on  |
| 8.2.12          | RECORD the i                 | nitial sample pH on Attachment  | 9.   |
| 8.2.13          | MEASURE out<br>Ca(OH)2, als  | approximately 11.5 gms of Calci<br>o known as hydrated lime.  | ium Hydroxide  |
| 8.2.14          | of the slurr                 | he Ca(OH) <sub>2</sub> to the resin sample<br>or three (3) minutes between ad<br>y is at least 11.5. ADD three<br>is final additional may or may                              | ditions until the pH<br>(3) additional gms of                  |
| 8.2.15          | RECORD the quitte final pH   | uantity of calcium hydroxide ad<br>on Attachment 9.   | ded to the slurry and  |

| GRU Nuc          | lear   | TMI-1<br>Operating Procedure   | Number<br>1104-281  |
|------------------|--|--|---|
| Tirle            | 1.1.1  |  | Revision No.  |
| Waste Solidific  | ation Proces   | s Control Program  | 9   |
| 8.2.16           | MEASURE O  | ut 178.2 gms of Portland Type I co   | emont into a separate   |
| 8.2.17           | RECORD the   | e weight of the cement on Attachm  | ent 9.  |
| 8.2.18           | Slowly AD  | D the cement to the test sample wi   | hile it is being mixed  |
| 8.2.19           |  | wo (2) minutes after all the cemer   |   |
| 8.2.20           | RECORD the   | e final sample volume on Attachmen   | nt 9.   |
| 9.2.21           | SEAL the t<br>± S°F.                                     | sample and allow the sample to CUP   | RE for 24 hours at 120  |
| <u>NOTE</u> :    | meets th<br>proceed                                      | nytime during the 24-hour cure tim<br>he acceptance criteria, the liner<br>However, no test solidification<br>ed without at least 24 hours of cu   | solidification may<br>n shall be dis-   |
| 8.2.22           |  | e acceptance criteria (Section 10.<br>Attachment 9.  | .0) has been met, sign  |
| 8.2.23           | CALCULATE<br>a liner ty<br>Radwaste C                    | Acceptance Criteria has been met p<br>the required quantities of cement<br>ype applicable for this waste type<br>Operations Engineering) and the So<br>t for Bead Resin (Attachment 10).   | t and additives using<br>a (as determined by  |
| NOTE :           |  | er shall be solidified using OP 11<br>nd Precoat Processing - Hittman.   | 04-28C, Primary   |
| O ALTERNATE TEST | SOLIDIFICAT  | ION PROGRAMS   |   |
| NOTE :           | should c<br>ments of<br>requires<br>procedur<br>liner ty | Test Solidification presented in<br>over the majority of the waste pr<br>TMI-1. In the event a different<br>processing or a waste stream cov<br>e but not having the appropriate<br>pe, a PCP Test Solidification can<br>current procedure provided by Wes | vocessing require-<br>t waste stream<br>vered by this<br>waste form or<br>the performed |

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| Nuclear                      | TMI~1<br>Operating Procedure | Number<br>1104-281 |
|------------------------------|------------------------------|--------------------|
| Title                        |                              | Revision No.       |
| Waste Solidification Process | Control Program              | 0                  |

- 9.1 Prerequisites
  - 9.1.1 A procedure is available for the particular waste stream to be processed.
  - 9.1.2 This procedure has been verified current by the Radwaste Ops. Manager or his designee and will be reviewed by the Radwaste Engineer prior to its use.
  - 9.1.3 The sample required by this procedure has been obtained and applicable chemistry parameters analyzed for by Plant Chemistry.
  - 9.1.4 The Ops Quality Assurance Group has been contacted to inform them of the pending Test Solid Fication to see if they care to witness the test.

OQA Monitor Contacted\_

Name / Date /

Time

- 9.1.5 Balance calibration data has been included on Attachment 11.
- 9.1.6 Attachment 11 has been completed.
- 9.2 Procedure
  - 9.2.1 Performed the applicable portions of the Westinghouse Hittman procedure.
- 10.0 ACCEPTANCE CRITERIA
  - 10.1 Solidification Acceptability
    - 10.1.1 The sample solidification is considered acceptable if there is not visual or drainable free water.
    - 10.1.2 The sample solidification is considered acceptable if it resists penetration.

| Str. Nucle           | TMI-1<br>Operating Procedure  | Number<br>1104-281 |
|----------------------|---|--------------------|
| Title                |   | Revision No.       |
| Waste Solidification | Process Control Program   | 9                  |
|                      | Physical examination shall be for resista<br>pound load applied to the surface of the<br>using a 1/2 inch diameter metal rod. The | solidified product |
|                      | using a 1/2 inch diameter metal rod. The  | solidification     |

+1 1b Weight 10 1bs -0 1b +0 in Diameter 1/2 inch -1/4 in

The rod tolerances are as follows:

denting of the surface is acceptable.

- 10.2 Solidification Unacceptability
  - 10.2.1 If the waste fails any of the criteria set forth in Section 10.1 the solidification will be termed unacceptable and a new set of solidification parameters will need to be established under the procedures in Section 10.3.
  - 10.2.2 If the test solidification is unacceptable then the same test procedure must be followed on each subsequent batch of the same type of waste until three consecutive test samples are solidi-fied.
- 10.3 Alternate Solidification Parameters
  - 10.3.1 If a test sample for <u>Class A unstable waste</u> fails to provide acceptable solidification of waste the following procedures should be followed.
    - a. Mix 454.5 gms of cement and 45.5 gms of ASMS with 400 mls of water to ensure that the problem is not a bad batch of cement.
    - b. Add additional 50 wt.% NaOH to raise the pH above 8 but less than 9.2 for borated wastes.
    - c. If the waste (other than waste oil) is only partially solidified, use lower waste to cement and Metso ratios. Using the recommended quantities of cement and Metso Beads, reduce the waste sample to 375 ml and continue reduci ; the sample volume by 25 ml, until the acceptability criteria of Section 10.1 are met.

| OP! Nuclear                  | TMI-1                                  | Number       |
|------------------------------|--|--------------|
|                              | Operating Procedure                    | 1104-281     |
| Title                        | All shares and a second state state of | Revision No. |
| Waste Solidifica ion Process | Control Program                        | 9            |

- d. If the waste oil mixture is only partially solidified try using lower waste to cement ratios. Reduce the quantity of waste by 25 ml. and the emulsifier by 1 ml., (This will result in a slightly higher concentration of emulsifier in the waste) and proceed with the test solidification. Continue with similar reductions until a satisfactory product is achieved.
- 10.3.2 For <u>Class A stable</u>, <u>Class B and C waste</u> test samples that "ail to solidify, Contact Radwaste Operations Engineering for resolution.

| <b>Nuclear</b>                                       | TMI-1<br>Operating Proce | edure           | Number   | 04-281 |
|--|--------------------------|-----------------|----------|--------|
| Title  |                          |                 | Revision | n No.  |
| Waste Solidification Proce                           | ess Control Program      |                 |          | 8      |
|  | ATTACHMENT 1             |                 | Page     | 1 of 4 |
| CLASS A UNSTABLE                                     | AND STABLE, CLASS B AND  | C TEST SOLIDIFI | CATION   |        |
| DATA   | SHEET FOR 4 TO 10 MT% B  | ORIC ACID       |          |        |
| Chemistry Parameters                                 | Balance Cal. Info.       | Liner No.:      |          |        |
| Sample Date  | CMTE No                  | Sample No.:_    |          | _      |
| Boron ppm  | Serial No                | Date:           |          | _      |
| Total Solids ppm                                     | Cal. Due Date            | Waste Class_    |          | _      |
| pH   |                          |                 |          |        |
| Total ActmCi/cc                                      |                          |                 |          |        |
| I. PRECONDITIONING:                                  |                          |                 |          |        |
| Weight Percent of Boric                              | Acid (in decimal form):  |                 |          |        |
| Boron (ppm) x .01 (<br>1748 = 1                      | ) x .01                  |                 |          | (1)    |
| Weight of Untreated Samp                             | 1e:                      |                 | gms      | (2)    |
| Volume of Untreated Samp                             | 1e:                      | <u>.</u>        | mls      | (3)    |
| Weight of 50% NaOH Added<br>within range per Section | to Adjust pH<br>4.2.4.   | - 25            | gms      | (4)    |
| pH of treated sample:                                |                          |                 |          |        |
| Weight of Anti-foam Adde                             | d:                       | 2012년 1월        | gms      | (5)    |
| 1 0111:  |                          |                 | ī        |        |
| Weight of Emulsifier Add                             | ed:                      |                 | gms      | (6)    |
| Volume of treated sample                             |                          |                 | mls      | (7)    |
| Weight of treated sample                             |                          |                 |          |        |
| (2) + (4) + (5) + (6) =                              | () + () + () + () =      |                 | gms      | (8)    |
|  |                          | _               |          |        |

E1-1

| Nuclear  | TMI-1<br>Operating Procedure |         | 104-281 |
|--|------------------------------|---------|---------|
|  |                              | Revisio | on No.  |
| Waste Solidification Process   | Control Program              |         | 8       |
|  | ATTACHMENT 1 (Cont'd)        | Page    | 2 of 4  |
| . DETERMINATION OF PERCENT S   | OLIDS OF SAMPLE:             |         |         |
| Weight of Boric Acid in Un   | treated Sample:              |         |         |
| (2) x (1) = ( ) x (  | ) .                          | gms     | (9)     |
| Height of 50% NaOH:  |                              |         |         |
| (4) x 0.5 = ( ) x 0.   | 5 *                          | gms     | (10)    |
| Weight of Solids in Treate   | d Sample:                    |         |         |
| (5) + (6) + (9) + (10) =<br>( ) + ( ) + ( ) + ( )                          |                              | gms     | (11)    |
| Percent Solids in Treated  | Sample:                      |         |         |
| 100 x (11) ÷ [(8)] =<br>100 x () ÷ [()] =                                  |                              | 1       | (12)    |
| I. DETERMINATION OF WATER IN S   | SAMPLE FOR SCLIDIFICATION:   |         |         |
| Volume of Treated Sample to  | b be Solidified:             | m1      | (13)    |
| Weight of Treated Sample to  | be Solidified:               | gms     | (14)    |
| Weight of Water in Sample (  | Contributed by Waste:        |         |         |
| $\left[\frac{(2)}{(8)} \times (14)\right] \times [1 - (1)]$                | 1 •                          |         |         |
| $\left[\frac{(\cdot)}{(\cdot)} \times (\cdot)\right] \times [1 - (\cdot)]$ | 1 -                          | gms     | (15)    |
| Weight of Water in Sample (  | Contributed By 50% NaOH:     |         |         |
| $\left[\frac{(4)}{(8)} \times (14)\right] \times 0.5 =$                    |                              |         |         |
| $\left[\frac{()}{()} \times ()\right] \times 0.5 =$                        |                              | gms     | (16)    |
| Total Weight of Water in Sa  | imple:                       |         |         |
| (15) + (16) = ( ) + ( ) =  |                              | gms     | (17)    |

| AD Nuclear   | TMI-1<br>Operating Procedure    | Number<br>1104-281    |
|--|---------------------------------|-----------------------|
| Title  |                                 | Revision No.          |
| Waste Solidification Process                           | Control Program                 | 8                     |
|  | ATTACHMENT 1 (Cont'd)           | Page 3 of 4           |
| V. DETERMINATION OF QUANTITY<br>SAMPLE SOLIDIFICATION: | OF PORTLAND TYPE I CEMENT AND M | ETSO BEADS TO USE FOR |
| Using Figure I, find the %<br>the Water/Cement Ratio:  | solids in sample (12), and DET  | ERMINE (18)           |
| Weight of Cement to Use:                               |                                 |                       |
| $\frac{(17)}{(18)} = \frac{()}{()} =$                  |                                 | gms (19)              |
| Weight of Metso Beads to u                             | se:                             |                       |
| (19) x 0.15 = ( ) x 0.1                                | 5 =                             | gms (20)              |
| Test Solidification Perform                            | med By:                         |                       |
| Name   | Date                            | Time                  |
| . SAMPLE INSPECTION                                    |                                 |                       |
| Sample cured for:                                      |                                 |                       |
| Hours Cured  |                                 |                       |
| Temp. Cured  |                                 |                       |
| Verified By  | Dat                             | e                     |
| Sample contains "No Free L                             | iquid":                         |                       |
| Verified By  | Dat                             | e                     |
| Sample "Resists Penetration                            | n":                             |                       |
| Verified By  | Date                            | e                     |

E1-3

|      | <b>Nuclear</b>   | TMI-1<br>Operating Procedur   | e Number                            |
|------|--|---|-------------------------------------|
| Tit  | tie  |   | Revision No.                        |
|      | Maste Solidification Proces                            | s Control Program   | 9                                   |
|      | Additional batches solidit                             | ATTACHMENT 1 (Cont'd)<br>fied based on this sample  | Page 4 of 4                         |
|      | Liner Waste<br>No. Vol. Date                           | Liner Waste<br>No. Vol. Date  | Liner Waste<br><u>No. Vol. Date</u> |
|      | 2.   | 5.  | 8.                                  |
|      | 3.   | 6.  | 9.                                  |
|      | 4.   | 7.  | 10.                                 |
| FOOT | NOTES:   |   |                                     |
|      | 1. Maximum allowable oi                                | 1 content for stable wast   | e is 1% by volume.                  |
| VI.  | INDEPENDENT VERIFICATION E                             |   |                                     |
|      | Test Sample Meets Acceptan<br>Criteria (Section 10)    | ceName  | / Date / Time                       |
|      | Test Solidification Data<br>Sheets (Calculations) Revi | the second se |                                     |
|      |  | Name  | / Date / Time                       |

| Nuclear Nuclear            |                                     | Nuclear TMI-1<br>Operating Procedure |  |                   | <u>-281</u><br>No. |
|----------------------------|-------------------------------------|--------------------------------------|--|-------------------|--------------------|
|                            | fication Process                    | Control Program                      |  | 8                 |                    |
|                            |                                     | ATTACHMENT 2                         |  | Page 1            | of 3               |
| SO                         | LIDIFICATION CAL                    | CULATION SHEET FOR                   | 4 TO 10 WT% BC   | RIC ACID          |                    |
|                            | Liner Ty                            | pe to be used                        |  |                   |                    |
| . Volume of L              | Intreated Waste t                   | o Add to Liner1.3:                   |  |                   |                    |
| ( <u>3)</u><br>(7) x       | Max. Treated Wa<br>from Solidificat | iste Vol.<br>ion Data Tables         |  |                   |                    |
| ( <u>)</u> x               |                                     | =ft                                  | 3  |                   | (21)               |
| I. Volume of A             | dditives to Add                     | to Liner:                            |  |                   |                    |
| NaOH:                      | $\frac{(4) \times 4.86}{(3)}$ x     | $(21) = () \times 4.86$              | x ( ) =  | gals              | (22)               |
| Anti-foam:                 | (5) x 7.48 x (3)                    | $(21) = () \times 7.48$              | x ( ) =  | gals              | (23)               |
| Emulsifier:                | (6) x 7.48 x (3)                    | $(21) = () \times 7.48$              | x ( ) =  | gals              | (24)               |
| II. Volume of 7            | reated Waste to                     | be Solidified <sup>1.</sup>          |  |                   |                    |
| (21) + (22)                | + (23) + (24)<br>7.48               | = () + () + ()                       | ) + ( )<br>.48 =   | ft <sup>3</sup>   | (25)               |
| V. Cement Quar             | tity for Full Sc                    | ale Solidification                   | et de la companya de |                   |                    |
| $\frac{(19)}{(13)}$ x 62.4 | $x (25) = \frac{()}{()} x$          | 62.4 x ( ) =                         |  | 1bs               | (26)               |
| (26) + 94 =                | ( ) + 94 =                          |                                      |  | bags*             |                    |
| . ASMS Quanti              | ty for Full Scal                    | e Solidification:                    |  |                   |                    |
| (26) x .15                 | = ( ) x .15 =                       |                                      |  | 1bs               | (27)               |
| (27) + 100                 | = ( ) + 100 =                       |                                      |  | bags <sup>2</sup> |                    |
|                            |                                     |                                      |  |                   |                    |

E2-1

| Nuclear                                   | TMI-1<br>Operating Procedure   | Number<br>1104-281       |
|---|--|--------------------------|
| Title                                     | Operating Procedure  | Revision No.             |
| Waste Solidification Proc                 | ess Control Program  | 9                        |
|   |  |                          |
|   | ATTACHMENT 2   | Page 2 of 3              |
| I. INDEPENDENT VERIFICATIO                | N BY GPUN MANAGEMENT   |                          |
| SOLIDIFICATION<br>CALCULATION SHEETS REVI |  |                          |
|   | Name / Dat   | e / Time                 |
| OOTNOTES                                  |  |                          |
|   | aste to be solidified in a single li<br>olume listed on the attached Solidif   |                          |
| Round off up to the nea                   | rest whole bag.  |                          |
|   | lume added to the liner in Steps/Equ<br>ed to the liner is less than the val   |                          |
| II. DETERMINATION OF THE QU               | ANTITY OF CEMENT ADDED TO WASTE:   |                          |
| Quantity of Cement Adde                   | d to Hopper:   | 1bs (28)                 |
| Quantity of Cement Left                   | in Hopper:   | 1bs (29)                 |
| Quantity of Cement Adde                   | d per ft.3 Waste:  |                          |
| $\frac{(28) - (29)}{(25)} = \frac{()}{(}$ | <u>()</u> =  | lbs_cement/<br>ft3_waste |
| Boric<br>For S                            | um Quantity of Cement Allowable for<br>Acid Class A Unstable Waste is 62 1<br>table waste solidifications all the<br>to the liner. | lbs ft.3.                |
| Quantity of Cement Adde                   | d Meets Minimum Requirements for uns   | stable waste forms:      |
| Verified By                               | Date   |                          |
|   | treated waste volume and minimum so<br>f the Solidification Data Tables for  |                          |
| Verified By                               | Date   |                          |

E2-2

| <b>Nuclear</b>                                      | Oper               | TMI-1<br>ating Procedure         | Number<br>1104-281 |
|---|--------------------|----------------------------------|--------------------|
| Title<br>Waste Solidification Pro                   | cess Control Pr    | ogram                            | Revision No.<br>7  |
|   | ATTACHMENT         | 2 (Cont'd)                       | Page 3 of 3        |
|   |                    | ON DATA TABLES<br>WT% BORIC ACID |                    |
|   | HN-100<br>Series 3 | HN-100<br>LVM<br>Series 3        |                    |
| Usable Liner<br>Vol. (cu. ft )                      | 141.1              | 157.5                            |                    |
| Max. Treated Waste<br>Vol. (cu. fi.)                | 104.4              | 116.6                            |                    |
| Max. Solidified Waste<br>Vol. (cu. ft.)             | 141.1              | 157.5                            |                    |
| Recommended Min.<br>Treated Waste Vol.<br>(cu. ft)2 | 98.1               | 103.8                            |                    |
| Min. Solidified Waste<br>Vol. (cu. ft) <sup>2</sup> | 132.6              | 140.2                            |                    |
| Max. Rad. Level                                     | 12                 | 12                               |                    |
| R/hr Contact  |                    |                                  |                    |

- For less than A<sub>2</sub> quantities of LSA waste. For greater than A<sub>2</sub> quantities of LSA waste, the maximum treated waste volume is 112.4 cu. ft. due to weight limitations.
- These minimums are required when shipping to Barnwell, to comply with the 15% maximum void space criteria for liners containing solidified stable waste forms.

| <b>Nuclear</b>                     | TMI-1<br>Operating Procedure                           |                     | Number 1104-28 |      |  |
|------------------------------------|--|---------------------|----------------|------|--|
| Title                              |  | -                   | Revision       |      |  |
| Waste Solidification Process       | Control Program  |                     | 13.4           | 8    |  |
|                                    |  |                     |                |      |  |
| 여행 감독 영화 가지 않는다.                   | ATTACHMENT 3   |                     | Page           | of 4 |  |
| CLASS A UNSTABLE AND<br>DATA SI    | D STABLE, CLASS B AND C T<br>HEET > 10 TO 20 WT% BORIC | EST SOLIDIF<br>ACID | ICATION        |      |  |
| Chemistry Parameters               | Balance Cal. Info.                                     | Liner No            | . :            | -    |  |
| Sample Date                        | CMTE NO  |                     | 0.:            |      |  |
| Boron ppm                          | Serial No  |                     |                |      |  |
| otal Solids ppm                    | Cal. Due Date  |                     |                |      |  |
| эн                                 |  |                     |                |      |  |
| otal ActµCi/cc                     |  |                     |                |      |  |
| . PRECONDITIONING                  |  |                     |                |      |  |
| Weight Percent of Boric Aci        | id (in decimal form):                                  |                     |                |      |  |
| Boron (ppm) x .01 (<br>1748 = 1748 | ) × .01 =  | - 22                |                | (1)  |  |
| Weight of Untreated Sample:        |  |                     | gms            | (2)  |  |
| Volume of Untreated Sample:        |  | - 201               | mls            | (3)  |  |
| Weight of 50% NaOH Added to        | Adjust pH per  |                     |                |      |  |
| Section 5.2.4:                     |  |                     | gms            | .42  |  |
| pH of treated sample:              |  |                     |                |      |  |
| Weight of Anti-foam Added:         |  | 1.12.55             | gms            | (5)  |  |
| 2 0111:                            |  | 1.041.2             | ī              |      |  |
| Weight of Emulsifier Added:        |  |                     | gms            | (6)  |  |
| Volume of treated sample:          |  |                     | mls            | (7)  |  |
| Weight of treated sample:          |  |                     |                |      |  |
| (2) + (4) + (5) + (6) = (          | ) * ( ) * ( ) * ( ) *                                  |                     | gms            | (8)  |  |
|                                    |  |                     |                |      |  |

| Nuclear   | Operating Procedure        |      | er<br>1104-281 |
|---|----------------------------|------|----------------|
|   |                            | Revi | sion No.       |
| Waste Solidification Proces   | s Control Program          |      | 8              |
|   | ATTACHMENT 3 (Cont'd)      | Page | 1 of 4         |
| 1. DETERMINATION OF PERCENT   | SOLIDS OF SAMPLE           |      |                |
| Weight of Boric Acid in U   | ntreated Sample            |      |                |
| (2) x (1) = ( ) x (   | ) .                        | gms  | (9)            |
| Weight of 50% NaOH:   |                            |      |                |
| (4) x 0.5 = ( ) x 0   | .5 •                       | gms  | (10)           |
| Weight of Solids in Treat   | ed Sample:                 |      |                |
| (5) + (6) + (9) + (10) =  |                            |      |                |
| ()+()+()+()   | •                          | gm.  | (11)           |
| Percent Solids in Treated   | Sample:                    |      |                |
| 100 x (11) ÷ [(8)] =<br>100 x () ÷ [()] =   |                            | 1    | (12)           |
| II. DETERMINATION OF WATER IN   | SAMPLE FOR SOLIDIFICATION: |      |                |
| Volume of Treated Sample  | to be Solidified:          | m 1  | (13)           |
| Weight of Treated Sample  | to be Solidified:          | gms  | (14)           |
| Weight of Water in Sample   | Contributed by Waste:      |      |                |
| $\left[\frac{(2)}{(8)} \times (14)\right] \times [1 - (1)]$   |                            |      |                |
| $\begin{bmatrix} (\cdot) & \mathbf{x} & (\cdot) \\ \hline (\cdot) & \mathbf{x} & (\cdot) \end{bmatrix} \mathbf{x} \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix} \mathbf{x} \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}$ | )] =                       | gms  | (15)           |
| Weight of Water in Sample   | Contributed by 50% NaOH:   |      |                |
| $\begin{bmatrix} (4) \\ (8) \end{bmatrix} \times (14) \times (0.5) = \begin{bmatrix} (-1) \\ (-1) \end{bmatrix}$  | ) × () × 0.5 •             | gms  | (16)           |
| Total Weight of Water in 1  | Sample:                    |      |                |
| (15) + (16) = ( ) + ( )   |                            | gms  | (17)           |

| - T11 | <b>Nuclear</b>                                      | TMI-1<br>Operating Procedure       | Number<br>1104-281    |
|-------|---|------------------------------------|-----------------------|
| 111   | cie.  |                                    | Revision No.          |
|       | laste Selidification Proces                         | ss Control Program                 | 8                     |
|       |   | ATTACHMENT 3 (Cont'd)              | Page 3 of 4           |
| IV.   | DETERMINATION OF QUANTITY<br>SAMPLE SOLIDIFICATION: | Y OF PORTLAND TYPE I CEMENT AND MI | ETSO BEADS TO USE FOR |
|       | Using Figure I, find the the Water/Cement Ratio:    | % solids in sample (12), and DETH  | C18>                  |
|       | Weight of Cement to Use:                            |                                    |                       |
|       | $\frac{(17)}{(18)}$ = $\frac{()}{()}$ =             |                                    | gms (19)              |
|       | Weight of Metso Beads to                            | use:                               |                       |
|       | (19) x 0.15 = ( ) x 0.                              | .15 =                              | gms (20)              |
|       | Test Solidification Perfo                           | n med By:                          |                       |
|       | Name  | Date                               | Time                  |
| ۷.    | SAMPLE INSPECTION                                   |                                    |                       |
|       | Sample cured for:                                   |                                    |                       |
|       | Hours Cured   |                                    |                       |
|       | Temp. Cured   |                                    |                       |
|       |   |                                    |                       |
|       | Verified By   | Dat                                | e                     |
|       | Sample contains "No Free                            | Liquid":                           |                       |
|       | Verified By   | Dat                                | e                     |
|       | Sample "Resists Penetra*"                           | ".on":                             |                       |
|       | Verified By   | Dat                                | e                     |
|       |   |                                    |                       |

|        | 2 Ni                 | ucle                | ar            | Op                     | TMI-<br>erating P   |          |             | Nu      | mber<br>1104-281      |
|--------|----------------------|---------------------|---------------|------------------------|---------------------|----------|-------------|---------|-----------------------|
| Title  |                      |                     |               |                        |                     |          |             | Re      | vision No.            |
| Waste  | Solidi               | fication            | Process       | Control                | Program             |          |             |         | 9                     |
| Add    | litional             | batches             | solidif       | ATTACHME<br>fied based | NT 3 (Co<br>on this |          | licific     |         | Page 4 of 4           |
|        | Liner<br>No.         | Waste<br>Vol.       | Date          | Liner<br>No.           |                     | Date     | Line<br>No. | r Ha    | ste<br>1. <u>Cate</u> |
| 2.     |                      |                     |               | 5.                     |                     | 1        | 8.          |         |                       |
| 3.     |                      |                     |               | 6.                     |                     |          | 9.          |         |                       |
| 4.     |                      |                     |               | 7.                     |                     |          | 10.         |         |                       |
| OTNOTE | S :                  |                     |               |                        |                     |          |             |         |                       |
| 1.     | Maxim                | um allow            | able of       | 1 content              | for Stab            | le Waste | is 1% b     | y volur | ne.                   |
| . INDE | EPENDENT             | VERIFIC             | ATION B       | Y GPUN MAN             | AGEMENT             |          |             |         |                       |
| Test   | t Sample<br>teria (S | Meets A<br>ection 1 | cceptan<br>() | ce                     | Name                |          | / D         | ate /   | Time                  |
|        |                      |                     |               |                        |                     |          |             |         |                       |

| <b>Nuclear</b>  | THI-1<br>Operating Procedure          | Numbe      | r<br>1104-28I |
|---|---------------------------------------|------------|---------------|
| Title   |                                       |            | ion No.       |
| Waste Solidification Proces                                 | s Control Program                     |            | 8             |
|   |                                       |            |               |
|   | ATTACHMENT 4                          | Pag        | e 1 of 3      |
| SOLIDIFICATION CAL  | CULATION SHEET FOR > 10 TO 20 WT%     | BORIC ACID |               |
| Liner t   | ype to be used                        |            |               |
| Volume of Untreated Waste                                   | to Add to Liner <sup>1</sup> .3:      |            |               |
| (3) Max. Treated<br>(7) x from Solidific                    | Waste Vol.<br>ation Data Tables =     |            |               |
| ( <u>)</u> x  | - •ft <sup>3</sup>                    |            | (21)          |
| . Volume of Additives to Ad                                 | d to Liner:                           |            |               |
| NaOH: (4) x 4.86 x (3)                                      | $(21) = () \times 4.86 \times () = -$ | gals       | (L.)          |
| Anti-foam: (5) x 7.48 x (3)                                 | $(21) = () \times 7.48 \times () = -$ | gals       | (23)          |
| Emulsifier: $\frac{(6) \times 7.48}{(3)}$ x                 | $(21) = () \times 7.48 \times () = -$ | gals       | (24)          |
| . Volume of Treated Waste to                                | o be Solidified <sup>1</sup> :        |            |               |
| $(21) + \frac{(22) + (23) + (24)}{7.48}$                    | = () + ( <u>) + () + ()</u><br>7.48 = | ft3        | (25)          |
| Cement Quantity for Full 5                                  | Scale Solidification:                 |            |               |
| $\frac{(19)}{(13)} \times 62.4 \times (25) = \frac{()}{()}$ | x 62.4 x ( ) =                        | lbs        | (28)          |
| (26) + 94 = ( ) 94 =  |                                       | bags2      |               |
| ASMS Quantity for Full Sca                                  | ale Solidification:                   |            |               |
| (26) x .15 - ( ) x .15 -                                    | · · · · · · · · ·                     | 1bs        | (27)          |
| (27) + 100 = ( ) 100 -                                      |                                       | bags2      |               |
|   |                                       |            |               |

|     | AD Nuclear   | TMI-1   | Number   |
|-----|--|---|--|
| TI  | tle  | Operating Procedure   | 1104-281                                       |
|     |  |   | Revision No.                                   |
|     | Waste Solidification Proces  | s Control Program   | 9  |
|     |  | ATTACHMENT 4  | Page 2 of 3                                    |
|     | SOLIDIFICATION CAL   | CULATION SHEET FOR > 10 TO 20 WT  | BORIC ACID                                     |
| Vt. | INDEPENDENT VERIFICATION   | BY GPUN MANAGEMENT  |  |
|     | SOLIDIFICATION<br>CALCULATION SHEETS REVIEW                                  | Not the case of the second s |  |
|     |  | Name / Da   | ate / Time                                     |
| 001 | INOTES   |   |  |
|     | The volume of <u>treated</u> wast<br>maximum treated waste volu              | te to be solidified in a single 1<br>ume listed on the attached Solidi  | iner cannot exceed th<br>fication Data Tables. |
|     | Round off up to the neares   | st whole bag.   |  |
| 3   | Use the actual waste volum<br>if the waste volume added<br>Step/Equation 21. | ne added to the liner in steps/eq<br>to the liner is less than the va   | uations 22, 23 and 24<br>lue obtained in       |
| 11. | DETERMINATION OF THE QUANT   | ITY OF CEMENT ADDED TO WASTE:   |  |
|     | Quantity of Cement Added t   | o Hopper:   | 1bs (28)                                       |
|     | Quantity of Cement Left in   | Hopper:   | 1bs (29)                                       |
|     | Quantity of Cement Added p   | er ft.3 Waste:  |  |
|     | $\frac{(28) - (29)}{(25)} = \frac{() - ()}{()}$                              | <u>)</u> -  | 1bs_cement/<br>ft3_waste                       |
|     | For STAB   | Quantity of Cement Allowable for<br>Acid Class A Unstable Waste is 60<br>LE waste solidifications all the<br>the liner.   | 0 1bs /f+ 3                                    |
|     | Quantity of Cement Added M   | eets the Minimum Requirements for   | r unstable waste form                          |
|     | Verified By  | Date  |  |
|     |  |   |  |

Verified By

Date

| <b>Nuclear</b>            | TMI-1<br>Operating Procedure                                | Number<br>1104-281 |
|---------------------------|---|--------------------|
| Title                     |   | Revision No.       |
| Waste Solidification Proc | cess Control Program  | 7                  |
|                           | ATTACHMENT 4 (Cont'd)                                       | Page 3 of 3        |
| 1                         | SOLIDIFICATION DATA TABLES<br>FOR > 10 TO 20 WT% BORIC ACID |                    |

|   | HN-100<br>Series 3 | HN-100<br>LVM<br><u>Series 3</u> 1 |
|---|--------------------|------------------------------------|
| Usable Liner<br>Nol. (cu. ft.)                                  | 141.1              | 157.5                              |
| Max. Treated Waste<br>Vol. (cu. ft.)                            | 101.3              | 113.1                              |
| Max. Solidified Waste<br>Vol. (cu. ft.)                         | 141.1              | 157.5                              |
| Recommended Min.<br>Treated Waste Vol.<br>(cu. ft) <sup>2</sup> | 95.2               | 100.7                              |
| Min. Solidified Waste<br>Vol. (cu. ft) <sup>2</sup>             | 132.6              | 140.2                              |
| Max. Rad. Level   | 12                 | 12                                 |
|   |                    |                                    |

R/hr Contact

- For less than Ap quantities of LSA waste. For greater than Ap quantities of LSA waste, the maximum treated waste volume is 106 cu. ft. due to weight limitations.
- These minimums are required when shipping to Barnwell, to comply with the 15% maximum void space criteria for liners containing solidified stable waste forms.

| <b>DPU</b> Nucle                    | ar   | TMI-1<br>Operating Procedur                 | .             | Number<br>1104- | 281 |
|-------------------------------------|--|---|---------------|-----------------|-----|
| Title                               |  |   |               | Revision N      |     |
| Waste Solidification                | n Proces                                       | Control Program                             |               | 9               |     |
|                                     |  | ATTACHMENT 5                                |               | Page 1 o        | f 2 |
| CLASS & UNSTABLE                    | AND STA  | BLE, CLASS B AND C TEST SO<br>FOR WASTE OIL | DLIDIFICATION | DATA SHEET      | ŗ   |
| Chem. Parameters (Conc.             | Waste)   | Balance Cal. Info                           | Liner No.     | i               |     |
| Sample Date                         |  | CMTE No.:                                   | Sample No     | .1              |     |
| Boron                               | _ppm   | Serial No.:                                 | Date:         |                 |     |
| Total Solids                        | _ppm   | Cal. Due Date:                              | Waste Clas    | \$\$1           |     |
| рH                                  |  |   |               |                 |     |
| Total Act.                          | _uCi/cc  |   |               |                 |     |
| I. SAMPLE PREPARATION               |  |   |               |                 |     |
| Volume of Oil to b                  | Volume of Oil to be Solidified:                |   |               | nis (1)         |     |
| Volume of Concentr                  | Volume of Concentrated Waste added to the oil: |   |               | n1s (2)         |     |
| Total Volume of Sa                  | Total Volume of Sample:                        |   |               | nls             |     |
| % Oil by Volume:                    |  |   |               |                 |     |
| $\frac{(1)}{(1) + (2)} \times 100 $ | ()*  | ) × 100 =                                   | `             | (3)             |     |
| Weight of 50 wt% N                  | aOH adde                                       | d to sample to raise pH $\rightarrow$       | 59            | ms (4)          |     |
| Quantity of Emulsi                  | fier to .                                      | Add to Sample:                              |               | n1s (5)         |     |
| Quantity of Anti Fi                 | oam Adde                                       | to Sample:                                  |               | n1s (6)         |     |
| Quantity of Portla                  | nd Type  | Cement Added to Sample:                     | 9             | ms (7)          |     |
| Quantity of Anhydro<br>to Sample:   | ous Sodii                                      | um Metasilicate Added                       | 9             | ms (8)          |     |
| Test Solidification                 | Perfor   | ned By:                                     |               |                 |     |
| Name                                |  | Date  | Tim           |                 |     |

Date

Time

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| Nuclear  |                       | TMI-      |         |              | Number             |
|--|-----------------------|-----------|---------|--------------|--------------------|
| Title  | Upe                   | rating P  | rocedur | e            | Revision No.       |
| Waste Solidification Proces                            | s Control P           | rogram    |         |              | 9                  |
|  | ATTACHMEN             | T 5 (Cor  | nt'd)   |              | Page 2 of 2        |
| I. SAMPLE INSPECTION                                   |                       |           |         |              |                    |
| Sample cured for:                                      |                       |           |         |              |                    |
| Hours Cured  |                       |           |         |              |                    |
| Temp. Cured  |                       |           |         |              |                    |
| Verified By  |                       |           |         | Date         | _                  |
| Sample contains "No Free                               | Liquid":              |           |         |              |                    |
| Verified By  |                       |           | -       | Date         | _                  |
| Sample "Resists Penetratio                             | on":                  |           |         |              |                    |
| Verified By  |                       |           |         | Date         |                    |
| Additional batches soliding                            | fied cased (          | on this s | ample : | solidificati | on:                |
| Liner Waste<br><u>No. Vol. Date</u>                    | Liner<br>No.          |           |         | Liner<br>No. | Waste<br>Vol. Date |
| 2.   | 5.                    |           |         | 8.           |                    |
| 3.   | 6.                    |           |         | 9.           |                    |
| 4.   | 7.                    |           |         | 10.          |                    |
| I. INDEPENDENT VERIFICATION E                          | BY GPUN MANA          | GEMENT    |         |              |                    |
| Test Sample Meets Acceptar<br>Criteria (Section 10)    | nce                   | Name      |         | / Date       | / Time             |
| Test Solidification Data<br>Sheets (Calculations) Revi | eved                  |           |         |              |                    |
|  | Management of Strends | Name      |         | / Date       | / Time             |

| Cement:  | Page<br>ga1/<br>ft3 | on No.<br>8<br>1 of 3<br>(9) |
|--|---------------------|------------------------------|
| ATTACHMENT 6<br>: SOLIDIFICATION CALCULATION SHEET FOR WASTE OIL<br>Liner type to be used<br>PARAMETERS FOR FULL SCALE SOLIDIFICATION<br>Emulsifier:<br>(5) x 7.48 + (1) = ( ) x 7.48 + ( ) =<br>Anti-foam<br>(6) x 7.48 x $\frac{1}{(1) + (2)} = ($ ) x 7.48 x $\frac{1}{(-) + (-)}$<br>Cement:   | -gal/<br>ft3        | 1 of 3                       |
| : SOLIDIFICATION CALCULATION SHEET FOR WASTE OIL<br>Liner type to be used<br>PARAMETERS FOR FULL SCALE SOLIDIFICATION<br>Emulsifier:<br>(5) x 7.48 + (1) = ( ) x 7.48 + ( ) =<br>Anti-foam<br>(6) x 7.48 x $\frac{1}{(1) + (2)} = ($ ) x 7.48 x $\frac{1}{(-) + (-)}$<br>Cement:   | -gal/<br>ft3        |                              |
| Liner type to be used<br>PARAMETERS FOR FULL SCALE SOLIDIFICATION<br>Emulsifier:<br>(5) x 7.48 + (1) = ( ) x 7.48 + ( ) =<br>Anti-foam<br>(6) x 7.48 x $\overline{(1) + (2)} = ($ ) x 7.48 x $\overline{(-) + (-)}$<br>Cement:   |                     | (9)                          |
| PARAMETERS FOR FULL SCALE SOLIDIFICATION         Emulsifier:         (5) x 7.48 + (1) = ( ) x 7.48 + ( ) =         Anti-foam         (6) x 7.48 x $\frac{1}{(1) + (2)} = ($ ) x 7.48 x $\frac{1}{(-) + (-)}$ Cement:   |                     | (9)                          |
| Emulsifier:<br>(5) x 7.48 + (1) = () x 7.48 + () =<br>Anti-foam<br>(6) x 7.48 x $\frac{1}{(1) + (2)} = () x 7.48 x () + ()$<br>Cement:   |                     | (9)                          |
| (5) x 7.48 + (1) = ( ) x 7.48 + ( ) =<br>Anti-foam<br>(6) x 7.48 x $\frac{1}{(1) + (2)}$ = ( ) x 7.48 x $\frac{1}{(-) + (-)}$<br>Cement:   |                     | (9)                          |
| Anti-foam<br>(6) x 7.48 x $\frac{1}{(1) + (2)} = (-) \times 7.48 \times \frac{1}{(-) + (-)}$<br>Cement:  |                     | (9)                          |
| (6) x 7.48 x $\frac{1}{(1) + (2)} = ( ) x 7.48 x \frac{1}{( ) + ( )}$<br>Cement:   |                     |                              |
| Cement:  |                     |                              |
| 1  | gal/<br>ft3         | (10)                         |
| (7) x 62.43 x $\overline{(1) + (2)} = ( ) x 62.43 x \overline{( ) + ( )}$  |                     |                              |
|  |                     | (11)                         |
| ASMS :   |                     |                              |
| (8) x 62.43 x $\frac{1}{(1) + (2)} = ( ) x 62.43 x ( ) + ( ) = ( ) = ( ) + ( ) = $ | -1bs/<br>ft3        | (12)                         |
| QUANTITIES TO BE ADDED FOR FULL SCALE SOLIDIFICATION   |                     |                              |
| Volume of untreated waste to add to liner<br>(Max Treated Waste Vol from Solidification<br>Data Tables):3  | _                   | (13)                         |
| Concentrated Waste to be added:  |                     |                              |
| 60% x (13) x 7.48 = 0.60 x ( ) x 7.48 =  | gals                | (14)                         |
| Waste Oil to be added:   |                     |                              |
| 40% x (13) = 0.40 x ( ) =  | ft3                 | (15)                         |
| 40% x (13) x 7.48 = 0.40 x ( ) x 7.48 =  |                     |                              |

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| ADD Nuclear                | TMI-1<br>Operating Procedure | Number<br>1104-281 |
|----------------------------|------------------------------|--------------------|
| fitle                      |                              | Revision No.       |
| Waste Solidification Proce | ss Control Program           | 9                  |
|                            | ATTACHMENT 6 (Cont'd)        | Page 2 of 3        |
| Emulsifier to be added:    |                              |                    |
| (15) x (9) = ( ) x (       | ) .                          | gals               |
| Anti-foam to be Added:     |                              |                    |
| (13) x (10) = ( ) x (      | ) *                          | gals               |
| ASHS to be added:          |                              |                    |
| (13) x (12) = ( ) x (      | ) * 2011 1 - 4 - 4 - 4       | 1bs (16)           |
| (16) * 100 = ( ) * 100     | 0                            | bags1              |
| Volume of cement to add    | to liner:                    |                    |
| (13) x (11) = ( ) x (      | ) =                          | 1bs (17)           |
| (17) * 94 = ( ) * 94 =     |                              | bags1              |
|                            |                              |                    |

## FOOTNOTES:

1 Round off up to the nearest whole bag.

- 2 Reduce the quantity of total waste in the liner by 1 ft<sup>3</sup> for every 10 gallons of anti-foam added to the liner. No adjustment is necessary for the first 10 gallons.
- 3 Use actual waste volume added to the liner in step/equations used in Section 11 if waste volume added to the liner is less than the value obtained in Step/Equation 13.
- 111. INDEPENDENT VERIFICATION BY GPUN MANAGEMENT

SOLIDIFICATION CALCULATION SHEETS REVIEWED

Name

/ Date / Time

| <b>Nuclear</b>                                  | TMI-1<br>Operating Pro | ocedure       | Number<br>1104-281 |
|---|------------------------|---------------|--------------------|
| Title   |                        |               | Revision No.       |
| Waste Solidification Proces                     | s Control Program      |               | 7                  |
|   | ATTACHMENT 6 (Con      | t'd)          | Page 3 of 3        |
| SOLIDIF   | ICATION DATA TABLES    | FOR MASTE OIL |                    |
|   | HN-100<br>Series 3     | HN-100<br>LVM |                    |
| Usable Liner Volume, (ft3)                      | 141.1                  | 157.5         |                    |
| Max. Waste Volume<br>(oil and conc. waste), ft3 | 93.7                   | 104.6         |                    |
| Max. Solidified<br>Volume, ft3                  | 141.1                  | 157.5         |                    |
| Maximum Rad Level<br>R/hr Contact               | 12                     | 12            |                    |

| Title         | 22 Nuclea           |   | TMI-1<br>ating Procedu | ire          | Numb  | 1104-281  |
|---------------|---------------------|---|------------------------|--------------|-------|-----------|
|               |                     |   |                        |              | Revi  | sion No.  |
| Mast          | e Solidification F  | rocess Control Pr   | ogram                  | i            |       | 8         |
|               |                     | ATTAC   | HMENT 7                |              | Pa    | ge 1 of 2 |
|               | CL*SS A STAR        | DLE, CLASS B AND C<br>FOR USE   | TEST SOLIDIF           | ICATION DATA | SHEET |           |
| Balance       | Cal. Info.          | Chemistry Param   | eters                  | Liner No.:_  |       |           |
| CMTE NO       | •                   | рн  |                        | Sample No.:  |       |           |
| Serial        | No                  | Gamma Scan  | mC1/m1                 | Date:        |       |           |
| Cal. Du       | e Date              | 1 011   | 1                      | Waste Class  |       |           |
| 1. <u>SA</u>  | MPLE PREPARATION    |   |                        |              |       |           |
| He            | ight of Dewatered   | Powered Resin   |                        |              | gms   | (1)       |
| Vo            | lume of Dewatered   | Powered Resin   |                        | -            | ml    | (2)       |
| He            | ight of Water Adde  | d to Powdered Res   | in:                    |              | gms   | (3)       |
| To            | tal of Volume of P  | owered Resin Slur   | ry:                    |              | ml    | (4)       |
| Qu            | antity of Anti-fpa  | m Agent Added to  | Sample:                |              | gms   | (5)       |
| Qu            | antity of oil in S  | ample   |                        |              | 2     | (6)       |
| Qu            | antity of Emulsify  | ing Agent Aujed t   | o Sample:              |              | gms   | (7)       |
| In            | itial pH of Sample  | :   |                        |              |       | (8)       |
| 11. <u>so</u> | LIDIFICATION        |   |                        |              |       |           |
| Qu            | antity of Ca(OH)2   | necessary to rais   | e pH > 11.5:           |              | gms   | (9)       |
| F1            | nal pH of Sample:   |   |                        |              |       | (10)      |
| Qui           | antity of Portland  | Cement Added to   | Sample                 |              | gms   | (11)      |
| F 11          | nal Sample Volume:  |   |                        |              | mls   | (12)      |
| Te            | st Solidification i | Performed By:   |                        |              |       |           |
| -             | Namo                | and the second se | Date                   | T            |       |           |

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| Nuclear   | Op                                      | TMI-<br>erating P |               |              | Number        | 4-281     |
|---|---|-------------------|---------------|--------------|---------------|-----------|
| Title   | ~ |                   | 1000001       |              | Revision      |           |
| Waste Solidification Proce                            | ss Control                              | Program           | 1.15          |              | 8. 6 B        | 9         |
|   |   |                   |               |              |               |           |
|   | ATTACHME                                |                   |               |              |               | ge 2 of 2 |
| GLASS A STABLE.                                       | CLASS B AND<br>FOR US                   | C TEST S          | OLIDIFI<br>AT | CATION DATA  | SHEET         |           |
| 11. SAMPLE INSPECTION                                 |   |                   |               |              |               |           |
| Sample cured for:                                     |   |                   |               |              |               |           |
| Hours Cured   |   |                   |               |              |               |           |
| Temp. Cured   |   |                   |               |              |               |           |
| Verified By   |   |                   |               | Date         |               |           |
| Sample contains "No Free                              | Liquid"                                 |                   |               |              |               |           |
| Verified By   |   |                   |               | Date         |               |           |
| Sample "Resists Penetrat                              | ion":                                   |                   |               |              |               |           |
| Verified By   |   |                   | -             | Date         | -             |           |
| Additional batches solid                              | fied based                              | on this           | sample :      | olidificat   | ion:          |           |
| Liner Waste<br>No. Vol. Date                          | Liner<br>No.                            | Waste<br>Vol.     | Date          | Liner<br>No. | Waste<br>Vol. | Date      |
| 2.  | 5.                                      |                   |               | 8.           |               |           |
| 3.  | 6.                                      |                   |               | 9.           |               |           |
| 4.  | 2.                                      |                   |               | 10.          |               |           |
| . INDEPENDENT VERIFICATION                            | BY GPUN MAN                             | AGEMENT           |               |              |               |           |
| Test Sample Meets Accepta<br>Criteria (Section 10)    | nce                                     | Name              |               | / Date       | / Time        |           |
| Test Solidification Data<br>Sheets (Calculations) Rev | iewed                                   | Name              |               | / Date       | / Time        | -         |
|   |   |                   |               |              |               |           |
|   |   | E 7 - 2           |               |              |               | 1372¢     |

| <b>Nuclear</b>  | TMI-1<br>Operating Procedure   | Number<br>1104-281                    |
|---|--|---------------------------------------|
| Title   |  | Revision No.                          |
| Waste Solidification Proces   | s Control Program  | 8                                     |
|   | ATTACHMENT &   | Page 1 of 3                           |
| : SOLIDIFICATI  | ON CALCULATION SHEET FOR USED I  | PRECOAT                               |
| Line  | r Type to be used  |                                       |
| . PARAMETERS FOR FULL SCALE   | SOLICIFICATION:  |                                       |
| Quantity of Water:  |  |                                       |
| $\frac{(3) \times 7.48}{(2)} = \frac{() \times 7.48}{()}$           |  | gal/ (13)<br>ft <sup>3</sup> of waste |
| Quantity of Anti-Foam Ager  | nt:  |                                       |
| $\frac{(5) \times 7.48}{(2)} = \frac{() \times 7.48}{()}$           |  | gal/ (14)<br>ft3 of waste             |
| Quantity of Emulsifier:   |  |                                       |
| $\frac{(7) \times 7.48}{(2)} = \frac{() \times 7.48}{()}$           |  | gal/ (15)<br>ft3 of waste             |
| Quantity of Ca(OH)2:  |  |                                       |
| $\frac{(9)}{(2)} \frac{x \ 62.43}{(2)} = \frac{() \ x \ 62.43}{()}$ | 1.   | 1bs/ (16)<br>ft <sup>3</sup> of waste |
| Quantity of Portland Type   | 1 Cement:  |                                       |
| $\frac{(11) \times 62.43}{(2)} = \frac{() \times 62.4}{()}$         | 13 .   | 1bs/ (17)<br>ft <sup>3</sup> of waste |
| I. QUANTITIES TO BE ADDED FOR                                       | R FULL SCALE SOLIDIFICATION  |                                       |
| Volume of Dewatered Powder  | red Resin to be Solidified:  | ft <sup>3</sup> (18)                  |
| Quantity of Water:  |  |                                       |
| (18) x (13) = ( ) x ( )   | •  | gal (19)                              |
| Quantity of Anti-Foam Ager  | nt:  |                                       |
| . (18) x (14) = ( ) x ( )   | •/> •/> •/> •/> •/> •/> •/> •/> •/> •/>  | ga1 (20)                              |
| Quantity of Emulsifier:   |  |                                       |
| (18) x (15) = ( ) x ( )   | <ul> <li>A 1 - A 1 -</li></ul> | gal (21)                              |

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|     | 리간 Nuclear   | TMI-1<br>Operating Procedure  | Number<br>1104-281               |
|-----|--|---|----------------------------------|
| Tit | tle  |   | Revision No.                     |
| +   | laste Solidification Proce   | ess Control Program   | 9                                |
|     |  | ATTACHMENT 8 (Cont'd)   | Page 2 of 3                      |
|     | : SOLIDIFICA   | TION CALCULATION SHEET FOR USED PRECOAT   |                                  |
|     | Quantity of Ca(OH)2:   |   |                                  |
|     | (1G) x (16) = ( ) x (<br>(22) + (100) = ( ) + (                          | · · · · · · · · · · · · · · · · · · ·   | 1bs (22)<br>bags <sup>2</sup>    |
|     | Quantity of Portland Typ   | e Cement:   |                                  |
|     | (18) x (17) = ( ) x (<br>(23) + (94) = ( ) + (                           | ) •<br>) •  | lbs (23)<br>bags <sup>2</sup>    |
|     | The volume of waste, to settled and treated wast Table for used precoat. | be solidified in a liner cannot exceed<br>e volume listed on the Class B Waste So | the maximum<br>lidification Data |
|     | Round up to the nearest  | whole bag.  |                                  |
| ίΙ. | INDEPENDENT VERIFICATION   | BY GPUN MANAGEMENT  |                                  |
|     | SOLIDIFICATION<br>CALCULATION SHEETS REVIO                               | WED   |                                  |

Name

/ Date / Time

| DI Nuclear                                    | TMI-1<br>rating Procedure | Number<br>1104-281 |
|---|---------------------------|--------------------|
| itle  |                           | Revision No.       |
| Waste Solidification Process Control Pr       | rogram                    | 8                  |
| ATTACHMEN                                     | T 8 (Cont'd)              | Page 3 of 3        |
| : SOLIDIFICATION DATA                         | TABLE FOR USED PRECOAT    |                    |
|   | HN-600 MUS                | HN-200 MU          |
| Usable Liner Volume, ft3                      | 59.3                      | 59.4               |
| Max. Solidified Waste Vol. ft3                | 59.3                      | 59.4               |
| Max. Dewatered Waste Vol., ft3                | 33.3                      | 33.3               |
| Min. Waste Vol. ft3                           | 32.9                      | 32.0               |
| Min. Solidified Waste Vol. ft3                | 58.5                      | 57.0               |
| Max. Radiation Level<br>R/hr Contact of Liner | 100                       | 800                |

| तित्र Nuc          | lear                         | TMI-1<br>Operating Proce             | dure           | Numb       | 1104-281  |
|--------------------|------------------------------|--------------------------------------|----------------|------------|-----------|
| Title              |                              |                                      |                | Revi       | sion No.  |
| Haste Solidifica   | tion Process Con             | trol Program                         |                |            | 8         |
|                    |                              | ATTACHMENT 9                         |                | Pa         | ge 1 of 2 |
| CLASS              | A STABLE, CLASS              | B AND C TEST SOLID<br>FOR BEAD RESIN | IFICATION DATA | SHEET      |           |
| Salance Cal. Info. | Chemistr                     | y Parameters                         | Liner No.:     |            |           |
| MTE NO             | pH                           |                                      | Sample No.     | : <u> </u> |           |
| erial No           | Gamma Sc                     | anmCi/ml                             | Date:          |            | <u> </u>  |
| Cal. Due Date      | 1 011                        |                                      | Waste Clas     | s :        |           |
| SAMPLE PREPARA     | TION                         |                                      |                |            |           |
| Sample Weight:     |                              |                                      |                | gms        | (1)       |
| Sample Volume:     |                              |                                      |                | m1         | (2)       |
| Weight of EC-3     |                              |                                      |                | gms        | (3)       |
| Weight of water    | 1                            |                                      |                | gms        | (4)       |
| Neight of Anti-    | foaming agent a              | dded to sample:                      |                | 15         | (5)       |
| Quantity of oil    | 1 in sample:                 |                                      |                | . 5        | (6)       |
| Height of Emuli    | sifier added to              | sample:                              |                | gm s       | (7)       |
| Initial pH of s    | sample:                      |                                      | · · · · ·      |            | (8)       |
| 1. SAMPLE SOLIDIFI | ICATION                      |                                      |                |            |           |
|                    | () <sub>2</sub> added to sam | ple to raise                         |                | _ gms      | (9)       |
| Final pH of sam    | nple:                        |                                      |                |            | (10)      |
| Height of Porti    | and Type 1 ceme              | nt added to sample                   | 1              | gms.       | (11)      |
| Final Sample Vo    | plume :                      |                                      | 1              | m1         | (12)      |
| Test Solidifica    | tion Performed               | By:                                  |                |            |           |
| Name               |                              | Date                                 |                | ime        |           |

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| Nuclear  |   | TMI-          |   |              | Number                   |
|--|---|---------------|---|--------------|--------------------------|
| Title  | Ope   | rating P      | roceduri  | 8            | 1104-281<br>Revision No. |
| Waste Solidification Proces                            | s Control P   | rogram        |   |              | 9                        |
|  |   |               |   |              |                          |
|  | ATTACHMEN   | T 9 (Co       | nt'd)   |              | Page 2 of 2              |
| CLASS A STUBLE, C                                      | LASS B AND<br>FOR B   | C TEST S      | OLIDIFIC<br>N   | CATION DATA  | SHEET                    |
| 1. SAMPLE INSPECTION                                   |   |               |   |              |                          |
| Sample cured for:                                      |   |               |   |              |                          |
| Hours Cured  | _   |               |   |              |                          |
| Temp. Cured  | _   |               |   |              |                          |
| Verified By  |   |               |   | Date         |                          |
| Sample contains "No Free                               | Liquid":  |               |   |              |                          |
| Verified By  |   |               |   | Dale         |                          |
| Sample "Resists Penetratio                             | on":  |               |   |              |                          |
| Verified By  |   |               | -   | Date         |                          |
| Additional batches solidi                              | fied based  | on this s     | sample s  | olidificati  | on:                      |
| Liner Waste<br>No. Vol. Date                           | Liner<br>No.  | Waste<br>Vol. | Date  | Liner<br>No. | Waste<br>Vol. Date       |
| 2.   | 5.  |               |   | 8.           |                          |
| 3.   | 6.  |               |   | 9.           |                          |
| 4.   | 1.  |               |   | 10.          |                          |
| INDEPENDENT VERIFICATION 6                             | BY GPUN MAN   | AGEMENT       |   |              |                          |
| Test Sample Meets Acceptar                             | nce   |               | <u>i</u>  |              |                          |
| Criteria (Section 10)                                  |   | Name          |   | / Date       | / Time                   |
| Test Solidification Data<br>Sheets (Calculations) Revi | ewed  |               |   |              |                          |
|  | and the second se | Name          | and the second se | / Date       | / Time                   |

| Nuclear  | TMI-1<br>Operating Procedure    | Number<br>1104-281<br>Revision No. |
|--|---------------------------------|------------------------------------|
|  |                                 | Revision No.                       |
| Maste Solidification Process                                 | Control Program                 | 8                                  |
|  | ATTACHMENT 10                   | Page 1 of 3                        |
| : SOLIDIFICATIO  | ON CALCULATION SHEET FOR BEAD R | SIN                                |
| Liner  | Type to be used:                |                                    |
| 11. PARAMETERS FOR FULL SCALE S                              | OLIDIFICATION                   |                                    |
| Quantity of EC-3:  |                                 |                                    |
| $\frac{(3) \times 6.3}{(2)} = \frac{() \times 6.3}{()} =$    |                                 | gal/ (13)<br>ft3 of waste          |
| Quantity of Water:   |                                 |                                    |
| $\frac{(4) \times 7.48}{(2)} = \frac{() \times 7.48}{()} =$  |                                 |                                    |
| Quantity of Anti-Foam Agent                                  | :                               |                                    |
| $\frac{(5) \times 7.48}{(2)} = \frac{() \times 7.48}{()} =$  |                                 | gal/ (15)<br>ft3 of waste          |
| Quantity of Emulsifier:                                      |                                 |                                    |
| $\frac{(7) \times 7.48}{(2)} = \frac{() \times 7.48}{()} =$  |                                 | gal/ (16)<br>ft3 of waste          |
| Quantity of Calcium Hydroxi                                  | de Ca(OH)2:                     |                                    |
| $\frac{(9) \times 62.43}{(2)} = \frac{() \times 62.43}{()}$  | •                               | 1bs/ (17)<br>ft3 of waste          |
| Quantity of Portland Type 1                                  | Cement:                         |                                    |
| $\frac{(11) \times 62.43}{(2)} = \frac{() \times 62.43}{()}$ | •                               | 1bs/ (18)<br>ft3 of waste          |
| I. QUANTITIES TO BE ADDED FOR                                | FULL SCALE SOLIDIFICATION       |                                    |
| Naste Volume of to be So'id                                  | ified1.3;                       | ft <sup>3</sup> (19)               |
| Quantity of EC-3:  |                                 |                                    |
| (19) x (13) = ( ) x ( ) =                                    |                                 | gal (20)                           |

1372¢

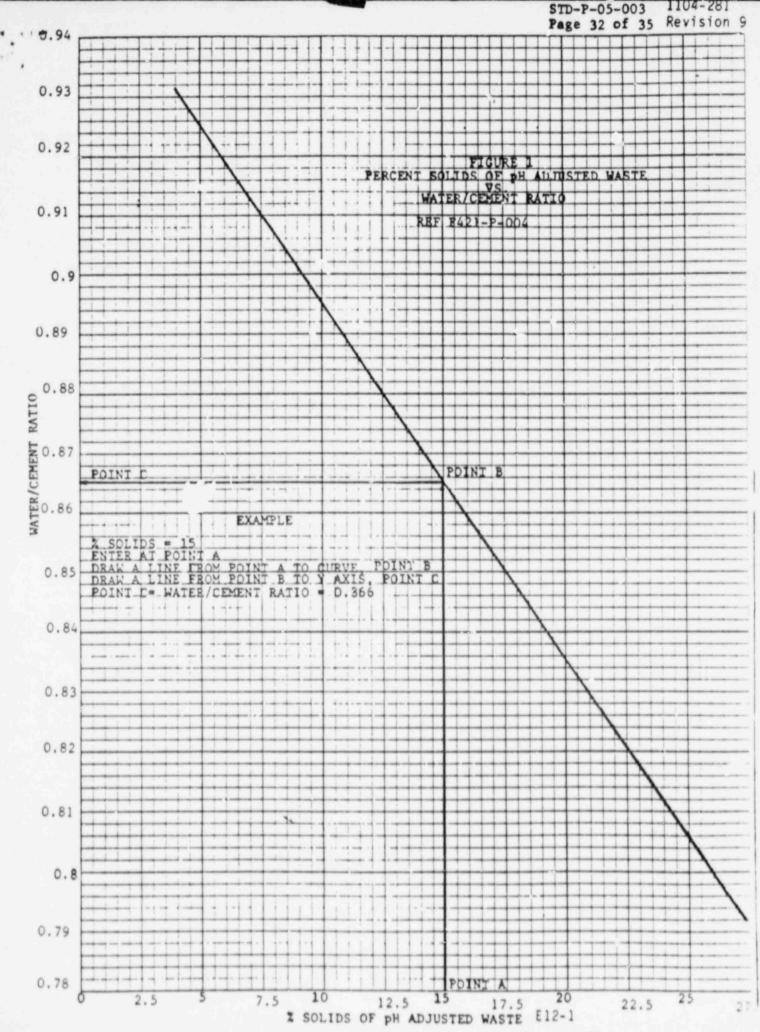
| L   | TMI-1<br>Operating Procedure  |                     | Numbe                          | r<br>1104-28I |
|-----|---|---------------------|--------------------------------|---------------|
| rit | tle   |                     | NAME ADDRESS OF TAXABLE PARTY. | ion No.       |
| -   | Waste Solidification Process Control Program  |                     |                                | 9             |
|     | ATTACHMENT 10 (Cont'd)  |                     |                                | Page 2 of 3   |
|     | SOLIDIFICATION CALCULATION SHEET FOR BEA  | D RESIN             |                                |               |
|     | Quantity of Water:  |                     |                                |               |
|     | (19) x (14) = ( ) x ( ) =   | 1                   | gal                            | (21)          |
|     | Qualitity of Anti-Foam Agent:   |                     |                                |               |
|     | (19) $x$ (15) = () $x$ () =   |                     | gal                            | (22)          |
|     | Quantity of Emulsifier:   |                     |                                |               |
|     | (19) x (16) = ( ) x ( ) =   |                     | gal                            | (23)          |
|     | Quantity of Calcium Hydroxide Ca(OH) <sub>2</sub> :   |                     |                                |               |
|     | (19) x (17) = ( ) x ( ) =<br>(24) $\div$ (100) = ( ) $\div$ 100 =   |                     | 1bs<br>bags2                   | (24)          |
|     | Quantity of Portland Type Cement:   |                     |                                |               |
|     | (19) x (18) = ( ) x ( ) =<br>(25) * (94) = ( ) * 94 =   |                     | 1bs<br>bags2                   | (25)          |
|     | The volume of dewatered bead resin to be solidified can<br>treated waste volume listed on the Class A Stable, Clas<br>Solidification Data Sheet for Bead Resin. | not exce<br>s B and | ed the<br>C Test               | maximum       |
|     | Round up to the nearest whole bag.  |                     |                                |               |
|     | Reduce the quantity of waste in liner by 1 ft <sup>3</sup> for ever<br>anti-foam agent plus emulsifier added to liner.  | y 10 gal            | ions of                        |               |
| Ι.  | INDEPENDENT VERIFICATION BY GPUN MANAGEMENT   |                     |                                |               |
|     | SOLIDIFICATION<br>CALCULATION SHEETS REVIEWED   |                     |                                |               |

| GPU Nucle   | ear             | TMI-<br>Operating F |                | Numbe            | 1104-281      |
|---|-----------------|---------------------|----------------|------------------|---------------|
| Title<br>Waste Solidificatio                                    | n Process Conti | rol Program         |                | Revis            | sion No.<br>8 |
|   | ATTAC           | HMENT 10 (C         | ont'd)         |                  | Page 3 of 3   |
| 1   | SOLIDIFICATION  | DATA TABLES         | FOR BEAD RESIN |                  |               |
|   | HN-100<br>LVMU  | HN-200              | HN-600         | HN-600<br>LVMVGS |               |
| Usable Liner<br>Volume (cu. ft.)                                | 148.8           | 59.4                | 64.0           | 61.7             |               |
| Max. Dewatered<br>Waste Volume (cu. ft.)                        | 120.0           | 47.9                | 51.6           | 49.8             |               |
| Max. Solidified<br>Waste Volume (cu. ft.)                       | 148.8           | 59.4                | 64.1           | 61.7             |               |
| Max. Rad. Level<br>R/hr Contact                                 | 12              | 800                 | 100            | 100              |               |
| Min. Recommended <sup>(1)</sup><br>Waste Vol (ft <sup>3</sup> ) | 106.9           | 46.0                | -              | 47.3             |               |
| Min Solidified <sup>(1)</sup>                                   | 132.6           | 57.0                | -              | 58.6             |               |

(1)

Grout will have to be added to the HN600 MU to increase the solidified waste volume to meet the 15% maximum void space criteria for shipment to Barnwell.

| <b>Nuclear</b>   | TMI-1<br>Operating Procedure     | Number<br>1104-28 |
|--|----------------------------------|-------------------|
| tle  | operating recedent               | Revision No.      |
| WastOlidification Proces                                   | s Control Program                | 7                 |
|  | ATTACHMENT 11                    | Page 1 of         |
| TEST SOLIDIFICAT   | ION USING WESTINGHOUSE - HITTMAN | PROCEDURE         |
| Waste to be Processed:                                     |                                  | <u>_</u>          |
| Westinghouse - Hittman Pro                                 | ocedure No                       |                   |
| Procedure - Title  |                                  |                   |
| Current Revision   |                                  |                   |
| Justification to use this                                  |                                  |                   |
| alternate test procedure:                                  |                                  |                   |
|  |                                  |                   |
|  |                                  |                   |
|  |                                  |                   |
|  |                                  |                   |
| -  |                                  |                   |
|  |                                  |                   |
|  |                                  |                   |
| Liner Type   |                                  |                   |
| Liner Type<br>Waste Class                                  |                                  |                   |
|  |                                  |                   |
| Waste Class  |                                  |                   |
| Waste Class<br>Balance Cal Info.                           |                                  |                   |
| Waste Class<br>Balance Cal Info.<br>CMTE No.               |                                  |                   |
| Waste Class<br>Balance Cal Info.<br>CMTE No.<br>Serial No. |                                  |                   |
| Waste Class<br>Balance Cal Info.<br>CMTE No.<br>Serial No. |                                  |                   |



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H-F