UNREVIEWED DISPOSAL QUESTION EVALUATION: CENTER SLIT TRENCHES ONE THROUGH FIVE OPERATIONAL COVERS REANALYSIS

Frank G. Smith, III
Robert F. Swingle, II

MAY 19, 2011

Savannah River National Laboratory
Savannah River Nuclear Solutions
Aiken, SC 29808

Prepared for the U.S. Department of Energy Under Contract Number DE-AC09-08SR22470

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REVIEWS AND APPROVALS

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D. A. Crowley, Manager, Radiological Performance Assessment Date

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E-Area Facility Approval

W. T. Goldston, Manager, Regulatory Integration Date

M. G. Looper, Solid Waste Engineering Manager Date

D. L. Beeler, Solid Waste Facility Manager Date

LIST OF ACRONYMS

ARRA	**American Recovery and Reinvestment Act**
CA	**Composite Analysis**
DAS	**Disposal Authorization Statement**
ELLWF	**E-Area Low Level Waste Facility**
PA	**Performance Assessment**
SA	**Special Analysis**
SOF	**Sum of Fractions**
SRNL	**Savannah River National Laboratory**
SWM	**Solid Waste Management**
UDQ	**Unreviewed Disposal Question**
UDQE	**Unreviewed Disposal Question Evaluation**
WITS	**Waste Information Tracking System**

EXECUTIVE SUMMARY

Accelerated placement of storm-water runoff covers over Slit Trenches 1 – 5 put the cover timing outside of the range considered in the 2008 SA (Collard and Hamm, 2008) which establishes Slit Trench disposal limits. Results from a recent study (Collard et al., 2011) demonstrate that the actual cover installation in December 2010 produces acceptable Slit Trench performance. Additionally, covering Slit Trench 5 separately from Slit Trenches 6 and 7, which will be operationally closed at a later date, does not adversely affect performance of the operationally closed trenches.

1.0 INTRODUCTION

Operational inventory limits for the disposal of solid low-level waste in Slit Trenches 1 – 7 were established by the Special Analysis (SA) performed by Collard and Hamm (2008). To determine disposal limits for the Slit Trenches, the SA followed the methodology used in the 2008 PA (WSRC, 2008) which assumed that the inventories in each trench were instantaneously placed in 12/1995, which is the date when SLIT1 began operation. The 2008 SA analyzed the impact from placing storm-water runoff covers simultaneously over Slit Trenches 1 – 7 at 5, 10 and 15 years after the inventory was introduced. To include a measure of conservatism in the limits, the lowest of the limits calculated for any storm-water runoff cover placement time or that calculated in the original 2008 PA was chosen as the operational limit for each radionuclide.

Through the availability of funding provided by the American Recovery and Reinvestment Act (ARRA), storm-water runoff covers were placed over Slit Trenches 1 – 5 in December 2010. SRNL was requested to perform a UDQE for this accelerated action (see Attachment 1). Table 1 below lists the operational dates for Slit Trenches 1 – 5 and the time elapsed between when the first waste package was disposed in each Slit Trench and when the storm-water runoff covers were placed.

Table 1 Slit Trench Operating Dates and Time Prior to Cover Placement.

Slit Trench	First Waste Package	Last Waste Package	Time from First Disposal to Cover (years)
1	12/1995	9/2003	15.0
2	9/2001	8/2006	9.2
3	10/2003	1/2010	7.2
4	2/2004	8/2010	6.8
5	5/2004	10/2006	6.6

As shown in Table 1, SLIT1 was covered 15.0 years after the date of the first waste package disposal. SLIT2 was covered 9.2 years after the date of the first waste package disposal in SLIT2 which falls within the window of ± 1.0 year within which the 2008 SA cover time analysis was assumed to be valid (Crowley and Butcher, 2008). Therefore, the analysis of SLIT1 and SLIT2 in the 2008 SA is considered adequate.

However, the cover timings for SLIT3, SLIT4 and SLIT5 are from 2.2 to 1.6 years beyond the nearest cover time of 5 years assumed in the 2008 SA analysis and fall outside of the acceptable one-year margin. Therefore, an additional study was conducted

by Collard et al. (2011) that assessed the impact on Slit Trench performance from a covering date that is between 12/2010 and 9/2011.

2.0 DISCUSSION

2.1 2011 Study Methodology

To better model actual Slit Trench performance, the following changes to the modeling approach used in the 2008 PA (WSRC, 2008) and 2008 SA (Collard and Hamm, 2008) were incorporated into the 2011 study (Collard et al., 2011):

1. Revised installation dates were used for the placement of storm-water runoff covers.
2. Slit Trench 5 was covered separately from Slit Trenches 6 and 7, which will be covered at a later date.
3. Actual final waste inventories were used and the resulting maximum doses at a receptor well 100 m from the E-Area boundary were calculated.
4. Updated K_d values (Kaplan, 2009) were used in the transport calculations.
5. Actual area percentages of non-crushable containers were used in the analysis to determine expected infiltration flows for cases that consider collapse of these containers.
6. Waste was assumed to be disposed in Slit Trench segments, rather than being uniformly distributed over the entire footprint of each Slit Trench.
7. Waste was assumed to be disposed in a Slit Trench segment throughout the time interval when that segment was operational.
8. Analyses of highly mobile radionuclides were extended beyond 130 years to account for the effects of dynamic compaction.

Because of the availability of plume interaction factors from the 2008 PA work for Slit Trenches 1, 2 and 5 as a group (ST125) and for Slit Trenches 3 and 4 as another group (ST34), these two groups of Slit Trenches were analyzed separately in the 2011 study.

2.2 2011 Study Results

Table 2, the upper and middle portions of which have been directly extracted from Table 1-1 in Collard et al. (2011), provides a summary of groundwater pathway dose and concentration results from the 2011 study and a comparison to Waste Information Tracking System (WITS) Sums of Fractions (SOFs). The upper portion of Table 2 lists maximum doses or concentrations found for groundwater exposure to gross alpha, beta-gamma, radium, uranium and groundwater all-pathways found in the 2011 study. The middle part of Table 2 shows a relative performance index for each groundwater exposure pathway obtained by dividing

the maximum dose or concentration calculated in the 2011 study by the allowable value. This measure is equivalent to a maximum Sum of Fraction (SOF) for the dose pathway. The lower part of Table 2 has been added to show the maximum SOF for each dose pathway as determined in the Waste Information Tracking System (WITS). The WITS SOF is based on the limits developed in the 2008 SA.

As shown in Table 2, the gross alpha concentration, beta-gamma dose and groundwater all-pathways dose calculated in the 2011 study fall between 7.5% and 92.0% of the allowable while the radium and uranium concentrations are relatively negligible. The closest approach to a limit for ST125 predicted by the 2011 study is 27.3% for the groundwater all-pathways dose. The closest approach to a limit for ST34 predicted by the 2011 study is 92.0% also for the groundwater all-pathways dose. The results should not be surprising as it is the objective of Solid Waste Management (SWM) to make optimum use of both the volumetric capacity as well as the inventory capacity of all available disposal units. For both Slit Trench sets, the groundwater all-pathways dose is closest to the allowable. For both sets, the maximum groundwater all-pathways dose is largely caused by Np-237 and to a lesser extent by the U-235 chain with smaller contributions from other radionuclide chains. Comparing the middle part of Table 2, which shows results from the 2011 study, to the bottom part, which gives the maximum SOF in WITS (based on the 2008 SA), it is found that, in all cases, the more detailed analysis in the 2011 study reduced the estimated maximum dose. Table 3, copied from Table 1-2 in Collard et al. (2011), shows computed SOFs for non-groundwater pathways. The largest SOF in Table 3 is 4.4% for post-drilling in Slit Trench 5.

Table 2 Summary of maximum doses and concentrations for groundwater exposure pathways.

Dose Pathway	Gross Alpha	Beta-Gamma	Radium	Uranium	Groundwater All-pathways
Allowable	15 pCi/L	4 mrem/yr	5 pCi/L	30 μg/L	25 mrem/yr
Maximum dose or concentration					
ST125	1.13E+00	6.49E-01	1.52E-03	1.68E-09	6.82E+00
ST34	3.95E+00	5.27E-01	9.49E-04	6.07E-09	2.30E+01
Relative Performance Index (ratio of maximum value to allowable)					
ST125	7.53E-02	1.62E-01	3.04E-04	5.60E-11	2.73E-01
ST34	2.63E-01	1.32E-01	1.90E-04	2.02E-10	9.20E-01
WITS Maximum SOF					
ST125	3.89E-01	1.00E+00	8.82E-02	1.67E-09	3.71E-01
ST34	2.78E-01	9.95E-01	1.48E-01	8.16E-10	9.40E-01

Table 3 Non-groundwater sums-of-fractions in Slit Trenches 1-5.

Dose Pathway	Resident	Post-drilling	Air Pathway	Radon Pathway
Allowable	100 mrem/yr	100 mrem/yr	10 mrem/yr	20 pCi/m^2-s
ST1	1.29E-03	2.68E-03	9.11E-06	1.44E-07
ST2	1.34E-02	8.60E-03	2.64E-05	4.71E-09
ST3	2.40E-03	2.43E-02	2.77E-05	3.56E-09
ST4	2.49E-03	1.63E-02	2.79E-05	7.89E-09
ST5	7.21E-03	4.40E-02	1.19E-04	1.96E-08

A key factor in the base case analysis in the 2011 study was the time assumed for placement of the storm-water runoff covers. This was set to 9/30/2011 (i.e., the end of FY11 when it was assumed that the covers would definitely be in place). When it became clear that the covers would be in place by the end of calendar year 2010, a sensitivity analyses was performed which showed that this shift of nine months in the timing of the cover placement had only a minor impact on Slit Trench performance. Therefore, the 2011 study concluded that placing storm-water runoff covers over Slit Trenches 1 – 5 in 12/2010 provides acceptable performance.

3.0 EVALUATION

1.a. Is the proposed activity or new information outside the bounds of the approved PA/CA (e.g., does the proposed activity or new information involve a change to the basic disposal concept as described in the PA/CA such as critical inputs/assumptions or an increase in inventory analyzed in the CA)?

No. Analysis of the new information (i.e., placement of Slit Trench operational covers at a different time than originally analyzed and covering Slit Trench 5 separately from Slit Trenches 6 and 7), indicates that the basic disposal concept as described in the current PA/CA and applicable SA (Collard and Hamm, 2008) and closure plan will not need to be changed. In fact, a new study (Collard et al., 2010), indicates that actual doses from this waste would be lower than previously indicated and that there is a larger margin with respect to the performance measures.

1.b. Would the proposed activity if implemented, or does the new information result in the PA/CA performance measures being exceeded?

No. As demonstrated above the new information does not result in PA/CA performance measures being exceeded. As shown in Table 2 and Table 3, no performance measures are exceeded. In fact the study indicates that with improvement in the analyses (e.g., use of as-disposed inventories and amounts of non-crushable waste, and actual timing of placement of the new operational covers) increases the margin of the waste doses from the performance measures.

1.c. Would the radionuclide disposal limits in the approved PA need to be changed to implement the proposed activity?

No. As demonstrated in this evaluation, when comparing the as-disposed inventories against the limits given in WSRC, 2008 and Collard and Hamm, 2008, the doses from the waste remain within the performance measures. Collard et al., 2010, shows that a more rigorous analysis actually increases the margin of doses from the performance measures. Therefore the current limits as provided in WSRC, 2008 and Collard and Hamm (2008), do not need to be changed.

1.d. Does the new information result in a change in the radionuclide disposal limits in the approved PA?

No. The new operational cover installation timing information will not result in a change in the radionuclide limits in the approved PA/SA. The previous limits do not result in exceedance of the performance measures and are demonstrated to be conservative herein.

1.e. Would the proposed activity if implemented, or does the new information result in a change to the DAS?

No. Since this evaluation demonstrates that the new information shows an even greater margin from regulatory performance measures for dose and radionuclide concentration, there is no need to revise limits as previously given by the approved PA and its subsequent SA. Therefore since the approved PA has be demonstrated to be acceptable, the applicable DAS based on the PA, is also acceptable.

4.0 CONCLUSION

Accelerated placement of storm-water runoff covers over Slit Trenches 1 – 5 put the cover timing outside of the range considered in the 2008 SA (Collard and Hamm, 2008) which establishes Slit Trench disposal limits. Results from a recent study (Collard et al., 2011) demonstrate that the actual cover installation in December 2010 produces acceptable Slit Trench performance. Additionally, covering Slit Trench 5 separately from Slit Trenches 6 and 7, which will be operationally closed at a later date, does not adversely affect performance of the operationally closed trenches.

5.0 KEY INPUTS AND ASSUMPTIONS

The following key inputs and assumptions for this Slit Trenches 1 through 5 study supplement all other key inputs and assumptions presented in the 2008 PA (WSRC, 2008), the 2008 SA (Collard and Hamm, 2008), 2010 study (Collard et al., 2011), and the Closure Plan (Phifer et al., 2009):

1. **Assumption: A continuous operational cover is placed over SLIT1, SLIT2, SLIT3, and SLIT4 within the time period from December 1, 2010 to September 30, 2011.**

   The base case performance calculations are based on operational covers becoming operative on September 30, 2011. This cover was assumed to extend over SLIT1, SLIT2, SLIT3, and SLIT4. A sensitivity study was performed to address the impact of this cover being placed at an earlier date. The earlier placement of the operational cover impacts only certain mobile species in a negative way – by delaying much of their release until subsidence occurs. The placement of the operational cover as early as January 1, 2011 was modeled. Negative impacts to the performance measures would fall within performance measures and objectives. Placement of the operational cover for a period of up to one month before the analysis time (i.e., up to December 1, 2010) will also produce acceptable results.

2. **Assumption: A continuous operational cover is placed over SLIT5 within the time period from December 1, 2010 to September 30, 2011.**

   The base case performance calculations are based on an operational cover becoming operative on September 30, 2011. This cover is assumed to extend over SLIT5 only. A sensitivity study was performed to address the impact of this cover being in-place or partially functioning at an earlier date. The earlier placement of the operational cover impacts only certain mobile species in a negative way. The placement of the operational cover as early as January 1, 2011 was modeled. Negative impacts to the performance measures would fall within performance guidelines. Placement of the operational cover for a period of up to one month before the analysis time (i.e., up to December 1, 2010) will also produce acceptable results.

3. **Assumption: The hydraulic performance of the operational and interim covers is maintained throughout their lifetimes.**

   This evaluation assumes that the operational covers, interim covers and supporting drainage structures are maintained throughout their lifetimes such that the infiltration rate through these covers is a constant value (i.e., local failures are repaired in a timely manner). A constant infiltration rate of 40 cm/yr is assumed for uncovered surfaces. A constant infiltration rate of 0.9144 cm/yr (0.36 in/yr) is assumed for the operational and interim covers. A timely manner implies that the hydraulic character of the covers is brought back to the above specifications within two to three months and negative impacts are minimized during that period to the degree possible.

4. **Assumption: Dynamic compaction will not be performed over SLIT3-Unit F containing the ETF activated carbon vessels and the portion of SLIT2-Unit 1 containing M-Area Glass (as per Phifer, et al. 2009).**

   Waste designated as Effluent Treatment Facility (ETF) special waste includes tritium (H-3) and I-129 adsorbed on activated carbon filters which are contained

in sealed stainless steel containers. A structural analysis (Estochen, 2010) predicts that these containers will not become hydraulically active for 133 years and will not collapse until after 3125 (the end of the analysis period). The ETF waste forms were analyzed by assuming the containers remain impervious to water penetration for 133 years and structurally intact for the 1130 year duration of the calculation. For the portion of SLIT2-Unit1 containing M-Area Glass, dynamic compaction could potentially crack the glass waste form leading to a significant increase in surface area thus increasing mass transfer releases. This assumption is copied from the 2009 Closure Plan (Phifer et al., 2009).

5. **Assumption: Drainage systems designed to carry away runoff from operational, interim, and final covers remove essentially all runoff.**

   It is assumed that the excess rainfall that does not penetrate through the covers is completely removed from the hydraulic system. Here drainage systems are assumed to carry all runoff a sufficient distance from the disposal units being considered such that its contribution to local Vadose Zone recharge is negligible. The "drainage" systems for the operational and interim covers are also assumed to operate as designed and to be maintained such that the above assumption is valid throughout the life of these covers up to the end of institutional controls (i.e., calendar year 2125). For the final cover it is assumed that the hydraulic aspects of the as designed "drainage" systems are met.

6.0 REFERENCES

(Collard and Hamm, 2008) L. B. Collard. and L.L. Hamm "Special Analysis of Operational Storm-water Runoff Covers Over Slit Trenches," SRNL-STI-2008-00397, Rev. 0, December 2008.

(Collard et al., 2011) L. B. Collard, L.L. Hamm, and F.G. Smith, "Study for the Dose Assessment of the Final Inventories in Center Slit Trenches One Through Five," SRNL-STI-2010-00760, Rev. 0, April 2011.

(Crowley and Butcher, 2008) D. A. Crowley and Butcher, B. T., 2008, SRNL Memorandum, "Transmittal of Slit Trench Operational Storm-water Runoff Covers Special Analysis and Additional Considerations, SRNL-L3500-2008-0003, December 18, 2008.

(Estochen, 2010) E. G. Estochen, "ETF Carbon Vessel Post Burial Failure Assessment (U)," M-CLC-E-00046 (Revision 0), Savannah River Nuclear Solutions, March 2010.

(Kaplan, 2009) D. I. Kaplan, "Geochemical Data Package for Performance Assessment Calculations Related to the Savannah River Site (U)," SRNL-STI-2009-00473, Rev. 0, March 15, 2010.

(Phifer et al., 2009) M. A. Phifer, K. P. Crapse, M. Millings and M. G. Serrato, "Closure Plan For The E-Area Low-Level Waste Facility," SRNL-RP-2009-00075, Revision 0.

(SRNS, 2010) *Savannah River Site DOE 435.1 Composite Analysis*, SRNL-STI-2009-00512, Revision 0, Savannah River Nuclear Solutions, LLC, Aiken, SC, 29808, June 10, 2010.

(SRNS, 2011) *Unreviewed Disposal Question (U),* SW-ENG-0601, Revision 7, Savannah River Nuclear Services, LLC, Aiken, SC, 29808, January 27, 2011.

(WSRC, 2008) "E-Area Low Level Waste Facility DOE 435.1 Performance Assessment," WSRC-STI-2007-00306, Revision 0, Washington Savannah River Company, LLC, Aiken, SC, March 2008.

ATTACHMENT 1
UDQ Screening

Unreviewed Disposal Question (U)	Procedure:	SW-ENG-0601
	Revision:	6
	Page:	8 of 13

ATTACHMENT 1 Page 1 of 2

UNREVIEWED DISPOSAL QUESTION (UDQ) SCREENING CRITERIA

Proposed Activity: See attached Sheet

REVIEW the following questions against the Proposed Activity:

1. **Yes** ☐ **No** ☒ **N/A** ☐

   Does the proposed disposal activity or new information involve a change to the disposal facility from what has been previously described or analyzed in the most recent Performance Assessment, Composite Analysis, approved Special Analyses, or approved UDQ Evaluations?

2. **Yes** ☒ **No** ☐ **N/A** ☐

   Does the proposed disposal activity or new information involve a change to the disposal process or procedures from what has been previously described or analyzed in the most recent Performance Assessment, Composite Analysis, approved Special Analyses, or approved UDQ Evaluations?

3. **Yes** ☐ **No** ☒ **N/A** ☐

   Does the proposed disposal activity or new information involve a change to the radionuclide disposal limits from what has been previously described or analyzed in the most recent Performance Assessment, Composite Analysis, approved Special Analyses, or approved UDQ Evaluations?

4. **Yes** ☐ **No** ☒ **N/A** ☐

   Does the proposed disposal activity or new information involve a change to the Waste Acceptance Criteria from what has been previously described or analyzed in the most recent Performance Assessment, Composite Analysis, approved Special Analyses, or approved UDQ Evaluations?

5. **Yes** ☐ **No** ☒ **N/A** ☐

   Does the proposed disposal activity or new information involve a change to what has been previously described or analyzed in the PA Inputs and Assumptions (I&A) Database?

ATTACHMENT 1 Page 2 of 2

UNREVIEWED DISPOSAL QUESTION (UDQ) SCREENING CRITERIA

6. **Yes** ☒ **No** ☐ **N/A** ☐

Does the proposed disposal activity or new information involve a change to the facility closure design or criteria from what has been previously described or analyzed in the most recent Performance Assessment, Composite Analysis, approved Special Analyses, approved UDQ Evaluations or associated Closure Plan?

7. **Yes** ☐ **No** ☒ **N/A** ☐

Does the proposed disposal activity or new information involve a test or experiment not described or analyzed in the most recent Performance Assessment, Composite Analysis, approved Special Analyses, approved UDQ Evaluations or associated Closure Plan?

8. **Yes** ☐ **No** ☒ **N/A** ☐

Does the proposed disposal activity or new information involve any analytical errors, omissions or deficiencies in the most recent Performance Assessment, Composite Analysis, approved Special Analyses, approved UDQ Evaluations or associated Closure Plan?

If all questions above are answered "No" or "N/A" (defined by a ✔ in the box provided), then implement Proposed Activity in Performance Assessment space. If any of the questions above answered "Yes" (defined by a ✔ in the box provided), then forward to SRNL for development of an UDQ Evaluation or Special Analysis.

Provide Explanation / Justification for all "Yes" answers:

See Attached Sheet

Is a UDQ Evaluation or Special Analysis required? **Yes** ☒ **No** ☐

SRR	Shawn R. Reed	12/8/10
Originator Signature	Name	Date
DJS	DFSimc	12/8/10
Reviewer Signature	Name	Date

The current Special Analysis for slit trench covers (see ref. below) does not have accurate assumptions regarding covering of Slit Trenches 1 – 4 and 5.
Ref. SRNL-STI-2008-00397, Rev. 0, Special Analysis of Operational Stormwater Runoff Covers Over Slit Trenches.

The reference assumes waste is disposed and receives bounding water infiltration up to the point that a cover is installed which reduces water infiltration to a minimum level. The duration from start of trench filling to covering was assumed to be 5, 10 and 15 years in the reference above. Additionally, the reference assumes that Slit Trench 5 is covered with Slit Trenches 6 and 7 under a common cover in reality Slit Trench 5 is being covered separately with Slit Trenches 6 and 7 to be covered in the out years. Therefore, these assumptions do not match the actual cover installation times and configuration for Slit Trench 5.

The expected durations from start of waste disposal to planned covering of Slit Trenches 1 – 4 and 5 are shown below. These covers are being installed through ARRA funding and under this funding these covers need to be in place by the end of September 2011.

Slit Trench 1	15.8 years	Disposal Start – 12/95	Cover Complete – 9/11
Slit Trench 2	10.0 years	Disposal Start – 9/01	Cover Complete – 9/11
Slit Trench 3	8.0 years	Disposal Start – 10/03	Cover Complete – 9/11
Slit Trench 4	7.5 years	Disposal Start – 2/04	Cover Complete – 9/11
Slit Trench 5	7.3 years	Disposal Start – 5/04	Cover Complete – 9/11

The new Special Analysis needs to assume actual durations above and covering configurations (i.e. Slit Trench 5 is covered by itself and not with Slit Trenches 6 and 7)

SRS {In Archive} Re: Need Info
William Knopf to: Shawn Reed 03/26/2009 02:34 PM

History: This message has been forwarded.
Archive: This message is being viewed in an archive.

See below. Let me know if you need anything else on this.

----- Forwarded by William Knopf/SRNS/Srs on 03/26/2009 02:32 PM -----

SRS William Knopf
12/08/2008 09:25 AM

To: Shawn Reed/SRNS/Srs@Srs
cc:
Subject: Re: Need First Waste Placement Dates

SLIT8 - 2/6/07

----- Forwarded by William Knopf/SRNS/Srs on 12/08/2008 09:21 AM -----

Don Sink
09/18/2006 08:47 AM

To: Elmer Wilhite/SRNL/Srs@Srs
cc: Glenn Taylor/SRNL/Srs@Srs, Gregory Flach/SRNL/Srs@Srs, Jim Cook/SRNL/Srs@Srs, Kevin Tempel/WSRC/Srs@Srs, Leonard Collard/SRNL/Srs@Srs, Luther Hamm/SRNL/Srs@Srs, Mark Phifer/SRNL/Srs@Srs, Robert Hiergesell/SRNL/Srs@Srs, Shawn Reed/WSRC/Srs@Srs, Sonny Goldston/WSRC/Srs@Srs, Tom Butcher/SRNL/Srs@Srs, William Knopf/WSRC/Srs@Srs
Subject: Start Dates for LLW Facilities

As you requested, please find below the start date for each LLW facility in E Area. In most cases, the data is available in WITS. However, in some cases (pre-1997), we can to query some SW personnel on their recollection.

EAV Facility - Start Date

LAW Vault - 9/1995
IL Vault - 9/1995
Engineered Trench # 1 - 2/2001
Engineered Trench # 2 - 6/2004
Slit Trench # 1 - 12/1995
Slit Trench # 2 - 9/2001
Slit Trench # 3 - 10/2003
Slit Trench # 4 - 2/2004
Slit Trench # 5 - 5/2004
Slit Trench # 6 - 4/2006
Slit Trench # 7 - 6/2006
NR 643-73 - 1/1987
NR 643-26E - 9/1995
CIG Trench # 1 - 8/2000

Shawn Reed/SRNS/Srs

Distribution:

S. E. Aleman, 735-A
P. M. Almond, 773-43A
A. B. Barnes, 999-W
D. L Beeler, 704-60E
B. T. Butcher, 773-43A
L. B. Collard, 773-43A
D. A. Crowley, 773-43A
S. D. Fink, 773-A
G. P. Flach, 773-42A
B. J. Giddings, 786-5A
W. T. Goldston, 705-3C
J. C. Griffin, 773-A
L. L. Hamm, 773-42A
S. J. Hensel, 773-42A
C. C. Herman, 999-W
R. A. Hiergesell, 773-43A
J. M. Jordan, 703-41A
D. I. Kaplan, 773-43A
D. Li, 999-W
M. G. Looper, 704-36E
S. L. Marra, 773-A
A. M. Murray, 773-A
F. M. Pennebaker, 773-42A
M. A. Phifer, 773-42A
S. R. Reed, 704-56E
K. A. Roberts, 773-43A
R. R. Seitz, 773-43A
D. F. Sink, 704-56E
F. G. Smith, III 773-42A
R. F. Swingle, II 773-43A
G. A. Taylor, 773-43A
K. L. Tempel, 704-56E
T. Whiteside, 773-42A
W. R. Wilmarth, 773-A
C. Wilson (1 file copy & 1 electronic copy), 773-43A - Rm.213