WPO 35552

REVISED INFORMAL MEMO

To: Joe Harvill, CTAC March 20, 1996

From: Paul Drez, PE CTAC

Subject: FINAL PRELIMINARY ESTIMATE OF COMPLEXING AGENTS IN TRU SOLIDIFIED WASTE FORMS SCHEDULED FOR DISPOSAL IN WIPP

PRELIMINARY FINAL

SUMMARY

This memo provides the best estimate of complexing agents, based on transuranic (TRU) waste generator/storage site input, in TRU waste expected to be shipped to the Waste Isolation Pilot Plant (WIPP) for disposal. The complexing agent inventories quoted in this memo are in response to a Sandia National Laboratory/New Mexico (SNL/NM) request for information to the U. S. Department of Energy (DOE) Carlsbad Area Office (CAO). The memo requesting the complexing agent information is contained in Appendix B of Revision 2 of the Transuranic Waste Baseline Inventory Report (TWBIR)(DOE, 1995). All waste inventory volumes quoted are derived from Rev. 2 of the TWBIR.

SNL/NM should use Table 3 as a summary of specific complexing agents that may be present in the TRU waste. Tables 1 and 2 provides a summary of Total Organic Carbon in the remote-handled (RH)-TRU sludges from Oak Ridge National Laboratory (ORNL) and a list of possible complexing agents that may contribute to the TOC in the sludges.

Estimates are provided in Table 4 of the volume of stored and projected TRU waste that contribute to the estimate of complexing agents in the waste. For contact handled (CH)-TRU waste, greater than 94% of TRU stored and projected final waste forms contribute to the complexing agent estimate and greater than 98% of the Solidified Organic final waste forms and greater than 92% of the Solidified Inorganic final waste forms. For RH-TRU waste, greater than 86% of TRU stored and projected final waste forms contribute to the complexing agent estimate and 100% of the Solidified Organic final waste forms and 100% of the Solidified Inorganic final waste forms.

FINAL

BACKGROUND

Information has been received from all sites that were requested to provide data on potential complexing agents in their solidified waste forms: Rocky Flats Environmental Technology Site (RFETS), Los Alamos National Laboratory (LANL) and ORNL. In addition, several TRU waste sites which do not generate solidified waste forms (or small quantities) have also responded. A copy of the CAO memo requesting the complexing agent information is included as Attachment 1.

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SWCF-A: 1.2.07.2.1; PA; TBUR

The term "complexing agent" is being used in lieu of "chelating agents" in this memo, since chelating agents usually have a certain structure (chelating comes from the Greek work "chele" for claw, as in a crab), and are considered a subset of complexing agents. That is, acetate ion will "complex" with some metals and increase their solubility but does not have the structure that would label it as a chelating agent. A "commonly" known chelating agent is EDTA (ethylenediaminetetraacetic acid), which contains functional (acetate) anion groups arrange in parallel which resemble a "claw" like structure for complexing the cations. EDTA has two "claw" structures at either end of the molecule.

The original scope of this task was to ask the TRU waste generator/storage sites about "aqueous-soluble" complexing agents in their solidified waste forms. As this task was researched, the authors realized that the term "aqueous-soluble" is only a relative term, since everything is "aqueous-soluble" at some concentration level. Therefore, every potential chemical compound that has been reported from the TRU waste sites is included and the task of selecting aqueous soluble compounds is left to the SNL personnel in charge of performance assessment calculations.

TRU WASTE SITE RESPONSES

ORNL

ORNL has provided a list of organic compounds which contain some aqueous-soluble compounds that are apparent complexing agents. A copy of the list of all compounds reported by ORNL to the BIR team is attached for completeness (Table 1). The list in Table 1 is from an ORNL report on low-level waste (Kaiser, 1988), but the same compounds are anticipated to occur in the TRU waste based on process history (but not necessarily at the same concentrations). ORNL cannot quantify these compounds in their RH-TRU solidified wastes, but have provided an estimate of Total Organic Carbon (TOC) for each RH-TRU waste tank (Table 2). The sum of the TOC from all the RH-TRU tanks is approximately 3691 kg. It is anticipated that most of the TOC in the tanks is not associated with complexing agents, but that has not been verified at this time. As a conservatism, SNL/NM can assume that any complexing agents listed in Table 1 could form the bulk of the TOC in the ORNL RH-TRU tanks.

LANL

Los Alamos National Laboratory has provided estimates of four complexing agents that are anticipated to occur in their TRU solidified waste streams and as materials used in decontamination and spill clean-up operations (that would occur with the debris wastes) (Attachment 2). The quantities of these compounds are summarized in Table 3.

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RFETS/INEL

The information provided by RFETS has been used to estimate the amount of complexing agents in the RFETS retrievable waste (post 1970) at Idaho National Engineering Laboratory (INEL). Attached is a listing of chemicals from RFETS that was provided to the BIR team as a basis for potential complexing agents in TRU waste scheduled for shipment to and disposal in WIPP (Table 3). This same list was originally put together as part of the documentation requested by the State of Nevada to document that less than 1% "complexing" agents occur in RFETS solidified low-level "saltcrete" waste that would be shipped to NTS for disposal (Attachment 3).

The list was provided as a yearly estimate of complexing agents used on site at RFETS. It is conservative to assume that all of these complexing agents would reside in the TRU waste. The inventory of complexing agents is the best estimate for all TRU waste generated across the entire RFETS site, which includes debris wastes. The mass of complexing agents reported in Table 3 for RFETS results from multiply the yearly estimates (in kilograms) by 20 years of production at RFETS (1970-1989), which includes RFETS waste in storage at INEL. The yearly estimates can be found in Attachment 3.

SRS

The Savannah River Site (SRS) has provided a letter in response to the DOE CAO request (Attachment 1) which is included as Attachment 4. SRS has provided information on three complexing agents used on site in connection with their operations, tributyl phosphate (TBP), tri-octyl phosphine oxide (TOPO) and tri-iso octylamine (TIOA). As discussed in the SRS letter, none of these compounds are expected to be found in SRS TRU waste.

Hanford

Hanford Operations has provided a listing from their database of potential chemicals in their TRU waste. The only chemical that appears on the list that might act as a chelating agent in aqueous solutions and has a reportable quantity associated with the waste is tributly phosphate (TBP). TBP is reported under three different spellings with a total of 92.5 kg. This value is summarized in Table 3. The entire list of chemicals reported by Hanford and quantities (in kg) are included in Attachment 5.

LLNL

Lawrence Livermore National Laboratory submitted the letter included as Attachment 6 documenting that no chelating agents occur in the LLNL TRU waste streams.

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ESTIMATED VOLUME OF TRU WASTE INCLUDED IN COMPLEXING AGENT MEMO

Table 4 contains a listing of the total TRU waste destined for disposal in WIPP (stored plus projected to 2022), listed in Column 2. Column 3 estimates what volume of waste from each major site that has contributed to the estimate of complexing agents in TRU waste. Columns 4 and 5 provide the same data for Solidified Organics and Solidified Inorganics final waste forms. The two rows labelled "PERCENTAGE" provide an estimate of the percentage of waste that TRU waste generator/storage sites have provided data for estimating complexing agents in the waste.

REFERENCES

Kaiser, L. L., 1988, "ORNL Inactive Waste Tanks Sampling and Analysis Plan," ORNL/RAP/LTR-88/24, April 29, 1988, Oak Ridge National Laboratory, Oak Ridge, Tennessee

U. S. Department of Energy, 1995, "Transuranic Waste Baseline Inventory Report (Revision 2)," DOE/CAO-95-1121, December 1995, Carlsbad, New Mexico

cc: R. Bisping, DOE/CAO
M. Chu, SNL/NM
L. Storz, SNL/NM
L. Sanchez, SNL/NM

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Table 1 Organic chemicals used regularly in the TPP (7920) and TURF (7930) and subsequently discharged to the ORNL LLLW system

Chemical	Approximate annual usage
Acetic acid	m[a]
Acetone	100 L
Adogen-364-HP (tri-n-triluarylamine)	100 L
Carbon tetrachloride	m
Deodorized mineral spirits (Amsco)	1000 L
2,5-di-tert-butylhydroquinone (DBHQ)	m
Deithylbenzene (DEB)	800 L
Diethylenetriaminepentaacetic acid (DPTA)	m
Di(2-ethylhexyl) phosphoric acid (HDEHP)	200 L
Di-isopropylbenzene (DIPB)	100 L
Ethanol	100 L
Ether	m
Ethylenediaminetetraacetic acid (EDTA)	m
2-ethyl-1-hexanol	m
α-hydroxyisobutyric acid (AHIB)	m
Isopropanol	m
Methanol	m
n-dodecane	m
n-paraffin (NPH)	m
Oxalic acid	m
Thenoyltrifluoroacetone (TTA)	m
Tributylphosphate (TBP)	m
Trichloroethylene (TCE)	m
Xylene	m

[a]m = minimal usage: ≤10 kg/year or ≤L/year.

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TABLE 2. ORNL TOTAL ORGANIC CARBON ESTIMATES

TRU TANKS	TANK NO.	VOLUME (m3)	MASS (kg)	TOC (mg/kg)	TOC (kg)
INACTIVE TANKS					
North Tank Farm	W-03	5.3	5670	5300	30.05
	W-04	18.2	24527	200	4.91
South Tank Farm	W-07	37.5	45715	1300	59.43
	W-08	11.4	14080	8400	118.27
	W-09	0.8	833	2900	2.42
	W-10	28	31650	4900	155.09
Old Hydrofracture Facility	T-01	3	4845	18600	90.12
	T-02	4.6	7328	28000	205.18
	T-03	7.7	14829	9140	135.54
	T-04	5	6242	4620	28.84
	T-09	1.9	2967	7620	22.61
ACTIVE TANKS					
Evaporator Facility	C-2	45.6	63353	3281	209.50
	W-21	27.5	38524	6480	249.64
	W-22	43.5	60939	22.1	1.35
	W-23	64.2	89818	4120	370.05
MVST	W-24	52	72861	2940	214.21
	W-25	90.7	126911	2330	295.70
	W-26	59.2	82930	6220	515.82
	W-27	69.1	96707	3135	303.18
	W-28	16.5	23051	2500	57.63
	W-29	46.4	64913	3534	229.21
	W-30	46	64383	3532	227.34
	W-31	26.3	36828	4470	164.62
				Total TOC	3690.69

Paul E. Drez

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TABLE 3. RF/INEL AND LANL COMPLEXING CHEMICALS ESTIMATE

POTENTIAL COMPLEXING AGENTS IN ROCKY FLATS (INCLUDING STORED AT INEL), LANL, HANFORD TRU WASTE				
COMPOUND	RF MASS (kg)(1)	LANL MASS (kg)(2)	HANFORD MASS (kg)(3)	TOTAL MASS (kg)
Ascorbic Acid	90	7		97
Acetic Acid	132	10		142
Sodium Acetate	1110			1110
Citric Acid	90	1100.5		1190.5
Sodium Citrate	400			400
Oxalic Acid	90	13706		13796
EDTA				23
8-Hydroxyquinoline	46			46
Tributly Phosphate	74		92.5	166.5
1,10 Phenanthroline	0.24			0.24
Dihexyl-n,n-diethylcarbamoyl-methylphosphonate	72			72

(1) Letter from W.F. Weston to E.S. Goldberg, No. 89-RF-3055, dated September 1, 1989 (Attachment 3)
(2) Memorandum from C.L. Foxx to P. Drez dated March 12, 1996 (Attachment 2)
(3) Memorandum from F.M. Coony and M.R. Kems to L.C. Sanchez thru S. Stoll, dated January 25, 1996 (Attachment 5)

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TABLE 4. CALCULATION OF AMOUNT OF WASTE COVERED IN COMPLEXING AGENT MEMO

Major Sites	Total TRU (m3)	Accounted For In Complexing Agent Estimate (m3)	Solidif. Org (m3)	Solidif. Inorg. (m3)		
CH-TRU(1)						
RL (9)	45515.43	45515.43	0	23.39		
INEL(2)	28606.74	25657.4	789.67	3349.6		
LLNL(3)	941.13	941.13	0	20.18		
LANL (4)	18405.15	18405.15	30.58	6922.02		
NTS (5)	627.91	627.91	0	5.67		
ORNL (6)	1560.42	0	0	0		
RFETS (7)	5107.92	5107.92	140.93	1423.01		
SRS (8)	9648.15	9648.15	0	1369.8		
Total Major Sites	110112.85	105903.09	961.18	13113.67		
Total CH-TRU	111721.43	111721.43	980	14108.51		
PERCENTAGE (10)		94.79%	98.08%	92.95%		
RH-TRU(1)						
RL (9)	21729.35	21729.35	0	0		
INEL (2)	220.72	196.98	3.56	65.27		
LANL (4)	193.13	1.93E+02	0	0		
ORNL (6)	2915.64	1243.33	0	1243.33		
Total Major Sites	25058.84	23362.79	3.56	1308.6		
Total RH-TRU	26930.88	26930.88	3.56	1308.6		
PERCENTAGE (10)		86.75%	100.00%	100.00%		
(1) Table 4-3 to 4-23, Rev. 2 TWBIR						
(2) Non RFETS Waste Subtracted						
(3) Letter from K. Hainebach to J. Teak dated March 7, 1996 (Attachment 6)						
(4) Memorandum from C.L. Foxx to P. Drez dated March 12, 1996 (Attachment 2)						
(5) NTS waste is derived from LLNL only, see (4)						
(6) ORNL was only asked to estimate complexing agents in solidified RH-TRU waste per DOE memorandum dated January 5, 1996 (Attachment 1)						
(7) Letter from W.F. Weston to E.S. Goldberg, Letter No. 89-RF-3055, dated September 1, 1989 (Attachment 3)						
(8) Letter from J. D'Amelio to J. Teak, SWE-SWE-96-0106, dated February 28, 1996 (Attachment 4)						
(9) Memorandum from F.M. Coony and M.R. Kerns to L.C. Sanchez thru S. Lott, dated January 25, 1996 (Attachment 5)						
(10) VOLUME PERCENTAGE OF TOTAL TRU WASTE, SOLIDIFIED ORGANICS AND SOLIDIFIED INORGANICS ACCOUNTED FOR IN COMPLEXING AGENT MEMO						

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ATTACHMENT 1

United States Government

Department of Energy

memorandum

Carlsbad Area Office
Carlsbad, New Mexico 88221

DATE: JAN 5 1996

REPLY TO ATTN OF: CAO:NTP:RLB 96-0605

SUBJECT: Additional Transuranic (TRU) Waste Data Request for Sandia National Laboratories' Waste Isolation Pilot Plan (WIPP) Performance Assessment

TO: Distribution

We have been informed by representatives from Sandia National Laboratories (SNL) working on WIPP Performance Assessment (PA) that they require more information on certain TRU waste-related parameters in order to assess their influence on WIPP PA (see attached copy of relevant pages form SNL memo).

Data for most of these parameters have already been received from the sites either through responses to the Baseline Inventory Report (BIR), Revision 2, questionnaire or by discussions with site representatives. However, since the request from SNL for data on water soluble organic ligands (i.e., chelating agents) was not received in time for inclusion in the BIR Rev. 2 data call, WIPP PA still needs data for this parameter. As per the SNL memo, the data are needed by the end of February 1996, and therefore it is being addressed through this request separately from the upcoming BIR Rev. 3 data call.

As documented in the SNL memo, WIPP PA would like to have "best estimates" that are realistic and not overly conservative. Consequently, all sites that have existing data on chelating agents present in their waste are requested to submit the best available information to the BIR technical staff by February 26, 1996. The details on the nature of the information being requested by WIPP PA are being provided in Table 3 of the attachment.

A representative from SNL WIPP PA will be available at the upcoming BIR, Revision 3, Data Call Meeting to be held in Concord, California, on January 10, 1996. We anticipate that a brief presentation will be made at this meeting by WIPP PA staff explaining the importance of the data followed by any questions from site representatives. If you have any questions/clarifications regarding this matter, please be ready to discuss these at the upcoming meeting in Concord with the SNL WIPP PA representative.

Thank you for your continued cooperation.

Russ Bisping

Russ Bisping
Waste Certification Manager

Attachment

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DOE/CAO-95-1121
December 1995

B) **Special Request Non-PA Items**

Also wanted at this time is additional information for several waste material characteristics. Although these characteristics have not been identified as waste material parameters to be used for WIPP PA, they are needed for non-PA scoping calculations to assess their influence on PA. Since these items are not currently PA parameters, inventory estimates of these characteristics as "additional information" in the TWBIR or supplied outside of the TWBIR via written correspondence. Below you will find an itemized list of these special request items.

1) **Non-radioactive Materials**

Additional information is needed on the five waste material characteristics (see Table 2): 1) vitrified wastes, 2) nitrates (NO_3^-), 3) sulfates (SO_4^{2-}), 4) phosphorus, and 5) cement. Of these waste parameters, the last four are needed for the gas generation modeling. The nitrates and the sulfates are involved in the denitrification and sulfate reduction processes which breakup the cellulosics, while the phosphorus is a nutrient for biodecay of cellulosics. The estimate of the mass quantities of cement in the waste inventory should include both the cement that is contained in the waste as cement itself (due to D&D activities, etc.,) and the cement found in various sludges. Cement consumes CO_2 due to its content of $Ca(OH)_2$. The estimates for this non-radioactive waste constituent need only be "best estimates" at this present time so that non-PA scoping calculations can be made to determine their importance on overall repository performance. (Do not generate upper-bound estimates that are overly conservative.)

2) **Residues**

"Best estimates" are needed for residues, in addition to those already identified at the Rocky Flats Plant (RFP), that have the possibility of being changed from a resource category to a TRU waste category.

3) **Organic Ligands (Chelating Agents)**

"Best estimates", from currently available information, are needed for major water-soluble organic ligands which are under consideration for the actinide source term (see Table 3). If it is not possible to obtain data from major waste generating sites then supply guidance on how a first-order estimate may be made (from existing information such as process knowledge etc.,) so that non-PA scoping calculations can be performed to ideatify if the presence of these ligands would have any significant impacts. (Do not generate estimates that are overly conservative.) Requested data is for final form "process-level" quantities used in production only for the key sites. If information on the "process-level" values does not exist at the key sites, then "laboratory-scale" values should be used in the requested assessment of the inventory. Should it be determined that more detailed information on organic ligands will be needed, you will be given a specific written request at a future time. This effort should be performed in parallel with the TWBIR. Technical data should be supplied in memorandum form by the end of February 1996 with supporting documentation by the end of March 1996.

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Table 3. Justification of Special Request For Info On Organic Complexing Agents. (a)

Ligand (b)	Discussion (c)
1) Total Complexants	The most valuable information at this time is a "best estimate" of the total amount of water soluble complexing agents (ligands) in the TRU waste matrix.
2) Citrate	Preliminary information indicates that citrate (citric acid) may be the largest used ligand at TRU waste generating sites. Hence, inventory quantities are very important.
3) Lactate	This is an important ligand that is produced by bacteria as part of its own metabolism. What is requested here is a "best estimate" of the quantity of lactate that actually exists in the TRU waste matrix (not just an initial amount supplied as part of a waste stream). However, if this information cannot be developed, then supply information on the initial amount.
4) Oxalate	This is an imporant ligand that is produced by bacteria as part of its own metabolism. What is requested here is a "best estimate" of the quantity of oxalate that actually exists in the TRU waste matrix (not just an initial amount supplied as part of a waste stream). However, if this information cannot be developed, then supply information on the initial amount.
5) EDTA	This ligand (ethylenediaminetetraacetic acid) is also of major importance due to its common use as a cleaning solvent.

(a) Information on these additional waste materials are needed for non-PA scoping calculations for assessment of their importance. The presence of these complexing agents are important for the actinide source term with respect to increasing the solubility of radionuclides.
(b) These items are ranked in the order of their importance in the actinide source term.
(c) Also supply any available information that TRU waste generation sites may have on the degradation or decay rates of ligands in current (and expected) waste matrixes if possible. In cases where no information is available, supply guidance on estimating first-order quantities.

LCS:6741:lcs/(95-2082)

Copy to:
P.E. Drez [Drez Environmental Associates]
D. Bretzke [Science Applications International Corporation]
S. Chakraborti [Science Applications International Corporation]
MS-1320, C.F. Novak [Dept. 6119]
MS-1328, H. Jow [Dept. 6741]

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JAN 5 1998

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ATTACHMENT 2

Los Alamos
NATIONAL LABORATORY
memorandum

Waste Management and Environmental Compliance
NMT-7, MS E501

To/MS: Paul Drez, Drez Environ. Assoc.
Thru: James I. Balkey, NMT-7, MS E501 998

From/MS: C. L. Foxx, NMT-7, MS E501 CLF
Phone/FAX: 7-2328/ 7-9201
Symbol: NMT-7-WM/EC-96-035
Date: March 12, 1996

SUBJECT: CHELATING AGENTS IN LANL WASTE

I am certain that I have not captured all chelating agents, but I believe that I have identified and quantified roughly the important materials. The chelators are found in three waste streams:

1) Cemented evaporator bottoms from TA-55
2) Cemented sludge from the TA-50 Pretreatment Plant and dewatered sludge from the TA-50 Liquid Waste Treatment Plant
3) Combustible waste from TA-55

The three streams are summarized below.

It should be noted that waste generation data and analyses exist over the time frame of 1980 through 1995 or shorter intervals to support the estimated values. In some cases, quantitative data is almost nonexistent and the results are qualitative at best. Like Rocky Flats, plutonium processing at LANL attempts to avoid chelating agents which can interfere with recovery operations. From your list of compounds of interest, I am unaware of any significant usage of lactate or EDTA, so they have been eliminated from detailed consideration. I have added ascorbate which has been used as a reducing agent in HCl solutions, but not in nitric acid which attacks and decomposes ascorbate. One of the above streams is not an immobilized stream, but I believe that it is an important contributor of a soluble chelating agent in the form of citrate. If this information is extraneous to your purposes, just ignore it.

Cemented evaporator bottoms from TA-55. The evaporator bottoms are derived from nitric acid solutions some of which (27%) contain oxalate resulting from the precipitation of plutonium oxalate. Because of the pervasive usage of oxalate, it is contained at lower concentrations even in those solutions that do not arise from filtering an oxalate precipitate. Those numbers are based on analytical results. In addition the drums contain on the average, 3.2 liters of analytical solution residues. Those solutions contribute a negligible additional quantity of oxalate and small quantities of ascorbate, citrate and acetate. We have semi-quantitative values from the analytical organization for those chelators, based on the quantities used in the analytical processes that give rise to the residues. We know that 28 liters of solution went into a drum of cemented waste on the average from 1980 through June of 1988. Since that time, the average has been 43 liters of solution. In addition we have information regarding the number of drums generated from May, 1987 through April, 1995. The drum numbers and alternate cemented forms

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for the remaining years are estimated. The totals based on those data and estimates are shown here.

oxalate	1600 kg	90.04 / 88.04	= 1632
ascorbate	7 kg	176.14 / 175.14	= 7.04 ≈ 7
citrate	0.5 kg	192.14 / 191.14	= 0.5 ≈ 0.5
acetate	10 kg	60.05 / 59.05	≈ 10

Cemented sludge from the TA-50 Pretreatment Plant and dewatered sludge from the TA-50 Liquid Waste Treatment Plant. Based on experience at the liquid waste treatment plant with upsets in the treatment process due to the presence of chelators in the waste stream, it has been assumed that TA-55 is the only significant source of chelating agents in the sludge generated at that facility. Three waste lines carry liquids from TA-55 to TA-50. The industrial waste line is thought to be reasonably free of chelating agents. The evaporator distillate in the process acid waste line is unlikely to contain significant quantities of chelators because the distillation process creates a sharp reduction in the content of nonvolatile solution species.

The process caustic waste line solution is dominated by oxalate filtrates in hydrochloric acid that have been subjected to caustic treatment and filtration. Under the conditions of that treatment the oxalate and ascorbate (used historically) are soluble and follow the solution to TA-50 for a ferrofloculation treatment. The solution is used to neutralize the nitric acid distillate. Because there is an excess of nitric acid, the neutralization is completed with the addition of stock sodium hydroxide. I have assumed that the short term excess of nitric acid decomposes the ascorbate leaving only the oxalate. I have estimated the oxalate concentration in the hydroxide filtrate at 0.075 moles/liter. If this number drives the calculation then we should sample the solution in the caustic holding tank at TA-50 and get a representative value.

Volumes of caustic solution generated by TA-55 were available for the years 1983 and 1986 through 1992. Volumes for all other years were estimated. I am assuming that the oxalate will appear in the sludges due to the low solubility of calcium oxalate and because the floculations have relatively high concentrations of calcium. In addition magnesium and aluminum oxalates are insoluble in a caustic environment. The oxalate precipitates will be found in the cemented sludge, whenever generated, and in the dewatered sludge from the early and middle 80's. These oxalates will also be found in the cement-filled corrugated metal pipe (CMP) waste stream generated at DP site when plutonium operations were located there. The total of oxalate in those waste streams is 11,800 kg. = 12070

Combustible waste from TA-55. The combustible waste stream contains rags that were used in decontamination and spill clean-up operations. In spill clean-up the rags from the first pass are nearly always TRU waste as measured on our MEGAS assay instrument. The rags are dampened with a solution labeled "versene". Versene is a name for EDTA. In the very early days of the laboratory versene solution may have contained EDTA, but it had been changed to sodium citrate solution by the time I arrived in 1969. Drums of combustible waste do not usually contain only decontamination rags and often contain no

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such rags. However our waste management personnel apparently used a unique identifier over about a four year period (1987 to 1991) for the decontamination rags. Each item also had a net disposal weight associated with it. Thus I was able to get a handle on the weight of decon rags generated in that time frame. The rags were discarded not dripping but distinctly damp. I dampened some cheesecloth, weighing before and after, to estimate the weight of solution contained in the rags. Knowing the weight of solution and the concentration of the citrate, I was able to calculate a weight of citrate in the discarded rags. In May, 1991 the usage of citrate for decontamination was restricted to certain matrices. I was able to locate records for versene solution preparation from 1989 into early 1991 and then again for the past year so I could understand usage before and after 1991. From that I have estimated the usage for the remaining years. With that information, I have estimated that the citrate contained in the combustible waste stream from 1971 to 2033 will be 1100 kg.

Cy: Andy Montoya, NMT-7, MS E501
NMT-7 File

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ATTACHMENT 3

CORRES. CONTROL
OUTGOING LTR. NO.

89RF3055

DIST.	LTR	ENCL
SANCHINI, D.J.		
BADER, C.P.		
ERFURDT, R.J.		
HEINTZ, E.R.		
HOOD, R.C.		
DEKER, E.H.		
KINZER, J.E.		
KIRBY, W.A.		
MCNETT, J.F.		
MEYERS, G.W.		
ROECKER, J.N.		
SHANNON, W.M.		
WESTON, W.F.	X	
WOZNIAK, B.D.		
YOUNG, E.R.		
BETCHER, D.H.		
CARNIVAL, G.J.		
FERRERA, D.W.		
HARMAN, L.K.		
HEBERT, J.L.		
HOEY, J.B.		
HOFFMAN, R.B.		
KLAMANN, R.L.		
KRIEG, D.M.	X	X
LO[illegible]URG, G.E.		
MC[illegible]Y, K.B.	X	
NAIMON, E.R.	X	X
NEWBY, R.L.		
TURNER, H.L.		
VELASQUEZ, R.N.		
CORRES. CONTROL	X	X
CONTRACT ADMIN.		
Arnold, P.M.	X	X
D'Amico, E.L.	X	X
Jaskot, G.F.	X	X
Wells, C.L.	X	X
CLASSIFICATION		
UNCLASSIFIED	X	X
CONFIDENTIAL		
SECRET		

AUTH. CLASSIFIER SIG.
Tim P. Fiklin
9/1/89
DATE

IN REPLY TO LTR. NO.
245RF89

DOE's
TRA VALS
Trans

ORIG. & TYPIST INITIALS
ELD

AL-46469 (Rev. 4/89))

Rocky Flats Plant
Aerospace Operations
Rockwell International Corporation
P.O. Box 464
Golden, Colorado 80402-0464
(303) 966-7000
Contractor to U.S. Department of Energy

SEP 0 1 1989

89-RF-3055

Edward S. Goldberg
Acting Area Manager, RFO

Attn: Mark Van Der Puy

APPLICATION TO SHIP SALTCRETE

Attached is a copy of the re-formatted Application to Ship Waste for saltcrete. This application addresses all the comments from the Nevada Operations Office document attached to your letter 1245-RF-89.

Please refer any questions regarding the attached application to E.L. D'Amico at (303) 966-5362 or P.M. Arnold at FTS 320-2056.

W.F. Weston, Director
Plutonium Operations

Orig. and 3 cc - E.S. Goldberg
Enc.

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Table 8 (continued)
Reference Documents/Results Outlining Compliance
to the General Waste Form Criteria

		Boxes," specifies Waste Operations personnel to visually inspect for and remove any excessive particulate from each stored saltcrete box.
Gases	Not Applicable	Saltcrete is not a gaseous waste and does not contain radioactive gases.
Stabilization	WO-5004	As described in WO-5004, "Waste Treatment Spray Dryer and Saltcrete Process," cement is added to the salt waste stream to immobilize the particulate, solidify the liquids and moderate oxidizing characteristics.
Etiologic Agents	Not Applicable	Saltcrete does not contain pathogens, infectious wastes or other etiologic agents.
Chelating Agents	Quantity and type of complexing agents used per year at Rocky Flats: Ascorbic Acid: 4.5 kg Acetic Acid: 6.6 kg Sodium Acetate: 55.5 kg Citric Acid: 4.5 kg Sodium Citrate: 20.0 kg Oxalic Acid: 4.5 kg EDTA: 1.15 kg	Between 5/15/87 and 5/7/88, 917 triwall boxes of saltcrete were produced. The estimated saltcrete generation for any given year is between 1200 to 1600 triwalls. The average net weight of one triwall box of saltcrete is approximately 1600 pounds. Total weight of saltcrete produced between 5/15/87 and 5/7/88 is 917 boxes * 1600 pounds * 1 kg/2.2 pounds = $6.67*10^5$ kg. As a worst case, if it is assumed that all 106.36 kg of complexing agents are

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Table 8 (continued)
Reference Documents/Results Outlining Compliance
to the General Waste Form Criteria

	8-Hydroxyquinoline: 2.3 kg Tributyl Phosphate: 3.7 kg 1,10 Phenanthroline: 0.012 kg dihexyl-n,n-diethylcarbamoyl methylphosphonate: 3.6 kg Total: 106.36 kg	disposed of with the saltcrete, then, $106.36/6.67*10^{5}=1.59*10^{-4}$ is the weight fraction of the complexing agents with respect to the saltcrete. Therefore, Rocky Flats' total yearly usage of complexing agents amounts to only 0.0159 weight percent of the total saltcrete production between 5/15/87 and 5/7/88. This extremely conservative estimate is well under the NTS limit of 1 weight percent.
GCD Waste	Not Applicable	Saltcrete does not meet any of the guidelines to be identified as a GCD waste.
Bulk LLW	Not Applicable	Saltcrete is not a bulk LLW.

4. Additional Mixed Waste Form Criteria

Table 9 references the documents (procedures, specifications, etc.) or test/analysis results that specify compliance to the Additional Mixed Waste Form Criteria outlined in Section 2.2.2 of NVO-325.

Table 9
Reference Documents/Results Outlining Compliance
to the Additional Mixed Waste Form Criteria

Criterion	Compliance Documents or Results	Comments
Treated Waste	Not Applicable	Saltcrete is a treated waste that meets the land disposal restrictions and

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ATTACHMENT 4

Westinghouse
Savannah River Company

P.O. Box 616
Aiken, SC 29802

February 28, 1996

SWE-SWE-96-0106
F/WSWE/XXX/ARNR
Response Required: N/A
Key Words: TRU Waste
Record Retention: Permanent

Jim Teak
Advanced Sciences, Incorporated
6739 Academy Road, N. E.
Albuquerque, New Mexico 87106-3345

Dear Mr. Teak:

FY96 TRANSURANIC WASTE BASELINE INVENTORY REPORT (TWBIR): RESPONSE TO THE TWBIR MEETING MINUTES REGARDING CHELATING AGENTS AND CONCRETE STABILIZATION (U)

The Savannah River Site (SRS) has reviewed its waste practices to determine whether chelating agents are present in retrievably stored TRU waste. SRS also has reviewed these practices to determine whether concrete has been used to solidify/stabilize TRU waste. These reviews revealed that SRS TRU waste steams do not currently contain chelating agents/complexants nor has SRS used concrete to solidify/stabilize TRU waste.

The Separations processes and the analytical/research laboratories at SRS have used chelating agents in the separation of plutonium from irradiated uranium and other materials. For example, tri-butyl phosphate (TBP) is the complexing agent used in SRS's PUREX process and many other laboratory processes. Also, agents such as tri-octyl phosphine oxide (TOPO) and tri-iso octylamine (TiOA) have been used or investigated through the years. However, none of these chelating agents/complexants has entered SRS TRU waste. The complexants are dissolved in organic solvents for use as liquid/liquid extractants in the separation process. These solvents are recycled until depleted and then discarded to SRS's solvent waste tanks in the Waste Disposal Facility. This means that SRS organic liquid streams have not entered the production lines (e.g., HB and FB-Lines) where most of SRS TRU waste is generated. Further, a small amount of liquid TBP containing TRU nuclides is generated by SRS laboratories. This laboratory waste is discarded to liquid waste streams, which are eventually disposed in SRS's High Level Waste Tanks. So, none of these liquid streams that contain complexants have entered SRS solid TRU waste streams.

SRS has not used concrete to solidify/stabilize TRU waste. The processes that generate slurries, which require stabilization, do not contain TRU radionuclides (e.g., plating of depleted uranium). For other processes that generate slurries, the waste is disposed in SRS's High Level Waste Tanks. Even the Low Level Waste (LLW) sludge generated by SRS's Effluent Treatment Facility (ETF) is disposed in the High Level Waste Tanks and is eventually

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fed to SRS's Saltstone Facility or the Defense Waste Processing Facility (DWPF). Finally, SRS does not expect to generate TRU waste containing chelating agents nor anticipate using concrete to solidify/stabilize TRU waste in the near-future.

Please direct your questions to L. Williams (803) 557-6759.

Sincerely,

Joseph A. D'Amelio
TRU Engineering Manager

JAD:lw

cc: A. Gibbs, 724-21E
W. T. Goldston, 705-3C
F. H. Gunnels, 705-3C
S. J. Mackmull, 703-A
S. J. Mentrup, 724-21E
D. Ormond, 703-A
L. Williams, 705-3C
Records Management, 705-3C
SWE Files, 705-3C

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ATTACHMENT 5

To: L. C. Sanchez, SNL January 25, 1996

Thru: Sheila Lott, CTAC

From: F. M. Coony and M. R. Kems, Hanford Site

RE: Additional TRU Waste Data Request for Sandia National Laboratories' Waste Isolation Pilot Plan Performance Assessment

References: 1) Memorandum, Russ Bisping, DOE/CAO to Distribution, same subject, dated January 5, 1996.

2) Trip Report, F. M. Coony to K. L. Hladek, January 15, 1996

The Reference 1 memo requests additional data on waste soluble organic ligands (i.e. chelating agents) from the generating sites by February 26, 1996.

Hanford's approach for responding to the additional data request is presented in the Reference 2 trip report. The first item of this approach is to provide SNL, through CTAC, a list of all hazardous constituents, and their quantities, that have been reported in solid TRU waste at Hanford since 1987, the date of the By-Product Rule.

The list of hazardous constituents and their quantities, from Hanford's record container tracking system, are presented in Table 2. The chemical names have been truncated to 30 characters. Hanford can provide complete names if needed. In some cases, the constituent is listed more than once because the constituent is spelled differently in the container tracking system. A quantity of 0.00 kg means typically that the constituent has been identified solely because it is a listed hazardous waste under RCRA. In these cases, the quantity is either absent or minimal.

Please evaluate the list of constituents, and indicate, in the space provided for each constituent, if the constituent is a soluble organic ligand. The suggested nomenclature is the following:

- N/A (meaning not soluble organic legand)
- C (meaning citrate
- L (meaning lactate)
- OX (meaning oxalate)
- EDTA (meaning ethylenediaminetetraacadid acids

Please indicate any other relevant information by footnotes.

To meet the requested due date, please provide a response to me (by fax) no later than February 5, 1996. Please copy CTAC on the response.

If you have any questions, please contact Mike Coony at 509-376-8774 or Mark Kems at 509-372-2383.

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MASS (KG)

Table 2. Quantities of Hanford Constituents

CONSTITUENT	MASS	
1,1,1-TRICHLOROETHANE	0.00	
2-BUTOXYETHANOL	0.02	
ACETONE	0.00	
ACID	0.14	
ALUMINUM NITRATE	0.10	
ALUMINUM NITRATE MONOHYDRATE	3.80	
AMERCOAT 234	0.05	
AMMONIUM CHLORIDE	0.01	
ARSENIC	0.02	
ASBESTOS	27.00	
BARIUM	1.86	
BERYLLIUM	0.17	
BIS(2-ETHYLHEXYL)PHTHALATE	0.82	
BISPHENOL A RESIN	0.54	
BUTYL ALCOHOL	0.41	
BUTYL GLYCIDYL ETHER	0.11	
CADMIUM	89.17	
CADMIUM HYDROXIDE	0.10	
CALCIUM CHLOROFLUOROPHOSPHATE	0.83	
CALCIUM HYDROXIDE	0.06	
CARBON TETRACHLORIDE	87.88	
CARBONTETRACHLORIDE	95.90	
CHLOROFORM	0.00	
CHROMIUM	14.52	
COPPER	0.00	
COPPER SULFATE	0.36	
CRESYLIC ACID	0.00	
CUPROUS CYANIDE	0.21	
CYANIDE SOLUTIONS	0.21	
CYCLOHEXANE	0.00	
DI(2-ETHYLHEXYL)PHTHALATE	0.06	
DI-OCTYL PHTHALATE	0.40	
DIOCTYL PHTHALATE	0.20	
DIOCTYL PHTHALATE (DOP)	8.47	
ETHANOL	0.20	
FERRIC NITRATE	4.38	
FORMIC ACID	0.21	
HEXONE	0.10	
HYDRAULIC FLUID	328.20	
HYDROCHLORIC ACID	0.07	

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HAZARDOUS CONSTITUENT	MASS (KG)	
KEROSINE	0.00	
LEAD	8,915.59	
LEAD ACID	0.27	
LEAD CHROMATE	28.97	
LEAD CHROMATE OXIDE	1.54	
LEAD CHROMATE,CHLORIN.PARAFFIN	1.33	
LEAD CHROMATES	0.05	
LEAD SHIELDING	5,587.50	
LIGHT AROMATIC NAPHTHA	0.30	
MERCURY	1.51	
MERCURY METAL	0.00	
METHYL ETHYL KETONE	0.00	
METHYL ISOBUTYL KETONE	0.00	
METHYLENE CHLORIDE	8.03	
NICKEL HYDROXIDE	0.10	
NITRIC ACID	1.21	
OIL	0.00	
PCB	130.13	
PHOSPHORIC ACID	0.33	
PHTHALIC ACID BENZYL BUTYL EST	0.00	
PHTHALIC ACID BIS(2-ETHYLHEXYL	0.00	
PHTHALIC ACID, BIS(2-ETHYLHEXY	0.05	
POTASSIUM CYANIDE	0.21	
POTASSIUM FLUORIDE	0.00	
POTASSIUM HYDROXIDE	5.80	
RESIDUAL TANK FARM CORE SAMPLE	0.80	
SELENIUM	1.10	
SILVER	0.00	
SODIUM	0.13	
SODIUM CYANIDE	0.21	
SODIUM FLUORIDE	1.08	
SODIUM HYDROXIDE	24.37	
SODIUM NITRATE	173.00	
SODIUM SULFATE	3.92	
STRIPCOAT	34.08	
SULFAMIC ACID	0.04	
SULFURIC ACID	1.53	
THENOYL TRIFLUOROACETONE	0.00	
TRI BUTYL PHOSPHATE	49.30	
TRIBUTYL PHOSPHATE	43.13	
TRIBUTYLPHOSPHATE	0.07	

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HAZARDOUS CONSTITUENT	MASS (KG)	WASTE CODE(S)
TRICHLOROETHENE	3.28	
TRIISOOCTYLAMINE	0.00	
TRIMETHYLBENZENE	1.01	
TRIOCTYLPHOSPHINE OXIDE	0.00	
VANADIUM PENTOXIDE AQUEOUS SOL	0.21	
XYLENE	4.23	

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ATTACHMENT 6

Lawrence Livermore National Laboratory

WASTE CERTIFICATION PROGRAM

WCP96-055

March 7, 1996

Jim Teak
Advanced Sciences Incorporated
6739 Academy Road NE
Albuquerque, NM 87109

Dear Jim,

This is in response to the CAO request concerning the presence of organic ligands (chelating agents) in TRU waste. I have consulted with Joe Magana, a chemist working in LLNL's Plutonium Facility. He tells me that there are no chelating agents in LLNL's TRU waste.

Sincerely yours,

Kem Hainebach

Kem Hainebach, Ph. D.
Waste Certification Engineer
Environmental Protection Department

KH:lh
c: Robert Fischer

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DEA Drez Environmental Associates

FAX COVER SHEET

DATE: March 20, 1996

TO:	COMPANY	FAX NO.	CONFIRMATION NO.
RUSS BISPING	CAO	505-887-0707	505-234-7446
MARGARET CHU	SNL/NM	505-848-0518	505-848-0778
JOE HARVILL	ASI/CTAC	505-887-5494	505-885-4218
LARRY SANCHEZ (GIVE TO JIM NOWAK)	SNL/NM	505-848-0705	505-848-0685
LENNY STORZ	SNL/NM	505-848-0881	505-848-0877
SAYAN CHAKRABORTI	SAIC	505-842-7798	505-842-7816
SHEILA LOTT	ASI/CTAC	505-823-6830	505-823-6873

FROM: PAUL DREZ PAGES TO FOLLOW: 25

SUBJECT/PROJECT: FINAL PRELIMINARY COMPLEXING AGENT MEMO

COMMENTS:

THESE ARE THE FINAL NUMBERS FOR THE COMPLEXING AGENTS. SNL/NM SHOULD USE THESE NUMBERS IN THEIR CALCULATIONS. THE ONLY NUMBER THAT HAS CHANGED SINCE THE MARCH 13, 1996 REVISED MEMO IS THE TRIBUTYL PHOSPHATE (INCLUDES ESTIMATE FROM HANFORD). I AM SENDING THIS MEMO TO ALL TRU WASTE SITES THAT CONTRIBUTED DATA FOR THEIR REVIEW (A SEPARATE FAX SHEET). COMMENTS ARE DUE BACK COB THIS FRIDAY FROM EVERYONE TO ME. THIS REVIEW BY THE TRU WASTE SITES WAS PART OF THE AGREEMENT OF PROVIDING DATA TO THE BIR TEAM. ONLY DOE CAN ISSUE A "FINAL" MEMO AFTER RESOLUTION OF COMMENTS WITH THE TRU WASTE SITES.

PAUL

P.S. ATTACHMENT 3 HAS BEEN INCLUDED WITH ONLY A FEW PERTINENT PAGES TO CUT DOWN ON THE FAXING OF PAPER!!!!!!

If you do not receive all pages, please call:

Paul Drez
Drez Environmental Associates
8816 Cherry Hills Rd., NE
Albuquerque, NM 87111
Phone: (505) 828-9857 FAX: (505) 828-1342

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