

5/11/1985

CAI RUN PLAN
for
RUN 21
RCRA TRIAL BURN

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HAZARDOUS WASTE SECTION

1.0 INTRODUCTION

The purpose of this test plan is to prescribe a procedure for a RCRA trial burn to be completed in the Los Alamos Controlled Air Incinerator (CAI). The purpose of this run is to demonstrate effective thermal destruction of the principal organic hazardous constituents (POHCs) carbon tetrachloride (CCl_4) and trichloroethylene (TCE) by achieving destruction and removal efficiencies (DREs) of 99.9999% or greater as required by the USEPA and NMEID.

2.0 OBJECTIVES

The objectives of this trial burn run are to demonstrate effective thermal destruction of CCl_4 and TCE by the Los Alamos CAI, and to provide emissions testing, sampling, analysis, and evaluation directed toward obtaining a RCRA operating permit allowing on-site incineration of Laboratory-generated RCRA wastes.

3.0 INCINERATOR FEED and TEST CONDITIONS

3.1 Feed Material

The incinerator will be operated with solid feed and liquid feed. Solid feed will consist of a mixture of carbon tetrachloride (CCl_4), trichloroethylene (TCE), and water absorbed on Pel-e-cel (shredded and pelletized corncobs). This mixture is contained in 5-gallon polyethylene containers in cardboard boxes. Liquid feed, consisting of a mixture of CCl_4 , TCE, #2 fuel oil and Alumagel (aluminum stearate for particulate generation) will be fed to the incinerator via the liquid injection burner. Measurements of liquid feed viscosity will be taken and recorded for each batch prior to incineration. Compositions of both the solid and liquid feed materials are presented in Table I. Procedures for preparation of both liquid and solid feed materials are given in Section 9.

TDF Treatment Development Facility (Bldg 50-37)
CAI - controlled Air Incinerator



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**Table I
LOS ALAMOS CAI
RCRA TRIAL BURN
FEED COMPOSITIONS**

**RCRA SOLID FEED
(per package, 4,676 Btu/lb)**

<u>Material</u>	<u>Weight %</u>	<u>Grams/box</u>	<u>Lbs/box</u>
Pel-e-cel (corn cobs)	41.29	6936	15.28
Water	4.13	694	1.53
Plastic jug	5.54	930	2.05
Cardboard box	4.05	680	1.50
Carbon tetrachloride	30.00	5040	11.10
Trichloroethylene (TCE)	15.00	<u>2520</u>	<u>5.55</u>
	Total	16800	37.00

**RCRA LIQUID FEED
(1400 lb batch, 7,542 Btu/lb)**

<u>Material</u>	<u>weight %</u>	<u>Lbs</u>	<u>Gal</u>	<u>Liters</u>
Alumagel	0.5	7	----	-----
Fuel oil	34.5	483	67.84	256.76
CCl ₄	45	630	47.40	179.41
TCE	20	<u>280</u>	<u>22.93</u>	<u>86.79</u>
		1400	139.15	526.68

PHYSICAL PROPERTIES

<u>Material</u>	<u>SpG</u>	<u>Density (lb/gal)</u>	<u>Heat content (Btu/lb)</u>
Fuel oil	0.854	7.12	18,968
CCl ₄	1.594	13.29	986
TCE	1.4642	12.21	2,301
Pel-e-cel	0.578	4.82	7,052
Cardboard	-----	-----	7,052
PE jug	-----	-----	18,687
Water	1.00	8.34	-----

viscosity?

3.2 Test Conditions

Four trial burn test periods will be conducted on each of four days (see Tables II and III). Liquid incineration will be tested in periods 1 and 2 while solid matrix incineration will be tested in periods 3 and 4. Periods 1 and 3 will be conducted at a secondary chamber temperature of 2200°F, while tests 2 and 4 will be conducted at a secondary chamber temperature of 2000°F. Oxygen concentrations will be maintained at 4-9% above stoichiometric. The stack sampling schedule for each test period is shown in Table IV. All sampling of the process will be directed by Clean Air Engineering (CAE).

**TABLE II
INCINERATOR TARGET OPERATING CONDITIONS**

Temperatures:	
Upper Chamber	2000-2200°F
Lower Chamber	Dependent on waste feed rate and excess O ₂
Condenser Outlet	130°F
Superheater Outlet	160°F
Pressure and Pressure Drops:	
Lower Chamber Pressure	-2 in. WG
Venturi Pressure Drop	50 in. WG
Feed Nozzle Atomizing Medium	60 PSIG
Flows:	
Venturi Solution	8 GPM
Absorber Solution	10 GPM
Tempering Steam (when above 700°F)	>15 lbs/hr
Other:	
Secondary Chamber O ₂ *	4-9%
Primary Chamber O ₂ *	4-9%
Scrub Sump pH	5

*Upper and Lower Chamber Excess Oxygen will be maintained as close as possible to the same percentages.

**Table III
LOS ALAMOS CAI
RCRA TRIAL BURN
INCINERATION TEST CONDITIONS**

Test Period #	Feed Type	Feed Rate (lb/h)	INCINERATOR CHAMBERS			
			Primary		Secondary	
			Temp, F	O ₂ , %	Temp, F	O ₂ , %
1	Liquid	150	>1550	4-9	2200	4-9
2	Liquid	150	>1550	4-9	2000	4-9
3	Solid	200	>1550	4-9	2200	4-9
4	Solid	200	>1550	4-9	2000	4-9

Notes:

- 1) The actual primary chamber temperatures will be those obtained from burning the particular feed stream at the specified feed rate with the primary chamber natural gas burners on low fire. From experience, this temperature will remain above 1550 °F.
- 2) The oxygen levels for both the primary and secondary chambers are given as a range because the actual level is that resulting from the temperature obtained and the specified feed conditions.

**Table IV
STACK GAS SAMPLING SCHEDULE
(for each test period above)**

Sampling Method	Number of Sample Periods	Sample Period Duration, min	Changeout Time (approx), min
EPA M5	3	64	60-90
VOST	6	20	5-15

Note: Both EPA Method 5 and VOST stack sampling will be initiated concurrently at the beginning of each test period in Table III.

3.3 Operating Procedures

This run is being performed under the provisions of, and in accordance with, the following Los Alamos National Laboratory Standard Operating Procedures (SOPs):

"Solid Waste Receiving and Storage,"
 "Liquid Waste Receiving and Storage,"
 "Hazardous Liquid Waste Receiving, Storage and Disposal" (Draft),
 "TDF Aqueous Liquid Transfer,"
 "Caustic Solution Preparation and Use,"
 "Respiratory Protection at the TDF."

4.0 SCHEDULE

Startup of the incinerator will begin at 0700 on Tuesday, September 2, 1986. Liquid matrix incineration testing will begin on Thursday morning, September 4. Waste feeding and sampling will take place only during the dayshift (0700-1900) with the incinerator to be placed in an idle mode firing on natural gas at night (1900-0700). Following completion of the test periods, approximately 24 hours cooldown time is required. Total length of the campaign is estimated to be 6 days (144 hours) from startup to shutdown. The proposed operating schedule is presented in Table V. The actual operating schedule may deviate markedly from this schedule.

**TABLE V
 TRIAL BURN OPERATING SCHEDULE**

<u>DATE/TIME</u>	<u>ACTIVITY</u>
9/02 0700	Begin CAI startup. Heatup @ 100°F/hr using lower and upper gas burners to reach 1600°F in lower chamber and 1900°F in upper chamber.
9/03 0700	After reaching 1600°F in primary chamber, light liquid burner initially on natural gas at low fire. Shut off lower gas burner. Attain conditions for Test Period 1: (Primary: 1900°F, 4-9% O ₂ , Secondary: 2200°F, 4-9% O ₂).
9/03 1400	Prepare liquid batch no. 1 in the feed tank according to procedure in Section 9.
9/04 0700	Checkout system. Test emergency waste cutoff. Ensure proper operation of liquid feed system.
9/04 0800	Begin liquid feed (batch no. 1) @ 150 lb/h. Attain conditions for Test Period 1: secondary chamber temperature 2200°F, primary and secondary chamber oxygen levels 4-9%.
9/04 0900	Begin Test Period 1. Collect samples as

directed by Clean Air Engineering.

- 9/04 1700 End Test Period 1.
- 9/04 1800 Complete incineration of liquid batch no. 1 by feeding until feed tank is empty. Return liquid burner to natural gas firing. Remove liquid atomizer. Adjust upper chamber temperature to 2000°F. Place CAI in idle mode for night shift.
- 9/04 2000 Prepare liquid feed batch no. 2 in feed tank according to procedure in Section 9.
- 9/05 0700 Begin liquid feed (batch no. 2) @ 150 lb/h. Attain conditions for Test Period 2: secondary chamber temperature 2000°F, primary and secondary chamber oxygen levels 4-9%.
- 9/05 0800 Begin Test Period 2. Collect samples as directed by Clean Air Engineering.
- 9/05 1600 End Test Period 2.
- 9/05 1700 Complete incineration of liquid batch no. 2 by feeding until feed tank is empty. Shut down liquid burner. Flush feed tank with fuel oil spray using three separate rinses of 1-2 gallons each. Feed each "heel" in tank to incinerator prior to next rinse. Transfer 5 gallons fuel oil to feed tank and feed to incinerator until tank is empty. Shut down fuel oil and liquid feed systems. Remove liquid atomizer. Relight primary chamber natural gas burner. Adjust upper chamber temperature to 2000°F. Place CAI in idle mode for night shift. Ensure proper operation of solid feed system during night shift by cycling elevator, rams, guillotine door. Charge storage glovebox with first set of boxes.
- 9/06 0800 Begin solid feed at 200 lb/h (5 boxes/h). Attain conditions for Test Period 3: secondary chamber temperature 2200°F, primary and secondary chamber oxygen levels 4-9%.
- 9/06 0900 Begin Test Period 3. Collect samples as directed by Clean Air Engineering.
- 9/06 1700 End Test Period 3. Stop solid feed to incinerator.
- 9/07 0800 Begin solid feed at 200 lb/h (5 boxes/h). Attain conditions for Test Period 4: secondary chamber temperature 2000°F, primary and secondary chamber oxygen levels of 4-9%.
- 9/07 0900 Begin Test Period 4. Collect samples as directed by contract samplers.
- 9/07 1700 End Test Period 4. Continue to incinerate solid feed matrix boxes until all 92 prepared boxes have been incinerated.

9/07 2100 Begin cooldown @ 150°F/hr.
9/08 1900 CAI process shutdown.

5.0 DATA AND SAMPLING

5.1 Data

The data acquisition system (DAS) will not be required during this test burn. Control room process recording and manual data acquisition will be conducted to verify system performance. Manual data will be taken and entered on the appropriate data sheets every 4 hours during heatup and cooldown, and every 2 hours during solid and liquid feed operations.

5.2 Sampling (See Table VI and Figure 1)

All process stream samples will be taken and handled in accordance with the documents "Requirements and Specifications for Offgas Sampling,"¹ "Quality Assurance Project Plan for a Controlled-Air Incinerator Trial Burn,"² and The Los Alamos National Laboratory RCRA Part B Permit Application, Appendix J, "RCRA Trial Burn Plan,"³ as amended. HSE-1 health physics personnel will monitor all samples (as possible) for presence of radioactive contamination prior to release.

Offgas Samples

Both EPA Method 5 sampling for particulates and HCl, and VOST sampling for CCl₄ and TCE will be performed by an independent sampling contractor, Clean Air Engineering (CAE), using EPA-approved and recommended methods.

Liquid Samples

Process liquid samples will be collected during periods of sample feed by TDF personnel under CAE direction and supervision and will then be presented to CAE for analysis by the analytical contractor. Samples of CCl₄ and TCE feedstocks, liquid feed mixture, makeup water, caustic solution, and process scrub solution will be withdrawn during each test period or batch as prepared (see Table VI) as requested by CAE.

Solid Samples

Process solid sample collection will be performed by TDF personnel under the direction and supervision of the sampling contractor. Samples of cellulosic feed stock (Pel-E-Cel), solid feed mixture, fresh and used activated carbon, and fresh and spent HEPA filter media will be taken as requested by the sampling contractor. Following completion of test periods, TDF personnel will cycle the gravity ash dropout system (GADOS) to

allow the ash to cool in the containment below the primary chamber. After sufficient time has elapsed for the ash to cool, the ash will be pneumatically transferred for collection and sampling. This process will be repeated following test periods 3 and 4.

TABLE VI
RCRA TRIAL BURN
SAMPLES FOR OFF-SITE ANALYSIS

Sample	Process Location	ANALYSES					No. of samples
		CCl ₄	TCE	Cl ⁻	Partic.	pH	
Fuel oil feed stock --each fuel oil tank reload (grab)	1	x	x	x			1-2
CCl ₄ feed stock --every drum of CCl ₄ (grab)	2	x					2-4
TCE feed stock --every drum of TCE (grab)	2		x				2-4
Cellulosic (Pel-E-Cel) feed stock --one bag of Pel-E-Cel (grab)	4	x	x	x			1 E
Liquid mixture feed --end of test period (grab)	3	x	x	x	x		6
Cardboard from box --one cardboard box (grab)	4	x	x	x	x		1 E
Polyethylene jug --one polyethylene 5 gal jug	4	x	x	x	x		1 E
Caustic solution --every batch prepared in caustic tank (grab)	8					x	4-6
Makeup water --end of every test period (grab)	6	x	x	x			12 E
Incinerator ash --end of test period 3, end of test period 4 (grab)	5	x	x	x		x	2 E
Scrubber discharge liquid --at beginning, middle, and end of each test period, then composited (grabs)	7	x	x	x		x	12 E

Sample	Process Location	ANALYSES					No. of samples
		CCl ₄	TCE	Cl ⁻	Partic.	pH	
Activated carbon (fresh) 13 --before trial burn (grab)		x	x	x		x	1 E
Activated carbon (used) 13 --end of each test period (grab)		x	x	x		x	12 E
Stack gas (VOST) 10 --3h during each sample period (continuous)		x	x				36 E
Stack gas blank (VOST) 10 --3h (continuous)		x	x				6 E
Stack gas EPA M5 11 --3h during each sample period (continuous)					x	x	12
Stack gas blank EPA M5 11 --3h (continuous)					x	x	2
EPA QC VOST/M5 sample 10/11 --before trial burn (continuous)		x	x	x	x		?
HEPA filter media (fresh) 9 --before trial burn (grab)		x	x				1 E
HEPA filter media (spent) 9 --after trial burn (grab)		x	x				1 E

Note: The "E" denotes those samples which will require extraction for one or more of the analyses.

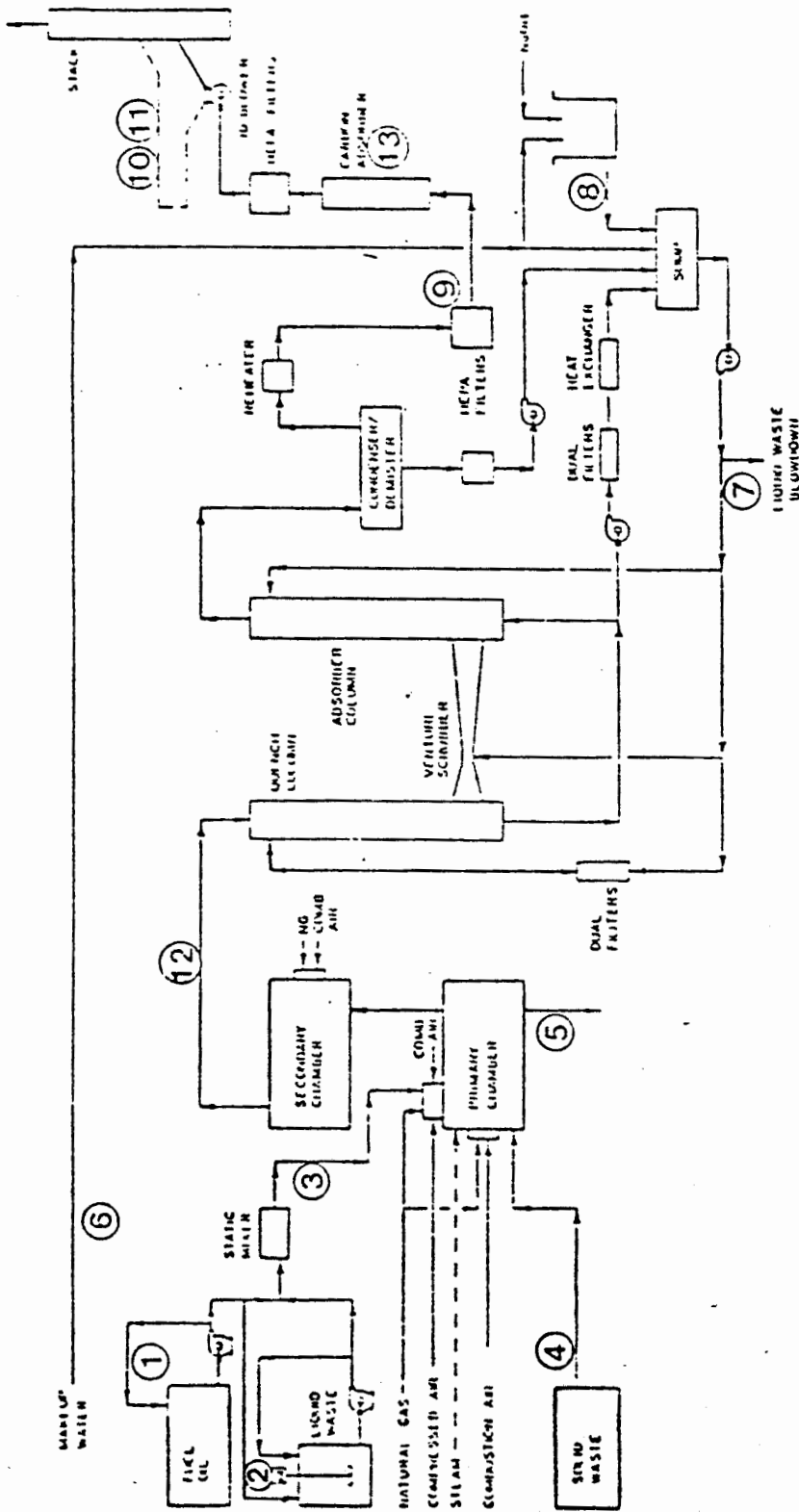


Fig. 1. Location of Sampling Points

6.0 ANALYTICAL REQUIREMENTS

Analysis of all samples will be carried out as per contract with the sampling and analytical contractors and in accordance with the documents "Requirements and Specifications for Offgas Sampling"¹, "Quality Assurance Project Plan for a Controlled-Air Incinerator Test Burn"², and The Los Alamos National Laboratory RCRA Part B Permit Application, Appendix J, "RCRA Trial Burn Plan"³, as amended.

6.1 Quality Assurance/Control

Project responsibility for quality assurance and quality control and applicable procedures to be followed are outlined in the document "Quality Assurance Plan for a Controlled-Air Incinerator Trial Burn."² Responsible parties in the project organizational structure are:

Regulatory Observers	NMEID, USEPA
Laboratory Management	Ray Garde, Leon Borduin
Trial Burn Project Manager	Ralph Koenig
Quality Assurance Officer	John Vavruska
Laboratory Analysis Coordinator	Larry Fields
Sampling Coordinator	Clean Air Eng.
Facility Operations Manager	David Hutchins
Facility Operators	TDF Staff

6.2 Continuous Offgas Monitors

The O₂/combustibles monitors will be operational during this incinerator run. The CO/CO₂ and the NO/NO_x continuous offgas monitors will also be required during this run. Sampling contractor will provide a NDIR CO/CO₂ monitor to support and provide backup data to the FID CO/CO₂ monitor on site.

6.3 Calibration Requirements

For offgas monitors: zero and span settings calibrated before each test period and as requested by sampling personnel, NMEID and USEPA, as per trial burn plan.

Sampling and analysis test equipment: as per EPA-600/4-77-027b and reference #1.

7.0 CAI PROCESS LOG

A formal log book for the CAI process operations and equipment modifications or run plan changes and inter-shift communications will be maintained.

8.0 STAFFING ASSIGNMENTS

**TABLE VII
OPERATIONS SHIFT ASSIGNMENT SCHEDULE**

Day Shift 0700 to 1900 hours

R.A. Koenig, Shift Supervisor
D.A. Hutchins
J.S. Vavruska
C.L. Gilley
J.R. Rutten

Night Shift 1900 to 0700 hours

C.L. Warner, Shift Supervisor
W.E. Draper
D.L. Melton

9.0 FEED PREPARATION PROCEDURES

9.1 RCRA TRIAL BURN LIQUID MATRIX FEED PREPARATION PROCEDURE

Following is a step-by-step procedure for preparation of a batch of liquid matrix feed for the RCRA trial burn in the Los Alamos Controlled Air Incinerator. One 1400 lb batch of feed will be required for each of the two liquid feed test periods of the trial burn. It is emphasized that operations involving open drums of carbon tetrachloride (CCl₄) or trichloroethylene (TCE) require the use of a full⁴ faced respirator equipped with an activated carbon canister. The operation of charging Alumagel powder to the feed tank through the opened lid requires the use of a self contained breathing apparatus (SCBA).

1. Transfer a drum of carbon tetrachloride (CCl₄) into the liquid feed room with the forklift, placing it on the scale and in the right hemispherical opening in the drum ventilation hood.
2. Verify that both ventilation blowers are on. Make sure the drum pump and convoluted teflon hose is attached to the bag filter and transfer header and that all valving is set to route liquid to feed tank #1. Record the gross weight of the CCl₄ drum in lbs.
3. FROM THIS POINT ON, A FULL FACE RESPIRATOR WITH ACTIVATED CARBON CANISTER MUST BE WORN. Remove the bung from the drum and insert the drum pump shaft into the bunghole until the end of the shaft rests on the bottom of the drum. Wrap a rag around the open area between the shaft and the bung to minimize release of vapors.
4. Begin transfer of CCl₄ to the feed tank #1 by pressing the air trigger on the drum pump. Note the loss in weight of the drum. The precise gross weight can be checked periodically by removing the shaft of the drum pump from the bunghole.
5. Stop transfer when 630 lbs of CCl₄ has been transferred to the feed tank. Record the reading in % on the tank liquid level meter. The reading should be approximately 27.5% which corresponds to 47.4 gallons.
6. Remove the CCl₄ drum from the scale and replace with a trichloroethylene (TCE) drum. Record the gross weight of the drum in lbs.
7. Begin transfer of TCE to the feed tank #1 by repeating steps 3 and 4 above using TCE rather than CCl₄.

8. Stop transfer when 280 lbs of TCE has been transferred to the feed tank. Record the reading in % on the tank liquid level meter. The reading should be approximately 43% which corresponds to a total of 70.3 gallons of liquid in the tank at this point.

9. Verify that valves are set up to route fuel oil to feed tank #1. Transfer fuel oil to tank #1 until a liquid level reading of 92% is attained. This corresponds to a total liquid volume of 139.15 gallons. The amount of fuel oil transferred should be 67.84 gal (483 lbs).

10. Turn on agitator in tank #1 and leave on for 10 minutes. Shut off agitator.

11. Wearing an SCBA, open the lid on feed tank #1 and charge 7 lbs of pre-weighed Alumagel to the tank. Close lid and secure with 3 C-clamps. All constituents are now in the feed tank.

12. Turn on the agitator and continue to blend the mixture for one hour. The feed batch is now ready to be fed to the incinerator.

9.2 RCRA TRIAL BURN SOLID MATRIX FEED PREPARATION PROCEDURE

Following is a step-by-step procedure for preparation of solid matrix feed material for the RCRA trial burn in the Los Alamos Controlled Air Incinerator. It is emphasized that steps 5 and 6 must be performed using a full face respirator equipped with an activated carbon canister.

1. Open the top lid on a box containing a 5 gal polyethylene jug. Unscrew the wide mouth cap and place on top of jug. Label the side of the box with an ID number.

2. Place the box/jug/cap on the digital balance and record the weight in lbs. Record the weight and punch the TR (tare) button on the balance.

3. Add the specified weight (15.28 lbs) of Pel-E-Cel (pelletized ground corn cobs) to the jug using a scoop and large polyethylene funnel supported on the ring stand. Record the actual weight of Pel-E-cel added to the jug. Punch the TR button on the balance. Note: For this operation, a dust mask must be worn.

4. Add the specified amount of water (1.53 lbs) to the jug through a separate funnel. Record the actual weight of water added to the jug.

5. Transfer a drum of carbon tetrachloride (CCl_4) into the liquid feed room with the forklift, placing it on the scale and in the right hemispherical opening in the drum ventilation hood. Verify that both ventilation blowers are on. Make sure the drum pump, transfer line and valve, and intermediate carboy assembly are ready for liquid transfer from the drum. FROM THIS POINT ON, A FULL FACE RESPIRATOR WITH ACTIVATED CARBON CANISTER MUST BE WORN. Remove the bung from the drum and insert the drum pump shaft into the bung hole until the end of the shaft rests on the bottom of the drum. Wrap a rag around the open area between the shaft and the bung to minimize release of vapors. Begin transfer of CCl_4 by pressing the air trigger on the drum pump. Release the trigger before the intermediate 5 gallon polyethylene carboy is full. Place a box/jug which has previously been loaded with Pel-E-Cel and water on the balance. Punch the TR button on the scale. Begin gravity transfer of CCl_4 from the intermediate carboy into the jug through the drain valve on the bottom of the carboy until the desired weight (11.10 lbs) has been reached. Record the actual weight of CCl_4 transferred and punch the TR button on the balance.

6. For addition of trichloroethylene (TCE) into the solid feed matrix, follow the exact procedure as outlined in step 5 above. The desired amount of TCE is 5.55 lbs. Record the actual weight of TCE added. Punch the TR button on the balance and record total weight of the solid matrix package. The desired total weight is 37.0 lbs. Replace cap tightly on polyethylene jug.

REFERENCES

1. "Requirements and Specifications for Offgas Sampling", Los Alamos Controlled Air Incinerator RCRA Part B Trial Burn (Revision 2, June 1986).
2. "Quality Assurance Project Plan for a Controlled-Air Incinerator Test Burn", Los Alamos National Laboratory, March 1986.
3. The Los Alamos National Laboratory RCRA Part B Permit Application, Appendix J, "RCRA Trial Burn Plan," 1985 (as amended).