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Decomposition of PCBs in Oils Using Gamma Radiolysis A Treatability Study—Final Report

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ABSTRACT

Several legacy hydraulic oil wastestreams contaminated with Aroclor 1260 and small amounts of ^{137}Cs have been in storage at the Idaho National Engineering Laboratory (INEL) due to the lack of appropriate treatment facilities. The goal of this study was to demonstrate that polychlorinated biphenyls (PCBs) could be selectively decomposed in the oils. Removal of the PCB component to less than the 2 mg/L treatment standard should result in a waste oil that is not regulated by the Toxic Substances Control Act.

Irradiation of the oils with high gamma-ray doses produces free electrons in the solution that react with PCBs. The reaction results in dechlorination of the PCBs to produce biphenyl. The gamma-ray source was spent reactor fuel stored in the Advanced Test Reactor canal at the INEL. A dry tube extends into the canal which allowed for positioning of samples in the proximity of the fuel. The gamma-ray dose rates at the samples varied from 10 to 30 kGy/h. This was measured using commercially available FWT-60 dosimeters. Irradiation of samples in a series of progressively increasing absorbed doses allowed the generation of rate constants used to predict absorbed doses necessary to meet the 2 mg/kg treatment standard.

Three separate irradiation experiments were performed. The first irradiation used a maximum absorbed dose of 183 kGy. This experiment demonstrated that the PCB concentration decreased and allowed calculation of preliminary rate constants. The second irradiation used a maximum absorbed dose of 760 kGy. From this experiment, accurate rate constants were calculated, and the necessary absorbed dose to achieve the treatment standard was calculated. In the third irradiation to 2,242 kGy, all three wastestreams were adequately decontaminated.

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INTRODUCTION

The radiation chemistry of the polychlorinated biphenyls (PCBs) and other halogenated hydrocarbons has received considerable study in a number of solvents. Among them have been water,[1] alkaline isopropanol,[2,3,4,5,6] neutral isopropanol,[7,8,9] cyclohexane,[10] petroleum ether[11] and electrical insulating oils.[12] Interest in PCB radiolysis results from the need to understand the nature of PCB reaction products in irradiated foods[10,11] and from the desire to design safer and more efficient disposal techniques.[6] This work will focus on radiolysis as a potential waste treatment process. Current U.S. Environmental Protection Agency (EPA)-approved treatment technology for PCBs requires incineration or high-efficiency boilers.[13] However, radiolysis has inherent benefits, e.g., the possibility of in situ treatment, selective destruction of PCBs, and nonoxidizing treatment that prevents formation of such undesirable products as dioxins.

The most thoroughly studied solvent has been alkaline isopropanol. It is well known that in alkaline isopropanol, decomposition proceeds rapidly via reductive, chain-reaction dechlorination to produce lesser-chlorinated "daughter" PCBs.[5,6] Upon continued irradiation, nonchlorinated biphenyl is produced. Reaction rates (G values) in excess of 1,000 molecules 100 eV^{-1} g^{-1} have been reported.[6] The radiation chemistry of isopropanol has been well studied, and it is known that degradation of PCBs in alkaline isopropanol solution occurs as a result of attack by reactive-reducing species generated by solvent radiolytic decomposition.[6] Dechlorination of PCBs in alkaline isopropanol is the result of electron transfer from the acetone radical anion, which is generated from the α-hydroxy isopropyl radical by direct isopropanol radiolysis under only alkaline conditions.[6] The series of reactions is shown below in Equations 1–6:

1 $(CH_3)_2CHOH + \gamma \longrightarrow (CH_3)_2CHOH^*$

2 $(CH_3)_2CHOH^* \longrightarrow e^-\,sol + (CH_3)_2CHOH^+$

3 $(CH_3)_2CHOH^+ \longrightarrow H^+ + (CH_3)_2\dot{C}OH$

4 $(CH_3)_2\dot{C}OH + OH^- \longrightarrow (CH_3)_2\dot{C}O^- + HOH$

5 $(CH_3)_2\dot{C}O^- + RCl \longrightarrow (CH_3)_2CO + Cl^- + \dot{R}$

6 $\dot{R} + (CH_3)_2CHOH \longrightarrow RH + (CH_3)_2\dot{C}OH$

Generation of the α-hydroxy isopropyl radical from ionized isopropanol is shown in Equation 3. This radical undergoes an acid-base reaction in the alkaline solution in Equation 4, producing the acetone radical anion. This anion then transfers an electron to a PCB molecule (or other chlorinated hydrocarbon) in Equation 5 causing dechlorination. In Equation 6, it can be seen that the dechlorinated PCB radical stabilizes as a dechlorination daughter species by proton abstraction from the solvent, creating a new α-hydroxy isopropyl radical and initiating the chain reaction. This chain reaction results in the high G values reported.[5,6] Because of these high G values, alkaline isopropanol has been the solvent of choice for organochlorine compound radiolysis studies since the pioneering work of Sherman.[2] Singh and others have proposed treatment of PCB-contaminated transformers using radiolysis in this solvent.[6]

The PCBs, however, are usually found in an oil matrix in actual wastes. It has been reported in at least one study that PCB radiolysis rates in oils are unacceptably low for use as a treatment technology.[12] This report contradicts that conclusion.

At the INEL, the radiolysis of PCBs in neutral isopropanol was investigated over a period of several years[7,8,9] as a first step toward modeling more "real world" solvents. It was determined that the dechlorination chain reaction which occurs in alkaline isopropanol does not occur in neutral isopropanol.[7] Consequently, PCB decomposition rates are about four orders of magnitude lower ($G = 0.1$ molecules 100 eV^{-1} g^{-1}). This is due to the fact that the α-hydroxy isopropyl radical produced by isopropanol radiolysis does not undergo an acid/base reaction in neutral solution to produce the acetone radical anion. The α-hydroxy isopropyl radical is apparently unable to participate in the chain-reaction dechlorination of PCBs.[7,8]

However, in this system PCB decomposition by dechlorination still occurs. It is accompanied by the ingrowth of daughter congeners produced by sequential dechlorination. Similar to radiolysis in alkaline isopropanol, the predicted end product of complete dechlorination is biphenyl. Although dechlorination rates are much lower in neutral isopropanol than in alkaline isopropanol, a 200 mg/L solution of PCB 200 was decomposed by an order of magnitude using amounts of radiation easily achievable in our system.[7]

When the natural logarithm of the PCB concentration was plotted versus the absorbed dose for experiments in neutral isopropanol, it was revealed that the reaction observed first-order kinetics. The slope of the line obtained is a reaction efficiency analogous to a rate constant. We called this slope the dose constant (d) since it was expressed in terms of reciprocal dose rather than time.[8] This dose constant was independent of initial PCB concentration and radiation dose rate in neutral isopropanol.[8] It was thus a valuable figure of merit in that system and was used instead of the more traditional G value. The G value suffers from a concentration dependence which makes it impractical for comparing experiments with different initial PCB concentrations. Much of the discussion to follow would not be possible without adopting the use of the dose constant.

Dose constants were obtained for 25 PCB congeners in neutral isopropanol.[9] It was found that a general increase in dose constant occurred as the number of chlorine atoms on the molecule increased. However, considerable variability existed among members of any selected homolog series. PCBs with the largest dose constants for their homolog series were para/meta substituted only. Apparently, chlorine substitution in the ortho position decreased neutral isopropanol radiolysis efficiency. When the dose constants for our 25 congeners were plotted versus their lowest unoccupied molecular orbital (LUMO) energies, a strong correlation was found.[9] The LUMO energies are those of Greaves[14] and were found to be lowest for congeners substituted in only the para and meta positions. These congeners, which decomposed quickly via radiolysis in neutral isopropanol, are the "planar" congeners. The lack of ortho substitution allows the two phenyl rings to achieve a nearly coplanar configuration, and the extended conjugation which results is thought to lower LUMO energy. Increasing chlorine substitution also leads to lower LUMO energies due to the electron-withdrawing nature of the chlorine. Low LUMO energies lead to high dose constants (high radiolysis rates). Congeners with ortho chlorine substitution are restricted from free rotation around the phenyl-phenyl bond, and the planar configuration is not easily adopted. They have higher LUMO energies. Ortho-substituted congeners also had lower dose constants.[9] Since it is well known that captured electrons reside in the LUMO energies,[15] these correlations strongly suggested that radiolytic PCB dechlorination in neutral isopropanol proceeds by electron capture. The source of these electrons is the interaction of gamma rays with the isopropanol solvent, as shown in Equation 2. These radiolytically produced high-energy electrons are rapidly thermalized and become solvated in polar media.[16] They are then able to react as a powerful chemical reducing agent.

It was confirmed that the solvated electron was the agent responsible for PCB dechlorination in neutral isopropanol via a series of scavenger experiments.[8] These experiments were performed by adding species known to have a high reaction rate with the suspected agent and observing the effect on PCB degradation. Reference to Buxton et al.[17] allowed the choice of appropriate scavenger species based upon their rates of reaction with various radicals. Although Buxton tabulated reaction rates in aqueous solution, extrapolation to isopropanol was valid since only relative rates were of concern.

The primary reactive agents produced by isopropanol radiolysis are solvated electrons, hydrogen atoms, hydroxyl radicals, and the α-hydroxy isopropyl radical.[16] The highest yield products are the electron and α-hydroxy isopropyl radical, production of which is shown in Equations 2 and 3. The rapid reaction of hydrogen atoms and hydroxyl radicals with the isopropanol to form the α-hydroxy isopropyl radical predicts that their contribution to PCB decomposition is small.[18] The following scavenger experiment confirmed this prediction.

Nitrobenzene is a scavenger species with a diffusion limited rate of reaction with solvated electrons[17] and a high rate with the α-hydroxy isopropyl radical.[19] Benzene has a rate of reaction with the solvated electron three orders of magnitude less.[17] Both scavengers have similar reaction rates with the hydrogen atom and the hydroxyl radical.[17] The benzene rate with the alcohol radical is unknown. Dose constants for irradiated samples containing nitrobenzene were decreased by a factor of two,[8] while benzene had no effect. These results indicated that hydrogen atoms and hydroxyl radicals do not have a significant role in the radiolysis of PCBs in neutral isopropanol. However, the experiment was insufficient to permit a choice between the solvated electron and the alcohol radical.

Sulfur hexafluoride was chosen as an electron scavenger.[8] It is well known that sulfur hexafluoride has a high rate of reaction with electrons. It is believed to have little affinity for the α-hydroxy isopropyl radical based upon analogy with its known rate for methyl radicals.[20] When experiments were sparged with sulfur hexafluoride, the dose constant was reduced by a factor of five. These results, as well as the trends exhibited with PCB LUMO energy, confirmed that the solvated electron was the primary agent of PCB dechlorination in irradiated neutral isopropanol. However, the sulfur hexafluoride experiment showed that even in the supposed absence of electrons a small amount of decomposition still occurred. This may be due to competition for the electrons with the scavenger by PCBs. However, minor participation by the α-hydroxy isopropyl radical through electron transfer cannot be discounted.[8]

Based upon this mechanism, the expected products of dissociative electron capture by PCBs in isopropanol are daughter PCB congeners of decreased chlorine content and free chloride ion. Daughter PCBs did grow into the irradiated neutral isopropanol solution with increasing absorbed dose.[7,8] The increase in free chloride ion with absorbed dose for irradiated solutions was linear, although substoichiometric.[8] Carbon and chlorine mass balances showed that not all the initial PCB mass was accounted for as these products. Mass balance recoveries for both carbon and chlorine were within a few percent of each other.[8] This was considered an indication that an unidentified product contained both the carbon and the chlorine. Additionally, irradiation of a ^{14}C labeled congener showed that 100% of the carbon activity remained in solution following irradiation.[9] These data suggested that unidentified semivolatile compounds were being generated. This was confirmed by mass spectrometric results, which identified peaks having a retention time greater than that of the original PCB and which were not attributable to dechlorination daughters.[9] These compounds were identified by a combination of mass spectrometry and derivatization techniques as solvent-PCB adducts.[9] They are probably formed by the pathway shown in Equation 7:

7 $\dot{R} + (CH_3)_2\dot{C}OH \text{ ---> } (CH_3)_2CROH$

The contribution of these adducts to the mass balance could not be evaluated by analytical chemistry due to the lack of appropriate calibration standards. However, when adduct formation was suppressed by nitrobenzene scavenging of the α-hydroxy isopropyl radical, stoichiometric dechlorination occurred.[8] Similarly, sparging of solutions with nitrous oxide prior to irradiation, which enhances the alcohol radical concentration via Equations 8 and 9,[19] enhanced the production of adducts.[8] Thus, it was concluded that PCB decomposition via radiolysis in neutral isopropanol was fully explained by a combination of reductive dechlorination by electron capture and formation of a series of solvent-PCB adducts. It is known that these adducts are also susceptible to reductive dechlorination.[8]

8 $N_2O + e^-_{sol} \text{ ---> } N_2 + \dot{O}^-$

9 $\dot{O}^- + (CH_3)_2CHOH \text{ ---> } (CH_3)_2COH + OH^-$

Results of these isopropanol studies have important implications for a PCB waste treatment process. The possibility of in situ PCB treatment is obvious. The penetrating nature of the gamma rays is evident in that the samples used for experimentation were separated from the fuel by the fuel cladding, a layer of water, the steel wall of the dry tube, the steel sample canister, and the glass walls of the sample vial.[7] Thus, it is possible to remotely treat PCB-containing articles. Also, it is evident that the PCBs were selectively attacked in the presence of the solvent. Further, the attack was reductive. This is an important consideration because the major objection concerning the currently approved PCB treatment of incineration is centered on the generation of small amounts of the toxic oxidative products of dioxin and dibenzofuran. These compounds are not generated in a reductive process.

Following the neutral isopropanol study, an investigation of PCB radiation chemistry in nonpolar solvents was begun at the INEL as a next step toward understanding PCB radiolysis in oils.[21] Isooctane was selected as an oil surrogate due to its improved amenability to analytical methods. Yields of various radicals from irradiated hydrocarbons have been studied,[16] and they are similar. Those radicals are hydrogen atoms, alkane radicals, and the quasi-free electron. Individual yields vary only slightly, so isooctane is a reasonable surrogate for many commercially available oils.

As in isopropanol, PCB degradation was found to occur at reasonable rates and to observe first-order kinetics.[21] A plot of the natural logarithm of PCB 200 concentration in isooctane versus absorbed dose is shown in Figure 1. Figure 2 shows PCB 200 daughter curves for typical data. These results are completely analogous to those in neutral isopropanol and immediately suggested a similar mechanism.

When the benzene/nitrobenzene scavenger experiment was repeated on isooctane solutions of PCBs, it was determined that the hydrogen atom was again not a significant contributor to degradation.[21] Sulfur hexafluoride sparging significantly reduced the decomposition of PCBs in isooctane, implicating the electron in this system too.

Oxygen is a known electron scavenger,[16] and many researchers conscientiously remove it from their systems prior to irradiation to study electron-promoted mechanisms.[4,5,6] Nitrogen sparging (to remove oxygen) increased the degradation rate, while oxygen sparging decreased the degradation rate of PCBs in isooctane.[21] This is consistent with a mechanism based upon electron capture.

Despite obvious similarities of PCB radiolysis in isooctane with that in isopropanol, the dose constant/LUMO energy correlation was not as obvious in isooctane. Further, the dose constants were found to depend on initial PCB concentration in isooctane.[21] Thus, congener dose constants were measured at identical initial concentrations for comparison, and the dose constant lost its advantage over the G value as a figure of merit in the isooctane system. It was demonstrated that the rate of individual congener decomposition was actually slightly higher in isooctane than in isopropanol.[21] This was explained by isopropanol competition for the available electrons in that solvent. Isooctane has no measurable capture rate for electrons.

A mass balance analysis of the PCB carbon and chlorine in isooctane solution following irradiation showed that a significant chlorine deficit occurred and that this deficit became greater with increasing dose.[21] No significant free chloride ion was measured in the irradiated isooctane. The only products found were daughter PCBs and PCB-isooctane adducts. It was demonstrated that all PCB carbon remained in the postirradiation solutions using radiolabeled PCBs.

Despite the obvious differences in PCB radiolysis in isooctane and isopropanol, the overall mechanism was believed to be similar; and experiments were next performed in transformer oil[21] and hydraulic oil (unpublished). Shell Diala A transformer oil was spiked with the commercial PCB mixture Aroclor 1260. The solution was irradiated as previously for individual congeners in other solvents, and it was found that an absorbed dose of 229 kGy reduced the Aroclor 1260 concentration from 5,000 to 1,800 mg/L.[21] Electron capture detector (ECD) chromatograms for the preirradiation and postirradiation samples are shown in Figure 3. These findings contradicted

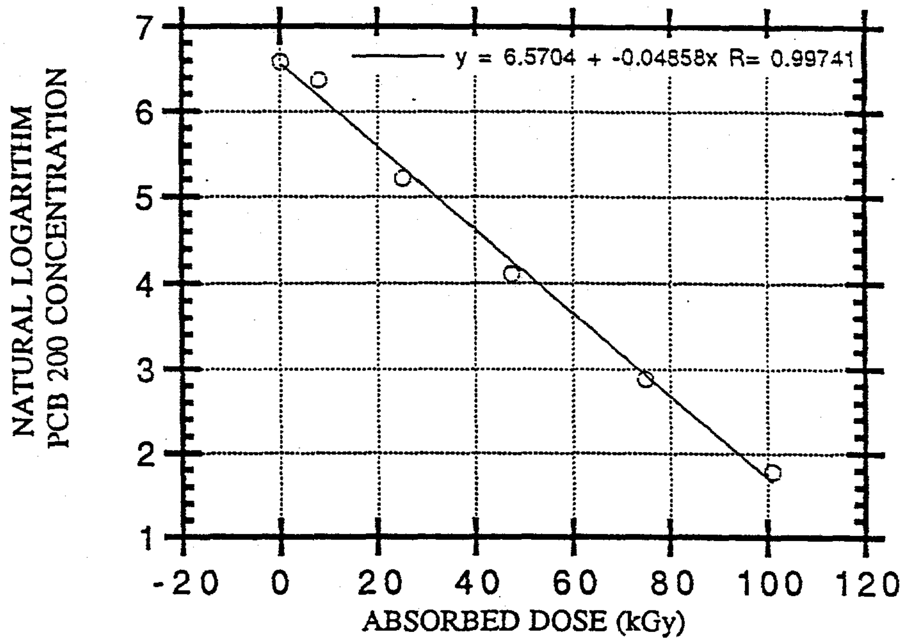


Figure 1. The natural logarithm of PCB 200 concentration versus absorbed dose. The initial concentration was 730 mg/L.

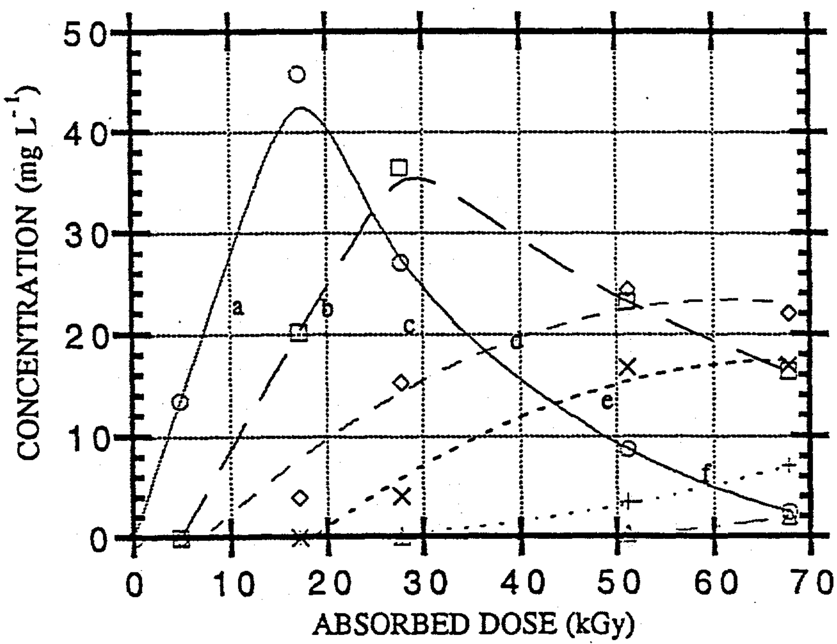


Figure 2. Production of dechlorination product PCBs from irradiated PCB 200: a, hepta-; b, hexa-; c, penta-; d, tetra-; e, tri-; and f, dichlorobiphenyls.

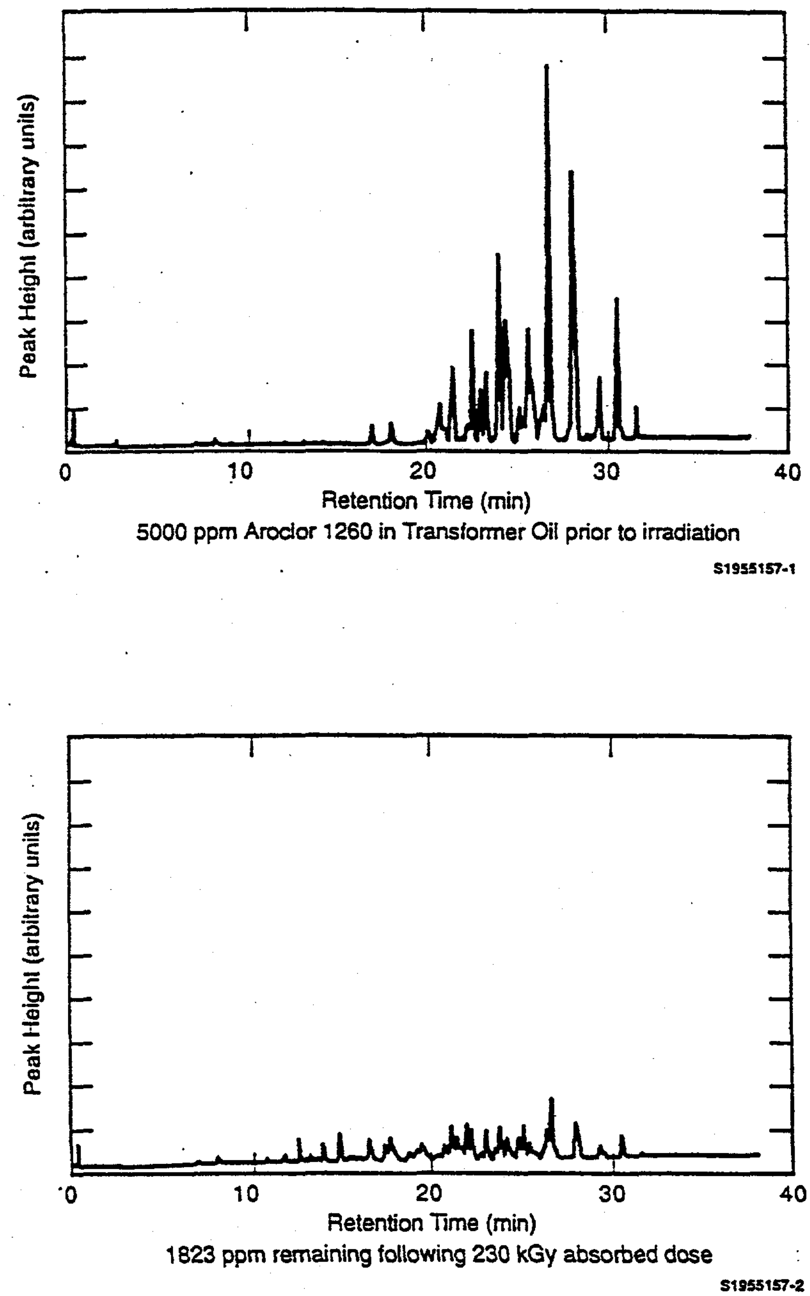


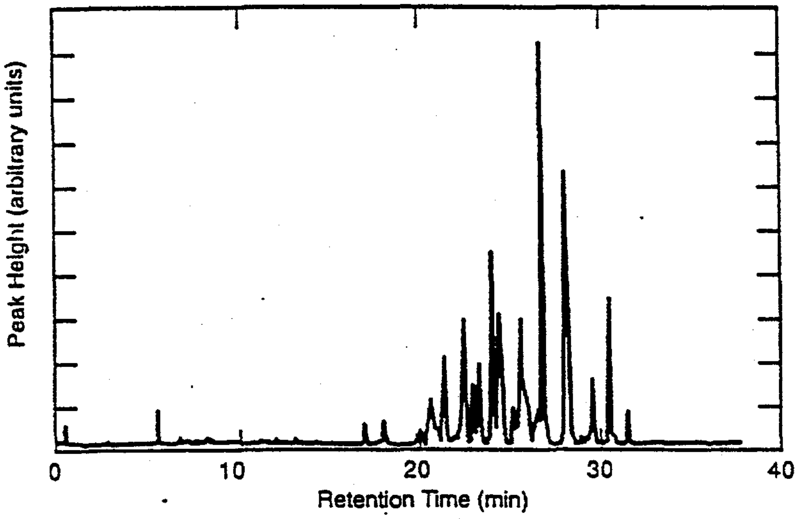
Figure 3. Electron capture detector gas chromatograms for Aroclor 1260 decomposition in Shell Diala A transformer oil. The top chromatogram is before irradiation; the bottom is following 230 kGy absorbed dose.

those of the only other known study concerning PCB radiolysis in electrical insulating oils. Webber[12] reported that no significant PCB decomposition occurred in "white insulating oils" even at high absorbed doses. The apparent contradiction may be explained by the relationship between dose constant and initial PCB concentration reported above for isooctane. Webber conducted most of his experiments at concentrations in excess of 10,000 mg/L. He was able to dechlorinate Aroclor 1260 in a single experiment performed at 40 mg/L.

PCB radiolysis in hydraulic oils was a special concern at the INEL. Several "wastes/reams" at the INEL contain hydraulic oils that are both radiologically and PCB contaminated. Removal of the PCB component would considerably decrease the regulatory constraints associated with handling these wastestreams. Harvest King hydraulic oil was spiked with 5,000 mg/L Aroclor 1260 and irradiated to a maximum absorbed dose of 229 kGy. The Aroclor concentration was reduced to 520 mg/L. The ECD chromatograms are shown in Figure 4. These data have not been previously reported in the literature.

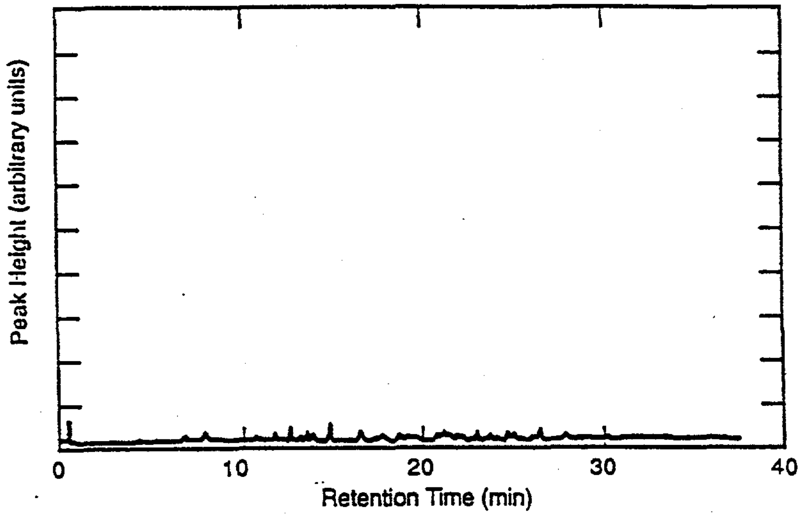
The Aroclor 1260 radiolysis experiments in transformer and hydraulic oil confirmed certain previous findings in isopropanol and isooctane. Inspection of the chromatograms in Figures 3 and 4 reveals that not only did significant PCB decomposition occur at moderate absorbed dose but also that daughter PCBs grew into the irradiated solutions. These appear in the chromatograms as new peaks at lower retention times. The PCBs decomposed by dechlorination in industrial oils. When transformer[21] and hydraulic oils (unpublished data) were sparged with sulfur hexafluoride prior to irradiation, the rate was suppressed to a similar extent as that reported for isooctane.

Further, the rate of PCB decomposition in hydraulic oil was much higher than in transformer oil. The finding that the rate is influenced by the type of oil has obvious implications for any treatment process based upon radiolysis.



5000 ppm Aroclor 1260 in Hydraulic Oil prior to irradiation

S1955024-1



566 ppm remaining following 230 kGy absorbed dose

S1955024-2

Figure 4. Electron capture detector gas chromatograms for Aroclor 1260 decomposition in Harvest King hydraulic oil. The top chromatogram is before irradiation; the bottom is following 230 kGy absorbed dose.

EXPERIMENTAL METHODS

Irradiations

Samples were irradiated using gamma rays from spent nuclear fuel at the Advanced Test Reactor (ATR) canal. A dry tube designed for experiment insertion allowed the samples to be lowered into a position surrounded by up to six fuel elements. The arrangement is shown in Figure 5. Dose rates varied with the age of the fuel and ranged from 30 to 1 kGy/h. A typical value during these experiments was 10 kGy/h. Previous work has demonstrated that decomposition rates are not affected by dose rate changes in this range.[9] The average gamma-ray energy was 700 keV. The samples were contained in 3-mL glass vials sealed inside stainless steel capsules.

A schematic of sample containers is shown in Figure 6. Samples were radiologically clean following irradiation (excepting the original contamination in the treatability study samples). Isotope gamma rays are not energetic enough to cause activation of the samples, and the multiple layers of containment prevented cross-contamination from the canal. Further details concerning the irradiation procedure may be found in Reference 7.

Absorbed doses to the samples were measured using the FWT-60 radiochromic film supplied by Far West Technology (Goleta, Calif.). The film calibration has been previously discussed in detail.[22] Samples were irradiated to an increasing series of absorbed doses by varying their exposure time in the dry tube.

Analytical Methods

The treatability study samples were analyzed for Aroclor 1260 content using a commercial laboratory (Maxim Technologies, Inc., St. Louis, Mo.). The laboratory performed a sulfuric acid digestion on the oils followed by hexane extraction of the PCBs. This fraction was then analyzed using electron capture detection gas chromatography.

INEL Oil Wastestreams

Oils used in the treatability study were selected from wastestreams in storage at the INEL's Mixed Waste Storage Facility. These oils were known to be contaminated with Aroclor 1260 (a commercial formulation containing a mixture of several PCB congeners) and small amounts of ^{137}Cs. Five wastestreams were available. They are designated 610, 611, 612, and 613 from crane crankcases and 1002 from the TAN V tanks.

Upon further characterization, it was discovered that wastestream 610 contained a very low PCB concentration, and it was not selected for use in the study. Wastestream 1002 was found to be mostly aqueous, and it too was not selected for use. Remaining wastestreams were the subject of the treatability study. Table 1 shows their characterization.

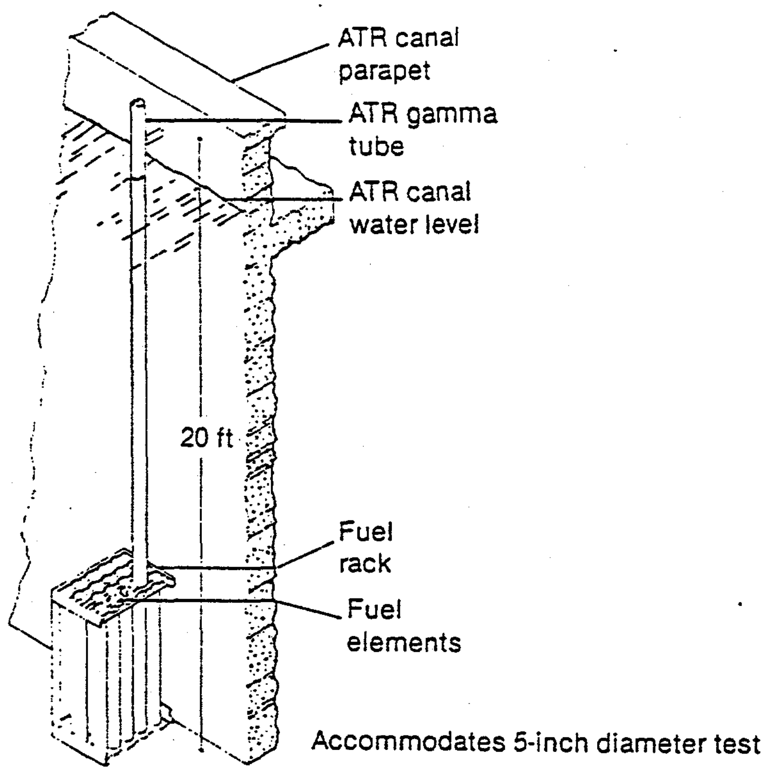


Figure 5. The ATR Gamma Facility, showing the dry tube extending from the canal surface into the spent fuel rack. The dry tube allows for experiment insertion into the high gamma-ray dose rates associated with the fuel.

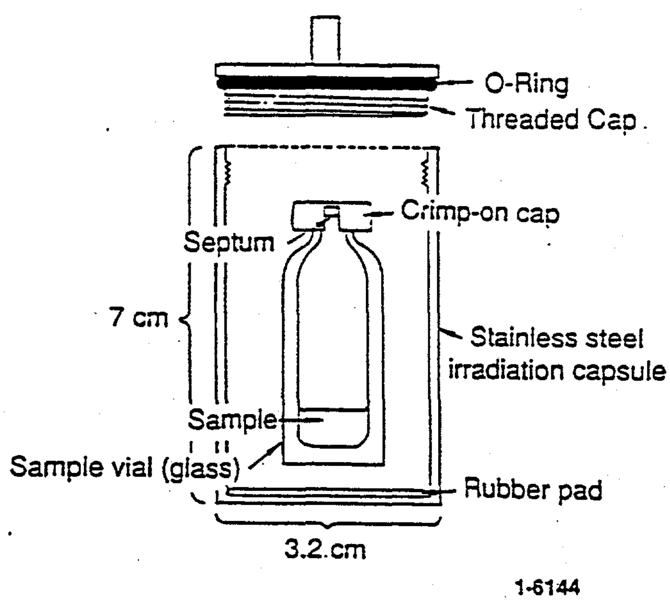


Figure 6. Schematic of the capsules used for experiment irradiations in the ATR Canal Gamma Facility dry tube. The multiple layers of containment prevented cross-contamination of the samples but allowed for in situ radiolysis of the PCBs.

Table 1. Characterization of wastestreams selected for treatability study.

Wastestream	Aroclor (ppm)	^{137}Cs (pCi/mL)	Comments
611	98	1.4E-1	Oil contains sediment, possible benzene, and unidentified peaks detectable by ECD
612	44	1.4E-1	Oil contains sediment
613	89	1.4E-1	Oil visually clear, possible lead contamination

TREATABILITY STUDY

Based upon the research described in the introduction of this report, a series of irradiations was designed to demonstrate the feasibility of decontamination of PCB-contaminated oils using gamma-ray radiolysis. Three radiologically contaminated PCB oils in storage at the INEL Mixed Waste Storage Facility were the subject of this treatability study. These oils are described in the experiments section of this report. They are designated wastestreams 611, 612, and 613. These oils are known to contain the impurities expected in any used industrial oil. It was unknown to what extent these impurities might interfere with the PCB electron capture reaction upon which successful treatment depended.

A preliminary irradiation was performed with a maximum absorbed dose of 183 kGy. A decrease in the Aroclor 1260 concentration was found in all three wastestreams, with wastestream 613 showing the most favorable results. Its Aroclor 1260 concentration was decreased by a factor of two. Dose constants are not reported here for this initial irradiation because the limited amount of decomposition does not provide for reasonable uncertainties to be calculated. Raw data provided by Maxim Technologies, Inc., for these samples and for the remaining samples analyzed in the study are shown in Appendix A.

A second irradiation to approximately 760 kGy was performed on the three wastestreams to generate the dose constants required to achieve the treatment standard. The absorbed doses and corresponding Aroclor 1260 concentrations for the irradiation of these wastestreams are shown in Table 2. Raw data are shown in Appendix A.

Table 2. Second irradiation results: The radiolytic destruction of Aroclor 1260 in INEL PCB wastestreams.

Absorbed dose (kGy)	Lab sample number	Aroclor (mg/kg)		
		611	612	613
0	6	95	45	92
106	7	84	33	66
185	8	69	28	36
285	9	47	23	24
483	10	18	13	7
757	11	8	8	2

It can be seen from these data that the treatment standard of 2 mg/kg was met in the second irradiation for wastestream 613 at an absorbed dose of 757 kGy. The treatment standard of

2 mg/kg is also the detection limit for the laboratory. The natural logarithm of these concentrations was plotted against the absorbed dose for each wastestream. The resulting dose constants were: 611 = 0.0035 +/- 0.0005 kGy^{-1}; 612 = 0.0023 +/- 0.0002 kGy^{-1}; 613 = 0.0052 +/- 0.0004 kGy^{-1}. Plots are shown in Figures 7–9. Corresponding ECD chromatograms for the untreated oil and following irradiation to 757 kGy are shown in Figures 10–12.

Dose constants determined from the second irradiation were used to calculate the absorbed doses required to achieve the 2 mg/kg goal for wastestreams 611 and 612. The calculation used was the standard first-order rate law:

10 $C = C_o e^{-dt}$

where C is the treatment standard of 2 mg/kg, C_O is the initial Aroclor concentration of the wastestream, d is the dose constant, and t is the absorbed dose (rather than time). The predicted absorbed doses required were determined to be 1,100 kGy for wastestream 611 and 1,350 kGy for wastestream 612.

A third and final irradiation was performed on all three wastestreams to a maximum absorbed dose of 2,242 kGy. Successful completion of the treatment standard was achieved at 1,069 kGy for all three wastestreams. These data are shown in Table 3 below. Raw data are shown in Appendix A.

Plots of the natural logarithm of the Aroclor concentrations versus absorbed dose are linear prior to achieving the detection limit, and the slopes are in excellent agreement with those measured for the second irradiation. These plots are shown in Figures 13–15. The corresponding ECD chromatograms are shown in Figures 16–18.

Table 3. Final irradiation results: The radiolytic destruction of Aroclor 1260 in INEL PCB wastestreams.

		Aroclor (mg/kg)		
Absorbed dose (kGy)	Lab sample number	611	612	613
0	12	90	34	81
178	13	59	26	40
677	14	10	10	2
1,069	15	2	2	2
1,851	16	2	2	2
2,242	17	2	2	2

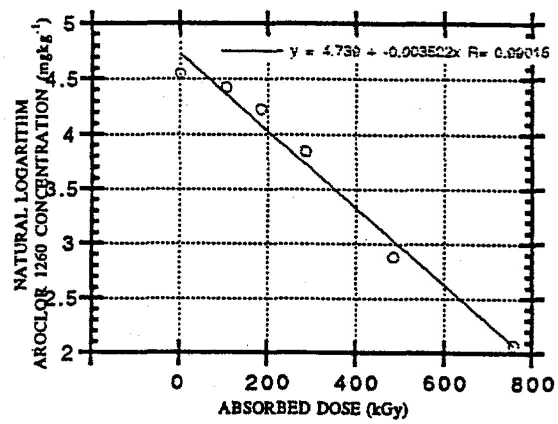


Figure 7. Dose constant plot for second irradiation of wastestream 611.

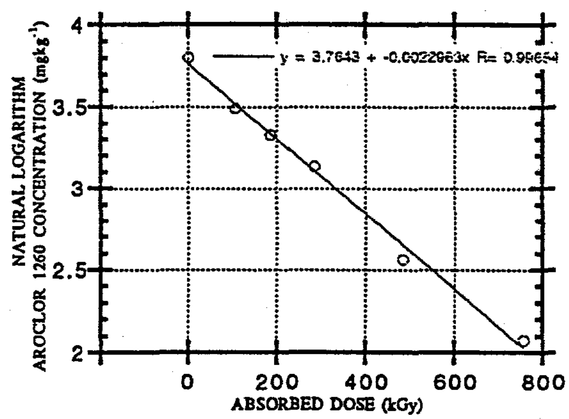


Figure 8. Dose constant plot for second irradiation of wastestream 612.

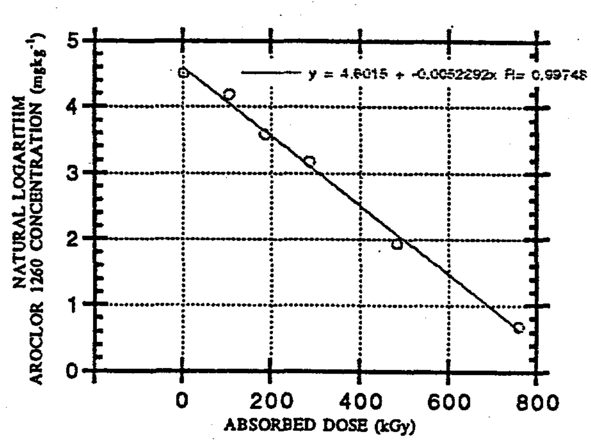
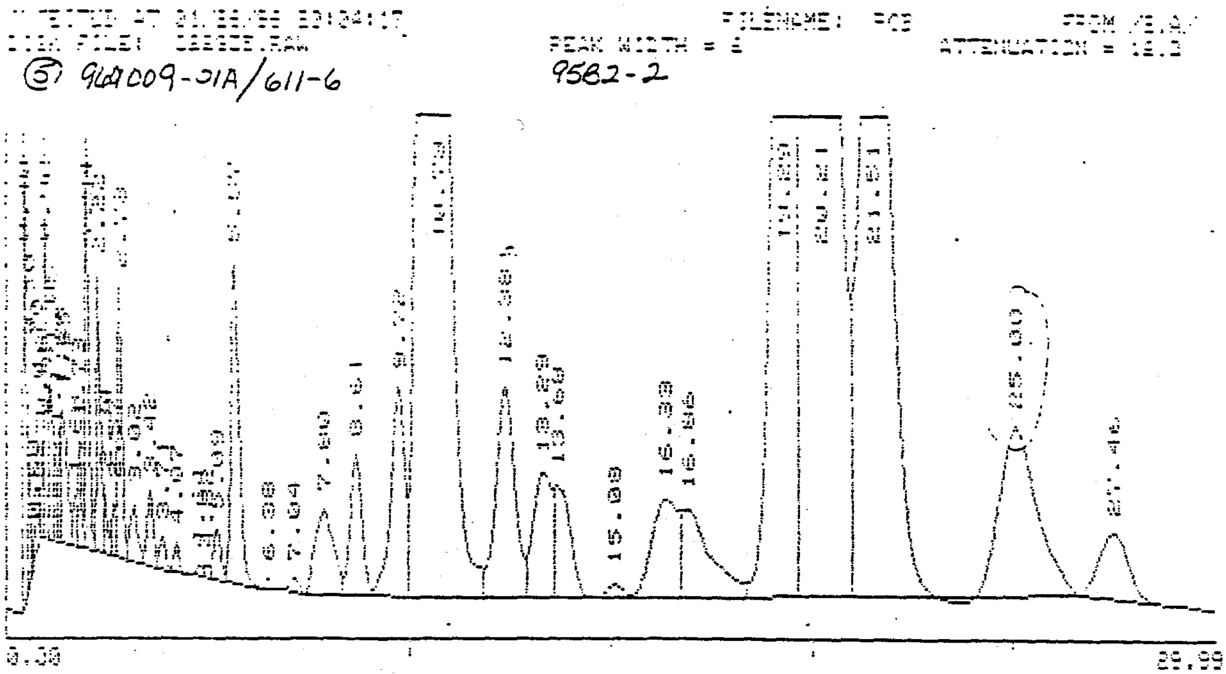


Figure 9. Dose constant plot for second irradiation of wastestream 613.



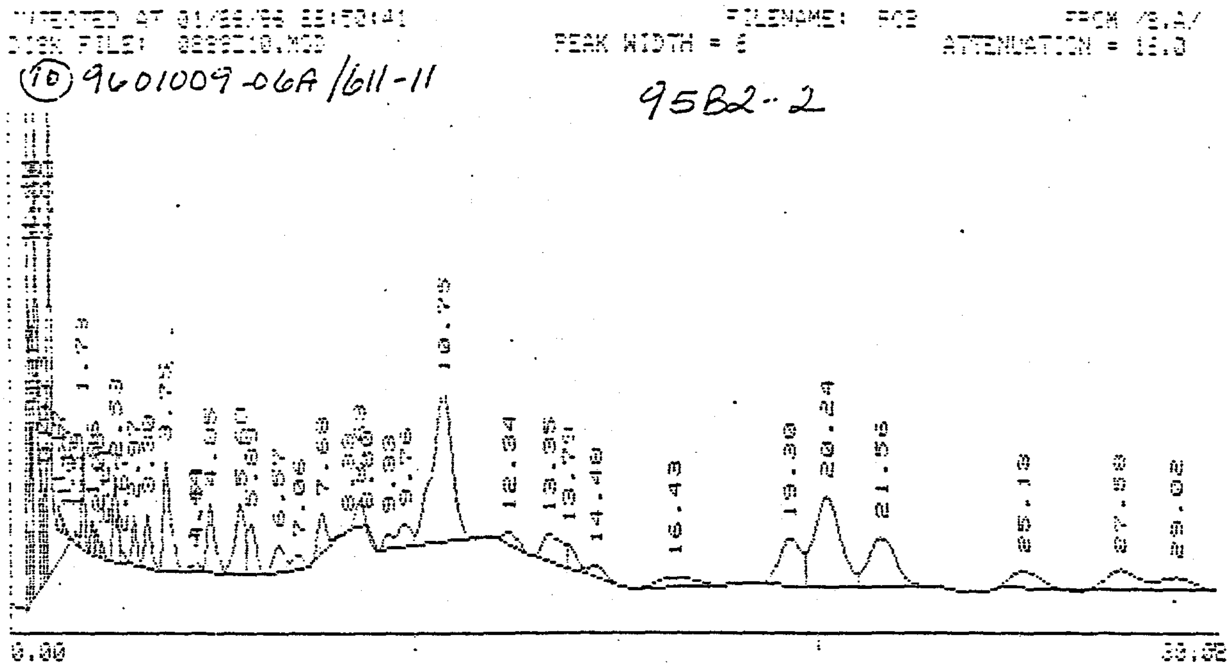


Figure 10. Electron capture detector gas chromatograms for second irradiation of wastestream 611. The top chromatogram is for the preirradiation sample; the bottom is following 757 kGy absorbed dose.

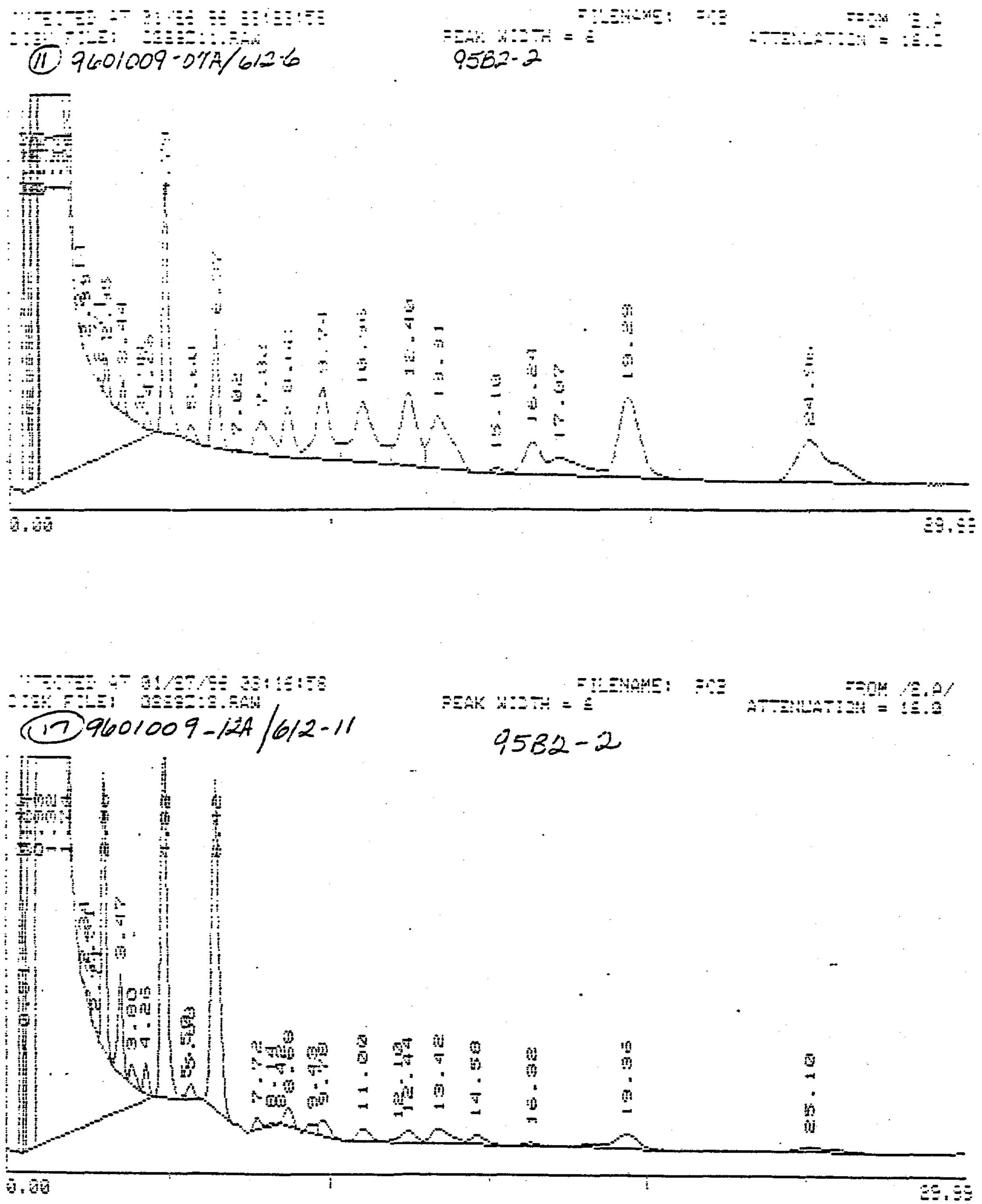


Figure 11. Electron capture detector gas chromatograms for second irradiation of wastestream 612. The top chromatogram is for the preirradiation sample; the bottom is following 757 kGy absorbed dose.

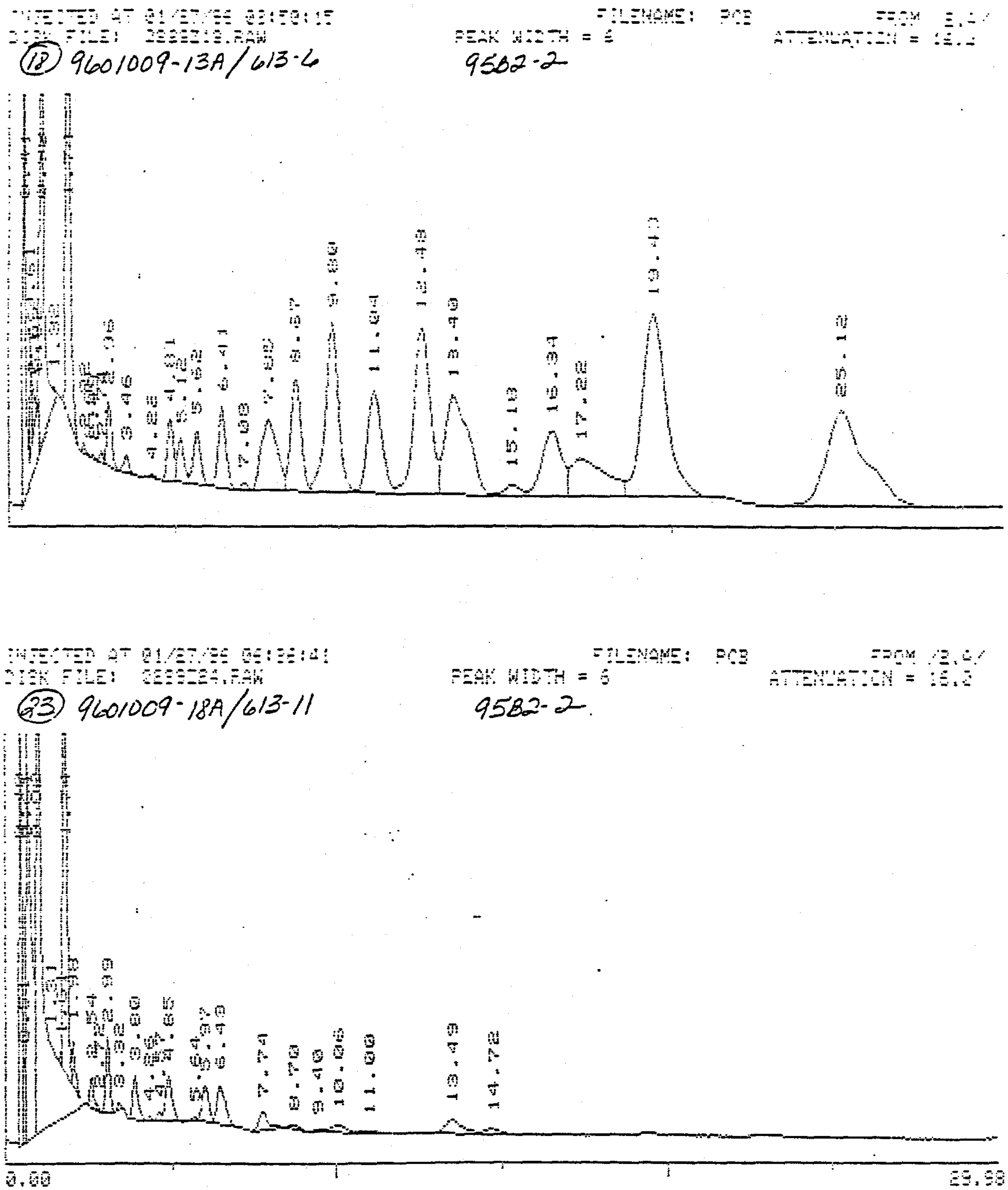


Figure 12. Electron capture detector gas chromatograms for second irradiation of wastestream 613. The top chromatogram is for the preirradiation sample; the bottom is following 757 kGy absorbed dose.

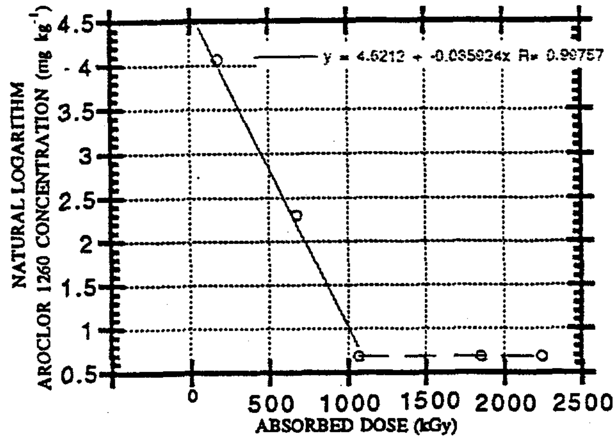


Figure 13. Dose constant plot for third irradiation of wastestream 611.

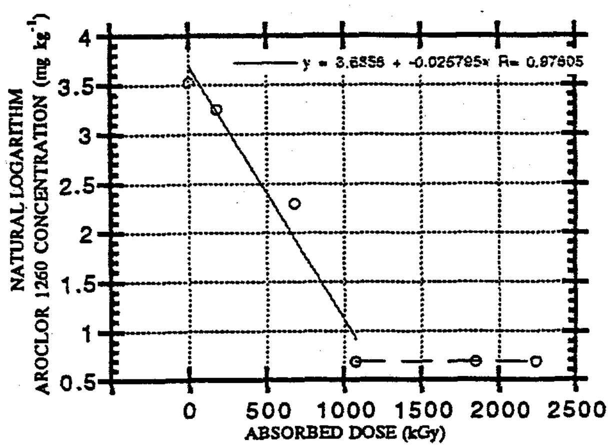


Figure 14. Dose constant plot for third irradiation of wastestream 612.

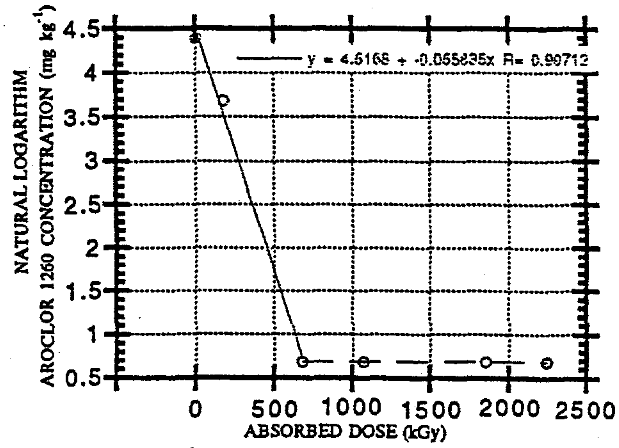


Figure 15. Dose constant plot for third irradiation of wastestream 613.

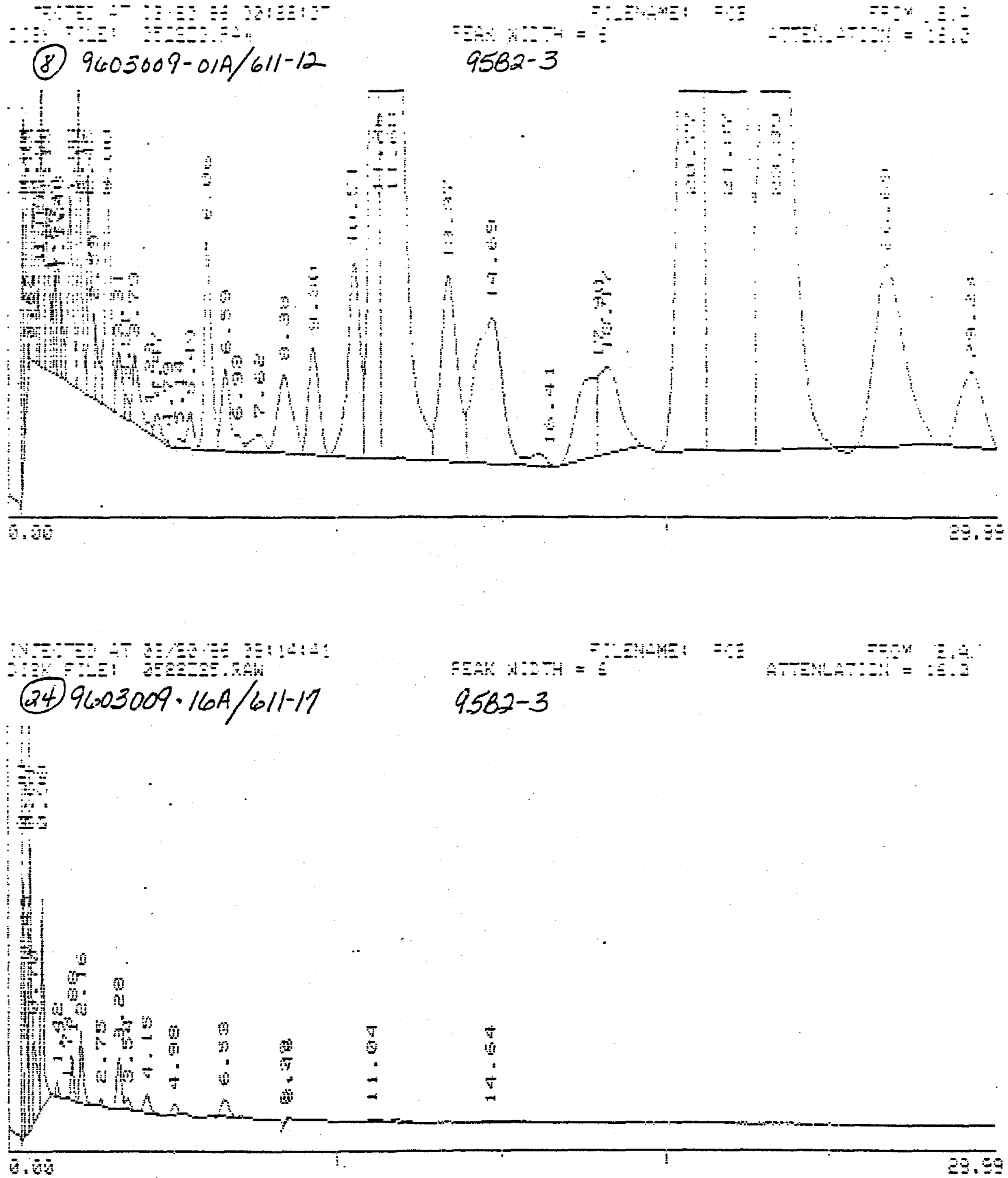


Figure 16. Electron capture detector gas chromatograms for third irradiation of wastestream 611. The top chromatograph is for the preirradiation sample; the bottom is following 1,851 kGy absorbed dose. The treatment standard of 2 mg/kg has been achieved.

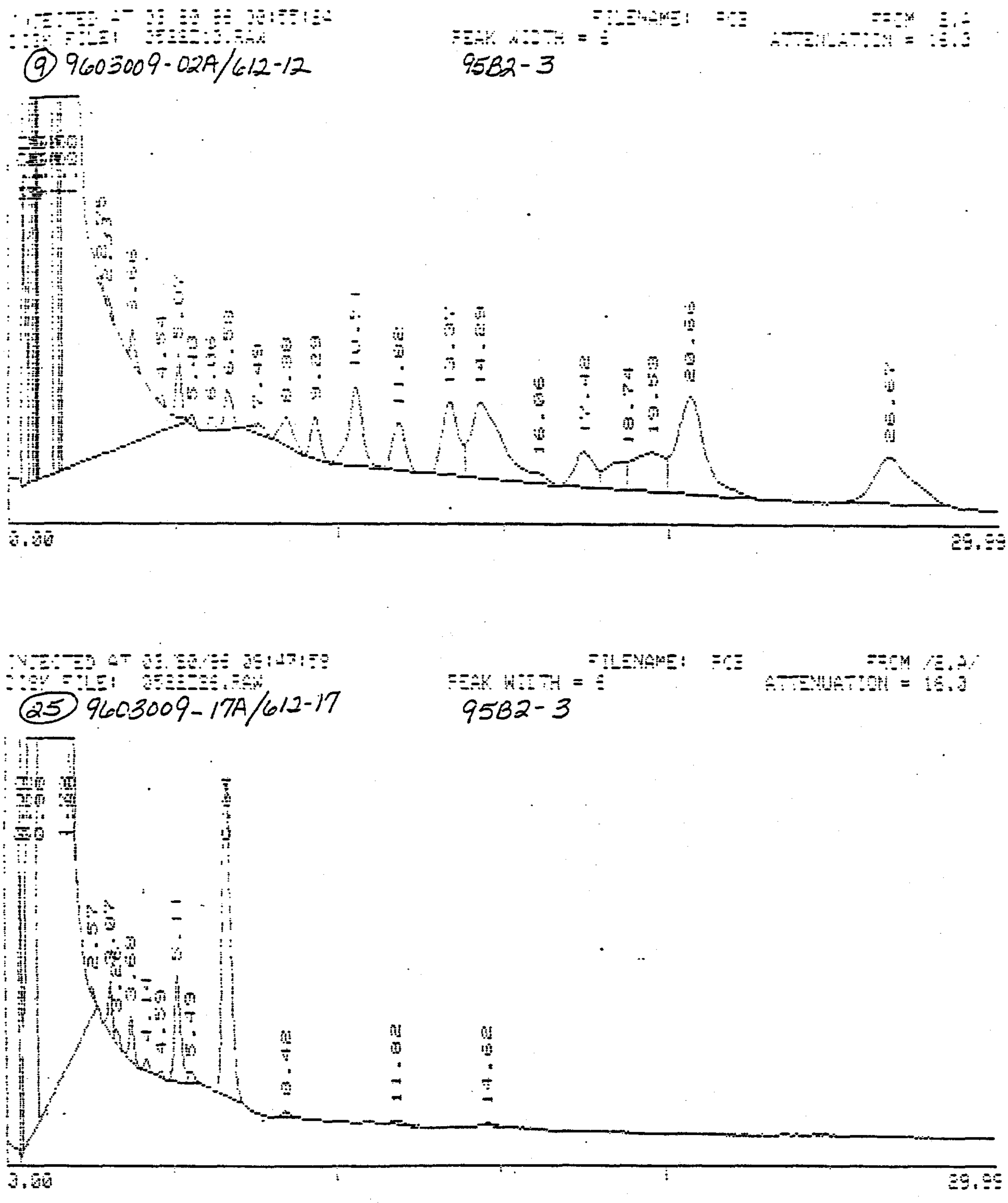
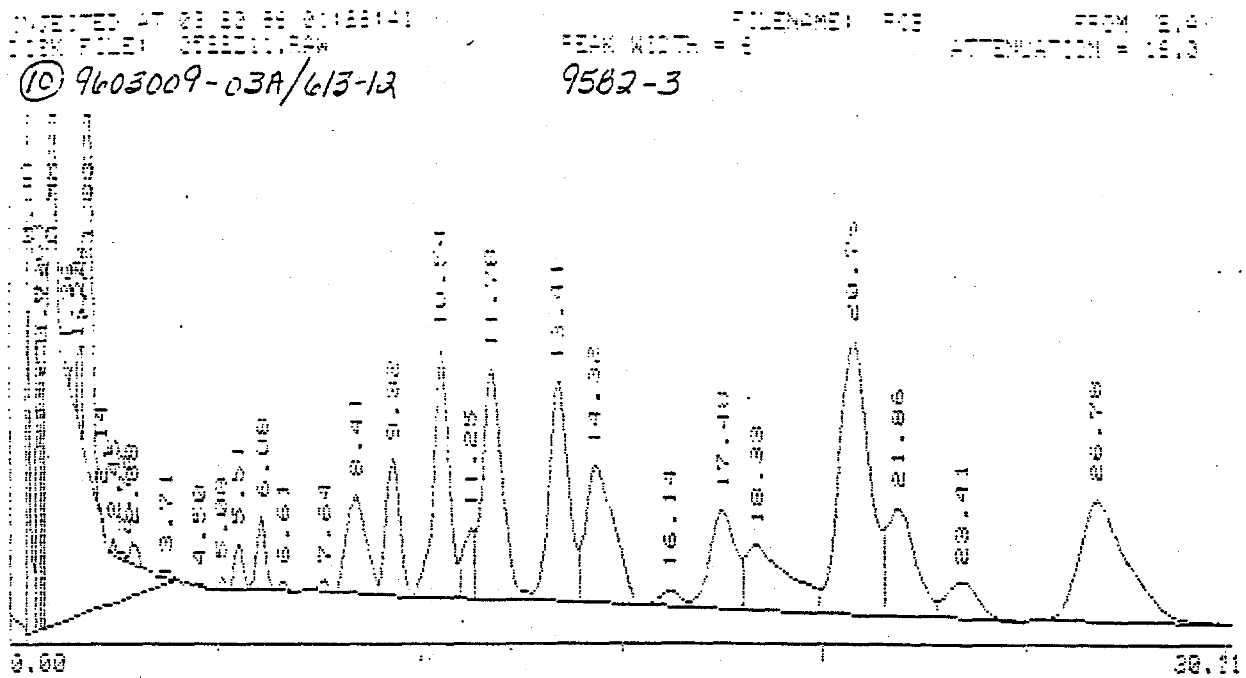


Figure 17. Electron capture detector gas chromatograms for third irradiation of wastestream 612. The top chromatograph is for the preirradiation sample; the bottom is following 1,851 kGy absorbed dose. The treatment standard of 2 mg/kg has been achieved.



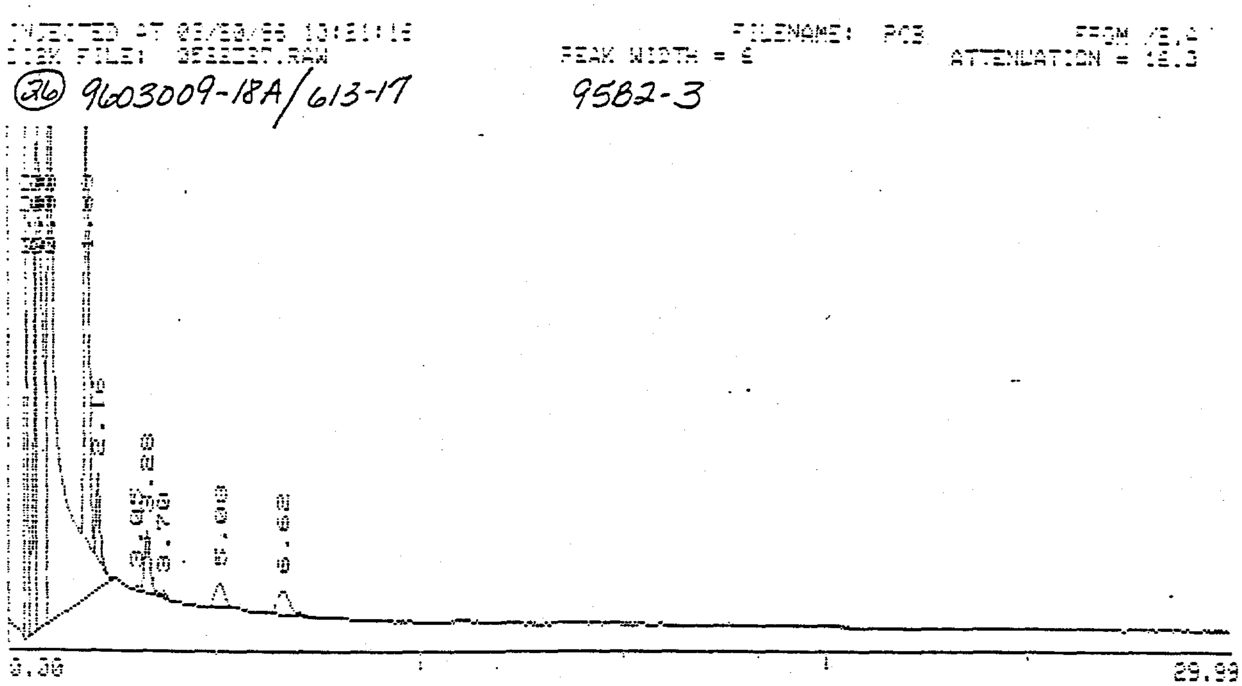


Figure 18. Electron capture detector gas chromatograms for third irradiation of wastestream 613. The top chromatograph is for the preirradiation sample; the bottom is following 1,069 kGy absorbed dose. The treatment standard of 2 mg/kg has been achieved.

CONCLUSIONS

The EPA-mandated treatment standard of 2 mg/kg was successfully met for the three INEL PCB wastestreams using gamma-ray radiolysis. The gamma-ray source was spent nuclear fuel at the ATR.

It is known from previous research that the radiolytic decomposition of PCBs in oils proceeds by electron capture resulting in dechlorination. This was demonstrated both by scavenger experiments in which PCB decomposition was suppressed by addition of electron-capturing agents and by the measured production of less-chlorinated congeners. The kinetics of the system is understood well enough from these earlier studies for adequate prediction of the absorbed doses required for adequate treatment of the INEL wastestreams. Required doses are within the range easily delivered using ATR spent fuel. These doses are also within the range that may be delivered using industrial isotope sources and accelerators.

Results of this study demonstrate conclusively that radiolysis is a viable process for selective treatment of PCBs in contaminated oils. The EPA treatment goal of 2 mg/kg was achieved even in the presence of electron-capturing impurities that are likely to be present in industrial oils. The presence of competing impurities was especially severe in wastestreams 611 and 612. This did not preclude adequate treatment.

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Appendix A

Maxim Technologies, Inc., Raw Analytical Data

1D

PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

610-0

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-01A

Sample wt/vol: 1 (g/ml)g Lab File ID:____________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/14/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	10	U

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

610-1

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-02A

Sample wt/vol: 1 (g/ml)g Lab File ID:__________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/14/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	10	U

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

610-2

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.: TOS-310 Sas:_______ SDG No.: 610-1

Matrix: (soil/water) OIL   Lab Sample ID: 9511034-03A

Sample wt/vol: 1 (g/ml)g   Lab File ID:____________

Level: (low/med) HAZ   Date Received: 11/10/95

%Moisture: not dec.   dec.   Date Extracted: 11/14/95

Extraction: WASTE DILUTION   Date Analyzed: 11/14/95

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	10	U

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

610-3

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL   Lab Sample ID: 9511034-04A

Sample wt/vol: 1 (g/ml)g   Lab File ID:___________

Level: (low/med) HAZ   Date Received: 11/10/95

%Moisture: not dec.   dec.   Date Extracted: 11/14/95

Extraction: WASTE DILUTION   Date Analyzed: 11/14/95

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	10	U

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

610-4

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-05A

Sample wt/vol: 1 (g/ml)g Lab File ID:___________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/14/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	10	U

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

610-5

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-06A

Sample wt/vol: 1 (g/ml)g Lab File ID:____________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/14/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	10	U

1D

PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

611-0

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-07A

Sample wt/vol: 1 (g/ml)g Lab File ID:__________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	91	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

611-1

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL   Lab Sample ID: 9511034-08A

Sample wt/vol: 1 (g/ml)g   Lab File ID:__________

Level: (low/med) HAZ   Date Received: 11/10/95

%Moisture: not dec.   dec.   Date Extracted: 11/14/95

Extraction: WASTE DILUTION   Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	100	

1D

PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

611-2

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-09A

Sample wt/vol: 1 (g/ml)g Lab File ID:____________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	91	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

611-3

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:_______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-10A

Sample wt/vol: 1 (g/ml)g Lab File ID:____________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	76	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

611-4

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL   Lab Sample ID: 9511034-11A

Sample wt/vol: 1 (g/ml)g   Lab File ID:__________

Level: (low/med) HAZ   Date Received: 11/10/95

%Moisture: not dec.   dec.   Date Extracted: 11/14/95

Extraction: WASTE DILUTION   Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	57	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

611-5

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:_______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-12A

Sample wt/vol: 1 (g/ml)g Lab File ID:____________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	64	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

612-0

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-13A

Sample wt/vol: 1 (g/ml)g Lab File ID:___________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	46	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

612-1

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-14A

Sample wt/vol: 1 (g/ml)g Lab File ID:__________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	40	

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EPA SAMPLE No.

612-2

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:_______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-15A

Sample wt/vol: 1 (g/ml)g Lab File ID:____________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	27	

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EPA SAMPLE No.

612-3

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.: TOS-310 Sas:______   SDG No.: 610-1

Matrix: (soil/water) OIL   Lab Sample ID: 9511034-16A

Sample wt/vol: 1 (g/ml)g   Lab File ID:__________

Level: (low/med) HAZ   Date Received: 11/10/95

%Moisture: not dec.   dec.   Date Extracted: 11/14/95

Extraction: WASTE DILUTION   Date Analyzed: 11/15/95

GPC Cleanup:(Y/N) N pH___   Dilution Factor: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	27	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

612-4

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:_______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-17A

Sample wt/vol: 1 (g/ml)g Lab File ID:____________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	25	

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EPA SAMPLE No.

612-5

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL   Lab Sample ID: 9511034-18A

Sample wt/vol: 1 (g/ml)g   Lab File ID:__________

Level: (low/med) HAZ   Date Received: 11/10/95

%Moisture: not dec.   dec.   Date Extracted: 11/14/95

Extraction: WASTE DILUTION   Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	28	

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EPA SAMPLE No.

613-0

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL   Lab Sample ID: 9511034-19A

Sample wt/vol: 1 (g/ml)g   Lab File ID:____________

Level: (low/med) HAZ   Date Received: 11/10/95

%Moisture: not dec. dec.   Date Extracted: 11/14/95

Extraction: WASTE DILUTION   Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	79	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

613-1

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:_______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-20A

Sample wt/vol: 1 (g/ml)g Lab File ID:____________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	71	

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EPA SAMPLE No.

613-2

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL   Lab Sample ID: 9511034-21A

Sample wt/vol: 1 (g/ml)g   Lab File ID:___________

Level: (low/med) HAZ   Date Received: 11/10/95

%Moisture: not dec. dec.   Date Extracted: 11/14/95

Extraction: WASTE DILUTION   Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	56	

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EPA SAMPLE No.

613-3

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL   Lab Sample ID: 9511034-22A

Sample wt/vol: 1 (g/ml)g   Lab File ID:__________

Level: (low/med) HAZ   Date Received: 11/10/95

%Moisture: not dec. dec.   Date Extracted: 11/14/95

Extraction: WASTE DILUTION   Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	38	

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EPA SAMPLE No.

613-4

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL   Lab Sample ID: 9511034-23A

Sample wt/vol: 1 (g/ml)g   Lab File ID:__________

Level: (low/med) HAZ   Date Received: 11/10/95

%Moisture: not dec.   dec.   Date Extracted: 11/14/95

Extraction: WASTE DILUTION   Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	33	

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EPA SAMPLE No.

613-5

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.: TOS-310 Sas:______ SDG No.: 610-1

Matrix: (soil/water) OIL Lab Sample ID: 9511034-24A

Sample wt/vol: 1 (g/ml)g Lab File ID:____________

Level: (low/med) HAZ Date Received: 11/10/95

%Moisture: not dec. dec. Date Extracted: 11/14/95

Extraction: WASTE DILUTION Date Analyzed: 11/15/95

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/g	Q
12674-11-2	--AROCLOR-1016	10	U
11104-28-2	--AROCLOR-1221	20	U
11141-16-5	--AROCLOR-1232	10	U
53469-21-9	--AROCLOR-1242	10	U
12672-29-6	--AROCLOR-1248	10	U
11097-69-1	--AROCLOR-1254	10	U
11096-82-5	--AROCLOR-1260	42	

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EPA SAMPLE No.

611-6

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.:TOS-310   Sas:______   SDG No.: 611-6_

Matrix: (soil/water) OIL   Lab Sample ID:9601009-01A__

Sample wt/vol: 1.0(g/ml)g   Lab File ID:__________

Level: (low/med) LOW   Date Received: 01/09/96

%Moisture: not dec.   dec.   Date Extracted: 01/11/96

Extraction: WASTE DILUTION   Date Analyzed: 01/26/96

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	95	

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EPA SAMPLE No.

611-7

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.:TOS-310 Sas:_______ SDG No.: 611-6_

Matrix: (soil/water) OIL Lab Sample ID:9601009-02A__

Sample wt/vol: 1.0(g/ml)g Lab File ID:____________

Level: (low/med) LOW Date Received: 01/09/96

%Moisture: not dec. dec. Date Extracted: 01/11/96

Extraction: WASTE DILUTION Date Analyzed: 01/26/96

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	84	

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EPA SAMPLE No.

611-8

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.:TOS-310 Sas:______ SDG No.: 611-6_

Matrix: (soil/water) OIL Lab Sample ID:9601009-03A__

Sample wt/vol: 1.0(g/ml)g Lab File ID:___________

Level: (low/med) LOW Date Received: 01/09/96

%Moisture: not dec. dec. Date Extracted: 01/11/96

Extraction: WASTE DILUTION Date Analyzed: 01/26/96

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	69	

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EPA SAMPLE No.

611-9

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.:TOS-310 Sas:_______ SDG No.: 611-6_

Matrix: (soil/water) OIL Lab Sample ID:9601009-04A__

Sample wt/vol: 1.0(g/ml)g Lab File ID:____________

Level: (low/med) LOW Date Received: 01/09/96

%Moisture: not dec. dec. Date Extracted: 01/11/96

Extraction: WASTE DILUTION Date Analyzed: 01/26/96

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	47	

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EPA SAMPLE No.

611-10

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.:TOS-310 Sas:______ SDG No.: 611-6_

Matrix: (soil/water) OIL Lab Sample ID:9601009-05A__

Sample wt/vol: 1.0(g/ml)g Lab File ID:____________

Level: (low/med) LOW Date Received: 01/09/96

%Moisture: not dec. dec. Date Extracted: 01/11/96

Extraction: WASTE DILUTION Date Analyzed: 01/26/96

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	18	

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EPA SAMPLE No.

611-11

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.:TOS-310 Sas:_______ SDG No.: 611-6_

Matrix: (soil/water) OIL Lab Sample ID:9601009-06A__

Sample wt/vol: 1.0(g/ml)g Lab File ID:____________

Level: (low/med) LOW Date Received: 01/09/96

%Moisture: not dec. dec. Date Extracted: 01/11/96

Extraction: WASTE DILUTION Date Analyzed: 01/26/96

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	8	

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EPA SAMPLE No.

612-6

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.:TOS-310   Sas:______   SDG No.: 611-6_

Matrix: (soil/water) OIL   Lab Sample ID:9601009-07A__

Sample wt/vol: 1.0(g/ml)g   Lab File ID:____________

Level: (low/med) LOW   Date Received: 01/09/96

%Moisture: not dec.   dec.   Date Extracted: 01/11/96

Extraction: WASTE DILUTION   Date Analyzed: 01/26/96

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	45	

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EPA SAMPLE No.

612-7

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.:TOS-310 Sas:_______ SDG No.: 611-6_

Matrix: (soil/water) OIL Lab Sample ID:9601009-08A__

Sample wt/vol: 1.0(g/ml)g Lab File ID:____________

Level: (low/med) LOW Date Received: 01/09/96

%Moisture: not dec. dec. Date Extracted: 01/11/96

Extraction: WASTE DILUTION Date Analyzed: 01/26/96

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	33	

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EPA SAMPLE No.

n12-8

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.:TOS-310   Sas:_______   SDG No.: 611-6_

Matrix: (soil/water) OIL   Lab Sample ID:9601009-09A__

Sample wt/vol: 1.0(g/ml)g   Lab File ID:____________

Level: (low/med) LOW   Date Received: 01/09/96

%Moisture: not dec.   dec.   Date Extracted: 01/11/96

Extraction: WASTE DILUTION   Date Analyzed: 01/27/96

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	28	

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EPA SAMPLE No.

612-9

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.:TOS-310 Sas:_______ SDG No.: 611-6_

Matrix: (soil/water) OIL Lab Sample ID:9601009-10A__

Sample wt/vol: 1.0(g/ml)g Lab File ID:____________

Level: (low/med) LOW Date Received: 01/09/96

%Moisture: not dec. dec. Date Extracted: 01/11/96

Extraction: WASTE DILUTION Date Analyzed: 01/27/96

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	23	

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EPA SAMPLE No.

512-10

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.:TOS-310 Sas:______ SDG No.: 611-6_

Matrix: (soil/water) OIL Lab Sample ID:9601009-11A__

Sample wt/vol: 1.0(g/ml)g Lab File ID:____________

Level: (low/med) LOW Date Received: 01/09/96

%Moisture: not dec. dec. Date Extracted: 01/11/96

Extraction: WASTE DILUTION Date Analyzed: 01/27/96

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	13	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

612-11

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.: TOS-310   Sas:______   SDG No.: 611-6_

Matrix: (soil/water) OIL   Lab Sample ID: 9601009-12A__

Sample wt/vol: 1.0(g/ml)g   Lab File ID:__________

Level: (low/med) LOW   Date Received: 01/09/96

%Moisture: not dec.   dec.   Date Extracted: 01/11/96

Extraction: WASTE DILUTION   Date Analyzed: 01/27/96

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	8	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

613-6

Lab Name: TCT ST LOUIS Contract: ER-TOS-310

Lab Code: TCT Case No.:TOS-310 Sas:_______ SDG No.: 611-6_

Matrix: (soil/water) OIL Lab Sample ID:9601009-13A__

Sample wt/vol: 1.0(g/ml)g Lab File ID:____________

Level: (low/med) LOW Date Received: 01/09/96

%Moisture: not dec. dec. Date Extracted: 01/11/96

Extraction: WASTE DILUTION Date Analyzed: 01/27/96

GPC Cleanup:(Y/N)_N pH___ Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	92	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

613-7

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.:TOS-310   Sas:______ SDG No.: 611-6_

Matrix: (soil/water) OIL   Lab Sample ID:9601009-14A__

Sample wt/vol: 1.0(g/ml)g   Lab File ID:__________

Level: (low/med) LOW   Date Received: 01/09/96

%Moisture: not dec.   dec.   Date Extracted: 01/11/96

Extraction: WASTE DILUTION   Date Analyzed: 01/27/96

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	66	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

613-8

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.:TOS-310   Sas:_______   SDG No.: 611-6_

Matrix: (soil/water) OIL   Lab Sample ID:9601009-15A__

Sample wt/vol: 1.0(g/ml)g   Lab File ID:____________

Level: (low/med) LOW   Date Received: 01/09/96

%Moisture: not dec.   dec.   Date Extracted: 01/11/96

Extraction: WASTE DILUTION   Date Analyzed: 01/27/96

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	36	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

613-9

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.:TOS-310   Sas:______   SDG No.: 611-6_

Matrix: (soil/water) OIL   Lab Sample ID:9601009-16A__

Sample wt/vol: 1.0(g/ml)g   Lab File ID:____________

Level: (low/med) LOW   Date Received: 01/09/96

%Moisture: not dec.   dec.   Date Extracted: 01/11/96

Extraction: WASTE DILUTION   Date Analyzed: 01/27/96

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	24	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

613-10

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.:TOS-310   Sas:______   SDG No.: 611-6_

Matrix: (soil/water) OIL   Lab Sample ID:9601009-17A__

Sample wt/vol: 1.0(g/ml)g   Lab File ID:___________

Level: (low/med) LOW   Date Received: 01/09/96

%Moisture: not dec.   dec.   Date Extracted: 01/11/96

Extraction: WASTE DILUTION   Date Analyzed: 01/27/96

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	7	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

613-11

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310

Lab Code: TCT   Case No.:TOS-310   Sas:_______ SDG No.: 611-6_

Matrix: (soil/water) OIL   Lab Sample ID:9601009-18A__

Sample wt/vol: 1.0(g/ml)g   Lab File ID:____________

Level: (low/med) LOW   Date Received: 01/09/96

%Moisture: not dec.   dec.   Date Extracted: 01/11/96

Extraction: WASTE DILUTION   Date Analyzed: 01/27/96

GPC Cleanup:(Y/N)_N pH___   Dilution Factor:____1____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/G	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	2	U

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

611-12

Lab Name: TCT ST LOUIS Contract: ER-TOS-310_____

Lab Code: TCT Case No.: TOS-310 Sas:_______ SDG No.: 611-12

Matrix: (soil/water/oil) OIL Lab Sample ID: 9603009-01A

Sample wt/vol: 1.0 (g/ml)_G__ Lab File ID:____________

Level: (low/med) LOW_ Date Received: 03/08/96

%Moisture: not dec.____ dec.____ Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__ Dilution Factor:__1______

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	90	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

611-13

Lab Name: TCT ST LOUIS Contract: ER-TOS-310_____

Lab Code: TCT Case No.: TOS-310 Sas:_______. SDG No.: 611-12

Matrix: (soil/water/oil) OIL Lab Sample ID: 9603009-04A

Sample wt/vol: 1.0 (g/ml)_G__ Lab File ID:____________

Level: (low/med) LOW_ Date Received: 03/08/96

%Moisture: not dec.____ dec.____ Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__ Dilution Factor:__1______

CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	59	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

611-14

Lab Name: TCT ST LOUIS Contract: ER-TOS-310______

Lab Code: TCT Case No.: TOS-310 Sas:_______.SDG No.: 611-12

Matrix: (soil/water/oil) OIL Lab Sample ID: 9603009-07A

Sample wt/vol: 1.0 (g/ml)_G__ Lab File ID:____________

Level: (low/med) LOW_ Date Received: 03/08/96

%Moisture: not dec.____ dec.____ Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__ Dilution Factor:__1______

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	10	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

611-15

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310_____

Lab Code: TCT   Case No.: TOS-310 Sas:_______ SDG No.: 611-12

Matrix: (soil/water/oil) OIL   Lab Sample ID: 9603009-10A

Sample wt/vol: 0.07 (g/ml)_G__   Lab File ID:____________

Level: (low/med) LOW_   Date Received: 03/08/96

%Moisture: not dec.____ dec.____   Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL   Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__   Dilution Factor:__1______

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	2	U

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EPA SAMPLE No.

611-16

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310______

Lab Code: TCT   Case No.: TOS-310 Sas:_______. SDG No.: 611-12

Matrix: (soil/water/oil) OIL   Lab Sample ID: 9603009-13A

Sample wt/vol: 1.0(g/ml)_G__   Lab File ID:____________

Level: (low/med) LOW_   Date Received: 03/08/96

%Moisture: not dec.____ dec.____   Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL   Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__   Dilution Factor:__1______

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	2	U

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

611-17

Lab Name: TCT ST LOUIS Contract: ER-TOS-310_____

Lab Code: TCT Case No.: TOS-310 Sas:______. SDG No.: 611-12

Matrix: (soil/water/oil) OIL Lab Sample ID: 9603009-16A

Sample wt/vol: 1.0 (g/ml)_G__ Lab File ID:____________

Level: (low/med) LOW_ Date Received: 03/08/96

%Moisture: not dec.____ dec.____ Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__ Dilution Factor:__1______

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	2	U

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

612-12

Lab Name: TCT ST LOUIS Contract: ER-TOS-310_____

Lab Code: TCT Case No.: TOS-310 Sas:_______ SDG No.: 611-12

Matrix: (soil/water/oil) OIL Lab Sample ID: 9603009-02A

Sample wt/vol: 1.0 (g/ml)_G__ Lab File ID:____________

Level: (low/med) LOW_ Date Received: 03/08/96

%Moisture: not dec.____ dec.____ Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__ Dilution Factor:__1______

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	34	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

612-13

Lab Name: TCT ST LOUIS Contract: ER-TOS-310_____

Lab Code: TCT Case No.: TOS-310 Sas:_______ SDG No.: 611-12

Matrix: (soil/water/oil) OIL Lab Sample ID: 9603009-05A

Sample wt/vol: 1.0 (g/ml)_G__ Lab File ID:____________

Level: (low/med) LOW_ Date Received: 03/08/96

%Moisture: not dec.____ dec.____ Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__ Dilution Factor:__1______

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	26	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

612-14

Lab Name: TCT ST LOUIS Contract: ER-TOS-310_____

Lab Code: TCT Case No.: TOS-310 Sas:______ SDG No.: 611-12

Matrix: (soil/water/oil) OIL Lab Sample ID: 9603009-08A

Sample wt/vol: 1.0 (g/ml)_G__ Lab File ID:____________

Level: (low/med) LOW_ Date Received: 03/08/96

%Moisture: not dec.____ dec.____ Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__ Dilution Factor:__1_____

CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__

CAS NO.	COMPOUND	(ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	10	

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

612-15

Lab Name: TCT ST LOUIS Contract: ER-TOS-310_____

Lab Code: TCT Case No.: TOS-310 Sas:_______.SDG No.: 611-12

Matrix: (soil/water/oil) OIL Lab Sample ID: 9603009-11A

Sample wt/vol: 1.0 (g/ml)_G__ Lab File ID:____________

Level: (low/med) LOW_ Date Received: 03/08/96

%Moisture: not dec.____ dec.____ Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__ Dilution Factor:__1______

CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	2	U

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

612-16

Lab Name: TCT ST LOUIS Contract: ER-TOS-310_____

Lab Code: TCT Case No.: TOS-310 Sas:_______.SDG No.: 611-12

Matrix: (soil/water/oil) OIL Lab Sample ID: 9603009-14A

Sample wt/vol: 1.0 (g/ml)_G__ Lab File ID:____________

Level: (low/med) LOW_ Date Received: 03/08/96

%Moisture: not dec.____ dec.____ Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__ Dilution Factor:__1______

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	2	U

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

612-17

Lab Name: TCT ST LOUIS Contract: ER-TOS-310______

Lab Code: TCT Case No.: TOS-310 Sas:_______.SDG No.: 611-12

Matrix: (soil/water/oil) OIL Lab Sample ID: 9603009-17A

Sample wt/vol: 1.0 (g/ml)_G__ Lab File ID:____________

Level: (low/med) LOW_ Date Received: 03/08/96

%Moisture: not dec.____ dec.____ Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__ Dilution Factor:__1_____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	2	U

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

613-12

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310_____

Lab Code: TCT   Case No.: TOS-310 Sas:______ SDG No.: 611-12

Matrix: (soil/water/oil) OIL   Lab Sample ID: 9603009-03A

Sample wt/vol: 1.0 (g/ml)_G__   Lab File ID:___________

Level: (low/med) LOW_   Date Received: 03/08/96

%Moisture: not dec.____ dec.____   Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL   Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__   Dilution Factor:__1_____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	81	

FORM 1 PEST   1/87 Rev.

1D

PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

613-13

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310_____

Lab Code: TCT   Case No.: TOS-310 Sas:_______ SDG No.: 611-12

Matrix: (soil/water/oil) OIL   Lab Sample ID: 9603009-06A

Sample wt/vol: 1.0 (g/ml)_G__   Lab File ID:____________

Level: (low/med) LOW_   Date Received: 03/08/96

%Moisture: not dec.____ dec.____   Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL   Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__   Dilution Factor:__1______

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	40	

FORM 1 PEST   1/87 Rev.

1D

PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

613-14

Lab Name: TCT ST LOUIS Contract: ER-TOS-310______

Lab Code: TCT Case No.: TOS-310 Sas:_______. SDG No.: 611-12

Matrix: (soil/water/oil) OIL Lab Sample ID: 9603009-09A

Sample wt/vol: 1.0 (g/ml)_G__ Lab File ID:_____________

Level: (low/med) LOW_ Date Received: 03/08/96

%Moisture: not dec.____ dec.____ Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__ Dilution Factor:__1______

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	2	U

FORM 1 PEST 1/87 Rev.

1D

PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

613-15

Lab Name: TCT ST LOUIS Contract: ER-TOS-310_____

Lab Code: TCT Case No.: TOS-310 Sas:_______ SDG No.: 611-12

Matrix: (soil/water/oil) OIL Lab Sample ID: 9603009-12A

Sample wt/vol: 0.20 (g/ml)_G__ Lab File ID:____________

Level: (low/med) LOW_ Date Received: 03/08/96

%Moisture: not dec.____ dec.____ Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__ Dilution Factor:__1_____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	2	U

FORM 1 PEST 1/87 Rev.

1D

PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

613-16

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310_____

Lab Code: TCT   Case No.: TOS-310 Sas:______ SDG No.: 611-12

Matrix: (soil/water/oil) OIL   Lab Sample ID: 9603009-15A

Sample wt/vol: 1.0 (g/ml)_G__   Lab File ID:___________

Level: (low/med) LOW_   Date Received: 03/08/96

%Moisture: not dec.____ dec.____   Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL   Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__   Dilution Factor:__1_____

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	2	U

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PESTICIDE ORGANICS DATA SHEET

EPA SAMPLE No.

613-17

Lab Name: TCT ST LOUIS   Contract: ER-TOS-310______

Lab Code: TCT   Case No.: TOS-310 Sas:______ SDG No.: 611-12

Matrix: (soil/water/oil) OIL   Lab Sample ID: 9603009-18A

Sample wt/vol: 1.0 (g/ml)_G__   Lab File ID:____________

Level: (low/med) LOW_   Date Received: 03/08/96

%Moisture: not dec.____ dec.____   Date Extracted: 03/19/96

Extraction (SepF/Cont/Sonc)WASTE DIL   Date Analyzed: 03/20/96

GPC Cleanup:(Y/N)_N pH__   Dilution Factor:__1______

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/G) _UG/G__	Q
12674-11-2	--AROCLOR-1016	2	U
11104-28-2	--AROCLOR-1221	2	U
11141-16-5	--AROCLOR-1232	2	U
53469-21-9	--AROCLOR-1242	2	U
12672-29-6	--AROCLOR-1248	2	U
11097-69-1	--AROCLOR-1254	2	U
11096-82-5	--AROCLOR-1260	2	U

Appendix B

Mandatory Reporting Requirements

Mandatory Reporting Requirements

Under the conditions of Permit Number ID4890008952 certain reporting requirements were established as itemized in sections 15 and 16 of that permit. This appendix contains those requirements.

16. a. The certification letter is included as an attachment to this report.

16. b. Records maintained under condition 15 are shown on pages ~~35-38~~ 92-95 of Appendix B.

16. c. A detailed discussion of process operations is given on page 12 of this report. There were no operational problems noted.

16. d. A chronology of significant events is shown on page ~~34~~ 96 of Appendix B.

16. e. The INEL quality assurance plan; document number WROC-PROJ-001241, July 1993, is shown as Appendix C of this report. Analyses supporting this study were Level IV analyses as defined by that plan. As required for Level IV analyses, these analyses were performed at an off-site laboratory maintaining CLP certification and supplying complete CLP data packages. The laboratory performing these analyses was Maxim Technologies Laboratory of St. Louis, MO. A separate data package was received for the samples associated with each irradiation experiment. Case narratives for the data packages may be found on pages ~~44-51~~ 97-104 of Appendix B. These case narratives specify the use of standards, spikes and blanks for each sample set.

The INEL Quality Assurance Plan also mandates that the off-site laboratory data packages be validated by independant review. This function was performed by the analyst and principal investigator associated with the treatability study upon receipt of the package at INEL.

An audit of Maxim was performed in 1994 by EG&G Rocky Flats in 1994. The conclusion of the audit was that ~~Maxim~~ supplied satisfactory results during the year previous to the audit. That report is included here as Appendix D.

16. f. Documentation showing that certain laboratory glassware was decontaminated is on pages ~~35-38~~ 92-95 of Appendix B. Documentation showing that the test waste was returned to the ~~mixed~~ waste storage facility (MWSF) is shown on page ~~43~~ 109. Total shipping history is found on pages ~~39-43~~ 105-109.

16. g. Documentation showing that waste generated by the treatability study was shipped to the MWSF is found on page ~~41~~ 107. This section requires that these wastes be disposed according to TSCA, however the permit acknowledges that disposal of radiologically contaminated TSCA waste is currently being negotiated.

PCB TEST REQUIRED DATA FORM

DATE: 12/5/95
OPERATOR: B.J. Mincher
ANALYST : R.E. Arbon
SUPERVISOR: W.L. Schwendiman

TEST DESCRIPTION;

Characterization, prior to irradiations

PCB CONCENTRATION AND VOLUMES (by sample):

610	0.187g original waste stream
611	0.184
612	0.193
613	0.184

- as above, diluted to 25mL with hexane for acid cleanup
- transferred 0.75 mL each for analysis.

DISPOSAL:

24.25 mL each hexane dilution to bulk PCB liquid waste
15 mL each H_2SO_4 to bulk PCB liquid waste

deconned 1 10mL vol. pipet and 4 25mL vol flasks with hexane rinse, rinsate to bulk PCB liquid waste
returned samples (from CFA) also disposed to liquid waste

PCB TEST REQUIRED DATA FORM

DATE: 10/15/95
OPERATOR: B.J. Mincher
ANALYST : R.E. Arbon
SUPERVISOR: W.L. Schwendiman

TEST DESCRIPTION;

initial waste stream irradiations

PCB CONCENTRATION AND VOLUMES (by sample):

610	3mL	x	6	=	18mL
611	3mL	x	6		18
612	3mL	x	6		18
613	3mL	x	6		18

aliquots of each go through cleanup procedure as per BJM VIII p85
balance to contract lab for analysis

DISPOSAL:

5mLs of hexane dilution x 24 samples to bulk PCB liquid
~~14~~ 15 mLs of H_2SO_4 x 24 bulk PCB liquid
decon 4 25mL vol flasks and 1 10mL pipet with hex rinse to bulk PCB
post analysis samples to bulk waste

PCB TEST REQUIRED DATA FORM

DATE: 11/29/95
OPERATOR: B.J. Mincher
ANALYST : R.E. Arbon
SUPERVISOR: W.L. Schwendiman

TEST DESCRIPTION; Irradiation # 2
3 mL x 6 each = 18 mL waste streams 611, 612, 613

PCB CONCENTRATION AND VOLUMES (by sample):

611	3 mL x 6 =	18 mL	@	83 ppm
612	"	18		33 ppm
613	"	18		86 ppm

aliquots of each go through cleanup as per BOM VIII p 85
balance to contract lab

DISPOSAL:

24.25 mL each hexane dilution to bulk liquid waste
15 mL each H_2SO_4 to PCB liquid
deconned 4 25 mL vol flasks
all hexane rinses to bulk waste
post analysis samples to bulk waste

PCB TEST REQUIRED DATA FORM

DATE: 2/7/96
OPERATOR: B.J. Mincher
ANALYST : R.E. Arbon
SUPERVISOR: W.L. Schwendiman

TEST DESCRIPTION; Irradiation # 3 - FINAL (?)

PCB CONCENTRATION AND VOLUMES (by sample):

~~610~~ 3.0ml

611	3mL x6 = 18	83ppm
612	3mL x6 = 18	33ppm
613	3mL x6 = 18	86ppm

3/5/96 aliquots of each go through cleanup procedure per BJM VII p85
balance to Maxim Labs

DISPOSAL:

15mL hexane dilution x 18 samples to bulk PCB liquid
15 mL H_2SO_4 x 18 to bulk liquid
all hexane rinses to bulk waste
disposed 5 25mL vol flasks

POST ANALYSIS SAMPLES TO BULK WASTE

Chronology of Significant Events

7/1/94 Wastestreams shipped from MWSF to Test Area North (TAN) for sampling.

7/14/94 Wastestream samples shipped from TAN to Test Reactor Area (TRA) in anticipation of permit.

9/15/95 Notice of Approval received by INEL.

10/5/95 Samples of the four wastestreams were characterized for Aroclor 1260 content by INEL.

10/15/95 Initial irradiation of the four wastestreams to 180 kGy.

10/25/95 Project personnel receive training on the contents of the permit.

11/27/95 Maxim Analytical results received for the first irradiation. Wastestream 610 dropped from consideration for testing. Absorbed doses for the next irradiation were calculated.

11/29/95 Second irradiation of three wastestreams to 757 kGy.

2/1/96 Maxim analytical results received for second irradiation. Maxim was asked to re-analyze to achieve a 2 ppm detection limit. Absorbed doses were calculated for the third irradiation.

2/7/96 Third irradiation of three wastestreams to 2242 kGy.

2/12/96 Repeat analytical results of second irradiation received from Maxim. Wastestream 613 is shown to have achieved treatment standard in the second irradiation.

3/26/96 Received Maxim results for third irradiation. All wastestreams achieved treatment standard.

4/30/96 Technical report finalized.

5/7/96 Wastes generated during study shipped to TAN.

5/9/96 Unused test waste returned to TAN.

5/20/96 Wastestreams shipped from TAN to MWSF. Treatability study complete.

3496

MAXIM
TECHNOLOGIES INC

December 7, 1995
95B2-00001

Ms. Donna Kirchner
Lockheed Idaho Technologies Co.
INEL Sample Management Office (SMO)
Field Data Coordinator (FDC)
2525 North Fremont
Idaho Falls, ID 83415-3910

Re: C92-170021-111 ER-TOS-310, Release #20

Dear Ms. Kirchner:

Enclosed is a data report for the analysis of the samples received by Maxim Technologies, Inc./Huntingdon-St. Louis under Subcontract No. C92-170021 (ER-TOS-310). The samples were collected from the Test Reactor Area (TRA) at INEL and the analytical results will be used to provide data for a waste management treatability study.

The LITCO site code, file I.D. and corresponding Maxim Technologies, Inc.-St. Louis laboratory sample number, date collected and parameter requested are listed below:

LITCO SITE ID	FILE ID	LAB #	DATE COLLECTED	PARAMETER
610-0	610-0	9511034-01A	10-15-95	PCB'S
610-1	610-1	9511034-02A	10-15-95	PCB'S
610-2	610-2	9511034-03A	10-15-95	PCB'S
610-3	610-3	9511034-04A	10-15-95	PCB'S
610-4	610-4	9511034-05A	10-15-95	PCB'S
610-5	610-5	9511034-06A	10-15-95	PCB'S
611-0	611-0	9511034-07A	10-15-95	PCB'S
611-1	611-1	9511034-08A	10-15-95	PCB'S
611-2	611-2	9511034-09A	10-15-95	PCB'S
611-3	611-3	9511034-10A	10-15-95	PCB'S
611-4	611-4	9511034-11A	10-15-95	PCB'S
611-5	611-5	9511034-12A	10-15-95	PCB'S
612-0	612-0	9511034-13A	10-15-95	PCB'S
612-1	612-1	9511034-14A	10-15-95	PCB'S
612-2	612-2	9511034-15A	10-15-95	PCB'S
612-3	612-3	9511034-16A	10-15-95	PCB'S
612-4	612-4	9511034-17A	10-15-95	PCB'S
612-5	612-5	9511034-18A	10-15-95	PCB'S

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LITCO SITE ID	FILE ID	LAB #	DATE COLLECTED	PARAMETER
613-0	613-0	9511034-19A	10-15-95	PCB'S
613-1	613-1	9511034-20A	10-15-95	PCB'S
613-2	613-2	9511034-21A	10-15-95	PCB'S
613-3	613-3	9511034-22A	10-15-95	PCB'S
613-4	613-4	9511034-23A	10-15-95	PCB'S
613-5	613-5	9511034-24A	10-15-95	PCB'S
AROCLOR 1260	AROCLOR 1260	9511034-25A	10-16-95	PCB'S

The samples corresponding to this data report and SDG arrived at Maxim Technologies, Inc.-St. Louis on November 10, 1995. Copies of the chain-of-custodies and shipping document forms were mailed to Ms. Donna Kirchner on November 14, 1995.

CASE NARRATIVE

PCB's

Twenty-five oil samples were submitted for PCB's analysis by SW846/8080 and assigned the SDG number 610-1. A matrix spike and matrix spike duplicate analysis was not performed for this SDG since the samples were prepared by waste dilution for oil matrices. A set of Laboratory Control Standards for Aroclor 1260 were analyzed for each group of twenty samples to generate precision and accuracy data for this sample case. All LCS recoveries are within recovery limits and maximum RPD. All samples were analyzed within the required holding time for sample analysis.

Copies of the sample data summary have also been included.

If you have any questions concerning these data reports, please call me at (314) 426-0880.

Sincerely,

Paul J. Smith
Sr. Project Manager

MAXIM
TECHNOLOGIES INC

February 5, 1996
95B2-00002

Ms. Donna Kirchner
INEL Sample Management Office (SMO)
Field Data Coordinator (FDC)
Lockheed Idaho Technologies Co.
2525 N. Fremont
Idaho Falls, ID 83415-3910

Re: C92-170021, Release #20, ER-TOS-310

Dear Ms. Kirchner:

Enclosed is a data report for the analysis of requested parameters for the samples received by Maxim Technologies, Inc./TCT-St. Louis under Subcontract No. C92-170021 (ER-TOS-310). The samples were collected from the test reactor area at INEL and the analytical data will be used to provide information necessary to verify the effectiveness of the gamma degradation treatment of PCB's.

The LITCO site code and corresponding Maxim Technologies, Inc.-St. Louis laboratory sample number, date collected and parameter requested are listed below:

SAMPLE ID	LABORATORY #	DATE COLLECTED	PARAMETER
611-6	9601009-01A	12-12-95	PCB'S
611-7	9601009-02A	12-12-95	PCB'S
611-8	9601009-03A	12-12-95	PCB'S
611-9	9601009-04A	12-12-95	PCB'S
611-10	9601009-05A	12-12-95	PCB'S
611-11	9601009-06A	12-12-95	PCB'S
612-6	9601009-07A	12-12-95	PCB'S
612-7	9601009-08A	12-12-95	PCB'S
612-8	9601009-09A	12-12-95	PCB'S

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SAMPLE ID	LABORATORY #	DATE COLLECTED	PARAMETER
612-9	9601009-10A	12-12-95	PCB'S
612-10	9601009-11A	12-12-95	PCB'S
611-11	9601009-12A	12-12-95	PCB'S
613-6	9601009-13A	12-12-95	PCB'S
613-7	9601009-14A	12-12-95	PCB'S
613-8	9601009-15A	12-12-95	PCB'S
613-9	9601009-16A	12-12-95	PCB'S
613-10	9601009-17A	12-12-95	PCB'S
613-11	9601009-18A	12-12-95	PCB'S

The samples corresponding to this data report and SDG arrived at Maxim Technologies, Inc.-St. Louis on January 9, 1996. Copies of the chain-of-custodies and shipping document forms were mailed to Ms. Donna Kirchner on January 10, 1996.

CASE NARRATIVE

PCB ANALYSES

Eighteen oil samples were analyzed by method SW846/8080 following a waste dilution by method 3580.

The method blank and calibration checks were acceptable for the sample analyses in this data package.

A laboratory control sample (LCS) and duplicate (LCS Dup) was performed with acceptable recoveries.

The samples were analyzed following the required dilutions due to high levels of suspected acetone in the samples. The detection limits were adjusted for the dilutions by multiplying the dilution factor by the contract required detection limits (CRDL).

A preliminary summary data report was sent by facsimile to Mr. Adrian Chapman of the LITCO/SMO on February 1, 1996. The laboratory was notified by Mr. Adrian Chapman on February 1, 1996 that the detection limits provided for in the summary data report were not at an acceptable level for environmental regulation and compliance. The detection limits for the final report were then adjusted to the required 2 ppm level by multiplying the dilution factor by the lower method detection limits (MDL) instead of the CRDL.

Data Packages for the PCB analyses have been assembled and are submitted in triplicate.

If you have any questions concerning these data reports, please call me at (314) 426-0880.

Sincerely,

Paul J. Smith

Paul J. Smith
Sr. Project Manager

MAXIM
TECHNOLOGIES INC

March 21, 1996
95B2-00003

Ms. Donna Kirchner
INEL Sample Management Office (SMO)
Field Data Coordinator (FDC)
Lockheed Idaho Technologies Co.
2525 N. Fremont
Idaho Falls, ID 83415-3910

Re: C92-170021, Release #20, ER-TOS-310

Dear Ms. Kirchner:

Enclosed is a data report for the analysis of requested parameters for the samples received by Maxim Technologies, Inc./TCT-St. Louis under Subcontract No. C92-170021 (ER-TOS-310). The samples were collected from the test reactor area at INEL and the analytical data will be used to provide information necessary to verify the effectiveness of the gamma degradation treatment of PCB's.

The LITCO site code and corresponding Maxim Technologies, Inc.-St. Louis laboratory sample number, date collected and parameter requested are listed below:

SAMPLE ID	LABORATORY #	DATE COLLECTED	PARAMETER
611-12	9603009-01A	03-07-96	PCB'S
612-12	9603009-02A	03-07-96	PCB'S
613-12	9603009-03A	03-07-96	PCB'S
611-13	9603009-04A	03-07-96	PCB'S
612-13	9603009-05A	03-07-96	PCB'S
613-13	9603009-06A	03-07-96	PCB'S
611-14	9603009-07A	03-07-96	PCB'S
612-14	9603009-08A	03-07-96	PCB'S
613-14	9603009-09A	03-07-96	PCB'S

SAMPLE ID	LABORATORY #	DATE COLLECTED	PARAMETER
611-15	9603009-10A	03-07-96	PCB'S
612-15	9603009-11A	03-07-96	PCB'S
613-15	9603009-12A	03-07-96	PCB'S
611-16	9603009-13A	03-07-96	PCB'S
612-16	9603009-14A	03-07-96	PCB'S
613-16	9603009-15A	03-07-96	PCB'S
611-17	9603009-16A	03-07-96	PCB'S
612-17	9603009-17A	03-07-96	PCB'S
613-17	9603009-18A	03-07-96	PCB'S

The samples corresponding to this data report and SDG arrived at Maxim Technologies, Inc.-St. Louis on March 8, 1996. Copies of the chain-of-custody and shipping document forms were mailed to Ms. Donna Kirchner on March 13, 1996.

CASE NARRATIVE

PCB ANALYSES

Eighteen oil samples were analyzed by method SW846/8080 following a waste dilution by method 3580.

The method blank and calibration checks were acceptable for the sample analyses in this data package.

A laboratory control sample (LCS) and duplicate (LCS Dup) was performed with acceptable recoveries.

Data Packages for the PCB analyses have been assembled and are submitted in triplicate.

If you have any questions concerning these data reports, please call me at (314) 426-0880.

Sincerely,

Paul J. Smith
Sr. Project Manager

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039. Expires 9-30-92

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. ID489000895 2	Manifest Document No. 94006	2. Page 1 of	Information in the shaded areas is not required by Federal law

3. Generator's Name and Mailing Address: MWSF @ PER 613, c/o EG+G Idaho, INEL, Scoville, ID 83415

4. Generator's Phone (208) 526-8232

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name: EG & G IDAHO, INC.
6. US EPA ID Number: ID489000895 2

C. State Transporter's ID

D. Transporter's Phone

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address: TAN 607 / Transfer Facility, INEL @ EG & G IDAHO, INC., Scoville, Idaho 83415
10. US EPA ID Number: ID489000895 2

G. State Facility's ID

H. Facility's Phone

	HM	11. US DOT Description (Including Proper Shipping Name, Hazard Class and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.	RQ	Hazardous Waste, Liquid, N.O.S., 9, NA3082, III (D008) Also Contains Trace Cs-137 and PCBs (89 PPM)	001	DM	193	Kg	D008
b.	RQ	Hazardous Waste, Liquid, N.O.S., 9, NA3082, III (D018) Also Contains Trace Cs-137 and PCBs	002	DM	398	Kg	D018
c.		Non-RCRA/Non-DOT Regulated Material Also Contains Trace Cs-137 and PCBs (44 PPM)	001	DM	57	Kg	
d.	RQ	Waste Radioactive Material, LSA, N.O.S., 7, UN2912 (PCBs-680 PPM), MFP, Liquid, Oxide, 12.0 mCi	002	DM	509	Kg	

J. Additional Descriptions for Materials Listed Above
a. WSID #613, BC5456, 55gal, O of S date: 5/5/92
b. WSID #610, BC5457, 85gal, 7.5PPM PCB, O of S date: 5/5/92
WSID #611, BC5455, 85gal, 98 PPM PCB, O of S date: 5/5/92
c. WSID #612, BC5458, 55gal, O of S date: 5/5/92
d. WSID #1002, BC698/699, 83gal, O of S date: 4/25/86

K. Handling Codes for Wastes Listed Above: 610

15. Special Handling Instructions and Additional Information
Items a+b, ERG #31
Item c, ERG-N/A
Item d, ERG #62
ON-SITE USE ONLY
Exclusive Use Shipment
24 hour Emergency Phone #(208) 526-1515

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name	Signature	Month Day Year
SHAWN PARKINSON	[signature]	07 11 94

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year
William F Bennett	William F Bennett	07 11 94

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month Day Year

GENERATOR / TRANSPORTER / FACILITY

ORIGINAL - RETURN TO GENERATOR

7-14-94

IDF 5480.3A
(REV. 03-91)
REF-ID ORDER 5480.3

U.S. DOE HAZARDOUS MATERIAL SHIPPING RECORD

Log No. 0X94071404 2

Page 1 of 3

BILL OF LADING # ______

ON-SITE [ ]* OFF-SITE [✓]

SHIPPING ORDER # ______

CHARGE NO. 3WST74101

Emergency Phone Number (208) 526-1515 or

FROM:	TO:
I.R. Anderson	Bruce Mincher
TAN 607	MTR 604 RCT Office
Scoville, ID 83401	Scoville, ID 83401
ATTN: 526-7366	ATTN: Anita Freeman

Item No	RQ	Proper Shipping Name Hazard Class, DOT ID #	Total Quantity	Packages No.	Packages Type	Packages Weight
1	NA	Radioactive Material, excepted package - limited quantity of material, 7, UN2910 (also contains PCBs, flammable liquids, metals)	7.72E-4	1	strong tight	40 lb

[illegible] 7-14-94 1300

THIS PACKAGE CONFORMS TO THE CONDITIONS AND LIMITATIONS SPECIFIED IN 49 CFR 173.421 FOR RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, UN 2910

For Ra... ...rm.

Labels Affixed NA

Placards Tendered NA

Tie Down Inspection Adequate NA — Name — Date / Time

Completed Vehicle Inspection Checklist NA Shane Lewis — Name — 7-14-94 0850 — Date / Time

Carrier EG&G, Idaho

This is to certify that the above-named materials are properly classified, described, packaged, marked, labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.
*(Shipments within the boundaries of the Idaho National Engineering Laboratory may be made in accordance with DOE-ID Order 5480.3)

Originating Shipper [signature] Date 14 JUL 94

Released for Transportation by Steve Harrell — Name — 7-14-94 1000 — Date / Time

Accepted for Transportation by Shane Lewis — Drivers Name — 7-14-94 0850 — Date / Time

2of2

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039. Expires 9-30-96

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. I D 4 8 9 0 0 0 8 9 5 2 | Manifest Document No. 9 6 1 0 5 | 2. Page 1 of 1 | Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Lynn Schwendiman MS 8102 — Lockheed Idaho Technologies Co.
TRA 678 / INEL — for U.S. Department of Energy
Scoville, Id. 83415

4. Generator's Phone (208) 526-8732

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name: LITCO
6. US EPA ID Number: I D 4 8 9 0 0 0 8 9 5 2

C. State Transporter's ID

D. Transporter's Phone

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address
~~HWSF / PER 615~~ TAN 607
LICO / INEL Attn: Matt Banister
Scoville, Id. 83415

10. US EPA ID Number: I D 4 8 9 0 0 0 8 9 5 2

G. State Facility's ID

H. Facility's Phone

GENERATOR

	HM	11. US DOT Description (Including Proper Shipping Name, Hazard Class and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.	X	Hazardous Waste, Solid, n.o.s., (D018,D008), 9, NA 3077, III, 98 PPM PCBs, and trace radionuclides less than 2 nCi/g	1	D M	2 4	K	D008 D018
b.	X	Waste Flammable Liquids, Corrosive, n.o.s., (Hexane, Sulfuric acid), 3, UN 2924, II, 98 PPM PCBs and trace radionuclides less than 2 nCi/g	1	D M	1 2	K	D001 D002 D008 D018
c.							
d.							

J. Additional Descriptions for Materials Listed Above
(a) 30 gal. UN1A2 drum, Barcode# 11075, W.S. Id# 1988
(b) 8 gal. UN1A2 drum, Barcode# 11074, W.S. Id# 1989

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
ON SITE USE ONLY
24 hr. Emergency Response # (208) 526-1515

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: Generator / Shipper — Greg Andrews / Stephen Keating | Signature: Greg Andrews / Stephen Keating | Month Day Year: 05 07 96

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Joe Emery | Signature: Joe Emery | Month Day Year: 05 07 96

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name | Signature | Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name | Signature | Month Day Year

Style F15 REV-6 Labelmaster, An American Labelmark Co., Chicago, IL 60646 (800)621-5808

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

STRAIGHT BILL OF LADING - SHORT FORM - ORIGINAL - Not Negotiable

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of the Bill of Lading

SHIPPER'S NO. 96SK068

AT	DATE	FROM	AGENT'S NO.
TRA 604	05/09/96	LOCKHEED IDAHO TECHNOLOGIES CO FOR U.S.DEPARTMENT OF ENERGY	

the property described below, in apparent good order except as noted (contents and condition of contents of packages unknown) marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Uniform Freight Classification in effect on the date hereof, if this is a rail or a rail water shipment, or (2) in the applicable motor carrier classification or tariff if this is a motor carrier shipment.

Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

CONSIGNEE AND DESTINATION (Mail or street address of consignee - For purposes of notification only)

TAN 607
LITCO / INEL
SCOVILLE, ID. 83415

ATTN:DAVE HARVEY (526-6544)

CARRIER LMIT SITE SERVICES

96SK068

CAR OR VEHICLE INITIALS & NO.

No. Pkgs.	HM	Kind of Package, Description of Articles, Special Marks and Exceptions	*Weight (Sub.to Cor.)	Class or rate
1 BOX	X	Radioactive Material,excepted package-limited quantity of material, 7, UN2910	20 lbs.	
		ERG# 61		
		This package conforms to the conditions and limitations specified in 49CFR 173.421		
		for radioactive material, excepted package -limited quantity of material, UN2910		

Subject to Section 7 of conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement.

The carrier shall not make delivery of this shipment without payment of freight and all other lawfull charges.

Per ______ (Signature of Consignor)

If charges are to be prepaid, write or stamp here. "To be Prepaid."

PREPAID

When charges are Prepaid, the United States Government will assume the freight charges and shipment is subject to the terms and conditions set forth in the standard form of the United States Government Bills of Lading and to any available special rates and charges.

Received $ ______ to apply in prepayment of the charges on the property described hereon.

______ Agent or Cashier

Per ______ (The signature here acknowledges only the amounts prepaid.)

Charges Advanced $ ______

C.O.D. SHIPMENT

C.O.D. Amt. ______

Collection Fee ______

Total Charges ______

SPECIAL INSTRUCTIONS TO CARRIER (WHEN CHECKED)

[X] IN THE EVENT OF AN EMERGENCY INVOLVING THIS SHIPMENT, PHONE COLLECT (208) 526-1515 ANY HOUR DAY OR NIGHT.

[ ] The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding ______ per ______

[ ] WARNING - Fissile Class III shipment personnel handling and stowing this shipment must be advised to not load more than ______ package per vehicle. In any loading or stowage area this shipment must be segregated by at least 20 feet from other packages bearing radioactive labels.

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is carrier's or shipper's weight. NOTE - Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

"THIS IS TO CERTIFY THAT THE ABOVE NAMED MATERIALS ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION, ACCORDING TO THE APPLICABLE REGULATIONS OF THE DEPARTMENT OF TRANSPORTATION."

LOCKHEED IDAHO TECHNOLOGIES CO. FOR US DEPT OF ENERGY
SCOVILLE,IDAHO 83415
TRA/INEL
Permanent postoffice address of shipper

SHIPPER, PER [signature] AGENT ______ PER [signature]

Page 1 of 1

A-3000-001 (06/94)

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039. Expires 9-30-96

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. ID489000895	Manifest Document No. 219.6.5.20	2. Page 1 of 1	Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
INEL c/o LITCO
TAN 607 TSCA Repackaging Area
Scoville, ID 83415

4. Generator's Phone (208 526-5232)

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name: LITCO
6. US EPA ID Number: ID489000895 2

C. State Transporter's ID

D. Transporter's Phone

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address
INEL c/o LITCO
MWSF @ PER-613
Scoville, ID 83415

10. US EPA ID Number: ID489000895 2

G. State Facility's ID

H. Facility's Phone -

GENERATOR

	HM	11. US DOT Description (Including Proper Shipping Name, Hazard Class and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.	X	Waste Radioactive Material, LSA, NOS, 7 UN2912, Cs137 Sr90, Pu239, Am241/Pu238 Liquid, Oxide, 11076-19mCi; 11077-2.8mCi; 11078-1.6mCi; 11079-22mCi; 1.5mCi; 1080, 11081-0.5mCi; Fissile Excepted LSA-II (PCBs 680ppm)	0.06	PM	984	K	D008 D018
b.	X	Waste Radioactive Material, LSA, N.O.S., 7, UN2912 Cs137, Sr90, Pu239, Am241/Pu238, Solid, Oxide, 11084-0.4mCi; 11085-0.4mCi; Fissile Excepted, LSA-II (PCBs 680ppm)	002	DM	216	K	D008 D018
c.	X	Waste Radioactive Material, LSA, N.O.S., 7, UN2912, Cs137, Sr90, Pu239, Am241/Pu238, Liquid, Oxide, 11082-1.3mCi; 11083-0.7mCi; Fissile Excepted LSA-II (PCBs-680ppm)	002	DM	115	K	D008 D018
d.	RQ	Hazardous Waste, Liquid, N.O.S., 9, NA3082, III (D007, D008) PCBs @ 27ppm and trace radionuclides less than 2nCi/g	001	PM	105	K	D007 D008

J. Additional Descriptions for Materials Listed Above
11a, WSID#1987, BCs#11076-11081, 55 Gal (Each)
11b, WSID#1988, BCs#11084, 11085, 55 Gal (Each)
11c, WSID#1989, BCs#11082, 11083, 55 Gal (Each)
} oos date 8/2/90
11d, WSID#1841 BC#10402, 30 Gal - oos Not Required

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
"Exclusive Use" Shipment
ON-SITE USE ONLY
24 Hour Emergency Phone (208) 526-1515

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name	Signature	Month Day Year
L.L. JONES C.E. Chugg	L L Jones C.E. Chugg	05 20 96

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year
Kevin Roy Steffler	Kevin Roy Steffler	05 20 96

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month Day Year
SHAWN TIGUE	Shawn Tigue	05 20 96

Style F15 REV-6 Labelmaster, An American Labelmark Co., Chicago, IL 60646 (800)621-5808

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

PRINTED ON RECYCLED PAPER USING SOYBEAN INK — PRINTED WITH SOY INK

ORIGINAL-RETURN TO GENERATOR

Appendix C

Quality Assurance Plan

Document No. WROC-PROJ-001241
Revision No. 1
Date July 1993

QUALITY ASSURANCE PROJECT PLAN FOR THE TREATMENT OF NON-INCINERABLE LAND DISPOSAL RESTRICTED MIXED WASTE PROJECT

Prepared By: W. S. Roesener Rev. 0
J. Banaee Rev. 1

Approvals:

T. J. Thiesen, Acting Unit Manager
WROC Technical Programs Unit

E. C. Garcia, Sr. Engineering Specialist
WROC Technical Programs Unit

E. Dumas, Engineering Specialist
Quality Assurance/Quality Control Unit

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G. L. Schwendiman, MS-8101
B. P. Thiesen, MS-3625
D. R. Tyson, MS-3625
Project File (E. C. Garcia), MS-8101
WROC Document Control, MS-8102

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ACRONYMS

CFR	Code of Federal Register
CLP	Contract Laboratory Program
DOE/ID	Department of Energy, Idaho Operations Office
DOE	Department of Energy
EPA	Environmental Protection Agency
FSP	Field Sampling Plan
INEL	Idaho National Engineering Laboratory
LDR	Land Disposal Restrictions
MWSF	Mixed Waste Storage Facility
PARCC	Precision, Accuracy, Representativeness, Completeness, Comparability
PMP	Project Management Plan
QA	Quality Assurance
QAMS	Quality Assurance Management Staff (of EPA)
QAPjP	Quality Assurance Project Plan
QC	Quality Control
QPP	Quality Project Plan
RCRA	Resource Conservation and Recovery Act
RE	Radiation Engineer
SAP	Sampling and Analysis Plan
SMO	Sample Management Office
SOP	Standard Operating Procedure
WAP	Waste Analysis Plan
WROC	Waste Reduction Operations Complex

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CONTENTS

TABLES AND FIGURES

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1. PROJECT DESCRIPTION

1.1 Introduction

This Quality Assurance Project Plan (QAPjP) discusses the objectives of the Treatment of Nonincinerable, Land Disposal Restricted, Mixed Waste Project (the Project) and describes how required quality will be achieved and maintained. The Project will study methods to treat and dispose of mixed waste, defined as waste containing both hazardous and radioactive components, generated at the Idaho National Engineering Laboratory. The background and objectives of the Project are discussed in Section 1 of this QAPjP. As discussed in the next paragraph, the controls required for some of the activities affecting quality did not fall conveniently under the chosen format for this QAPjP. Those specific controls are also discussed in this section.

The Project is managed by Waste Reduction Operations Complex (WROC) Technical Programs; it must, therefore, meet the requirements of QPP-034, Revision 4, "Quality Program Plan for the Waste Reduction Operations Complex."[1] Because the Project involves collection of environmental data (e.g. waste treatment data), it must also meet the requirements of DOE/ID-10166, "Environmental Compliance Planning Manual at the Idaho National Engineering Laboratory."[2] DOE/ID-10166 specifies the use of applicable quality guidance including QAMS-005/80, "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans,"[3] and NQA-1, "Quality Assurance Program Requirements for Nuclear Facilities."[4] The formats required by QAMS-005/80 and NQA-1 are slightly different; however, both must be satisfied. The approach for this QAPjP, consistent with the direction of QPP-034, Section 5.2, is to use the 16 element format of QAMS-005/80, i.e., a title page, a table of contents, and 14 sections. The elements required by NQA-1 that fits into one of the 14 sections of this QAPjP, are discussed in that section. Elements of NQA-1 that do not belong in a specific section of this QAPjP are

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Table 1-1. Cross reference for NQA-1 elements to applicable sections of QAPjP

NQA-1 Element	Section of QAPjP
1. Organization	2. Project Organization and Responsibility[a]
2. Quality Assurance Program	1. Project Description sections: 1.1 Introduction[a] 1.2 Background[a] 1.3 Project Objectives[a] 1.4 Indoctrination and Training 9. Internal Quality Control Checks and Frequency[a] 14. Quality Assurance Reports to Management[a]
3. Design Control	3. Quality Assurance Objectives for Measurement Data in Terms of Precision, Accuracy, Completeness, Representativeness, and Comparability[a]
4. Procurement Document Control	1. Project Description section: 1.5 Procurement Document Control/Control of Contractors
5. Instructions, Procedures, and Drawings	4. Sampling Procedures[a]
6. Document Control	1. Project Description section: 1.6 Document Review Approval and Control
7. Control of Purchased Items and Services	1. Project Description section: 1.7 Control of Purchased Items and Services
8. Identification and Control of Items	1. Project Description section: 1.8 Identification and Control of Items
9. Control of Processes	7. Analytical Procedures[a]
10. Inspection	1. Project Description section: 1.9 Inspections
11. Test control	12. Specific Routine Procedures to Assess Data Precision, Accuracy, and Completeness[a]
12. Control of Measuring and Test Equipment	6. Calibration Procedure and Frequency[a] 11. Preventive Maintenance[a]
13. Handling, Storage, and Shipping	5. Sample Custody[a]
14. Inspection, Test, and Operating Status	1. Project Description section: 1.10 Inspection, Test, and Operating Status
15. Control of Nonconforming Items	1. Project Description section: 1.11 Control of Nonconforming Items
16. Corrective Action	13. Corrective Actions[a]
17. Quality Assurance Records	1. Project Description section: 1.12 Quality Assurance Records
18. Audits	10. Performance and System Audits and Frequency[a]

a. These sections are in accordance with QAMS-005/80.

included in Section 1. A cross reference of NQA-1 and QAMS-005/80, as reflected in the contents of this QAPjP, is shown in Table 1-1.

Two elements of QPP-034 are applicable to the Project but not addressed by QAMS-005/80 and NQA-1 requirements. Those two elements, readiness review and computer software configuration management, are included in this section.

This QAPjP addresses programmatic, quality affecting data generating activities (including waste characterization) associated with treatment of nonincinerable mixed wastes in a general way. Specific sampling and analysis plans that need to be developed are identified. These sampling and analysis plans will be prepared separately. It is intended that this QAPjP be easy to revise to incorporate quality assurance requirements for characterization and treatment of additional nonincinerable waste streams.

1.2 Background

The Idaho National Engineering Laboratory (INEL) generates mixed wastes during its daily operations. Mixed wastes contain both radioactive and hazardous components, as defined by the Department of Energy (DOE) and the Environmental Protection Agency (EPA). Mixed wastes generated at the INEL are currently stored at the INEL Mixed Waste Storage Facility (MWSF).

All mixed wastes stored at the MWSF fall under Land Disposal Restrictions (LDRs) as promulgated by the EPA in Resource Conservation and Recovery Act (RCRA) regulations, and require treatment to meet current federal and state regulations for disposal. Long-term storage of hazardous and mixed wastes is prohibited by RCRA; therefore, strategies to treat and/or destroy INEL mixed wastes must be developed and implemented.

Mixed wastes that cannot be stored have been characterized and categorized into distinct waste streams.[5] Potentially suitable treatments for these streams have been specified based on engineering studies.[6,7] Some of the streams were found to be good candidates for incineration at the Waste Experimental Reduction Facility incinerator. Other streams were found to be nonincinerable. Although potential treatments were identified in engineering studies for the nonincinerable streams, the INEL is not currently able to perform such treatments. The purpose of this project is to develop the capacity at the INEL to treat nonincinerable LDR mixed waste streams.

Treatments to be developed for nonincinerable waste streams are based on effective stabilization, or rendering the waste non-hazardous by chemical or physical means. The general approach for each treatment will be the same. A bench-scale test will be designed and performed. The results of bench-scale test will be used to design and construct a full-scale process. No intermediate pilot-scale will be needed because the relative size of the process equipment is small. Appropriate permits and procedures, including operation, maintenance, and sampling procedures, will be written for the full-scale process. Next, the full-scale process will be tested to prove that it is capable of producing a treated waste stream that is not land disposal restricted. Finally, the process will be operated to treat the current waste, making it acceptable for disposal. Concurrent support tasks necessary for completing the project include: permitting, preparing and or revising safety and quality documents (Health and Safety Plans, Sampling and Analysis Plans, RCRA plans), and training of personnel.

1.3 Project Objectives

The objectives of the Project are:

a. to obtain a permit and to treat feed streams of nonincinerable LDR mixed wastes such that the product streams are acceptable for disposal:

  - at the Radioactive Waste Management Complex as non-hazardous, radioactive wastes, or

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- to a lined evaporation pond as non-hazardous waste waters that are nearly free of radioactive constituents,

b. to determine the acceptable range of feed stream characteristics that will result in product streams that meet the first objective, and

c. to protect the health and safety of employees and the public while performing treatment.

To fulfill the above objectives, the following data related questions must be answered:

a. what are the compositions of the various product waste streams,

b. how and to what degree will the initial process, and final waste forms be sampled and analyzed,

c. what radiation fields are generated in the vicinity of the waste streams and process equipment,

d. what are the potential airborne levels of chemicals and radioactive contaminants of concern in the vicinity of waste streams and process equipment, and

e. how do the above parameters vary over a range of feed stream characteristics?

For situations where the first question cannot be answered because measurement techniques do not exist but where Best Demonstrated Available Technologies are defined as standard by the EPA, the appropriate question to answer is:

a. was the proper procedure used to treat the waste?

1.4 Indoctrination and Training

Indoctrination and training shall be provided to personnel performing activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained. The requirements of QPP-034, Section 5.2.3, shall be invoked without exception.

1.5 Procurement Document Control/Control of Subcontractors

The preparation and review of procurement documents shall be controlled to assure that adequate quality is specified or referenced for any items or services to be furnished. The requirements of QPP-034, Section 5.4, and Project Management Plan (PMP) WROC-PROJ-00111, Section 24.2, shall be invoked without exception.

1.6 Document Control

The preparation, review, approval, issue, and change of documents that specify quality requirements or prescribe activities affecting quality for the Project shall be controlled to assure that correct documents are used and referenced. The requirements of QPP-034, Section 5.6, and PMP WROC-PROJ-00111, Section 15.1, shall be invoked without exception.

1.7 Control of Purchased Items and Services

The quality of purchased materials, equipment and services shall be controlled to assure conformance to procurement document requirements. The requirements of QPP-034, Section 5.7, and PMP WROC-PROJ-00111, Section 24.3, shall be invoked without exception.

1.8 Identification and Control of Items

Controls shall be established to assure that only correct and accepted items are used and installed. The requirements of QPP-034, Section 5.8, shall be invoked without exception.

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1.9 Inspection

Inspections required to verify conformance of items and activities to requirements shall be performed by personnel independent from those who performed or directly supervised the item or activity being inspected. The requirements of QPP-034, Section 5.10, and PMP WROC-PROJ-00111, Section 24.3, shall be invoked without exception.

1.10 Inspection Test and Operating Status

The status of items and operating facilities shall be identified (QPP-034, Section 5.14) and controlled to assure that items that have not passed required inspections and tests are not inadvertently installed, used, or operated. The requirements of QPP-034, Section 5.14, shall be invoked without exception.

1.11 Control of Nonconforming Items

Items that do not conform to requirements shall be controlled by a quality engineer or the project manager by inspection or evaluation to prevent inadvertent use or installation. The requirements of QPP-034, Section 5.15, shall be invoked without exception.

1.12 Quality Assurance Records

Sufficient records shall be specified, prepared, and maintained to furnish objective evidence of quality. Such records shall be legible, identifiable, retrievable, and protected against damage, deterioration, or loss. The requirements of QPP-034, Section 5.17, shall be invoked without exception and with the following clarification.

Records that will be generated by the Project and that are not clearly addressed by the QPP-034, Quality Records Index are shown in Table 1-2.

1.13 Readiness Review

Prior to the performance of tests, experiments, or other operational functions, the status or prerequisites of the specified functions shall be validated by an independent readiness committee/process review. The requirements of QPP-034, Section 5.19, shall be invoked without exception.

1.14 Computer Software Configuration Management

Computer software configuration shall be controlled. The requirements of QPP-034, Section 5.21, and PMP WROC-PROJ-00111, Section 15.1.9, shall be invoked without exception.

e 1-2. Project specific additions to QPP-034 Quality Records Index

Record	Storage Location	Retention Responsibility	Retention Time Per DOE Order 1324.2A (Attachment #, Item #)	
pling Analysis Plans	PER-601	WROC DCC	V-1	8a(1)[a]
pling Results and lysis of the Results	PER-601	WROC DCC	V-1	8b[b]
t Plans and Results	PER-601	WROC DCC	V-14	6a[c]
te Analysis Plans	PER-601	WROC DCC	V-1	8a(1)[a]
te Analysis Plan sults	PER-601	WROC DCC	V-1	9b[d]

V-1 8a(1) Permanent.

V-1 8b Permanent.

V-14 6a Until the item is removed from service.

V-1 9b Permanent.

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2. PROJECT ORGANIZATION AND RESPONSIBILITY

This section describes organizational structure, functional responsibilities, levels of authority, and lines of communication for activities associated with the Project that affect quality. The requirements of QPP-034, Section 5.1, and PMP WROC-PROJ-00111, Section 3, shall be invoked without exception with the following clarification.

The organizational structure established by WROC for management of quality related activities is identified in QPP-034, Section 5.1 (will be revised in the summer of 1993). The structure in QPP-034 extends from the top of the EG&G structure to the unit manager level. Specific interfaces between unit managers, the Project Manager, task performers, the various operational support organizations, and the quality oversight organization are shown in Figure 2-1.

The Project Manager is responsible under the WROC Technical Programs Unit Manager for all aspects of the Project. The Project Manager is responsible for managing activities in accordance with guidance documentation of the Resource Management System. Specific quality responsibilities are identified in this QAPjP. The Project Manager may approve minor changes to this QAPjP in accordance with requirements of QPP-034, Section 5.6.2, and PMP WROC-PROJ-00111.

The task performers are responsible for achieving quality in their individual tasks. Many of the tasks performed involve design and testing of waste treatment processes. Process input and output streams must be carefully monitored and processes carefully operated to ensure conformance to the strict requirements of protecting health and safety. Therefore, careful quality control is required in most aspects of each task performed. Specific quality responsibilities of task performers are identified in this QAPjP.

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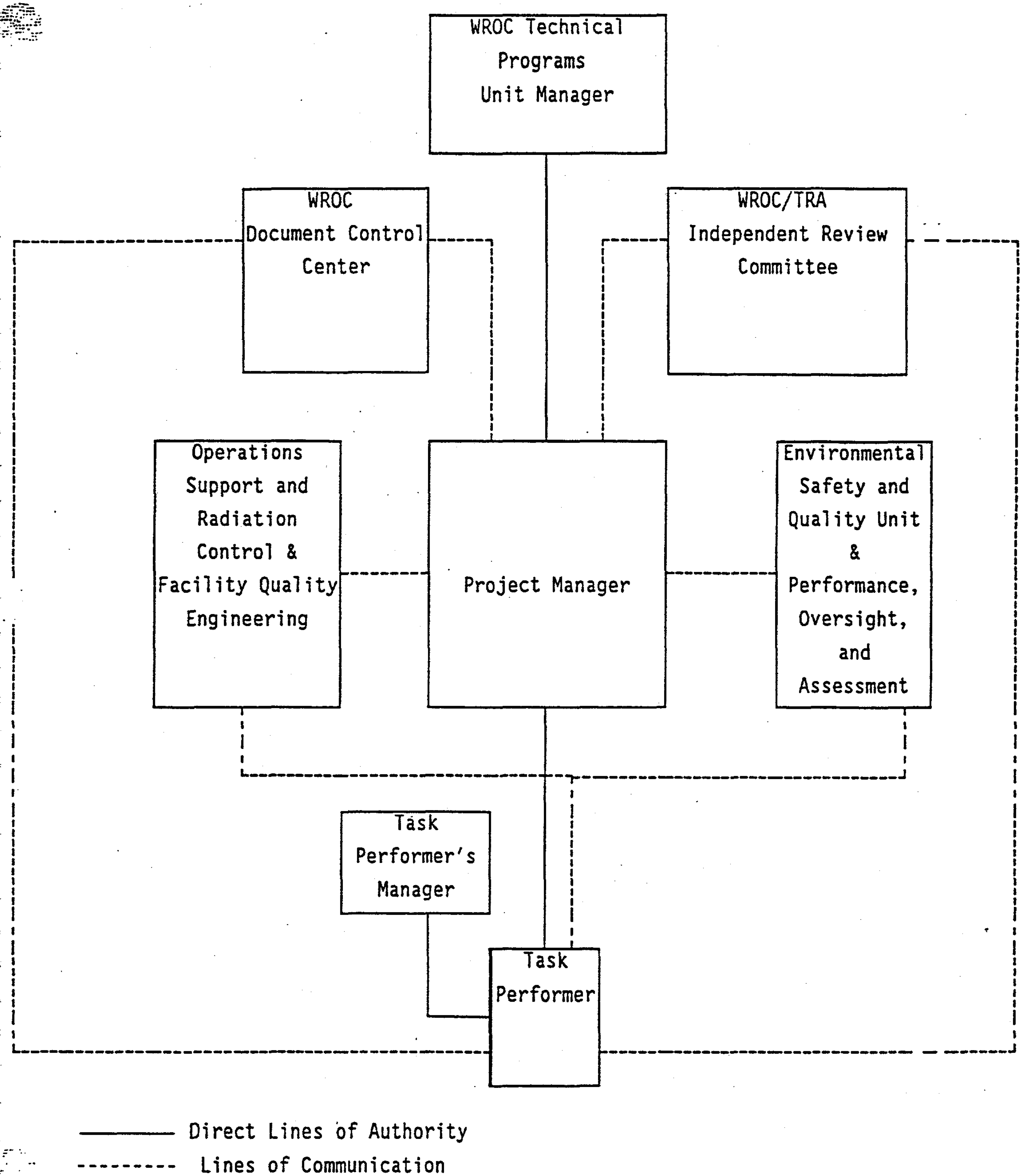

Figure 2-1. Organization chart for the Treatment of Nonincinerable Land Disposal Restricted Mixed Waste Project.

The task performer's manager is responsible to ensure that work performed under his jurisdiction is consistent with this QAPjP.

The WROC Document Control Center is responsible for maintaining controlled documents in accordance with this QAPjP and PMP WROC-PROJ-00111.

The WROC or facility Independent Review Committee reviews the controlled documents identified in this QAPjP.

The Environmental, Safety, and Quality organization monitors the quality performance of the Project to verify appropriate implementation of requirements of this QAPjP.

Operations Support and Radiation Control personnel support the Project as required/requested to meet quality requirements of this QAPjP.

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3. QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION,ACCURACY, COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

The design of treatment processes must be defined, controlled, and verified. QPP-034, Section 5.3, contains requirements to be followed to ensure quality in design of components and systems and shall be invoked without exception. Furthermore, the design must be in accordance with the regulatory requirements covered in 40 CFR 261.4, 260.10, and DOE Order 5400.3. In addition, to ensure quality of design, quality assurance objectives for measurement data in terms of precision, accuracy, representativeness, completeness, and comparability must be established.

Quality assurance objectives for measurement of data are arrived at in a step-wise fashion. First, general project objectives are defined, then specific questions that must be answered to meet the objectives are developed, and finally, the specific measurement to be made and the associated precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters are specified, as well as other applicable data quality objectives. A measurement system is then designed that will meet the quality objectives at the least possible cost. The first two steps were dealt with in Section 1.3 of this QAPjP. The PARCC parameters cannot be established at this time as the processes have not yet been fully defined. Specific measurements and PARCC parameters will be included in a sampling and analysis plan (SAP) and a waste analysis plan (WAP) for each treatment process. Procedures for identifying PARCC parameters and other data quality objectives are included in EPA/540/g-87/003, "Data Quality Objectives for Remedial Response Activities"[8] and in EG&G MP-17, "Standard Method for Data Quality Planning."[9] Since both documents contain a full description of methods for identifying data quality objectives, those procedures will not be discussed further here.

However, the specific site objectives and associated questions already developed do allow general classification of the data needs under the five-level analytical system defined by EPA. The five analytical levels and their application to data needs for the Project are presented in this section. A summary of the discussion is presented in Table 3-1.

EPA defines five levels of analytical strategies[8] with Level I the least costly and complex and Levels IV and V the most costly and complex. Level I is used for field screening or analyses using portable instruments. Results are often not compound-specific and not quantitative, but results are available in real time.

For the Project, data needed to answer the questions on radiation fields and airborne chemicals and radionuclides in the vicinity of the process equipment can be partially supplied by simple field monitors such as self-reading dosimeters, area radiation and air monitors, and Drager tubes (EPA Level I). Data needed to answer questions on waste composition to determine the success of a test and to optimize the process can be partially supplied by simple in-line process monitors such as pH and conductivity probes.

Level II analyses are also used in the field but use more sophisticated portable analytical instruments; sometimes the instruments are set up in mobile laboratories. Level II methods result in a wide variety of data quality, depending on the use of calibration standards, reference materials, sample preparation equipment, and operator training. Results are available in real-time or in several hours. This level may also include laboratory measurements made using non-EPA approved analytical methods.

For the Project, the balance of the data needed to answer questions on radiation fields and airborne chemicals and radionuclides in the vicinity of the process equipment can be supplied by simple field monitors that are read in special laboratories. Examples include air filters, filter badges, and radiation badges (EPA Level II). Much of the remaining data needed to determine the success of a test and to optimize the process can be supplied by

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non-EPA approved measurement procedures that determine levels of RCRA Appendix IX listed wastes and radionuclides.

Level III analyses are performed in an analytical laboratory. Analytical methods must be approved by the EPA (or equivalent), but are not necessarily Contract Laboratory Program (CLP) procedures (CLP procedures are discussed below). Uncertainties in analytical results are quantified on a sample-set basis by the use of duplicates and matrix spikes. Documentation and validation procedures for individual samples are followed, but CLP data packages are not required.

For the Project, some of the data needed to determine the success of a test and to optimize the process may be obtained using Level III analyses. Level III data are also needed for characterization of RCRA Appendix IX listed wastes and radionuclides when seeking a permit from the EPA/State of Idaho to operate a process.

Level IV analyses are performed at off-INEL laboratories following procedures approved by EPA. Data are reported using a complete CLP data package. Uncertainty at the data-set level is quantified by the use of duplicates and matrix spikes. Individual analyses are extensively documented and the entire data analysis process is validated by independent review of the laboratory data package. Thus, uncertainties are known and the data are technically and legally defensible. The CLP is a Comprehensive Environmental Response, Compensation, and Liability Act program, and the list of analytes in the Hazardous Substance List is shorter than the RCRA Appendix IX list. However, it is accepted practice at EG&G Idaho, Inc. that Level IV analyses include Appendix IX constituents analyzed using approved EPA methods and accompanied by a CLP data package.

For the Project, data needed to answer questions on waste composition as they relate to final disposal can almost all be supplied by CLP analyses for

RCRA Appendix IX hazardous wastes.

Level V analyses are performed at an INEL or off-INEL laboratory using non-standard analytical techniques. This analytical level is used for analytes for which no procedure has been approved by the EPA. CLP data package documentation and validation are required for analyses directly related to disposal, but not for Level V analyses performed during the testing and permitting phases.

For the Project, the remainder of the data needed to answer questions on waste composition for testing, permitting, and final disposal will be supplied by non-standard procedures. Any radionuclide measurements necessary for disposal will be Level V analyses, since the EPA has not approved any radioanalytical procedures.

Table 3-1. Analytical Level matrix: required analytical levels, and expected approach (methods and/or monitors)

	Level I	Level II	Level III	Level IV	Level V
Health and Safety: Radiation fields around process equipment	Area radiation monitors hand held monitors and self reading dosimeters	Dosimeters	NA	NA	NA
Airborne chemicals in vicinity of process equipment	Organic vapor analyzers and Drager tubes	Vapor badges and filters	NA	NA	NA
Airborne radionuclides in vicinity of process equipment	Continuous air monitors	Filters and continuous air monitors	NA	NA	NA
Characterization of Waste Streams: Test and optimization	Process monitoring instrumentation, e.g. Ph probes and conductivity monitors	Hazardous Waste or Appendix IX Lists and radionuclides using non-EPA approved procedures	Hazardous Waste or Appendix IX Lists using EPA approved procedures	NA	Radionuclides without CLP data package
Permit application	NA	NA	Hazardous Waste or Appendix IX Lists using EPA approved procedures	NA	Radionuclides without CLP data package
Disposal	NA	NA	NA	Hazardous Substance or Appendix IX Lists using EPA approved methods with CLP data package	Radionuclides with CLP data package

4. SAMPLING PROCEDURES

Sampling activities affecting quality shall be prescribed by and performed in accordance with documented instructions (SAP), procedures, or drawings appropriate to the circumstances of the activities. Instructions, procedures, and drawings shall contain or reference quantitative and qualitative acceptance criteria necessary to determine satisfactory achievement of prescribed activities (data quality objectives). The requirements of QPP-034, Section 5.5, shall be invoked without exception and with the following clarification.

Sampling will be performed in a controlled fashion so that only representative samples are analyzed and used for decision making. Written sampling procedures contained in the SAP are part of the control scheme and will include:

- where, when, and how to sample,
- what kind of sample container to use,
- cleanliness techniques and requirements,
- preservation techniques and requirements,
- labeling instructions, and
- field tracking instructions.

Written analytical procedures are another important part of the scheme and are prepared as discussed in Section 7 of this QAPjP.

4.1 Sampling and Analysis Plans

The purpose of a SAP is to provide specific guidance for field and laboratory activities associated with a treatment task. SAPs will be prepared in accordance with Appendix A to this QAPjP.

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4.2 Waste Analysis Plans

In accordance with RCRA, Section 264.13(b), an owner operator of a hazardous waste treatment, storage, or disposal facility must develop and follow a written WAP that describes the procedures that will be carried out to comply with the waste analysis requirements of Section 264.13(a). These requirements shall be met by using the SAP discussed previously. Therefore, the WAPs will be similar to the SAPs but will be tailored to the operational phase rather than the test phase of the Project. In accordance with RCRA, a WAP should demonstrate to EPA or State permitting officials that the facility owner/operator knows what information is needed to operate the facility properly. In addition the facility owner/operator must demonstrate that they have in place a program to gather the necessary information. The RCRA regulations do not require a specific format for the WAP. However, the plan should be organized to address the following five major areas.[10]

- Facility description
- Identification of wastes to be managed
- Process tolerance limits
- Waste parameters to be monitored
- Waste sampling, analysis, and Quality Assurance/Quality Control (QA/QC) Procedures.

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5. SAMPLE CUSTODY

Measures shall be established to control the handling, packaging, cleaning, preservation, storage, transporting, and shipping of material and equipment to prevent damage or loss and to minimize deterioration. The requirements of QPP-034, Section 5.13, shall be invoked without exception and with the following clarification.

Chain-of-custody documentation is required for control of all samples. Project samples falling under data quality levels IV and V (see Table 3-1) that require CLP data packages also require chain-of-custody documentation. Procedures for control of samples, including chain-of-custody when necessary, shall be referenced or included in the SAPs.

6. CALIBRATION PROCEDURES AND FREQUENCY

Measuring and-test equipment used for activities affecting quality shall be controlled and calibrated at specified intervals and adjusted to maintain required accuracy. The requirements of QPP-034, Section 5.12, shall be invoked without exception and with the following clarification.

Standard operating procedures, detailed operating procedures, or manufacturers instructions for calibration of equipment will be referenced or included in the SAPs.

7. ANALYTICAL PROCEDURES

Processes that affect the quality of items or services shall be controlled. The requirements of QPP-034, Section 5.9, shall be invoked without exception and with the following clarification.

Analytical processes recommended by the EPA for RCRA projects will be used for analysis of samples collected in support of the Project when necessary to attain the required quality of data. SW-846, "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods,"[11] contains most of the EPA approved analytical procedures and shall be used.

References to specific procedures or written procedures to be used will be included in the SAPs.

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8. DATA REDUCTION, VALIDATION, AND REPORTING

The data reduction scheme, validation criteria, and reporting requirements shall be described for each measurement parameter. The specific routine procedures for assessing data quality discussed in Section 12 of this QAPjP are related to the data reduction and validation of this section.

Data reduction refers to computations and calculations performed on data. This includes, but is not limited to, summary statistics, standard errors, confidence limits, tests of hypothesis relative to the parameters, and model verification. Data reduction procedures, equations, and units of measurement will be specified in the SAPs.

Data validation is the process by which a sample measurement, method, or piece of data is judged to determine whether it is useful for a specified purpose. Data validation methods depend on the type of study that generated the data, the type of sampling, the test method, and the end use of the data. The systematic process to be used to review data, including principal criteria that will be used for comparison to determine validity and the methods to be used to identify and treat outliers, will be specified in the SAPs.

The final reporting of data for each task is the responsibility of the task manager with oversight by the Project Manager. The format for reporting data shall be specified in the SAPs.

The responsibilities for those involved in data reduction, validation, and reporting are identified below.

Experimenters/Operators:

- read self reading dosimeters,
- perform regular air sampling and record results as required,
- wear appropriate monitors (e.g., dosimeters, badges),
- respond to area monitor alarms,

- monitor and record process parameters, and
- perform and record results of simple analytical procedures to check process operation.

Radiation Control and Health support staff:[12]

- ensure radiological equipment is calibrated and functioning properly,
- perform radiological surveying of the task site, equipment (before and after decontamination), and samples,
- collect and analyze smears as directed by the radiation engineer (RE),
- supervise decontamination of equipment (radiological contaminants),
- provide the Occupational Medical Program and RE with radiological monitoring information as requested,
- Notify immediately the Field Team Leader of any radiological occurrence that must be reported as directed by the EG&G Idaho, Inc. Safety Manual, Section 3, Appendix II, and
- Accompany the victim to the nearest INEL Medical Facility for the evaluation if significant contamination from a confirmed internal body deposition of a radioactive materials occurs.

Support Laboratories:

- process dosimeters and film badges and record and report data, and
- analyze samples and record and report data.

Task Manager:

- review filed records, validate in the field or immediately thereafter, and
- gather various records and reports and prepare summary reports.

Project Manager:

- review the summary reports prepared by the task managers.

The analytical data (field and laboratory data) is evaluated by the Environmental Restoration/Waste Management Department Sample Management Office (SMO) according to their Standard Operating Procedures (SOP). The validation are based on the four standard procedures: SMO-SOP-12.1.3 (Gas Chromatography/Mass Spectrometry) and SMO-SOP-12.1.4 (Gas Chromatography) for organics, SMO-SOP-12.1.5 for inorganics, and SMO-SOP-12.1.2 for radioactivity.

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9. INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

The adequacy of the quality program shall be regularly assessed through a system of internal checks. The requirements of QPP-034, Section 5.2.4, shall be invoked without exception and with the following clarification.

Specific checks and frequencies applicable to the Project shall be identified in the SAPs.

10. PERFORMANCE AND SYSTEMS AUDITS AND FREQUENCY

A comprehensive system of planned and scheduled quality audits shall be conducted to verify that systems and performance within the Project are in compliance with all aspects of this QAPjP and the documents specified by this QAPjP. The requirements of QPP-034, Section 5.18, shall be invoked without exception and with the following clarification.

Audits will be the responsibility of the Project Manager. Audits will be performed by an EG&G certified quality engineer from Operations Support and selected technical support staff and will be announced and planned. The quality engineer will determine the frequency of auditing for each task and, in conjunction with the task manager, will prepare a schedule of audits for each task. The schedule of audits shall be included in the SAPs. Guidance for preparation of written audit plans related to measurement systems is presented below for both the system and performance audits.

10.1 System Audits

System audits consist of evaluating all components of the applicable measurement systems to determine their proper selection and use. The total data production process that includes test site activities and both on-site and off-site analytical services will be covered by systems audits. At least one systems audit will be performed before or shortly after systems are operational.

Items to be audited in the systems audit at the test site will include, but need not be limited to:

- quality assurance organization,
- sampling methodologies and written procedures for sampling,
- equipment applicability, availability, calibration, and condition,
- methods of sample handling, i.e., packaging, labeling, preserving, transporting, and archiving,

- personnel experience, qualifications, and training,
- response to corrective actions, and
- records and documentation including chain-of-custody forms, sample tags, sample shipping logbooks, sample collection logbooks, SAPs, standard operating procedures, and detailed operating procedures.

Items to be audited in the systems audit at the analytical laboratories (no audit requirements for EPA Level II) will include, but need not be limited to:

- analytical and support instrumentation maintenance and calibration logs,
- refrigerator and freezer temperature logs,
- distilled/deionized water supply records,
- sample tracking system,
- standard tracking system,
- reagent chemical log-in, tracking, and disposal,
- laboratory and sample security,
- assessment of good laboratory practices,
- use of control charts, blind samples, and other QC checks, and
- personnel qualifications.

10.2 Performance Audits

Performance audits normally will be conducted after the data production systems are operational and generating data. These audits independently collect measurement data by using performance evaluation samples to determine the accuracy of the total measurement system or portion thereof.

Performance audits will be conducted at the test site as data are being generated, reduced, and analyzed. Items audited will include, but need not be limited to:

- calibration records of field equipment,
- daily entries in logbooks,
- sampling procedures,
- decontamination procedures,
- photographs,

- video logs, and
- data logs.

Analytical laboratory performance audits will be conducted on a routine basis by the Laboratory Quality Assurance Manager and the quality engineer and will include, but need not be limited to:

- verification of written procedures and analysts understanding of same,
- announced inspections of the sample handling group (storage, tracking),
- announced inspections of the analytical process record keeping, and
- a minimum review of 25% of all analytical data and calculations.

11. PREVENTIVE MAINTENANCE

General preventive maintenance procedures are adequately addressed by the calibration procedures referenced in Section 6 of this QAPjP. No elaboration is necessary. Equipment specifics are provided in project specific documentation.

APPENDIX A

All SAPs written for the WROC treatability study project will follow the suggested outline in EPA guidance for conducting Remedial Investigation and Feasibility Studies.[13] The level of detail for each item will be appropriate to the task being performed, thereby eliminating the need for distinct formats for unlike projects.

A SAP consists of a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPjP). The FSP and QAPjP may be separate documents or may be combined into a single document. The FSP should be written such that a field sampling team unfamiliar with the site would be able to gather the sample and field information required. The QAPjP need not be generated each time a SAP is prepared. Only those aspects of a QAPjP that are project specific or not available elsewhere need be explicitly described. If information is already contained in other documents (e.g., WROC QPP, this document), including EPA guidance documents, it need only be referenced. The following is the format for SAPs.[14] All elements should be addressed, even if only noted to be "not applicable."

Sampling and Analysis Plan:

* Title Page
* Table of Contents
* Quality Assurance Project Plan. Elements of the QAPjP should be by reference whenever possible.
  - Project Description: Include identification of the phase work and general objectives of the investigation, description of the location, size, and important physical features of the site, a chronological site history including previous sampling efforts, and specific project objectives for this data-gathering effort and the ways the data will be used to meet those objectives. Include a table or chart showing project organization and line authority, identifying positions responsible for ensuring the collection of valid measurement data and routine assessment of measurement systems for precision and accuracy.

- QA Objectives: Define data quality objectives for the data based on the intended use of the data. Analytical methods, detection limits, instrument precision, QA/QC samples, completeness, representativeness, and comparability should be described or referenced.

- Site Selection and Sampling Procedures: Describe statistical methods or rationale for choosing sampling sites and frequencies. Field measurements for test procedures not documented elsewhere should be included. For each sampling procedure include or reference description of techniques or guidelines used to select sampling sites; description of the specific sampling procedures; description of the containers and procedures used for sample collection, preservation, transport, and storage; preparation of sampling equipment and containers to avoid sample contamination; sample preservation methods; time considerations for shipping samples; chain of custody procedures and forms; and field documentation. Sample custody in the field and laboratory will be discussed or referenced and examples of forms provided.

- Analytical Procedures and Calibration Procedures: Procedures for each measurement and parameter will be included or referenced.

- Data Reduction, Validation, and Reporting: Data reduction schemes, including equations, used in validating the data will be included or referenced. If only a percentage of the data is to be validated, that percentage will be stated.

- Internal Quality Control Checks: All specific internal QC methods to be used and the way in which they will be used should be identified or referenced, including replicates, spike samples, split samples, blanks, and standards. This function will be performed by the Sample Management Office.

- Performance and System Audits: The internal and external performance and system audits required to monitor the capability and performance of the measurement systems will be included or referenced. The auditing will be performed by the Quality Engineering (Quality Assurance/Quality Control Unit).

- Calculations of Data Quality Indicators: Specific procedures to assess precision, accuracy, and completeness of data will be included or referenced.

- Corrective Actions: Actions which will be implemented if QA requirements are not met will be included or referenced.

- Quality Assurance Reports to Management: The method(s) used to report the performance of the measurement system and data quality will be included or referenced.

* **Field Sampling Plan**

    - Site Background: If analysis of existing data cannot be referenced, a description of the site and surrounding areas, a discussion of known and suspected contaminant sources, probable transport pathways, specific data gaps and ways the sampling is designed to fill those gaps, and other information about the site should be included in this section.

    - Sampling Objectives: Describe clearly and succinctly the intended uses of the data.

    - Sample Location and Frequency: Identify each sample matrix to be collected and the constituents to be analyzed, including QA/QC samples, and the locations of existing and/or proposed sample points. Table and figures should be used.

    - Sample Designation: A sample numbering system should be established for each project. The sample designation should include the sample number and the location identifier, as a minimum. A SAP Table will be prepared and included in accordance with Environmental Restoration Project Directive 2.4.

    - Sampling Equipment and Procedures: Describe the step-by-step instructions for each type of sampling including equipment to be used and decontamination procedures. Standard Operating Procedures, Detailed Operating Procedures, or other Environmental Restoration/Waste Management Department approved procedures shall be used and referenced whenever possible.

    - Sample Handling and Analysis: Include sample preservation methods, type(s) of sample jars, sample labels, field documentations, shipping requirements, holding items, and waste disposal methods.

    - Waste Management: Describe methods for waste management (e.g., identification, generation, minimization, disposal, storage, and transportation).

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Appendix D

Audit Report on Maxim Technologies, Inc.

EG&G Idaho

"Providing research and development services to the government"

INTEROFFICE CORRESPONDENCE

SEP 1994
Received
C.S. Watkins

Date: August 22, 1994

To: G. R. Thomas, MS 3521

From: W. J. Isle, MS 3902 W. J. Isle

Subject: DESK AUDIT OF HUNTINGDON CONSULTING ENGINEERS AND ENVIRONMENTAL SCIENTISTS, TWIN CITY TESTING (TCT) ST. LOUIS DIVISION. ST. LOUIS, MISSOURI - WJI-13-94

A desk audit has been conducted for TCT St. Louis using the March 1994 audit by EG&G Rocky Flats as an aid.

Attached are copies of the EG&G Rocky Flats Audit Report, the Quality Audit Checklist used, letters from the inorganic and organic auditors with their comments, the EG&G 1090 forms with findings, the EG&G 1094 form and the EG&G 1095 form.

A closeout conference call was held on August 15, 1994 with Paul Smith and Mike Travis of TCT. Continued approval is recommended upon satisfactory resolution to the attached findings.

If you have any questions please contact me at 526-2312 or OfficeVision WJI.

dkw

cc: (w/o Attach)
R. D. Carmichael, MS 4146
K. J. Izbicki, MS 3910
R. J. Sheehan, MS 3910
R. G. Thompson, MS 3940

(w/Attach)
ARDC File, MS 3922
✓SMO File, MS 3910
W. J. Isle File (2)

TCT - ST. LOUIS

TECHNICAL SURVEILLANCE REPORT

Laboratory

TCT - St. Louis
1908 Innerbelt Business Center
St. Louis, Missouri 63114-5700
(314) 426-0880

Surveillance Date

March 21-22, 1994

Surveillance Team

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Theodore Wall, Staff Associate

This work was conducted on behalf of EG&G Rocky Flats (Rocky Flats Plant - Golden, Colorado) under subcontract #ASC230675DB.

TCT - ST. LOUIS
TECHNICAL SURVEILLANCE REPORT
March 21-22, 1993

INTRODUCTION

The purpose of this technical surveillance conducted at Twin City Testing (TCT) of St. Louis, Missouri was to evaluate TCT's corrective actions taken to resolve the Findings, Observations, and Comments identified as a result of the audit conducted February 4, 1993. The requirements specified in EG&G Rocky Flats Statement of Work, General Radiochemistry and Routine Analytical Services Protocol (GRRASP) - Part A, General Analytical Services Protocol [1] and the audit report were used to guide the surveillance. The GRRASP requirements are related to receipt, storage, handling, tracking, security, chain-of-custody, preparation, analysis, and reporting of EG&G Environmental Restoration (ER) sample analyses.

This report and the attached checklists describe the results of this technical surveillance. The surveillance was conducted on March 21-22, 1994 by Paul Gomez of EG&G Rocky Flats, and William Meise, Jill Gaschler, and Theodore Wall of QuantaLex, Inc.

The scope of the surveillance covered sample receiving, internal sample chain-of-custody, and specific aspects of organics, metals, and water quality parameters. The corrective actions taken by the laboratory since the last audit and revised TCT Standard Operating Procedures (SOPs) were examined and evaluated for adequacy. Checklists used to guide the surveillance are included in Attachments I through IV.

GENERAL CHEMISTRY OPERATIONS

General chemistry analyses of Rocky Flats ER samples are to be conducted according to the requirements, methods, and detection levels specified in *GRRASP - Part A* [1] and references [2-11] listed at the end of this report. TCT analytical chemistry operations were reviewed in terms of the Findings, Observations, and Comments cited in the audit report and included:

- Sample Receiving
- Sample Identification and Storage
- Sample Chain-of-Custody
- Sample Analysis
- Laboratory Equipment and Instrumentation (including calibrations)
- Standard Operating Procedures

All technical surveillance information related to general chemistry operations is summarized in detail on the Laboratory Surveillance Checklist included in Attachment I, the Organic Surveillance Checklist included in Attachment II, the Inorganic Surveillance Checklist included in Attachment III, and the Water Quality Parameter Surveillance Checklist included in Attachment IV of this report.

SUMMARY OF SURVEILLANCE RESULTS

Findings, Observations, and Comments resulting from the surveillance of TCT's general chemistry analysis operations are described below. A *Finding* identifies an essential requirement that is not being met or a deficiency for which corrective action has not been effectively implemented. An *Observation* is a problem which, if left uncorrected, could result in a condition affecting the quality of analytical work being performed. *Comments* refer to noteworthy laboratory conditions observed by the auditors during the surveillance.

Laboratory Sample Custody Operations

New Audit Observations:

1. The laboratory sample numbers were cross-referenced to an abbreviation of the EG&G Rocky Flats sample numbers rather than to the complete EG&G Rocky Flats sample numbers. The laboratory sample numbers should be cross-referenced to the complete EG&G Rocky Flats sample numbers.

2. The laboratory name was not evident on the Radioactive Sample Receipt form used in the sample receiving area. The laboratory name should appear on pre-printed laboratory documents.

3. An SOP addressing laboratory security was not available. An SOP addressing laboratory security should be available to the auditor at the time of the audit.

New Audit Comment:

1. The sample coolers were not routinely opened under a functioning fume hood in the sample receiving area.

Organic Analysis Operations

The Findings, Observations, and Comments stated below comprise the results of the previous on-site audit related to organic analysis operations. The surveillance results indicate the extent to which TCT has addressed and resolved these items.

During the on-site surveillance, TCT operations, procedures, and documentation were reviewed to evaluate the corrective actions taken in response to the previous audit. The results of this surveillance evaluation are stated below:

Previous Audit Observations:

1. The laboratory name did not consistently appear on pre-printed laboratory documents. The laboratory name should appear on pre-printed laboratory documents.

   Observation number one was resolved. The corrective action taken was adequate to remedy the deficiency cited, with the exception of the Radioactive Sample Receipt form.

New Audit Observations:

1. The laboratory name and the activity performed was not consistently documented in the logbooks; unused portions of documents were not consistently Z'd out. In addition, the binder of the balance calibration logbook AE163 had come unglued. The laboratory name and the activity performed should be documented in the logbooks and unused portions of documents should be crossed out.

2. The medium-level volatile soil extraction SOP for analyses by EPA CLP SOW 2/88 specified the addition of surrogates to the 5 milliliter purge sample rather than to the 10 milliliter methanol extract. The SOPs should accurately reflect the operating conditions in effect for the analyses of EG&G Rocky Flats samples and the laboratory should not deviate from the procedures in the EPA CLP SOW 2/88 without the written consent of EG&G Rocky Flats.

3. The standard preparation logbooks in the organic preparation laboratory were not reviewed and signed to indicate review. Logbooks should be reviewed and the review should be documented by a signature.

New Audit Comments:

1. The resumes did not demonstrate that Josephine Wade and Robert McAlevey met the supervisory requirements outlined in the EPA CLP SOW 2/88.

2. The semivolatile extraction SOP for analyses by EPA CLP SOW 2/88 included extraction at an acidic pH to be conducted prior to extraction at a basic pH if the initial raw sample had a pH of 6 or less. The EPA CLP SOW 2/88 indicates that the basic pH extraction should be performed before the acidic pH extraction.

Inorganic Analysis Operations

The Findings, Observations, and Comments stated below comprise the results of the previous on-site audit related to inorganic analysis operations. The surveillance results indicate the extent to which TCT has addressed and resolved these items.

During the on-site surveillance, TCT operations, procedures, and documentation were reviewed to evaluate the corrective actions taken in response to the previous audit. The results of this surveillance evaluation are stated below:

Previous Audit Findings:

1. Soil laboratory control samples (LCS) were not analyzed for soil samples. (Reference: CLP SOW 7/88, page E-13). A certified soil LCS should be analyzed with all soil samples.

   Surveillance Result:

   Finding number one was not resolved and remains a finding.

Previous Audit Observation:

1. The results for ICP analysis were not reported to the correct number of significant figures on the EPA Form 1s and in the raw data. ICP results should be reported to the correct number of significant figures.

   Surveillance Result:

   Observation number one was resolved. The corrective action taken was adequate to remedy the deficiency cited.

Previous Audit Comment:

1. The SOP for the non-TAL metals analysis was in draft form.

   Surveillance Result:

   Comment number one was resolved. The corrective action taken was adequate to remedy the deficiency cited.

New Audit Finding:

1. The IDLs reported in the data package observed during the audit were not from the latest IDL study. [Reference: CLP SOW 7/88, page E-14.] The IDLs reported for metals analytes must be from IDL studies performed within the past three months.

New Audit Observations:

1. The SOP for the non-TAL analytes did not include the CRDLs for the non-TAL analytes. Analytical SOPs should include documentation of relevant detection limits.
2. Supervisory review was not documented in the maintenance and deionized water logbooks. Supervisory review should be documented when performed in all logbooks.
3. The laboratory name did not appear on the front cover of several laboratory notebooks. The laboratory name should appear on the cover or binding of all laboratory notebooks.
4. Improper error correction was found in several laboratory notebooks. Errors should be corrected by drawing a single line through the error and initializing and dating the correction.

New Audit Comments:

1. The posted SOP in the laboratory for glassware washing was not the current revision.
2. Automatic pipet MP#9 was not calibrated within the past year as required by the laboratory SOP.
3. The laboratory will install a new ICP in April of 1994.

Water Quality Parameter Analysis Operations

The Findings, Observations, and Comments stated below comprise the results of the previous on site audit related to water quality parameter analysis operations. The surveillance results indicate the extent to which TCT has addressed and resolved these items.

During the on-site surveillance, TCT operations, procedures, and documentation were reviewed to evaluate the corrective actions taken in response to the previous audit. The results of this surveillance evaluation are stated below:

Previous Audit Findings:

1. All SOPs for water quality parameter analyses did not reflect preparation methods for soil samples. (Reference: GRRASP/GASP, Version 2.1, Attachment 1, Section III, page 84, D-5.) Water Quality Parameter analytical SOPs should indicate how soil samples are to be prepared and analyzed.

   Surveillance Result:

   Finding number one was downgraded to an observation. All WQP SOPs except those for alkalinity and fluoride analyses contain preparation methods for soil samples.

2. All SOPs for Water Quality Parameters did not reflect the QC requirements of GRRASP. (GRRASP/GASP Version 2.1, Exhibit 1.) The Water Quality Parameters SOPs should reflect all the QC requirements of GRRASP.

   Surveillance Result:

   Finding number two was downgraded to an observation. The ammonia, total phosphorus, ortho-phosphate, TDS, TSS, TOC, and TOX SOPs observed during the audit did not reflect all the QC requirements of GRRASP.

Previous Audit Observations:

1. An SOP was not readily available at the reagent storage cooler. The SOP should be updated to describe where samples are to be relocated in case of cooler breakdown.

   Surveillance Result:

   Observation number 1 was resolved. Corrective action taken was adequate to remedy the deficiency cited.

2. Alkalinity buffers were not initialed and dated. A record should be kept of when the buffers and reagents are received at the laboratory.

   Surveillance Result:

   Observation number 2 was resolved. The corrective action taken was adequate to remedy the deficiency cited.

3. Ion chromatography standard logs and technician standard logs for calibration analyses were not accurately maintained and assembled in a bound notebook to show past performance and instrument history.

Surveillance Result:

Observation number 3 was resolved The corrective action taken was adequate to remedy the deficiency cited.

4. The current SOP for ammonia analysis was in draft form. The SOP for ammonia analysis should be finalized and forwarded to EG&G Rocky Flats for approval.

Surveillance Result:

Observation number one was resolved. The corrective action taken was adequate to remedy the deficiency cited.

<u>Previous Audit Comment:</u>

1. All bound notebooks, loose leaf benchsheets, and documents containing "EEI" should be changed to "TCT - St. Louis."

Surveillance Result:

Comment number 1 was not resolved and remains a comment.

New Audit Finding:

1. White-out appeared in the Ion Chromatography logbook. [Reference: GRRASP/GASP, Version 2.1, Attachment 1, page 116, 2.1.7.] All corrections to logbooks and benchsheets must be made by drawing a single line through the error and initialing and dating the correction.

New Audit Observation:

1. The SOP for alkalinity did not address how bicarbonate, carbonate, and hydroxide alkalinity would be determined if the pH of the original sample was greater than 8.3 or if the pH was within the pH range of 4.3 to 8.3.

REFERENCES

[1] EG&G Rocky Flats, *General Radiochemistry and Routine Analytical Services Protocol (GRRASP)*, Statement of Work, 7/91.

[2] QuantaLex, Inc., *Standard Operating Procedures for Conducting Non-Radiochemical Laboratory Audits for EG&G Rocky Flats*, (Rev. 6/92).

[3] USEPA, Contract Laboratory Program, *Statement of Work for Organics Analysis (Multi-Media, Multi-Concentration)*, Rev. 2/88).

[4] USEPA, Contract Laboratory Program, *Statement of Work for Inorganics Analysis (Multi-Media, Multi-Concentration)*, No. 787, 7/88.

[5] USEPA, *Methods for Chemical Analysis of Water and Wastes* (EPA-600/4-79-020), March 1984.

[6] *APHA/AWWA Standard Methods for the Examination of Water and Waste Water*, 17th Edition, 1989.

[7] USEPA, *Test Method for Evaluating Solid Waste*, Physical Chemical Methods, SW-846, Third Edition, 1986.

[8] USEPA, *Methods for the Determination of Organic Compounds in Drinking Water* (EPA-600/4-88/039), September 1989.

[9] 40 CFR 136 Appendix A, pp. 131:4201 - 131:4349, October 26, 1984.

[10] USEPA, *Methods 615 and 619*, EMSL office of Research and Development, Cincinnati, Ohio, January 1982.

[11] *Federal Register*, Volume 55 No. 126, Appendix II, Method 1311 (TCLP), June 29, 1990.

TCT - St. Louis

Consulting Engineers, Scientists and Analytical Services

1908 Innerbelt Business Center Drive
St. Louis, Missouri 63114-5700
Phone (314) 426-0880
Fax (314) 426-4212

June 8, 1994

Paul C. Gomez
General Analytical Program Chemist
Sample Management Office
Dept. ER-SMO Building 080
EG&G Rocky Flats, Inc.
Rocky Flats Plant
Rocky Flats, CO 80403

Subject: Audit Report for Audit Conducted on March 21-22, 1994 - PCG-019-94

Dear Mr. Gomez,

We have received the technical surveillance audit report for the audit conducted by EG&G and QuantaLex on March 21-22, 1994 and offer the following responses and corrective actions:

<u>Laboratory Sample Custody Operations</u>

<u>New Audit Observations</u>

1. The laboratory sample numbers were cross-referenced to an abbreviation of the EG&G Rocky Flats sample numbers rather than to the complete EG&G Rocky Flats sample numbers. The laboratory sample numbers should be cross-referenced to the complete EG&G Rocky Flats sample numbers.

   TCT-St. Louis Response

   The number of digits used in the EG&G Rocky Flats sample number is not compatible with the number of sample number spaces allowed in the EPA forms. The laboratory sample numbers are cross-referenced to the complete EG&G Rocky Flats samples numbers in the narrative.

2. The laboratory name was not evident on the Radioactive Sample Receipt form used in the sample receiving area. The laboratory name should appear on pre-printed laboratory documents.

   TCT-St. Louis Response

   During the audit, TCT-St. Louis was in the process of updating its radiation safety program and procedures under the guidance of the NRC in order to comply with the new NRC regulations. A copy of a revised Radioactive Package Receipt form indicating the company name is included with this submittal.

3. An SOP addressing laboratory security was not available. An SOP addressing laboratory security should be available to the auditor at the time of the audit.

TCT-St. Louis Response

At the time of the audit, TCT-St. Louis was awaiting the installation of its new alarm system. The system, installed in April, 1994, is designed for fire and heat detection, for detection of window breakage and unauthorized entry into doorways, and for monitoring the temperature of walk-in coolers. A SOP on facility security is currently in draft form. The final draft is due to be completed by July 15, 1994. A copy of the SOP will be sent to EG&G after the review and approval process has been completed.

New Audit Comment:

1. The sample coolers are not routinely opened under a functioning fume hood in the sample receiving area.

TCT-St. Louis Response

At present the hood in the sample receiving area is too small for the type of cooler used in sample transport. Plans are being drawn-up for the next fiscal year to place a large hood over the sample receipt table, so that the sample coolers could be opened under a vented area.

Organic Analysis Operations

New Audit Observations:

1. The laboratory name and the activity performed was not consistently documented in the logbooks; unused portions of documents were not consistently Z'd out. In addition, the binder of the balance calibration logbook AE163 had come unglued. The laboratory name and the activity performed should be documented in the logbooks and unused portions of documents should be crossed out.

TCT-St. Louis Response

The laboratory name and activity performed will be documented on the inside front cover of the logbook. We have found that notations made to the outside front cover generally get "rubbed off". Usually the activity performed is marked on the spine of the logbook. However, with the preparations taking place involving the name change of the company, the best place to add any "missing" documentation such as a company name is to the inside front cover. A greater effort will be made by the section supervisors in their periodic review of the logbooks to ensure that all unused pages are properly "Z'd" out. The balance calibration logbook will be replaced. Any unused pages will be "z'd" out before the book is archived.

2. The medium-level volatile soil extraction SOP for analysis by EPA CLP SOW 2/88 specified the addition of surrogates to the 5 milliliter purge sample rather than to the 10 milliliter methanol extract. The SOPs should accurately reflect the operating conditions in effect for the analyses of EG&G Rocky Flats samples and the laboratory should not deviate from the procedures in the EPA CLP SOW 2/88 without the written consent of EG&G Rocky Flats.

TCT-St. Louis Response

TCT-St. Louis SOP, 4200-METH-MS-06, Volatile Organic Compounds Using GC/MS by CLP Method 2/88, is currently being revised to follow the medium-level volatile soil extraction procedures in EPA CLP SOW 2/88. The final draft is due to be completed by July 15, 1994. A copy of the SOP will be sent after the review and approval process has been completed.

3. The standard preparation logbooks in the organic preparation laboratory were not reviewed and signed to indicate review. Logbooks should be reviewed and the review should be documented by a signature.

TCT-St. Louis Response

Effective immediately, a greater effort will be made by the section supervisor to ensure that the standard preparation logbooks are reviewed with the review documented by a signature.

New Audit Comments:

1. The resumes did not demonstrate that Josephine Wade and Robert McAlevey met the supervisory requirements outlined in the EPA CLP SOW 2/88.

TCT-St.Louis Response

Copies of the resumes that have been updated to indicate supervisory experience are included with this submittal.

2. The semivolatile extraction SOP for analyses by EPA CLP SOW 2/88 included extraction at an acidic pH to be conducted prior to extraction at a basic pH if the initial raw sample had a pH of 6 or less. The EPA CLP SOW 2/88 indicates that the basic pH extraction should be performed before the acidic pH extraction.

TCT-St. Louis Response

This change in procedure was done for a client with special analytical problems. Recoveries on the acid analytes improved significantly by reversing the order of extraction. A second SOP will be created that indicates the EPA CLP SOW 2/88 sequence of extraction. The draft SOP should be finished by July 15, 1994. A copy of the SOP will be sent to EG&G after the review and approval process has been completed.

Inorganic Analysis Operations

Previous Audit Findings:

1. Soil laboratory control samples (LCS) were not analyzed for soil samples. (Reference: CLP SOW 7/88, page E-13). A certified soil LCS should be analyzed with all soil samples.

Surveillance Result: Finding number one was not resolved and remains a finding.

TCT-St. Louis Response

As far as can be determined, no LCS for soils is available that is spiked with all the metals of interest. Ottawa sand can be spiked, but sand is not truly representative of a soil sample. An interim decision was made during the audit close-out meeting that a notation would be added to the narrative indicating that a soil LCS was not available. The lead auditor, Paul C. Gomez, stated that he would check into the availability of a soil LCS with his contacts with other contractors.

New Audit Finding:

1. The IDLs reported in the data package observed during the audit were not from the latest IDL study. [Reference: CLP SOW 7/88, page E-14.] The IDLs reported for metals analytes must be from IDL studies performed within the past three months.

TCT-St. Louis Response

Effective immediately, greater care will be taken to insure that the proper IDL studies are included in the data package.

New Audit Observations:

1. The SOP for the non-TAL analytes did not include the CRDLs for the non-TAL analytes. Analytical SOPs should include documentation of relevant detection limits.

TCT-St. Louis Response

Standard Operating Procedure, 4200-METH-INO-36, Non TAL Metals Analysis Using Inductively Coupled Argon Emission Spectroscopy by SW-846 Method 6010 does list estimated detection limits in Table 1. A copy of this SOP is included in this submittal for reference. The detection limits listed are only given as a guide. The actual method detection limits are sample dependent and vary with sample matrix.

2. Supervisory review was not documented in the maintenance and deionized water logbooks. Supervisory review should be documented when performed in all logbooks.

TCT-St. Louis Response

Effective immediately, a greater effort will be made by the section supervisor to ensure that the maintenance and the deionized water logbooks are reviewed in a timely manner with the review documented by a signature.

3. The laboratory name did not appear on the front cover of several laboratory notebooks. The laboratory name should appear on the cover or binding of all laboratory notebooks.

TCT-St. Louis Response

The laboratory name and activity performed will be documented on the inside front cover of the logbook. We have found that notations made to the outside front cover generally get "rubbed off". Usually the activity performed is marked on the spine of the logbook. However, with the preparations taking place involving the name change of the company, the best place to add any "missing" documentation such as a company name is to the inside front cover.

4. Improper error correction was found in several laboratory notebooks. Errors should be corrected by drawing a single line through the error and initializing and dating the correction.

TCT-St. Louis Response

Standard Operating Procedure, 4200-DATA-GEN-10, Laboratory Data Documentation states in Section 7.1.3 that corrections, when necessary, are made by drawing a single line through the incorrect information and entering the correct information. All corrections are to be initialed and dated by the person making the correction. A copy of this SOP is included in this submittal for reference. The section manager will ensure that the procedures in the SOP are followed, effective immediately.

New Audit Comments:

1. The posted SOP in the laboratory for glassware washing was not the current revision.

TCT-St. Louis Response

The Standard Operating Procedure, 4200-PREP-GEN-02A, Preparation of Sample Containers and Glassware, posted in the metals digestion preparation

laboratory is the current revision. An incorrect date was listed in the SOP list.

2. Automatic pipet MP#9 was not calibrated within the past year as required by the laboratory SOP.

TCT-St. Louis Response

Automatic pipet MP#9 was taken out of service during the audit.

3. The laboratory will install a new ICP in April of 1994.

TCT-St. Louis Response

The ICP was installed at the end of April, 1994.

Water Quality Parameter Analysis Operations

Previous Audit Findings:

1. All SOPs for water quality parameters did not reflect preparation methods for soil samples. Reference GRRASP/GASP, Version 2.1, Attachment 1, Section III, page 84, D-5.) Water Quality Parameter analytical SOPs should indicate how soil samples are to be prepared and analyzed.

   Surveillance Result: Finding number one was downgraded to an observation. All WQP SOPs except for alkalinity and fluoride analyses contain preparation methods for soil samples.

TCT-St. Louis Response

Standard Operating Procedures, 4200-METH-INO-25, Alkalinity by EPA Method 310.1, and 4200-METH-INO-28, Fluoride by EPA Method 340.2 are currently under revision. A section concerning preparation methods and analysis for soil samples will be included. The anticipated completion date is August 1, 1994. After review and approval, copies of the SOPs will be sent for your review.

2. All SOPs for Water Quality Parameters did not reflect the QC requirements of

GRRASP. (GRRASP/GASP Version 2.1, Exhibit 1.) The Water Quality Parameters should reflect all the QC requirements of GRRASP.

Surveillance Result: Finding number two was downgraded to an observation. The ammonia, total phosphorus, ortho-phosphate, TDS, TSS, TOC, and TOX SOPs observed during the audit did not reflect all the QC requirements of GRRASP.

TCT-St. Louis Response

This observation requires further clarification on the part of the audit team. Upon review of the Standard Operating Procedures mentioned, the SOPs concerning ammonia, total phosphorus, TDS, and TSS appear to be missing references to matrix spikes or laboratory control samples. The SOPs concerning orthophosphate and TOC appear to contain all the required QC parameters. TOX is not a contract parameter. The SOPs on ammonia, total phosphorus, TDS, and TSS will be revised to reflect all of the QC requirements by August 1, 1994. I will await your response to a second review of the orthophosphate and TOC SOPs. Copies of both SOPs are included in this submittal.

Previous Audit Comment:

1. All bound notebooks, loose leaf benchsheets, and documents containing "EEI" should be changed to "TCT-St. Louis".

   Surveillance Result: Comment number 1 was not resolved and remains a comment.

TCT-St. Louis Response

October 1, 1994 is the expected completion date for the name change-over (from TCT-St. Louis to Huntingdon) of all laboratory documents.

New Audit Finding:

1. White-out appeared in the Ion Chromatography logbook. [Reference: GRRASP/GASP, Version 2.1, Attachment 1, page 116, 2.1.7.] All corrections

to logbooks and benchsheets must be made by drawing a single line through the error and initialing and dating the correction.

TCT-St. Louis Response

Standard Operating Procedure, 4200-DATA-GEN-10, Laboratory Data Documentation states in Section 7.1.3.2 that write overs, correction fluid or tape, or any correction technique which results in illegible original data is not acceptable. The section manager will ensure that the procedures in the SOP are followed, effective immediately.

New Audit Observation:

1. The SOP for alkalinity does not address how bicarbonate, carbonate, and hydroxide alkalinity would be determined if the pH of the original sample was greater than 8.3 or if the pH was within the pH range of 4.3 to 8.3.

TCT-St. Louis Response

Standard Operating Procedure, 4200-METH-INO-25, Alkalinity by EPA Method 310.1 will be revised to address the bicarbonate, carbonate, and hydroxide alkalinity determinations. The anticipated completion date is August 1, 1994. After review and approval, a copy of the SOP will be sent for your review.

Please note that any findings, observations, or comments marked as resolved were not addressed. If there are any questions or comments concerning the response to this audit or to the materials submitted, please contact me at (314) 426-0880.

Sincerely,

Michael A. Travis

Michael A. Travis
Quality Assurance Manager

RRES. CONTROL
TGOING LTR NO.
ORDER # 5700.1K
4 RF 6929

EG&G ROCKY FLATS

EG&G ROCKY FLATS, INC.
ROCKY FLATS PLANT, P.O. BOX 464, GOLDEN, COLORADO 80402-0464 • (303) 966-7000

June 28, 1994

94-RF-06929

TCT-St. Louis
1908 Innerbelt Business Center Drive
St. Louis, Missouri 63114-5700

Attn: Mike Travis

REVIEW OF TCT-ST. LOUIS SURVEILLANCE AUDIT RESPONSE AND COMPLETION OF MARCH 21-22, 1994 AUDIT - PCG-032-94

The Environmental Monitoring Department has reviewed your written response to the findings and observations noted during the March 21-22, 1994 site visit to your laboratory. Your response included a schedule for implementation and persons responsible for implementing the corrective actions as requested.

An evaluation of the response to the findings is as follows:

Laboratory Sample Custody Operations New Observations

Observation 1: Corrective Action Completed. The laboratory shall use the entire client sample identification number on the electronic data deliverable.

Observation 2: Corrective Action Completed.

Observation 3: Corrective Action Completed. Although the laboratory did not submit the time and person responsible for the corrective action.

Laboratory Sample Custody Operations New Comments

Comment 1: Corrective Action Completed. A schedule of hood installation was not provided and the person responsible for corrective action.

Organic Analysis Operations New Observations

Observation 1: Corrective Actions Completed

DISTRIBUTION	LTR	ENC
...BAL, M.E.		
...TMAN, H.S.		
...ANCH, D.B.		
...RNIVAL, G.J.		
...PP, R.D.		
...VIS, J.G.		
...IPERA, D.W.		
...NN, B.J.		
...RMAN, L.K.		
...ALY, T.J.		
...DAHL, T.		
...BIG, J.G.		
...TCHINS, N.M.		
...L, R.E.		
...BY, W.A.		
...ESTER, A.W.		
...NN, H.P.		
...RX, G.E.		
...DONALD, M.M.		
...KENNA, F.G.		
...NTROSE, J.K.		
...RGAN, R.V.		
...ZUTO, V.M.		
...TER, G.L.		
...ING, T.L.		
...NDLIN, N.B.		
...LOCK, G.H.		
...GER, S.G.		
...EWART, D.L.		
...LLIVAN, M.T.		
...ANSON, E.R.		
...KINSON, R.B.		
...SON, J.M.		
...ANT, R.S.		
[illegible]	X	
[illegible]	X	
[illegible]	X	
RRES CONTROL	X	
...S/T130G		
...M RECORDS ...MT (2)	X	
...ASSIFICATION		
...I		
...CLASSIFIED		
...NFIDENTIAL		
...CRET		

...THORIZED CLASSIFIER SIGNATURE
...MENT CLASSIFICATION
...EW WAIVER PER
...SSIFICATION OFFICE

...PLY TO RFP CC NO:

...ON ITEM STATUS
PARTIAL/OPEN
☐ CLOSED
APPROVALS:

...& TYPIST INITIALS
...MAS

(REVISED 2/94)

Organic Analysis Operations New Observations Cont'd

Observation 2: Corrective Actions Completed.

Observation 3: Corrective Actions Completed.

Organic Analysis Operations New Comments

Comment 1: Corrective Actions Completed.

Comment 2: Corrective Actions Completed. Although there is no specific lab representative mentioned for the corrective action.

Inorganic Analysis Operations Previous Findings

Finding 1: Corrective Action Addressed. The laboratory does not have an internal LCS for soil analysis. The laboratory should attempt again to contact the independent agencies to find a source.

Inorganic Analysis Operations New Findings

Finding 1: Corrective Action Completed.

Inorganic Analysis Operations New Observations

Observation 1: Corrective Action Completed.

Observation 2: Corrective Action Completed.

Observation 3: Corrective Action Completed.

Observation 4: Corrective Action Completed.

Inorganic Analysis Operations New Comments

Comment 1: Corrective Action Completed.

Comment 2: Corrective Action Completed.

Comment 3: Action Completed.

Water Quality Parameter Analysis Operations Previous Findings

Finding 1: Corrective action completed with the exception of the alkalinity and fluoride SOPs. The SOPs will be corrected by the laboratory by August 1, 1994, upon which the laboratory shall submit controlled copies of the procedures. The finding is now graded as an observation.

Finding 2: Corrective action noted for the procedures observed. The SOPs for ammonia, total phosphorus, TDS, and TSS have completed action by the laboratory. The finding has been graded to an observation. The observation is the result of quality control (QC) samples not described in the procedures. The samples are initial and Continuing Calibration Verification (ICV and CCV) samples as well as their corresponding blank (ICB and CCB) samples. The TOX procedure per your response is so noted as not being a contract parameter.

Water Quality Parameter Analysis Operations Previous Comments

Comment 1: Corrective Action Completed.

Water Quality Parameter Analysis Operations New Findings

Finding 1: Corrective Action Completed.

Water Quality Parameter Analysis Operations New Observations

Observation 1: Corrective Action Completed.

If you have any questions regarding the audit or require any information, please contact me directly at (303)966-8614 or by FAX at (303)966-8575. Thank you for your cooperation.

Paul C. Gomez
General Analytical Program Chemist
Sample Management Organization
EG&G Rocky Flats, Inc.

mbc

cc:
K. A. Wegner - QuantaLex, Inc.

LABORATORY SURVEILLANCE CHECKLIST

PRE-AUDIT MEETING

Laboratory:

TCT - St. Louis

Audit Duration:

March 21-22, 1994

Laboratory Address:

1908 Innerbelt Business Center Drive
St. Louis, Missouri 63114-5700

Telephone:

(314) 426-0880

Auditors:

Jill Gaschler
Theodore Wall

Auditing Organization:

QuantaLex, Inc.
300 Union Boulevard
Suite 600
Lakewood, Colorado 80228
(303) 763-8881

Analyses:

Sample Receiving

Reviewed by: AK 7/26/94

SAMPLE RECEIVING

1. Who is the designated sample custodian?

Jim Shetley is the designated sample custodian.

Source: *Fred Grabau*

2. Who is the designated alternate sample custodian?

Larry Goddard and Mark Shrader are the alternate sample custodians.

Source: *Jim Shetley*

3. Describe the laboratory sample receiving areas.

The sample receiving area is large with one overhead door. There is adequate space for sample storage (both refrigerator and warm). The work space for opening coolers was well organized and there was adequate space in the fume hood for the coolers.

Source: *OBA*

4. Describe the sample receiving procedures in use at the laboratory.

The coolers are received on a dock. The coolers are placed on a table and the airbills are signed. The exterior of the coolers are radiation-screened for alpha, beta, and gamma activity. The coolers are opened on the table and the samples are removed and placed on the table. The sample containers are radiation screened for alpha, beta, and gamma activity. Problems are noted on the chain-of-custody records. The samples are logged into the LIMS system and internal tracking documents are generated. If radioactivity was evident, the samples and tracking documents are marked with a radiation label.

Source: *Jim Shetley*

5. Are coolers opened in a contamination-free area under a functional hood?

No. Coolers are opened on a table unless the exterior of the coolers is marked as an inhalation hazard.

Source: *Jim Shetley*

6. Are the coolers/samples radiation screened upon arrival?
The coolers and sample containers are screened for alpha, beta, and gamma activity.

Source: *Jim Shetley*

7. Describe the radiation screening process?
The exterior of the cooler is screened with pancake monitors before the cooler is opened. In addition, the sample containers are screened after they are removed from the cooler. The monitors are tested with a radioactive source prior to use the insure that the monitors are functioning. The sample custodian documents the radioactivity of each sample on a radioactive sample receipt form. Each sample and the associated tracking records are marked with a radiation sticker if radioactivity was detected.

Source: *Jim Shetley*

8. Is the temperature of the cooler checked and recorded upon receipt of containers?
The temperature of the cooler is checked when it is opened. The temperature is recorded on the chain-of-custody record.

Source: *Jim Shetley/OBA*

9. Are shipping records signed and dated?
The shipping records are signed and dated.

Source: *Jim Shetley*

10. How are shipping discrepancies or problems resolved?
The sample custodian contacts the project manager for resolution of shipping discrepancies.

Source: *Jim Shetley*

11. Where is the resolution documented?
The resolution is documented on the chain-of-custody record.

Source: *Jim Shetley*

12. Sample Receiving Documentation Used

Document Title	Document Purpose	Signed/Dated by Analyst (Y/N)	Lab Name/ Activity Identified (Y/N)	Proper Error Correction (Y/N)	Entries in Ink (Y/N)
TCT-St. Louis Custody Transfer Record	*Documents custody*	*Y*	*Y*	*None Observed*	*Y*
Radioactive Sample Receipt	*Documents radioactivity screening of samples*	*N/A(1)*	*N(2)*	*N/A(1)*	*N/A(1)*

Source: *OBA*

Comments: *(1) A blank form was audited; these questions could not be completed.*

(2) The laboratory name does not appear on the form.

13. Are all documents in chronological order?

Shipping and receiving personnel use the LIMS system and pre-printed forms rather than logbooks.

Source: *Jim Shetley*

14. Are sample receiving documents reviewed by the supervisor?

The sample receiving documents are reviewed and signed by the project manager.

Source: *Jim Shetley*

15. Additional comments about sample receiving:

None

SAMPLE STORAGE AND IDENTIFICATION

16. Storage Area Inventories

	Location	Description
Metal Raw Samples	*Shipping and Receiving*	*Large, walk-in refrigerator*
Volatile Samples	*Shipping and Receiving*	*Small, walk-in refrigerator*
Extractables	*Shipping and Receiving*	*Large, walk-in refrigerator*
Wet Chem Raw Samples	*Shipping and Receiving*	*Large, walk-in refrigerator*

Source: *Jim Shetley/Fred Grabau*

17. Are temperature logs maintained for all cold storage areas?

Temperature logs are maintained for all cold storage areas.

Source: *OBA*

18. How are samples identified?

Samples are identified using a computer-printed label which includes the TCT-St. Louis sample number as well as other relevant information.

Source: *Jim Shetley*

19. If the laboratory uses a unique laboratory number, where is the cross-reference to the field identification number documented?

The unique laboratory number is cross-referenced to the client number in the LIMS system and on the sample container label. However, the client number must be abbreviated if it exceeds 12 characters. Many EG&G Rocky Flats sample numbers exceed 12 characters.

Source: *Fred Grabau*

20. Are samples that require preservation stored in such a manner as to maintain their preservation?

The samples are stored to maintain preservation.

Source: *OBA*

21. Are volatile samples stored separately from semivolatile samples?

Volatile and semivolatile samples are stored separately.

Source: *OBA*

22. Is there a sufficient amount of sample storage in sample receiving?

There is a sufficient amount of storage space in sample receiving.

Source: *OBA*

23. Storage Documentation Used

Document Title	Document Purpose	Signed/Dated by Analyst (Y/N)	Lab Name/ Activity Identified (Y/N)	Proper Error Correction (Y/N)	Entries in Ink (Y/N)
Huntingdon Refrigerator/ Freezer Temperature Log	*Documents temperature checks*	*Y*	*Y*	*None observed*	*Y*
TCT-St. Louis Custody Transfer Record	*Documents internal chain-of-custody*	*Y*	*Y*	*None observed*	*Y*

Source: *OBA*

Comments: *None*

24. Additional comments on sample storage:

None

LABORATORY AND SAMPLE SECURITY

25. How does the laboratory maintain the custody of the samples in the laboratory?

The samples remain in locked refrigerators in the sample receiving area. The sample custodian transfers the samples between the refrigerators and the analysts.

Source: *Jim Shetley*

26. Does the laboratory have designated secure areas?

The entire laboratory is a secure area. In addition, access to the samples and refrigerators in sample receiving is limited; the refrigerators are locked after business hours.

Source: *Fred Grabau/Jim Shetley*

Are the secure areas only accessible to authorized personnel?

Yes. The reception area is monitored. The overhead door in sample receiving is locked unless in use and monitored. The remaining doors are locked at all times. In addition, the sample refrigerators are locked and access is limited to the sample custodian and the alternate sample custodians.

Source: *Fred Grabau/Jim Shetley*

How do authorized personnel gain access to the designated secure areas?

Laboratory personnel and visitors enter the laboratory through the front door. Access to samples in sample receiving is available only through the sample custodians.

Source: *Fred Grabau/Jim Shetley*

27. Additional comments on laboratory and sample security:

None

28. SOP Review

	Title	Accurate (Y/N)	Meets Requirements (Y/N)
Sample Receiving	*Sample Receipt for CLP and CLP Equivalent Samples 4200-GENL-SS-2*	*Y*	*Y*
Radiation Screening	*Sample Receipt for CLP and CLP Equivalent Samples 4200-GENL-SS-2*	*N (1)*	*Y*
Sample Storage	*Sample Storage 4200-GENL-LOG-05*	*Y*	*Y*
Sample Identification	*Sample Receipt for CLP and CLP Equivalent Samples 4200-GENL-SS-2*	*Y*	*Y*
Refrigerator Corrective Action	*Sample Storage 4200-GENL-LOG-05*	*Y*	*Y*
Security	*None available (2)*	*N/A*	*N/A*
Safety	*Right-to-Known Training 4200-SAFE-GEN-01*	*Y*	*Y*

Additional comments on SOP review:

(1) The laboratory SOP specified all sample coolers should be screened in the fume hood.

(2) A specific SOP for laboratory security was not available.

INORGANIC LABORATORY SURVEILLANCE CHECKLIST

Laboratory:

TCT - St. Louis

Audit Duration:

March 21-22, 1994

Laboratory Address:

1908 Innerbelt Business Center Drive
St. Louis, Missouri 63114-5700

Telephone:

(314) 426-0880

Auditor:

William Meise

Auditing Organization:

QuantaLex, Inc.
300 Union Boulevard
Suite 600
Lakewood, Colorado 80228
(303) 763-8881

Analyses:

Inorganic Analyses

1. Personnel Qualifications

	Name	Qualified (Y/N)	Resume (Y/N)
Laboratory Manager	*Amy Sumariwalla*	Y	Y
Inorganic Laboratory Supervisor (B.S. or B.A. science, 3 years related experience, 1 year supervisory experience)	*Bill Lesko*	Y	Y
ICP Spectroscopist (B.S. or B.A. science, 2 years ICP experience)	*Starla Hodapp* *Jon Buerck*	Y Y	Y Y
ICP Operator (B.S. or B.A. science, 1 year ICP experience)	*Jill Ott*	Y	Y
AA Operator (B.S. or B.A. science and 1 year experience for flame, graphite furnace, cold vapor)	*John Midkiff* *Mike Schoenborn* *Ali Kasiri*	Y Y Y	Y Y Y
Inorganic Sample Preparation Specialist (high school diploma, college chemistry, 6 months experience)	*Tim Flaherty* *Kevin Schoenborn*	Y Y	Y Y
Wet Chemistry Analysts (B.S. or B.A. science and 6 months experience, or 2 years experience)	*Rhea Henderson* *Mark Schrader*	Y Y	Y Y
Back-up Technical Person (B.S. or B.A. science and 1 year experience for ICP, AA, classical chemistry, and sample preparation)	*Mark Schrader*	Y	Y
Quality Assurance Supervisor	*Mike Travis*	Y	Y
Glassware Technician	*Lab Analyst*	N/A	N/A
Sample Custodian	*Jim Shetely*	Y	Y
Data Manager	*Marti Ward*	Y	Y

Source: *Bill Lesko*

Comments: *For the purpose of this audit: OBA=Observed by Auditor; N/A=Not Applicable*

2. Does the laboratory appear to have adequate work space (6 linear feet of open bench per analyst)?
   Yes.

3. Is the laboratory clean and organized in a manner that is appropriate for trace level analysis?
   Yes.

4. Are the exhaust hoods functional?
   Yes

Source: *OBA*

5. How often are exhaust hood flows checked and recorded?
   The hood flows are checked twice a year. The hood flow is recorded on the Hood Performance record sheet.

Source: *Bill Lesko*

6. What is the distilled/demineralized water source?
   The distilled/demineralized (DI) water source is a millipore water system.

Source: *Bill Lesko*

7. How often is the distilled/demineralized water quality checked and recorded?
   The DI water is checked daily for conductivity, weekly for permanganate and potassium, and monthly for total matter and bacteria. The feed water is checked weekly for pH, and chlorine, and monthly for TDS, soluble iron, and total iron.

Source: *Bill Lesko*

8. Is the analytical balance located away from drafts and areas of rapid temperature changes?
   The balance is located away from drafts and areas of rapid temperature change.

Source: *OBA*

9. How often is the analytical balance calibrated by a certified technician?
   The balance is checked yearly by a certified technician.

Source: *Bill Lesko*

10. Is the balance routinely checked with the appropriate range of class weights before use?

Yes. The balance is checked daily with S-class weights.

Source: *Bill Lesko*

11. Are the results of balance check with class S weights recorded?

Yes. The results are recorded in the Balance Calibration Logbook.

Source: *OBA*

12. Is an adequate drying oven available with a temperature monitoring device?

Yes. A drying oven is available.

Source: *OBA*

13. What are the procedures for glassware washing and storage?

The procedure is to soak glassware in a hot soapy water, scrub, rinse glassware with DI water, rinse glassware three times with 1:1 nitric acid, and rinse glassware three times with DI water.

Source: *OBA*

14. Are the SOPs for glassware washing available?

Yes. The SOP is available.

Source: *OBA*

15. Do the SOPs prescribe an adequate amount of acid treatment of the glassware?

Yes. The glassware is rinsed three times with nitric.

Source: *OBA*

16. Are standard preparation SOPs available in the proper area?

Yes. The standard preparation SOPs are available in the proper area.

Source: *OBA*

17. Are standards dated upon receipt?

Yes. The standards are dated upon receipt and the date opened.

Source: *OBA*

18. Are expired standards used to prepare instrument calibration standards?

No. Expired standards are not used to prepare instrument calibration standards.

Source: *OBA*

19. Are standard containers labeled with concentration *Y*, preparation date *Y*, and preparer's name *Y* ?

Comments: *The expiration dates are also recorded.*

Source: *OBA*

20. Is the reference/spiking/calibration standards preparation and tracking logbook(s) maintained?

Yes. A reference/spiking/calibration standard preparation and tracking logbook is maintained.

Source: *OBA*

21. If automatic pipets for standards preparation are used, are the pipets calibrated on a regular basis?

The automatic pipets are calibrated yearly. The auditor noticed during the audit that pipet MP #9 was not calibrated within the past year.

Source: *Mark Schrader*

22. What are the procedures used to prepare standards?

Standards are prepared according to the prescribed method.

Source: *OBA*

23. What are the procedures used to digest metals for water/soil samples?

A soil LCS is not digested with the soil samples.

Source: *Mark Schrader*

24. What are the procedures used to prepare mercury samples?

Mercury water samples are prepared using SW-846 method 7470. Mercury soil samples are prepared using SW-846 method 7471.

Source: *Mark Schrader*

25. What are the procedures used to prepare cyanide samples?

Cyanide samples are prepared by the CLP SOW method. A soil LCS is not digested with the soil samples.

Source: *Mark Schrader*

26. What are the procedures used to prepare hexavalent chromium samples?

Hexavalent chromium is prepared using SW-846 method 7196.

Source: *Mark Schrader*

27. Are sample preparation SOPs readily available?

Yes. Sample preparation SOPs are available.

Source: *OBA*

28. Is the pH of the samples checked and recorded by the preparation technician?

Yes. The pH is checked by the preparation technician.

Source: *Bill Lesko*

29. How are samples identified during preparation?

The samples are identified by the lab sample number written on glassware or bottle.

Source: *Bill Lesko*

30. How are digestates identified?

The digestates are identified by the lab number written on the sample container.

Source: *Bill Lesko*

31. Are standards stored separately from the digestates?

Yes. Standards are stored separately from digestates.

Source: *OBA*

Storage Area Inventories:

	Location	Description
Metals Digestates	*Analysis lab*	*Cabinet*
CN Distillates	*Analysis lab*	*On bench top*
Metals Standards	*Sample preparation area*	*Cabinet*

Source:

32. Do the examined digested cases contain LCSs __*Y*__, duplicates __*Y*__, ICB __*Y*__, CCB __*Y*__, PB __*Y*__, and matrix spikes __*Y*__?

Source: *OBA*

33. How are samples measured and transferred to the beakers for digestion?

The samples are measured and transferred to the beakers by graduated cylinder.

Source: *Bill Lesko*

34. Are the samples filtered before analysis or allowed to settle?

Soils are filtered prior to analysis.

Source: *Bill Lesko*

35. Standard and Sample Preparation Documentation

Document Title	Document Purpose	Signed/Dated by Analyst (Y/N)	Lab Name/ Activity Identified (Y/N)	Proper Error Correction (Y/N)	Entries in Ink (Y/N)
Hood Performance Record	*Recording of hood flows*	*Y*	*N(1)*	*Y*	*Y*
DI Water Supply Log	*Recording of conductivity*	*Y*	*N(1)*	*Y*	*Y*
Feed Water Supply Log	*Recording of feed water*	*Y*	*N(1)*	*Y*	*Y*
Balance Calibration Log	*Recording of weights*	*Y*	*Y*	*Y*	*Y*
Temperature Log for Oven	*Recording of oven temperatures*	*Y*	*N(2)*	*Y*	*Y*
Glassware SOP	*SOP*	*Y*	*Y*	*N(3)*	*Y*
Inorganic Standard Log	*Recording of standards preparation and spiking mixes*	*Y*	*Y*	*Y*	*Y*
Metals Prep Log Book #91 1994-20	*Recording of LCS and spike concentration*	*Y*	*N(1)*	*Y*	*Y*

Source:

Comments: *(1) The lab name did not appear on several logbooks.*

(2) The oven logbook had the lab name of EEI on the cover.

(3) The SOP for glassware washing had several crossouts on it.

36. Are logbooks in chronological order?

Yes.

Source: *OBA*

37. Are standard and sample preparation documents reviewed by the supervisor?

Yes. However, the logbooks are not signed by the supervisor.

Source: *OBA*

38. Additional comments on standard and sample preparation, Questions 2-37:

The SOPs for mercury preparation reference the SW-846 methods rather than the CLP SOW methods.

Proper error correction was not performed in several of the logbooks observed.

SAMPLE ANALYSIS

39. ICP Instrumentation

ICP ID Number	Manufacturer	Model	Type: Sequential or Simultaneous	Installation Date
#2	*Leeman*	*PS3000*	*Both*	*2/18/92*
Unknown	*TJA*	*61E Trace*	*Simultaneous*	*Approx. 4/94*

Source: *Bill Lesko*

	Instrument #2	
	Y/N	Source
40. Are the appropriate SOPs available?	*Y*	*OBA*
41. Are calibration intensity gain records kept?	*Y*	*Bill Lesko*
42. Has the instrument been modified in any way?	*N*	*Bill Lesko*
43. Is the instrument properly vented?	*Y*	*OBA*
44. Is a mass flow controller used?	*N*	*Bill Lesko*
45. Is an auto sampler used?	*Y*	*Bill Lesko*
46. Is the interference correction automatically performed?	*Y*	*Bill Lesko*
47. Are interelement correction (IEC) factors updated yearly or more frequently?	*Y*	*Bill Lesko*
48. If IEC factors are not used, is there any evidence that they or other wave lengths should be used?	*N/A*	*N/A*
49. Is a maintenance logbook maintained?	*Y*	*OBA*

50. If internal standards are used, which elements are used? Is a CRDL standard run for all ICP elements?

Internal standards are not used. A CRDL standard is analyzed for all ICP elements

Source: *Bill Lesko*

51. Additional comments on ICP analysis, Questions 39-50:

During the audit, the laboratory received a new ICP. The ICP will be operational in April, 1994.

52. Atomic Absorption (AA) Instrumentation

AA ID Number	Manufacturer	Model	Installation Date	Graphite Furnace, Flame or both
Instrument #9	*Perkin Elmer*	*Zeeman 4100*	*1991*	*GFAA*
Instrument #7	*Varian*	*Zeeman 400*	*1993*	*GFAA*
Instrument #3	*Varian*	*400*	*1987*	*Both*
Instrument #4	*Varian*	*Zeeman 400*	*1988*	*GFAA*
Instrument #6	*Varian*	*V20*	*1988*	*Flame*

Source: *Bill Lesko*

53. For what elements is the graphite furnace used?

The graphite furnace is used to analyze arsenic, lead, thallium, selenium, amd silver.

Source: *Bill Lesko*

54. For what elements are the flame absorption techniques used?

Flame absorption is used to analyze potassium.

Source: *Bill Lesko*

55. For what elements are the flame emission techniques used?

Flame emission is used to analyze potassium.

Source: *Bill Lesko*

	Instrument #6		Instrument #9		Instrument #7	
	Y/N	Source	Y/N	Source	Y/N	Source
56. Is the appropriate portion of the SOPs available?	*Y*	*OBA*	*Y*	*OBA*	*Y*	*OBA*
57. Are element-specific SOPs listing instrument conditions, background correction, instrument conditions, and instrument sensitivity available?	*Y*	*OBA*	*Y*	*OBA*	*Y*	*OBA*
58. Are calibration (sensitivity) results kept?	*Y*	*Bill Lesko*	*Y*	*Mark Schrader*	*Y*	*Bill Lesko*
59. Has the instrument been modified?	*N*	*Bill Lesko*	*N*	*Mark Schrader*	*N*	*Bill Lesko*
60. Is the instrument properly vented?	*Y*	*OBA*	*Y*	*OBA*	*Y*	*OBA*
61. Is the unit equipped with a flameless accessory?	*N*	*OBA*	*Y*	*Mark Schrader*	*Y*	*Mark Schrader*
62. Are Pyrolytic Cuvettes used?	*N*	*Bill Lesko*	*Y*	*Mark Schrader*	*Y*	*Mark Schrader*
63. Are LVOV platforms or pyrolytic tubes used for atomization?	*N*	*Bill Lesko*	*Y*	*Mark Schrader*	*N*	*Bill Lesko*
64. Is maintenance by service contract?	*N*	*Bill Lesko*	*Y*	*Bill Lesko*	*Y*	*Bill Lesko*
65. Is a maintenance logbook kept?	*Y*	*OBA*	*Y*	*OBA*	*Y*	*OBA*
66. What matrix modifier is used for: As: *$Ni(NO_3)_2$ and $PdMgNO_3$* Pb: *Phosphoric acid* Se: *$Ni(NO_3)_2$ and $PdMgNO_3$* Tl: *Sulfuric acid*		*Bill Lesko*		*Bill Lesko*		*Bill Lesko*
67. Are electrodeless discharge lamps (EDLs) or hollow cathode lamps (HCLs) used?	*N/A*	*N/A*	*EDL*	*Mark Schrader*	*HCL*	*Bill Lesko*

	Instrument #3		Instrument #4	
	Y/N	Source	Y/N	Source
56. Is the appropriate portion of the SOPs available?	*Y*	*OBA*	*Y*	*OBA*
57. Are element-specific SOPs listing instrument conditions, background correction, instrument conditions, and instrument sensitivity available?	*Y*	*OBA*	*Y*	*OBA*
58. Are calibration (sensitivity) results kept?	*Y*	*Bill Lesko*	*Y*	*Bill Lesko*
59. Has the instrument been modified?	*N*	*Bill Lesko*	*Y*	*Bill Lesko*
60. Is the instrument properly vented?	*Y*	*OBA*	*Y*	*OBA*
61. Is the unit equipped with a flameless accessory?	*Y*	*Mark Schrader*	*N*	*Bill Lesko*
62. Are Pyrolytic Cuvettes used?	*Y*	*Mark Schrader*	*Y*	*Bill Lesko*
63. Are LVOV platforms or pyrolytic tubes used for atomization?	*Y*	*Bill Lesko*	*N*	*Bill Lesko*
64. Is maintenance by service contract?	*N*	*Bill Lesko*	*N*	*Bill Lesko*
65. Is a maintenance logbook kept?	*Y*	*OBA*	*Y*	*OBA*
66. What matrix modifier is used for: As: *$Ni(NO_3)_2$ and $PdMgNO_3$* Pb: *Phosphoric acid* Se: *$Ni(NO_3)_2$ and $PdMgNO_3$* Tl: *Sulfuric acid*		*Bill Lesko*		*Bill Lesko*
67. Are electrodeless discharge lamps (EDLs) or hollow cathode lamps (HCLs) used?	*HCL*	*Bill Lesko*	*Super Lamp*	*Bill Lesko*

68. Additional comments on AA analysis:

None

69. Mercury Analysis Instrumentation

Instrument ID Number	Manufacturer	Model	Installation Date
6	*Varian*	*Varian V20*	*1988*

Source: *Bill Lesko*

70. Are calibration records kept for mercury analysis.

Yes. Calibration records are kept.

Source: *OBA*

	Building ____	
	Y/N	Source
71. Is a hollow cathode lamp used?	*Y*	*Bill Lesko*
72. Are the appropriate SOPs available?	*Y*	*OBA*
73. Are the calibration standards prepared with the samples?	*Y*	*Bill Lesko*
74. Is the instrument properly vented?	*Y*	*OBA*
75. Is a maintenance logbook kept?	*Y*	*OBA*

76. Additional comments on mercury analysis:

None

77. Cyanide Analysis Instrumentation

Method	Instrument Manufacturer	Model	Installation Date
CLP SOW	*Technicon*	*AAII*	*1984*

Source: *Bill Lesko*

	Y/N	Source
78. Are the appropriate SOPs available?	*Y*	*OBA*
79. Are instrument calibration records kept?	*Y*	*OBA*
80. Are enough preparation apparatus available to complete analysis prior to holding times?	*Y*	*OBA*
81. Is a maintenance log kept?	*Y*	*OBA*

82. How are reagents prepared and stored?

The reagents are prepared according to the method and are stored in cabinets.

Source: *Bill Lesko/OBA*

83. Is the laboratory capable of performing amenable cyanide analysis?

Yes. The laboratory is capable of performing amenable cyanide analysis.

Source: *Bill Lesko*

84. Additional comments on cyanide analysis:

None

85. Hexavalent Chromium [Cr(VI)] Analysis Instrumentation

Method	Instrument Manufacturer	Model	Installation Date
SW-846 Method 7196	*Bausch & Lomb*	*Spectronic 501*	*1984*

Source: *Mark Schrader/OBA*

		Y/N	Source
		Y/N	Source
86.	Are the appropriate SOPs available?	*Y*	*OBA*
87.	Are instrument calibration records kept?	*Y*	*OBA*
88.	Is a maintenance log kept?	*Y*	*OBA*
89.	Is the laboratory able to perform the analysis before holding times are exceeded?	*Y*	*Bill Lesko*

90. Additional comments on hexavalent chromium analysis:
None

91. Sample Analysis Documentation

Document Title	Document Purpose	Signed/Dated by Analyst (Y/N)	Lab Name/ Activity Identified (Y/N)	Proper Error Correction (Y/N)	Entries in Ink (Y/N)
Maintenance Log Book	*Maintenance log for several instruments*	*Y*	*N*	*Y*	*Y*
ICP Run Log	*Run log*	*Y*	*Y*	*Y*	*Y*
GFAA Run Log	*Run log*	*Y*	*Y*	*Y*	*Y*
Mercury Run Log	*Run log*	*Y*	*Y*	*Y*	*Y*

Source: *OBA*

92. Are instrument run logs maintained so as to enable a reconstruction of the run sequence of individual instruments, and are logbooks in chronological order?

Yes

Source: *OBA*

93. Additional comments on sample analysis documentation and instrument run logs:

The lab name was not on front cover of several maintenance logbooks.

DATA HANDLING AND REVIEW

94. Who is responsible for document control?

Marti Wood is responsible for document control.

Source: *Marti Ward*

95. Are manual data calculations spot checked by a second person?

Yes

Source: *Marti Ward*

96. What manufacturer/model of LIMS system (if any) does the lab have?

The laboratory will start using the ChemWare LIMS system in the near future. Currently, the laboratory uses a Perkin-Elmer system for sample tracking.

Source:

97. Is the LIMS system used and validated for calculating results?

No. The LIMS system is not curently used for validating and calculating results.

Source: *Chuck Ward*

98. What data package reviews are performed?

The data packages are reviewed by the analyst, the data review group, and the project manager.

Source: *Marti Ward*

99. Are data review and data package assembly SOPs readily available?

Yes. Data review and data package assembly SOPs are readily available.

Source: *OBA*

100. Where are data package documents filed?

The data packages are kept in the laboratory for three months. The packages are then sent to an off-site storage facility.

Source: *Marti Ward*

101. Describe the procedures used to assemble data packages.

Data packages are assembled according to the SOPs.

102. List documents found in data packages reviewed.

Data Package Number	*SDG 4110*		

CLP package - metals

EPA forms 1-14

Raw data

The IDL study was from March and April and the samples were analyzed in August.

103. Are the data packages organized in a consistent manner?

Yes. The data packages are organized in a consistent manner.

Source: *OBA*

104. Are document inventories containing a list of document groups and number of pages per document group available for each data package?

Yes. Document inventories are available.

Source: *OBA*

105. Additional comments on data handling and review, Questions 94-104:

ICP results are reported to the correct significant figures.

106. SOP Review

	Title	Accurate (Y/N)	Meets Requiremen (Y/N)
Glassware Washing	*Preparation of Sample Containers and Glassware*	N(1)	Y
Standards Traceability	*Preparation and Storage of Standards*	Y	Y
Sample Preparation	*Digestion of Water Samples for GFAA by CLP Method SOW ILMO2.0 3/90*	Y	Y
	Digestion of Soil Samples for GFAA by CLP Methods (SOW 7/88)	Y	Y
	Digestion of Water Samples for ICP and Atomic Absorption	Y	Y
	Spectroscopy by CLP Methods (SOW 7/88)		
	Digestion of Soil Samples for ICP and Atomic Absorption Spectroscopy by CLP Methods (SOW 7/88)	Y	Y
ICP Analysis	*Metals Using Inductively Coupled Argon Emission Spectroscopy by CLP Methods (SOW ILMO1.0)*	Y	Y(3)
Graphite Furnace AA Analysis	*Metals Analysis Using Graphite Furnace Atomic Absorption Spectroscopy*	Y	Y(3)
Flame AA Analysis	*Metals Analysis Using Atomic Absorption Spectroscopy*	Y	Y(3)
Mercury Analysis	*Mercury in Water by SW-846 Method 7470*	Y	N(2)
Cyanide Analysis	*Determination of Total Cyanide Using AAII by EPA 335.3; Procedure #4200-METH-INO-1A Rev. 1 #/1/93*	Y	Y
Hexavalent Chromium Analysis	*Hexavalent Chromium by SW-846 Method 7196; Procedure #4200-METH-INO-02B 9/8/93*	Y	Y

SOP Review (continued)

	Title	Accurate (Y/N)	Meets Requirements (Y/N)
Data Review	*Data Validation*	*Y*	*Y*
Data Package Assembly	*Contract Laboratory Program Complete Sample Data File Package Assembly and Submittal (Inorganic Data Package Assembly for CLP and CLP Equivalent Reports)*	*Y*	*Y*

107. Additional comments on SOP review:

(1) The SOP for glassware washing in the inorganic lab was outdated.

The SOP for the non-TAL analytes does not list the CRDLs for the non-TAL analytes.

(2) SOPs should reference the CLP methods for mercury.

(3) Non-TAL metals analysis SOP references SW-846 method 6010.

WATER QUALITY LABORATORY SURVEILLANCE CHECKLIST

PRE-AUDIT MEETING

Laboratory:

TCT - St. Louis

Audit Duration:

March 21-22, 1994

Laboratory Address:

1908 Innerbelt Business Center Drive
St. Louis, Missouri 63114-5700

Telephone:

(314) 426-0880

Auditor:

William Meise

Auditing Organization:

QuantaLex, Inc.
300 Union Boulevard
Suite 600
Lakewood, Colorado 80228
(303) 763-8881

Analyses:

Water Quality Parameters

1. Personnel Qualifications

	Name	Qualified (Y/N)	Resume (Y/N)
Laboratory Manager	*Amy Sumariwalla*	Y	Y
Inorganic Laboratory Supervisor (B.S. or B.A. science, 3 years related experience, 1 year supervisory experience)	*Bill Lesko*	Y	Y
IC Operator (B.S. or B.A. science, 1 year IC experience)	*Lyubov Polonskaya* Starla Hodapp *Jon Buerck*	Y Y Y	Y Y Y
Auto Analyzer Operator (B.S. or B.A. science and 1 year experience for auto analyzer system)	*Jon Buerck*	Y	Y
Inorganic Sample Preparation Specialist (high school diploma, college chemistry, 6 months experience)	*Tim Flaherty* *Kevin Schoenborn*	Y Y	Y Y
Wet Chemistry Analysts (B.S. or B.A. science and 6 months experience, or 2 years experience)	*Mark Schrader* *Rhea Henderson* *Lyubov Polonskaya*	Y Y Y	Y Y Y
Soil Chemistry Analysts (B.S. or B.A. science and 6 months experience, or 2 years experience)	*Mark Schrader* *Rhea Henderson*	Y Y	Y Y
Back-up Technical Person (B.S. or B.A. science and 1 year experience for auto analyzer, classical chemistry, and sample preparation)	*Mark Schrader*	Y	Y
Quality Assurance Supervisor	*Mike Travis*	Y	Y
Glassware Technician	*Lab Analyst*	N/A	N/A
Sample Custodian	*Jim Shetely*	Y	Y
Data Manager	*Marti Warld*	Y	Y

Source: *Mark Schrader*

Comments: *For the purpose of this audit: OBA = Observed by Auditor; N/A = Not Applicable.*

Reviewed by: KK 4/26/94

2. Are standards dated upon receipt?

Yes. All standards for all analyses are dated upon receipt at the lab.

Source: *OBA*

3. Standard and Sample Preparation Documentation

Document Title	Document Purpose	Signed/Dated by Analyst (Y/N)	Lab Name/ Activity Identified (Y/N)	Proper Error Correction (Y/N)	Entries in Ink (Y/N)
IC Log	*Recording of calibration data*	*Y*	*Y*	*N*	*Y*
IC Inorganic Non-Metals Standards Log	*Standards log*	*Y*	*Y*	*Y*	*Y*
IC Laboratory Notebook - Anions	*Logbook of IC runs*	*Y*	*N*	*Y*	*Y*
SOP for Preparation and Storage of Standards	*SOP*	*Y*	*Y*	*Y*	*Y*

Source: *OBA*

Comments: *The Ion Chromatograph logbook had errors corrected with "white-out".*

4. Wet Chemistry SOP Review

	Title	Accurate (Y/N)	Meets Requirements (Y/N)
Soil Extraction	*Various methods*	*Y*	*N (1)*
IC Analysis	*Determination of Inorganic Anions by EPA 300.0 #4200-METH-INO-17A Revision 1 4/23/93*	*Y*	*Y*
Auto Analyzer Analysis	*Ammonia by EPA 350.1 #4200-METH-INO-18 Rev 0 2/11/93*	*Y*	*N (2)*
Titrimetric Analysis	*Standard Operating Procedure Alkalinity by EPA Method 310.1*	*Y*	*N (3)*
IR Analysis	*TOC by EPA 415.1 #4200-METH-INO-09B Rev. 2 5/22/92*	*Y*	*N (3)*
Spectrophotometer Analysis	*Total Phosphorus by EPA 365.3 #4200-METH-INO-19A Rev. 1 4/20/93*	*Y*	*N (3)*

SOP comments:

(1) The SOPs for fluoride and alkalinity did not contain soil preparation methods.

(2) The SOP for alkalinity does not reflect the relationship of pH carbonate and bicarbonate.

(3) The SOPs for ammonia, total phosphorus, o-phosphate, TDS, TSS, TOX, and TOC did not reflect the QC requirements of GRRASP.

EG&G IDAHO, INC. - ENVIRONMENTAL RESTORATION PROGRAM - QUALITY AUDIT CHECKLIST

Laboratory or Facility Name: TCT ST Louis

Address: 1908 INTERBELT BUISNESS CENTER DRIVE, ST. Louis, MISSOURI, 63114-5700

Date of Audit: DESK AUDIT JULY 13, 1994   Auditor Signature: W. J. Isle 8/22/94

LABORATORY PERSONNEL CONTACTED:

Name	Title	Name	Title
MIKE TRAVIS	QUALITY ASSURANCE MANAGER		

AUDIT QUESTIONS AND PROCEDURES	RESPONSE	REFERENCE	COMMENTS
1. Has the laboratory manager been identified?	(Y) N		
2. Has the laboratory QA officer been identified?	(Y) N		
3. Does the QA officer report to senior management?	(Y) N		
4. Has a sample custodian been identified?	(Y) N		
5. Has a document custodian been identified?	(Y) N		
6. Are QC responsibilities and reporting relationships clearly defined?	(Y) N		

EG&G IDAHO, INC. - ENVIRONMENTAL RESTORATION PROGRAM - QUALITY AUDIT CHECKLIST

AUDIT QUESTIONS AND PROCEDURES	RESPONSE	REFERENCE	COMMENTS
7. Have all laboratory personnel been trained according to site requirements?	(Y) N		
8. Are all QA procedures and revisions documented in written form and assigned a unique identification code including date of implementation?	(Y) N		
9. Are all procedures and protocols implementing the QA program approved by the QA officer and laboratory management prior to usage?	(Y) N		
10. Has a formal corrective action program been implemented?	(Y) N		
11. Are the following elements of a QA and QC program adequately covered, maintained, and implemented:	(Y) N		
a. Personnel?	(Y) N		
b. QA and QC responsibilities and reporting relationships?	(Y) N		
c. Facilities and equipment?	(Y) N		
d. Analytical instrument operations?	(Y) N		
e. Documentation procedures?	(Y) N		
f. Procurement and inventory practices?	(Y) N		

AUDIT QUESTIONS AND PROCEDURES	RESPONSE	REFERENCE	COMMENTS
g. Preventive maintenance?	(Y) N		
h. Reliability of data?	(Y) N		
i. Data review and validation?	(Y) N		
j. Feedback and corrective action?	(Y) N		
k. Instrument calibration?	(Y) N		
l. Recordkeeping, data storage, and security?	(Y) N		✓
m. Sample custody and handling?	(Y) N		
n. Internal audits?	(Y) N		
o. Personnel training procedure?	(Y) N		
12. Are there established written procedures for training staff to perform analytical methods?	(Y) N		
a. Do these procedures contain specific precision and accuracy levels to be achieved by the analysts before they can begin working on actual samples?	(Y) N		
b. Are training records maintained?	(Y) N		
c. Are quality assurance procedures documented and available to the analysts?	(Y) N		

EG&G IDAHO, INC. - ENVIRONMENTAL RESTORATION PROGRAM - QUALITY AUDIT CHECKLIST

AUDIT QUESTIONS AND PROCEDURES	RESPONSE	REFERENCE	COMMENTS
13. Have maintenance procedures been written for each instrument used for analysis?	(Y) N		
a. Is a manufacturer's manual available to support these written procedures?	(Y) N		
b. Are dedicated instrument operation logs maintained for each analytical instrument?	(Y) N		
14. Are records maintained in a logbook of all instrument maintenance?	(Y) N		
15. Have the instruments been maintained in accordance with the applicable QA and QC manual and instrument operations manual?	(Y) N		
16. Are unknown, round-robin performance evaluation standards from EPA routinely analyzed?	Y N		
a. Are results documented?	Y N		
b. Are all results within applicable QC limits?	Y N		
c. Have corrective actions been documented?	(Y) N		
17. Have standard curves and quality control limits been adequately documented?	(Y) N		

EG&G IDAHO, INC. - ENVIRONMENTAL RESTORATION PROGRAM - QUALITY AUDIT CHECKLIST

AUDIT QUESTIONS AND PROCEDURES	RESPONSE	REFERENCE	COMMENTS
a. Are quality control charts maintained for each routine analysis?	(Y) N		
18. Does the analytical and QC data meet the QC criteria as specified in the applicable QAPP, SAP, and QA and QC manuals?	(Y) N		
19. Do QC records show corrective action when analytical results fail to meet QC criteria?	(Y) N		
20. Are quality control data accessible for all analytical results?	(Y) N		
21. Are data calculations documented?	(Y) N		
22. Are data calculations checked by a second person?	(Y) N		
a. Do supervisory personnel routinely review the data and QC results?	(Y) N		
b. Are all data and records retained under security for the period required by the applicable project QA plan and applicable sampling and analysis plans?	(Y) N		
23. Does the laboratory appear to have adequate workspace?	(Y) N		

AUDIT QUESTIONS AND PROCEDURES	RESPONSE	REFERENCE	COMMENTS
24. Is the laboratory secure?	(Y) N		
25. Are document custody procedures written and accessible to all appropriate individuals?	(Y) N		
26. Are written document preparation and custody procedures available to all appropriate personnel?	(Y) N		
27. Does the laboratory maintain project files which include all samples and laboratory custody and analysis data, documents, and records?	(Y) N		
a. Are all documents in a project file uniquely and sequentially numbered?	(Y) N		
28. Does the facility have a secure designated area where all laboratory and sampling records are stored?	(Y) N		
a. Is access to this area restricted to authorized individuals?	(Y) N		
b. Are all records maintained permanently?	(Y) N		
c. Is a master inventory list maintained?	(Y) N		
d. Are records presently as represented by the inventory?	(Y) N		

EG&G Idaho

"Providing research and development services to the government"

INTEROFFICE CORRESPONDENCE

Date: July 27, 1994

To: [redacted]

From: K. J. Izbicki, MS 3910

Subject: DESK AUDIT REPORT FOR HUNTINGDON CONSULTING ENGINEERS AND ENVIRONMENTAL SCIENTISTS, TWIN CITY TESTING - ST. LOUIS DIVISION, ST. LOUIS, MISSOURI, CONDUCTED ON JULY 26, 1994 - KJI-49-94

Attached is the subject desk audit report.

If you have any questions or need additional information, please contact me at 526-1474 or OfficeVision ID KJI.

kji

Attachment:
As Stated

cc: C. S. Watkins, MS 3910
ARDC Files
SMO Files
K. J. Izbicki File

I. TITLE

Desk Audit Report for the Organic Analytical Laboratory Section of Huntingdon Consulting Engineers and Environmental Scientists, Twin City Testing - St. Louis Division

II. BACKGROUND

On May 13 & 14, 1993, various representatives from EG&G Idaho, Inc. (hereafter referred to as EG&G Idaho) performed an analytical services audit on Huntingdon Consulting Engineers and Environmental Scientists, Twin City Testing - St. Louis Division (hereafter referred to as TCT). The audit was conducted at the TCT laboratory in St. Louis, Missouri. Following the audit, an organic audit report, authored by Rod Grant (see RDG-120-93) was submitted to the lead auditor, Bill Isle. Because Mr. Grant had no audit findings, he recommended giving INEL SMO approval to TCT for performing organic analyses.

III. INTRODUCTION

EG&G Idaho Company Procedure 3.8 "Supplier Evaluation" and ER&WM policy dictates that an ER&WM approved analytical laboratory must undergo an annual evaluation in order to maintain their approval status. Therefore, TCT was due to be reaudited by ER&WM in May of 1994. In compliance with Company Procedure 3.8 and as a cost savings action, ER&WM elected to perform an in-house evaluation (desk audit) rather than an on-site audit of TCT. The organic desk audit consisted of ER&WM's examination and evaluation of the documentation that resulted from an on-site audit of TCT by EG&G Rocky Flats on March 21-22, 1994. Pertinent documentation from the EG&G Rocky Flats audit includes; (a) the technical surveillance report along with TCT's response, (b) the laboratory surveillance checklist, (c) the organic laboratory surveillance checklist, and (d) the water quality parameter surveillance checklist.

Based on my inspection of EG&G Rocky Flats' surveillance checklists, it is my professional opinion that the EG&G Rocky Flats and ER&WM organic audit criteria are comparable. As a result, I am confident that ER&WM can safely use the EG&G Rocky Flats 1994 audit of TCT (i.e., by way of reciprocity) rather than performing its own on-site audit of TCT.

IV. AUDIT FINDINGS, LABORATORY RESPONSES, AND ER&WM REPLIES

EG&G Rocky Flats found no findings during the March 1994 audit of TCT. According to EG&G Rocky Flats documentation all observations and comments concerning organic analyses were satisfactorily resolved in TCT responses. The INEL SMO agrees with EG&G Rocky Flats that the resolutions provided by TCT are adequate.

V. CONCLUSION

It is my recommendation that the INEL SMO concur with the organic observation and comment resolutions agreed upon by EG&G Rocky Flats and TCT.

EG&G Idaho

"Providing research and development services to the government"

INTEROFFICE CORRESPONDENCE

Date: July 21, 1994

To: W. J. Isle, MS 3902

From: R. J. Sheehan, MS 3910 RJS

Subject: DESK AUDIT REPORT FOR HUNTINGDON CONSULTING ENGINEERS AND ENVIRONMENTAL SCIENTISTS, TWIN CITY TESTING - ST. LOUIS DIVISION, ST. LOUIS, MISSOURI, CONDUCTED ON JULY 15, 1994 - RJS-01-94

Attached is the subject desk audit report.

If you have any questions or need additional information, please contact me at extension 6-5269 or OfficeVision ID: RQT.

knt

Attachment:
As Stated

cc: C. S. Watkins, MS 3910 CSW
ARDC Files
SMO Files
R. J. Sheehan File

I. TITLE

Desk Audit Report for the Inorganic Analytical Laboratory Section of Huntingdon Consulting Engineers and Environmental Scientists, Twin City Testing - St. Louis Division

II. BACKGROUND

On May 13 & 14, 1993, various representatives from EG&G Idaho, Inc. (hereafter referred to as EG&G Idaho) performed an analytical services audit on Huntingdon Consulting Engineers and Environmental Scientists, Twin City Testing - St. Louis Division (hereafter referred to as TCT). The audit was conducted at the TCT laboratory in St. Louis, Missouri. Following the audit, an inorganic audit report (see RJS-36-93) was submitted to the lead auditor (Bill Isle). The inorganic audit findings from this report (RJS-36-93) were incorporated into Bill Isle's initial report (see WJI-17-93, Rev 1) which was submitted to TCT.

TCT's original response to Bill's initial report (WJI-17-93, Rev 1) did not adequately address all of the inorganic audit findings. Subsequently, Bill submitted an internal correspondence (see WJI-26-93), to EG&G Idaho procurement, recommending that TCT be given interim EG&G Idaho Environmental Restoration and Waste Management Department (hereafter referred to as ER&WM) analytical laboratory approval. It was recommended that this interim approval period be preset for an amount of time in which TCT could reasonably close out the audit findings. All of the audit findings were officially closed (see WJI-01-94) in February of 1994.

III. INTRODUCTION

EG&G Idaho Company Procedure 3.8 "Supplier Evaluation" and ER&WM policy dictates that an ER&WM approved analytical laboratory must undergo an annual evaluation in order to maintain their approval status. Subsequently, TCT was due to be reaudited by ER&WM in May of 1994. In compliance with Company Procedure 3.8 and as a cost savings action, ER&WM elected to perform an in-house evaluation (desk audit) rather than an on-site audit of TCT. The inorganic desk audit consisted of ER&WM's examination and evaluation of the documentation that resulted from an on-site audit of TCT by EG&G Rocky Flats on March 21-22, 1994. Pertinent documentation from the EG&G Rocky Flats' audit includes; (a) the technical surveillance report along with TCT's response (attached), (b) the laboratory surveillance checklist (attached), (c) the inorganic laboratory surveillance checklist (attached), and (d) the water quality parameter surveillance checklist (attached).

Based on my inspection of EG&G Rocky Flats' surveillance checklists, in conjunction with my experience in auditing to ER&WM's inorganic checklist, it is my professional opinion that the EG&G Rocky Flats and ER&WM inorganic audit criteria are comparable. As a result, I am confident that ER&WM can safely use the EG&G Rocky Flats 1994 audit of TCT (i.e., by way of reciprocity) rather than performing its own on-site audit of TCT.

Two inorganic findings (see section IV of this report) were made during the ER&WM desk audit of TCT. TCT is required to submit a corrective action plan for each of these findings.

IV. AUDIT FINDINGS, LABORATORY RESPONSES, AND ER&WM REPLIES

1. DESK AUDIT FINDING #1

EG&G Rocky Flats Previous Audit Finding:

Soil laboratory control samples (LCS) were not analyzed for soil samples. (Reference: CLP SOW 7/88, page E-13). A certified soil LCS should be analyzed with all soil samples.

Surveillance Result: This finding was not resolved and remains a finding.

TCT Response:

"As far as can be determined, no LCS for soils is available that is spiked with all the metals of interest. Ottawa sand can be spiked, but sand is not truly representative of a soil sample. An interim decision was made during the audit close-out meeting that a notation would be added to the narrative indicating that a soil LCS was not available. The lead auditor, Paul C. Gomez, stated that he would check into the availability of a soil LCS with his contacts with other contractors."

ER&WM Reply:

The fact that a soil LCS can not be found that contains all of the metals of interest does not justify not using a soil LCS of any kind. Soil samples that contain certified concentrations of most if not all CLP TAL metals can be obtained commercially (e.g. Environmental Research Associates). An LCS soil sample(s), containing as many pertinent analytes as possible, should be prepared and analyzed with each batch of ER&WM soil samples.

ER&WM does not accept TCT's interim decision with EG&G Rocky Flats of only adding a notation to the narrative indicating that a soil LCS was not available. It is requested that TCT; (a) determine which of the relevant analytes cannot be obtained in LCS soil matrix form, (b) obtain a soil LCS that contains as many pertinent analytes as is commercially available, and (c) submit a written plan that outlines how TCT will prepare LCSs for all future batches of ER&WM soil samples.

DESK AUDIT FINDING #1 will remain open pending an acceptable response from TCT.

2. DESK AUDIT FINDING #2

EG&G Rocky Flats Audit Finding:

Audit question #21 on page 5 of EG&G Rocky Flats' inorganic laboratory surveillance checklist states; "If automatic pipets for standards preparation are used, are the pipets calibrated on a regular basis?" The EG&G Rocky Flats' auditor (William Meise), listing Mark Schrader of TCT as his source, states; "The automatic pipets are calibrated yearly. The auditor noticed during the audit that pipet MP#9 was not calibrated within the past year."

TCT Response:

"Automatic pipet MP#9 was taken out of service during the audit."

ER&WM Reply:

The EG&G Rocky Flats' finding that, as of March 1994, TCT calibrates their automatic pipets on a yearly basis is either; (a) erroneous, or (b) in direct conflict with written statements made by TCT in February of 1994. In a corrective action response (see GRT-04-94) to a 1993 ER&WM inorganic audit finding, TCT, by way of written correspondence (dated February 3, 1994), stated the following:

"Automatic pipets are currently calibrated at six month intervals. These pipets will be checked against that calibration on a daily basis at time of use. A log will be maintained documenting the daily calibrations. All the manufacturer's recommendations for tolerances will be used. Upon failure to meet calibration specifications, the pipet will be marked "out of service" until it has been repaired. Increased use of Class A volumetric pipets will also be implemented."

It is requested that TCT submit a written correspondence that; (a) explains the conflicting statements that appear to have been made to two separate audit teams, (b) delineates the automatic pipet calibration procedure that is actually employed by TCT, (c) details personnel training in regard to the automatic pipet calibration procedure, and (d) describes the process that TCT uses to verify that the automatic pipet calibration procedure is being correctly followed by TCT personnel. Furthermore, it is requested that TCT submit; (a) a list of all automatic pipets employed by TCT, including all pertinent information for each pipet (i.e., manufacturer's name, pipet type, pipet volume or volume range, pipet identification number, and the manufacturer's recommended tolerance limits), and (b) copies of all logbook entries documenting the daily automatic pipet calibration checks performed by TCT from February 3, 1994 until the present.

DESK AUDIT FINDING #2 will remain open pending an acceptable response from TCT.

V. <u>CONCLUSION</u>

With the exception of two findings outlined in the EG&G Rocky Flats report, it is my recommendation that ER&WM concur with the inorganic finding resolutions agreed upon by EG&G Rocky Flats and TCT. Details of the two exceptions are delineated in section IV of this report. TCT should not receive full ER&WM inorganic laboratory approval until such time that; (a) EG&G Rocky Flats closes all of their inorganic audit findings, and (b) TCT adequately addresses the two inorganic desk audit findings outlined in this report.

EG&G Idaho, Inc.

FORM EG&G-1090
(Rev. 1-92)

SUPPLIER EVALUATION/SURVEY FINDINGS

Section I

Supplier Name: Huntingdon Consulting Engineers and Environmental Scientists (a.k.a.; TCT)

Discussed With: Paul Smith and Mike Travis | Survey Date(s): 7/15/94

Discrepancy

Document Reference: (Cite Section and Paragraph) TCT's corrective action response (dated 2/3/94) to 1993 ER&WM audit f...

Requirements: TCT automatic pipets; (1) calibrated at 6 mo. intervals, (2) calibration check on daily basis, (3) calibration checks logged, (4) manufacturer's tolerances used, and (5) specificatio... failure results in discontinued use of pipet.

Observation:

EG&G Rocky Flats' 1994 audit of TCT noted a change in TCT's automatic pipet calibration policy.

Recommended Corrective Action: It is requested that TCT; (1) explain conflicting calibration policies, (2) delineate actual calibration policy, (3) detail internal training of calibration policy, (4) describe verification process for ensuring calibration policy is employed, (5) supply a list of all automatic pipets including pertinent inform... for each pipet, and (6) submit copies of all daily automatic pipet calibration checks logged since 2/3/94.

Lead Auditor/Evaluator's Signature: W. J. Isle / Bob Sleelan | Date: 8/22/94

*Supplier must complete section II within 30 days of receipt

Section II

Corrective Action Response:

Submitted By: | Date:

Section III to be completed by Procurement Quality

Section III

Review of Corrective Action Response:
☐ Satisfactory ☐ Unsatisfactory

Evaluated By: | Date:

Comments:

☐ Finding Closed

Approved By: | Date:

White copy - Vendor/Supplier Pink copy - Procurement Agent Yellow copy - Procurement Quality

*Mail to: EG&G Idaho, Inc., Procurement Quality, P.O. Box 1625, Idaho Falls, ID 83415-2083

EG&G Idaho, Inc.

FORM EG&G-1090
(Rev. 1-92)

SUPPLIER EVALUATION/SURVEY FINDINGS

Section I

Supplier Name: Huntingdon Consulting Engineers and Environmental Scientists (a.k.a; TCT)

Discussed With: Paul Smith and Mike Travis

Survey Date(s): 7/15/94

Discrepancy

Document Reference: (Cite Section and Paragraph) USEPA CLP SOW 788 (Pg. E-13)

Requirements: One solid LCS must be prepared and analyzed for every group of solid samples in a Sample Delivery Group, or for each batch of samples digested, whichever is more frequent.

Observation:

Solid LCSs are not employed.

Recommended Corrective Action: It is requested that TCT; (a) determine which of the relevant analytes cannot be obtained in LCS soil matrix form, (b) obtain a soil LCS that contains as many pertinent analytes as is commercially available, and (c) submit a written plan that outlines how TCT will prepare LCSs for all future batches of ER&WM soil samples

Lead Auditor/Evaluator's Signature: W. J. [signature] / Bob Skeelan

Date: 8/22/94

*Supplier must complete section II within 30 days of receipt

Section II

Corrective Action Response:

Submitted By:

Date:

Section III to be completed by Procurement Quality

Section III

Review of Corrective Action Response:
☐ Satisfactory ☐ Unsatisfactory

Evaluated By:

Date:

Comments:

☐ Finding Closed

Approved By:

Date:

White copy - Vendor/Supplier Pink copy - Procurement Agent Yellow copy - Procurement Quality

Mail to: EG&G Idaho, Inc., Procurement Quality, P.O. Box 1625, Idaho Falls, ID 83415-2083

EG&G Idaho, Inc.

FORM EG&G-1094
(Rev. 6-93)

SUPPLIER QUALITY ASSURANCE SYSTEM SOURCE EVALUATION

Supplier Name: TCT ST. LOUIS

Street Address: 1908 INTERBELT BUSINESS CENTER DRIVE

City: ST. LOUIS State: MO. Zip Code: 63114-5700

Contacts: Quality: MICHAEL A. TRAVIS (MGR)

Management:: Sales:

Phone No: 314 426-0880 / 1-800-377-7344

Facility information: (principal product or service) ANALYTICAL LABORATORY SERVICES

Code stamps/industry certificates: (ASME, NRC, etc.) N/A

Stated quality program: NQA-1 Quality Manual No: QAP-SL-102B Revision: APRIL 9, 92

Quality Element	Review rating	Quality Element	Review rating
1. Organization	S	11. Test control	S
2. Quality assurance program	S	12. Control of measuring and test equipment	S
3. Design control	N/A	13. Handling storage and shipping	S
4. Procurement document control	S	14. Inspection test and operating status	S
5. Instruction, procedures and drawings	S	15. Control of nonconformimg items	S
6. Document control	S	16. Corrective action	S
7. Control of purchased items and services	S	17. Quality assurance records	S
8. Identification and control of items	S	18. Audits	S
9. Control of processes	S	19. Other: INORGANIC/ORGANIC	M
10. Inspection	S		

NOTES

1. Mark each of the quality elements listed above, that are not applicable to this evaluation with an N/A.
2. For those quality elements that are applicable, rate each element as follows:
   S = Satisfactory M = Marginal U = Unsatisfactory

Results of review: ____ Approved X Conditionally approved ____ Disapproved

Describe marginal/unsatisfactory ratings: (add additional comments on reverse side) SEE ATTACHED INORGANIC EVALUATION FOR MARGINAL APPROVAL

Evaluation type: ____ Initial X Annual ____ Periodic

Comments: SEE ATTACHED QUALITY CHECKLIST; INORGANIC EVALUATION AND ORGANIC EVALUATION.

Evaluator: K. J. IZBICKI, R. J. SHEEHAN Date: W. J. ISLE W. J. Isle 7/29/94	Procurement Quality:	Date:

EG&G Idaho, Inc.
FORM EG&G-1095 (Rev. 11/85)

QUALITY SUPPLIER APPROVAL

Purchase Order/Subcontract No. C92170021

Supplier TCT ST LOUIS Address 1908 INNERBELT BUISNESS CENTER DRIVE ST. LOUIS, MO 63114-5700

S.A./Buyer ______ Q.E. Review ______

Program/Material ______

1. The Supplier is listed on:

   Approved Supplier's List (EG&G): QA System APPROVED ANALYTICAL LAB LIST.

   ASME Certified Supplier's List: Stamp ______ Exp. Date ______ QA System ______

   CASE Register: QA System ______

2. The Supplier has a satisfactory performance record: (Ref: Supplier Perf. Rpt.)

   Comments: PERFORMANCE HAS BEEN SATISFACTORY OVER THE LAST YEAR

3. Has the potential supplier's performance (quantitative data and corrective action responsiveness) been evaluated? ☒ Yes ☐ No

4. Has the potential supplier's Quality or Inspection Manual been evaluated? ☒ Yes ☐ No

5. Is source survey required? ☐ Yes ☒ No

COMMENTS: ______

The above supplier is considered qualified to perform the tasks specified in the indicated Purchase Order/Subcontract.

Quality Procurement Signature ______ Date ______

White - Quality Yellow - Requester