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Hill Air Force Base, Utah

Final

Dioxin and Herbicide Characterization of UC-123K Aircraft-Phase I

July 2009

Final

Dioxin and Herbicide Characterization of UC-123K Aircraft

Phase I

Prepared for

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July 2009

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ACRONYMS

2,4,5-T	2,4,5-Trichlorophenoxyacetic acid
2,4-D	2,4-Dichlorophenoxyacetic acid
2,4-DB	4-(2,4-dichlorophenoxy)butyric acid
ACSS	Aircraft Sustainment Squadron
AFB	Air Force Base
AMARG	Aerospace Maintenance and Regeneration Group
CCV	Continuing Calibration Verification
GC	Gas Chromatography
HpCDD	Heptachlorodibenzo-*p*-dioxin
HpCDF	Heptachlorodibenzofuran
HRGC	High-Resolution Gas Chromatography
HRMS	High-Resolution Mass Spectrometry
HxCDD	Hexachlorodibenzo-*p*-dioxin
HxCDF	Hexachlorodibenzofuran
MCPA	2-Methyl-4-chlorophenoxyacetic Acid
MCPP	1-(3-chlorophenyl)piperazine dihydrochloride
NIOSH	National Institute of Occupational Safety and Health
OCDD	Octachlorodibenzo-*p*-dioxin
OCDF	Octachlorodibenzofuran
PCDD	polychlorinated dibenzodioxin
PCDF	polychlorinated dibenzofuran
PeCDD	Pentachlorodibenzo-*p*-dioxin
PeCDF	Pentachlorodibenzofuran
QA/QC	Quality Assurance/Quality Control
SAP	Sampling and Analysis Plan
TCDD	2,3,7,8-Tetrachlorodebenzo-p-dioxin
TCDF	2,3,7,8-Tetrachlorodibenzofuran
TEQ	Toxic Equivalence Value
USEPA	United States Environmental Protection Agency

1.0 EXECUTIVE SUMMARY

Four of the 18 UC-123K aircraft being stored by the 309th Aerospace Maintenance and Regeneration Group (AMARG) at Davis Monthan Air Force Base (AFB) were sampled for residual Agent Orange constituents on 18 and 19 February 2009. These constituents include 2,4-D and 2,4,5-T, the primary herbicidal components of Agent Orange, and dioxins/furans, which are incidental manufacturing byproducts present in Agent Orange that pose the primary human health concern. A total of 138 samples, including surface wipe samples on interior and exterior surfaces and air samples, were analyzed.

Analytical results indicate that:

- There were no detectable levels of Agent Orange constituents on the exterior of the four aircraft that were sampled.
- There were no detectable levels of Agent Orange constituents found in any of the air samples collected within the four aircraft that were sampled.
- Concentrations of 2,4-D and 2,4,5-T detected inside the aircraft were very low with respect to risk-based screening levels of concern and do not pose a significant risk.
- Two of the four aircraft had trace[1] levels of dioxins/furans on interior floor locations with non-detectable levels on other interior aircraft surfaces. These two aircraft are considered to be "clean."
- The other two aircraft had low levels of dioxin/furans, near the risk-based screening level, on all interior surfaces that were sampled. These two aircraft are considered to have low level contamination that does not pose a significant risk to personnel involved in short term recycling activities.
- Samples taken from inside a spray tank present in a fifth aircraft had the highest concentrations detected, while concentrations detected on the exterior of the tank and the spray control box were consistent with other interior aircraft samples.

The sampling results can be used to support the decision to recycle the aircraft through normal migration plan procedures since current levels of contamination do not pose a significant risk to personnel involved in short term recycling activities. Comparison of the current sampling results to herbicide sampling completed in 1996 indicates that there may be as many as eight additional aircraft with non-detectable or trace levels of Agent Orange constituents. Additional sampling could be used to assess the condition of the remaining 14 aircraft prior to recycling or reuse.

[1] "Trace" is used in this report to refer to contaminant levels less than three times the average method detection limit reported by the analytical laboratory.

2.0 INTRODUCTION

There are currently 18 UC-123K aircraft being stored by the 309th Aerospace Maintenance and Regeneration Group (AMARG) at Davis Monthan AFB. The aircraft are owned and managed by the 505th Aircraft Sustainment Squadron (ACSS) at Hill AFB. They are suspected of containing residual herbicide and dioxin/furan contamination from use as Agent Orange defoliant spray aircraft during the Vietnam War.

A first phase sampling of four aircraft was conducted on 18 and 19 February 2009 following procedures described in the *UC-123K Sampling and Analysis Plan* (SAP) (Select Engineering Services, 2009). The sampling event consisted of the collection of 124 "wipe" samples from interior and exterior aircraft surfaces and 16 air samples from the interior of the aircraft. (Two wipe samples were subsequently lost or broken by the laboratory leading to the analysis of a total of 138 samples.) Samples were sent to TestAmerica analytical laboratories (Sacramento, CA) and were analyzed for Agent Orange constituents including the chlorinated herbicides 2,4-Dichlorophenoxyacetic acid (2,4-D), and 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T), the primary constituents of Agent Orange and also dioxins and furans (dioxins/furans), of which 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) is the primary chemical of concern. The objective of the sampling event was to provide information to be used to estimate the extent of aircraft contamination and to protect the health and safety of recycling personnel.

This report presents sampling protocols and analytical results from the sampling event. Results of quality assurance/quality control (QA/QC) data and recommendations for aircraft disposition and additional sampling are also presented. Additional information about previous sampling and aircraft history can be found in the *SAP*.

2.1 Background on Agent Orange and Reporting Conventions

Agent Orange was one of several tactical herbicides used as a defoliant during the Vietnam War. Known for the orange band on the 55 gallon drums in which it was shipped, Agent Orange accounted for approximately 60% of the various defoliants that were utilized in Vietnam from 1962 to 1971 (Young *et. al.*, 2008). Agent Orange was a mixture of two herbicides, 2,4-D and 2,4,5-T which are toxic to vegetation but relatively non-toxic to people and animals. However, Agent Orange also contained smaller quantities of other chemicals that were generated as byproducts during the production of 2,4,5-T. These chemicals were polychlorinated dibenzodioxins (dioxins) and polychlorinated dibenzofurans (furans) that are extremely insoluble compounds that tend to persist in the environment and accumulate in fatty tissues. Seventeen of the 210 chemicals in the dioxin/furan class are considered to be toxic. Of these 17 dioxins/furans, the most toxic is 2,3,7,8-TCDD that is considered to be a human carcinogen. This is the primary dioxin/furan byproduct in Agent Orange.

To assess the potential occupational risk of exposure to the aircraft currently in storage, the aircraft were tested for both the chlorinated herbicides and dioxins/furans, although the dioxins/furans (particularly 2,3,7,8-TCDD) are the primary chemicals of concern. Because of the increased risk that the dioxins/furans potentially pose, the analytical method used to detect their presence is much more sensitive than the method used for the chlorinated herbicides. Consequently, the units used to report the results of the current sampling event are different for the two classes of chemicals. Surface concentrations of the chlorinated herbicides are reported in micrograms per square meter ($\mu g/m^2$) and surface concentrations of dioxins/furans are reported in nanograms per square meter (ng/m^2). A microgram is one millionth of a gram and a nanogram is one billionth of a gram.

Since an area of only 100 cm^2 was wiped for each surface sample, the results from the laboratory were converted to a mass per square meter basis for reporting. This convention is followed throughout the body of the report; however, the raw results are presented on a mass per 100 cm^2 (per wipe) basis in Appendix E. In addition, for ease of presentation, the results of the 17 dioxin/furan compounds that were assayed were combined into one representative value known as a Toxic Equivalence Value (TEQ). This value is calculated by assigning relative "toxic equivalency factors" to the individual dioxin or furan compounds, with 2,3,7,8-TCDD receiving a factor of one, and summing the equivalent toxicity values for each compound to result in a single TEQ value that represents the dioxin/furan level for each sample. Results of this calculation are also presented in Appendix E.

For technical accuracy, results are presented in this report as either less than, or greater than the practical quantitation limit reported by the laboratory. The practical quantitation limit is the smallest concentration of the analyte of interest that can be reported with a specified degree of confidence and is often higher than the actual method detection limit. The method detection limit is the smallest concentration that can be measured and reported while having a specified confidence that the concentration is greater than zero. In most cases for dioxins/furans analyzed during this sampling event, the two values were identical, while the practical quantitation limit was commonly greater than the method detection limit for chlorinated herbicides. Both values can be found in the spreadsheet entitled "UC-123-all data-excel.xlxs" found in Appendix I. Use of the practical quantitation limit versus the method detection limit has no consequence on the presented conclusions of this report.

3.0 AIRCRAFT SELECTION

The four aircraft that were sampled were selected based on their known operational history and current condition assessed during a site visit in October 2008. The selected aircraft have tail numbers 54-0585, 55-4571, 55-4532, and 55-4544 and have been highlighted in the historical listing in Appendix A. Pictures of the aircraft are shown in Figures 3-1 to 3-4. Accessibility to the interior floor area was a major consideration in aircraft selection. Some aircraft were so full of equipment (fuel tanks, seating etc.) that access to the floor and other areas inside the fuselage would have been limited.

Three of the selected aircraft (54-0585, 55-4571, 55-4532) are known or suspected to have been utilized as herbicide sprayers in Vietnam. The fourth aircraft (55-4544) does not have a history of Vietnam service, although it could have been involved in other Agent Orange spraying operations. Aircraft 55-4571 was specifically selected because it contained a 1000 gallon herbicide tank and pump system, although samples taken on tank surfaces were taken from the tank and control panel in a different aircraft (54-0605), with a separate tank system, because the tank had an open access port. Three of the aircraft have camouflage paint schemes (55-4571, 55-4532, and 55-4544) while the other aircraft (54-0585), is painted gray. AMARG records indicate that this aircraft was used "overseas as a herbicide sprayer," but Vietnam usage was not confirmed by a review of combat records. The common factor among all aircraft is their extended storage at the AMARG facility.

Figure 3-1. Aircraft 54-0585

Figure 3-2. Aircraft 54-4571

Figure 3-3. Aircraft 55-4532

Figure 3-4. Aircraft 55-4544

4.0 SAMPLE COLLECTION AND ANALYTICAL METHODS

4.1 Sample Quantity and Locations

A total of 140 samples were collected for analysis, however only 138 samples were analyzed due to one broken and one lost sample at the analytical laboratory. 70 samples were analyzed for dioxins/furans and 68 were analyzed for chlorinated herbicides. 16 samples (listed in Table 4-1) were collected for each analyte class (dioxins/furans or chlorinated herbicides) in each aircraft, including field blanks and interior air samples, for a total of 128 aircraft samples (Table B-1, samples #1 to #128). Three samples for each analyte class were taken from spray tank surfaces in aircraft 54-0605 (Table B-1, samples #129 to #134) and an additional two field blanks for air sampling media (Table B-1, samples #140 and #142) and four background air samples (Table B-1, samples #143 to #146) were also analyzed. Samples collected and analyzed for quality assurance/quality control are further discussed in Section 6.0.

Sampling areas were described in the *SAP*. Interior and exterior areas were pre-selected in an effort to characterize both worst-case (e.g., interior floor, wing underside) and incidental (e.g., interior bulkhead wall, interior ceiling) contamination scenarios. Specific sample locations within each sample area were chosen randomly using a predefined grid system scaled to the size of the area. If a randomly selected area was not accessible, a new location was randomly chosen. In an effort to reduce sampling variability, wipe sampling was conducted by only one member of each two-person sampling team and each sampling team consistently collected samples at the same locations in or on each aircraft. Aircraft sample types and locations are listed in Table 4-1. Sample locations are shown in Figure 4-1. A comprehensive list of all samples with summary results is found in Appendix B, Table B-1 with specific locations for each sample shown in Appendix C.

Table 4-1. Aircraft Sample Locations and Descriptions (per analyte class)

Sample #	Description
1	Wing underside (trailing edge)
2	Exterior cargo door
3	Front side exterior fuselage
4	Back side exterior fuselage
5	Interior floor
6	Interior floor
7	Interior floor
8	Interior floor
9	Front interior bulkhead wall
10	Interior ceiling (between wings)
11	Interior rear frame
12	Air sample collected during sampling
13	replicate of either ext. cargo door, ext. wing, int. wing, or int. rear frame
14	replicate of either ext. cargo door, ext. wing, int. wing, or int. rear frame
15	Interior blank
16	Exterior blank

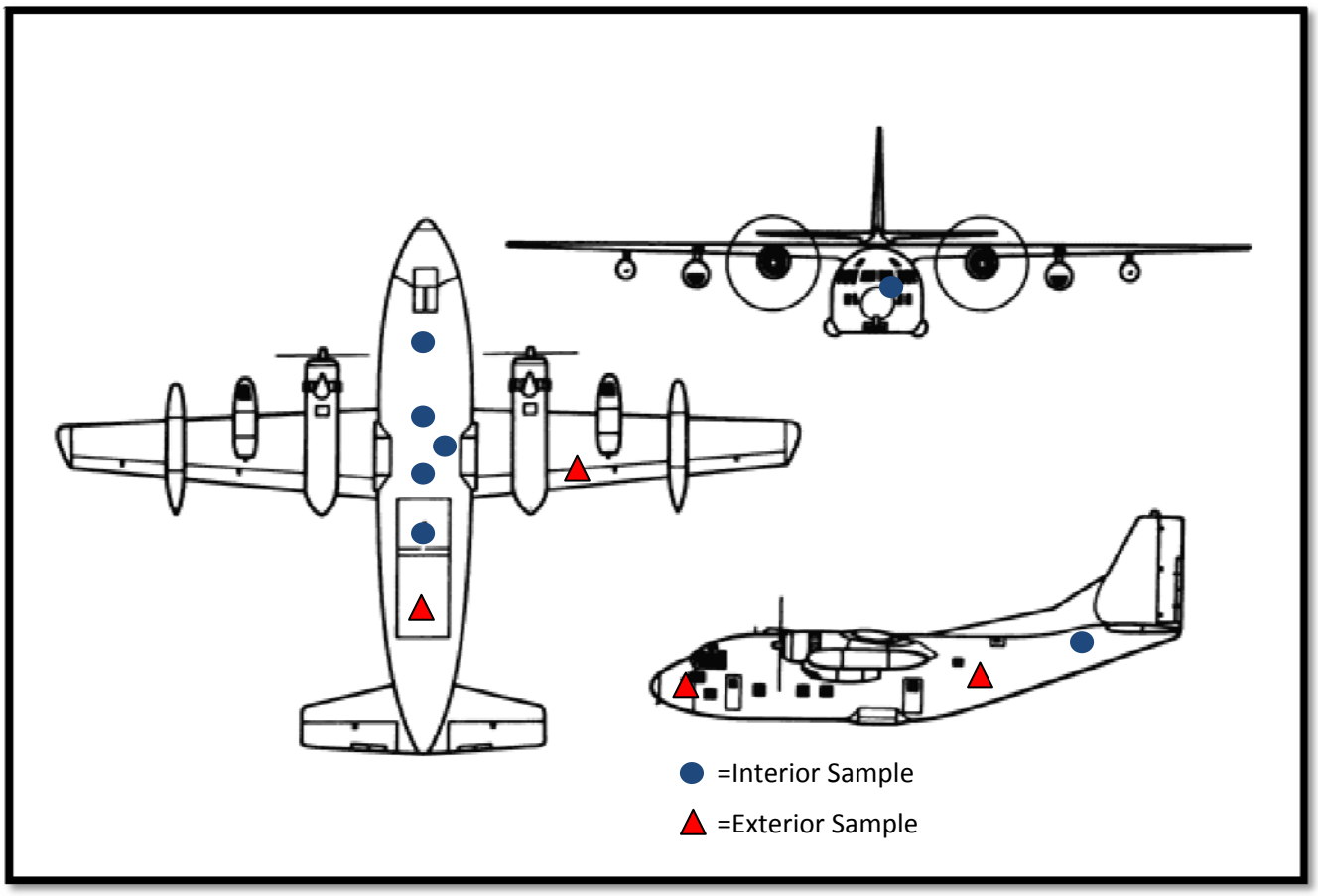

Figure 4-1. Aircraft Sampling Locations

4.2 Surface Wipe Sampling Protocol

Surface samples were collected according to the procedure described in the *SAP* which was based on based on the standard polychlorinated biphenyl (PCB) wipe method (Smith, 1987). In summary, a 100 square centimeter area was wiped with gauze pads wetted with hexane (for dioxin/furan samples) or water (for herbicide samples). The size of the area was defined by using a plastic template that was removed from the area prior to sampling. Two gauze pads were used for each sample location.

4.3 Air Sample Protocol

Air samples for herbicides were collected according to the sampling method of the National Institute of Occupational Safety and Health (NIOSH) Method 5001 (Appendix E of the *SAP*.) This method is used to collect ambient air samples for analysis of 2,4-D, and 2,4,5-T. In accordance with the method, samples were collected within the fuselage of each aircraft with a SKC Air

Check 2000 pump on a binderless glass fiber filter at a rate of approximately 2 Liters/minute for 60 minutes.

Air samples for dioxins/furans were collected according to EPA method TO-10A (Appendix F of the *SAP*), a low flow sampling method that collects the air sample on a polyurethane foam (PUF) plug. Samples were collected at a flow rate of approximately 4 liters/minute for approximately 4 hours. Air samples were intended to represent typical exposure levels for an unprotected worker that may enter the aircraft in efforts to clean out debris prior to recycling.

4.4 Analytical Methods

Two analytical methods were employed for chemical characterization of the aircraft. Because of the past usage as defoliant sprayers, the primary chemicals of concern on the aircraft are the chlorinated herbicides 2,4-D (2,4-Dichlorophenoxyacetic acid), 2,4,5-T (2,4,5-Trichlorophenoxyacetic acid) (the primary constituents of Agent Orange), and polychlorinated dibenzodioxins (dioxins) and polychlorinated dibenzofurans (furans) that were present as manufacturing byproducts in the Agent Orange defoliant. USEPA Methods 8151A (http://www.epa.gov/epawaste/hazard/testmethods/sw846/pdfs/8151a.pdf) and 8290 (http://www.caslab.com/EPA-Methods/PDF/8290.pdf) were employed to analyze for these two chemical classes. Method 8151A analysis was performed at the TestAmerica laboratory in Denver, CO and method 8290 analysis was performed at TestAmerica Laboratory in West Sacramento, CA. Specific analytes and reporting limits for these two methods are listed in Appendix D.

5.0 RESULTS

Summary results of the sampling and analysis for the three primary Agent Orange constituents of concern, dioxins/furans (represented by a toxic equivalence value, TEQ), 2,4,5-T, and 2,4-D are presented in Table B-1 of Appendix B on a mass per square meter basis**.** Average interior results are shown in Table 5-1. Complete results for all analytes, as reported by the laboratory, are presented in Appendix E on a mass per wipe (100 cm^2) basis**.** Analytical results indicate that:

- There were no detectable levels of Agent Orange constituents on the exterior of the four aircraft that were sampled.
- There were no detectable levels of Agent Orange constituents found in any of the air samples collected within the four aircraft that were sampled.
- Concentrations of 2,4-D and 2,4,5-T detected within the aircraft (maximum concentrations of 1600 and 1100 µg/m^2 for 2,4-D and 2,4,5-T respectively) were very low with respect to the risk-based screening level of concern of 100,000 µg/m^2.
- Two of the four aircraft (55-4544 and 54-0585) had trace levels of dioxins/furans (less than three times the average method detection limit of 1.4 ng/m^2 TEQ) on interior floor surfaces (maximum of 3.9 ng/m^2 TEQ) and non-detectable levels on other interior surfaces.
- Two of the four aircraft had low levels of dioxin/furans (average concentrations of 14.6 and 18.2 ng/m^2 TEQ, for aircraft 55-4571 and 55-4532 respectively) on all interior surfaces that were sampled (see Appendix G for statistical calculations.)
- Samples taken from inside the spray tank in aircraft 54-0605 had concentrations of 111 ng/m^2 TEQ, 280,000 µg/m^2 2,4,5-T, and 120,000 µg/m^2 2,4-D, while concentrations found on the exterior of the tank and the spray control box were consistent with other interior aircraft samples.

Table 5-1. Fraction of Samples with Detectable Interior Concentrations and Average Interior Concentrations for Each Aircraft.

Aircraft	Analyte	Fraction of Interior Samples with Detectable Concentrations	Average Detected Concentration
55-4571	Dioxin/Furans*	9/9	14.6
	2,4-D ($\mu g/m^2$)	9/9	587
	2,4,5-T ($\mu g/m^2$)	9/9	518
55-4532	Dioxin/Furans*	7/7	18.2
	2,4-D ($\mu g/m^2$)	5/7	453
	2,4,5-T ($\mu g/m^2$)	7/7	502
55-4544	Dioxin/Furans*	3/7	2.0
	2,4-D ($\mu g/m^2$)	0/7	none
	2,4,5-T ($\mu g/m^2$)	1/7	22
54-0585	Dioxin/Furans*	4/9	2.95
	2,4-D ($\mu g/m^2$)	1/9	150
	2,4,5-T ($\mu g/m^2$)	3/9	124

*Reported as ng/m^2 TEQ

5.1 Comparison to Previous Sampling

The results are consistent with the previous sampling for herbicides that was conducted in 1996 (DO Consulting Ltd., 1996, digital copy included in Appendix I). Both aircraft that were found to have trace concentrations of dioxins/furans and sporadic detections of herbicides during the current sampling event (45-0585 and 55-4544) had non-detectable levels of herbicides on the fuselage floor in the 1996 sampling event. The two aircraft that had low level dioxin/furan concentrations and herbicide detections in all interior surface samples during the current sampling (55-4532 and 55-4571) had detectable herbicide levels in samples taken from the floor in 1996.

If this trend holds true for the other aircraft in storage, there may be at least an additional eight aircraft that may have either non-detectable or trace levels of dioxin within the interior fuselage. These aircraft (54-0618, 54-0628, 55-4547, 54-0635, 54-0701, 54-0607, 54-0685, and 54-0583) also had floor samples that indicated non-detectable levels of herbicides in 1996. These results are consistent with combat damage records research conducted by Dr. Paul Cecil indicating that aircraft 54-0583, 54-0585, 54-0635, 54-0685, 55-4544 were never assigned to operation Ranch Hand in Vietnam at any time.

Chemical concentrations of dioxins/furans found during the current sampling event were significantly lower than concentrations found in “Patches,” the UC-123K that is currently on display at the Air Force National Museum at Wright-Patterson AFB (Weisman and Porter, 1994,

digital copy included in Appendix I). Discrete samples taken from "Patches" in 1994 showed interior concentrations ranging from 200 ng/m^2 TEQ to 1400 ng/m^2 TEQ with detectable concentrations on the aircraft exterior. Composite samples collected in 1995 showed an average interior 2,3,7,8-TCDD (dioxin) concentration of 45 ng/m^2. The aircraft was subsequently decontaminated based on a cleanup action level of 25 ng/m^2 and is currently on display.

5.2 Risk Characterization

The risk-based screening level value for surface concentrations of dioxins/furans is calculated to be 23 ng/m^2 based on 2,3,7,8-TCDD (see Appendix F.) This is similar to the 25 ng/m^2 action level used in the previously mentioned "Patches" decontamination project. Acceptable levels of 2,4-D and 2,4,5-T are calculated to be much higher at 100,000 µg/m^2. These risk-based concentration levels are based on an industrial exposure scenario with a duration of one year as described in Appendix F. For assessment of dioxin/furan concentrations, the toxic equivalence value (TEQ) was used to consider the cumulative toxic potential of all dioxins and furans, although for most samples where a detection occurred, 2,3,7,8-TCDD was the only dioxin found. The TEQ was conservatively calculated using the laboratory reported practical quantitation limit value for those compounds that were considered "non-detect."

Results of the current sampling and analysis indicate that low levels of Agent Orange constituents, near the risk-based screening level value, were present in the interior of two of the four aircraft that were sampled. The average concentrations of dioxins (calculated as TEQ values) within the two aircraft were 14.95 and 18.2 ng/m^2 for aircraft 55-4571 and 55-4532 with 95% Upper Confidence Limit (UCL) values of 21.7 and 24.7 ng/m^2 respectively (indicating that there is 95% confidence that the mean concentrations within the aircraft are at or below these levels.) These data are presented graphically in Figure 5-1. Based on the calculated risk screening level of 23 ng/m^2 for 2,3,7,8-TCDD, the current levels are not great enough to warrant concern for personnel involved in short term recycling activities.

Detected concentrations of the herbicide 2,4-D averaged 587 and 453 µg/m^2 with calculated 95% UCLs of 911 and 781 µg/m^2 in the interior of aircraft 44-4571 and 55-4532 respectively. Average 2,4,5-T concentrations were 518 and 502 µg/m^2 with 95% UCLs of 698 and 815 µg/m^2 in aircraft 44-4571 and 55-4532 respectively. These data are presented graphically in Figure 5-2. These levels are well below the 100,000 µg/m^2 screening level value and should not pose a health risk for personnel involved in short term recycling activities.

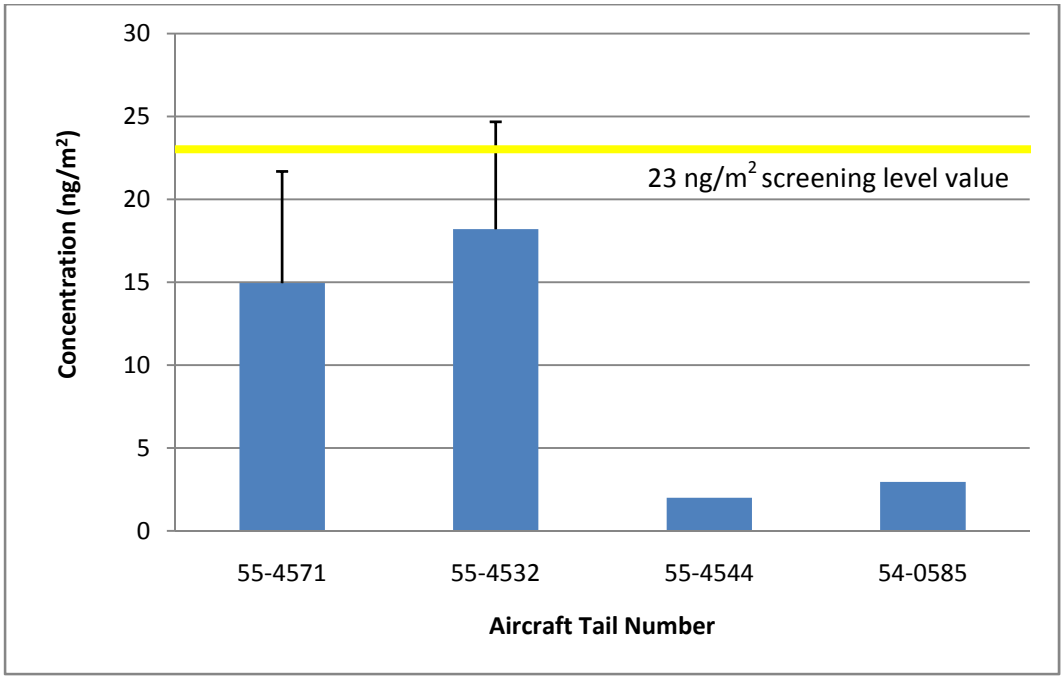

Figure 5-1. Average Interior Concentrations of Dioxins/Furans, Reported as ng/m^2 TEQ, Compared to the Risk-Based Screening Level Value of 23 ng/m^2. Error bars indicate 95% upper confidence limits for average values approaching the risk-based standard.

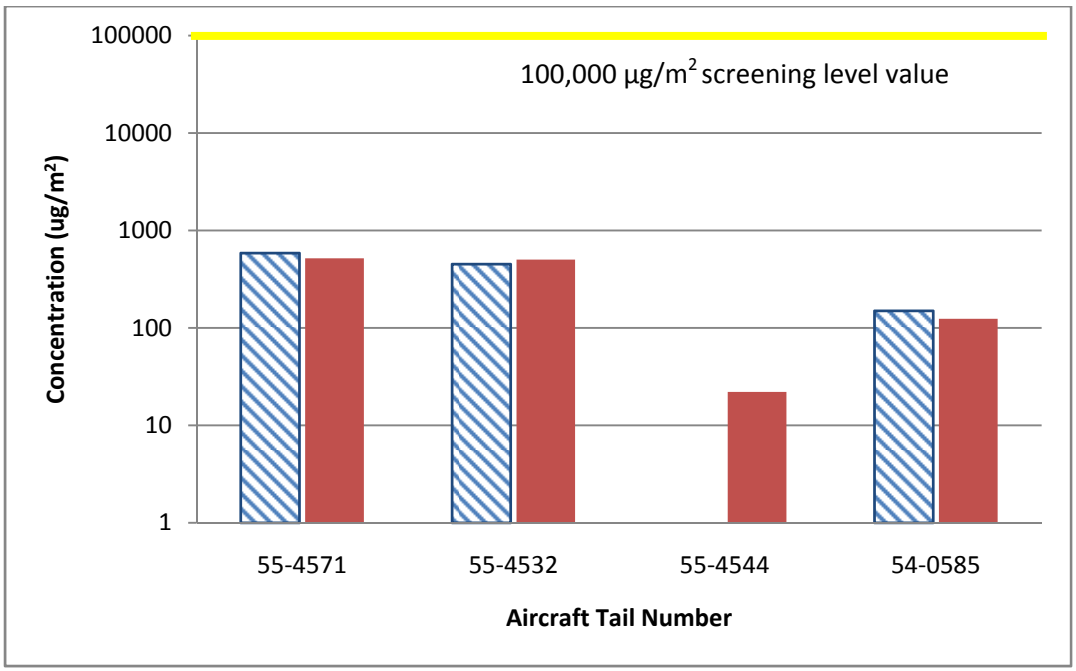

Figure 5-2. Average Interior Concentrations of 2,4-D (blue, diagonal fill) and 2,4,5-T (red, solid fill), Compared to the Risk-Based Screening Level Value of 100,000 µg/m^2. Note log scale of concentration axis.

6.0 QUALITY ASSURANCE PROGRAM

6.1 Quality Assurance/Quality Control Samples

Quality Assurance/Quality Control (QA/QC) samples consisted of trip blanks, field blanks, replicate samples, exterior background air samples, and laboratory spikes (specified in the *SAP*) as described below:

- **Trip Blanks:** Duplicate trip blanks for each analyte class and each sample matrix were collected, but were not analyzed due to the low risk of contamination presented by the analytes of concern. These samples were archived by the laboratory to be analyzed in the event that sample media contamination was suspected, but analysis was not necessary. Internal laboratory blanks were utilized to ensure that sample media was not contaminated.

- **Field Blanks:** One wipe sample blank was collected inside and outside during sampling of each aircraft to assess the tendency for samples to become contaminated while being exposed to the atmosphere inside and outside the aircraft. Field blanks for air samples were treated in a similar manner to normal samples; however they were never connected to sampling pumps. All field banks were found to be free of contamination.

- **Replicate Samples:** Replicate samples were collected in each aircraft for each wipe test analytic class on specified surfaces as listed in table 4-1 and Appendix B, Table B-1. The only replicate samples with detectable levels of Agent Orange constituents were taken from the interior rear frame of aircraft 55-4571. Relative percent differences (RPD) for concentrations of 2,4,5-T, 2,4,-D, and dioxins (as TEQ) were 15%, 80%, and 75%, indicating that nature of the contamination on this surface was generally heterogeneous in nature. Because other replicates were taken on surface that did not have detectable levels of contamination, a general statement about the nature of contamination on other vertical surfaces within the aircraft cannot be made. RPDs for replicate samples taken on floor surfaces were lower at 30 and 32% for aircraft 55-4571 and 55-4532 respectively. This finding and the observation that the highest residual concentrations were generally found on the floor, indicate that replicate floor samples are likely a good indicator of the level of interior aircraft contamination.

- **Exterior Background Air Samples:** Duplicate air samples were collected outside of the aircraft by hanging samplers on the fence of the UC-123K aircraft storage area. No contamination was found in background air samples.

- **Matrix Spikes:** Because of the expected heterogeneity of the normal field samples, matrix spikes were not collected in the field. Sampling media matrix spikes were prepared and analyzed in the laboratory as part of standard laboratory QA/QC procedures.

6.2 Data Validation

All analytical results were submitted by TestAmerica laboratories as electronic data deliverables and reviewed and validated by AQS Environmental and Analytical Science (Ogden, UT). All data packages were subjected to Level III validation with 10% of the data validated at Level IV standards. Electronic copies of complete validation reports can be found in Appendix I on the included CD-ROM. Validation included review of the following:

- Instrument quality parameters
- Chain-of-custody and sample receipt documentation
- Case narratives
- Analyte lists and reporting limits
- Reporting units and holding times
- Laboratory control sample/laboratory control sample duplicate data
- Method blanks and surrogate recoveries
- Instrument stability parameters
- Internal standard recoveries and retention times
- Continuing calibration verification analyses
- Target compound identification
- Instrument tuning and “window defining mixture” analysis
- Instrument run logs (level IV validation)
- Raw data outputs for QC samples, calibrations, and client samples (level IV validation)
- Laboratory review checklists and approval forms (level IV validation)
- Analysts notebook pages (level IV validation)
- Second column/second detector confirmation (level IV validation)
- Transcriptions and calculations (level IV validation)
- Initial calibration data (level IV validation)

If analytes were not detected above the laboratory specified practical quantitation limit or quality issues were found with any of the above parameters, the data were flagged with the following qualifiers:

U=Not detected above the practical quantitation limit.
J=Estimated value. The result is estimated due to associated QC problems.
UJ=Estimated detection limit. Result is estimated and may be a false negative due to related QC problems.
JA=The analyte was positively identified, but the quantitation is an estimate.
JJ= Estimated result. Agreement between first and second column results is not within +/- 40%

Findings of the data validation review and resultant qualifiers are as follows:

- Practical quantitation limits for many of the dioxin and furan compounds were elevated with respect to the reporting limits specified in the sampling and analysis plan (Appendix D, Table D-1). The validation report noted that "most of these compounds were not excessively above the project limits and should not be seen as problematic." In addition, even with elevated practical quantitation limits, almost all samples had quantitation limits below 2 ng/m^2 based on TEQ calculations (see Appendix E, Table E-1), and all were well below the 23 ng/m^2 screening level. **No data were flagged based on elevated quantitation limits.**
- Several of the compounds in the Laboratory Control Samples for both methods 8290 and 8150A had a high bias. Since these compounds were not detected, the data is deemed acceptable. **These results were flagged with a "UJ" in Appendix E**.
- Laboratory Control Samples for method 8150A was biased low for the analyte 2,4,5-TP (Silvex) for samples 81-92. This compound was not detected in these or any other samples. **These results were flagged with a "UJ" in Appendix E**.
- For method 8151A, the case narrative noted problems with the continuing calibration for Dinoseb, Dicamba, MCPA and MCPP. The laboratory did not provide sufficient information to fully evaluate the effect of the CCVs on the sample results. These compounds were not detected in the samples. As noted above, several recoveries in the Laboratory Control Sample (LCS) were above the method control limits for some of these compounds. Since these compounds were not detected and the LCS had acceptable recoveries or a high bias, the CCV is not believed to have an adverse effect on the results. **No data were flagged based on this finding**.
- Sample 142, the air filter field blank, was prepared outside of the holding time for method 8151A. There were no detections in this sample, which is consistent with the results of interior and background air samples that were collected. **No data were flagged based on this finding**.

- The surrogate for sample 121 had a slightly high recovery. No compounds were detected in this sample, therefore, the high bias does not affect the reported results. **No data were flagged based on this finding**.
- The surrogate for sample 132 was diluted out. The dilution was performed due to high concentrations of target analytes. The low surrogate recovery is due to dilution and is not seen as a problem. **No data were flagged based on this finding**.
- 2,3,7,8-TCDD in Sample 6 did not quite meet ion abundance criteria. Ion ratio was 0.61, which was outside the acceptance range of 0.65 – 0.89 but near the lower limit. The laboratory chose to report this analyte as an Estimated Maximum Possible Concentration (EMPC). **This result was flagged with a "JA" qualifier.**
- There was one continuing calibration standard , affecting Samples 73 – 77, 79 and 80, that had a percent difference of 1,2,3,4,7,8-HxCDD and OCDF above 20% but below 25% deviation from the initial calibration curve. This should be considered a minor anomaly that does not adversely affect the data. **No data were flagged based on this finding**.
- Several compounds had a high bias in the continuing calibration samples for method 8150A. This is not seen as a problem since these compounds were not detected in the samples. In all cases, the recovery from the alternate column was within acceptable method limits. **No data were flagged based on this finding**.
- The surrogate recoveries for Samples 57 and 90 were high and were outside of the laboratory control limits. Although the recoveries were above the laboratory control limits, they are considered to be acceptable based on industry standards. **No data were flagged based on this finding**.
- Sample 17 was broken during extraction and was not recoverable. **No result was reported.**
- The case narrative noted the loss by the laboratory of Sample 117 during transport during shipment to the Denver lab. **This sample could not be found and no result was reported.**
- There was a discrepancy between the chain of custody and one of the samples received at the laboratory. The laboratory reported in their narrative that a PUF was received labeled #142, but the chain of custody indicated it should have been a filter, and that the sample was logged in as #140 to comply with instructions from the client. **No data were flagged based on this finding**.
- The result for MCPP in field sample 116 should be considered suspect. The second column confirmation did not agree within the method specified limits of 40%. The amount on the primary column was 810 µg/Wipe and the amount on the secondary column was 310 µg/Wipe. The amount reported was the lower of the two values (310 µg/Wipe). The method specifies that the higher of the two values be used. The lab did flag this datum as estimated, however it is believed that the result that should have

- For method 8151A (Herbicides), MCPA and MCPP had a high bias in some of the CCVs. Since MCPA was not detected in the samples and the bias was high in the CCV, this is not seen as problematic for this analyte. Since MCPP was detected in samples 116 and 118, the high bias causes less certainty for these results. **These samples were flagged with a "J" qualifier**.

Overall, the data were found to be sufficient to meet project objectives and no data were qualified as rejected.

7.0 CONCLUSIONS

Results of the UC-123 sampling indicated that no Agent Orange residues were found on the exterior of any aircraft or in air samples taken inside the aircraft. Two of the aircraft that were sampled had trace levels of residues, within three times the method detection limit, on the fuselage floor but can essentially be considered "clean." The other two aircraft that were sampled had levels of Agent Orange residues on all interior fuselage surfaces that were tested. The average concentrations found in these two aircraft are statistically near the risk-based screening level for dioxins/furans, based on a one-year industrial exposure scenario, but should not pose a significant risk to personnel involved in short term recycling activities.

Interior floor areas were not found to be more heterogeneously contaminated than interior wall surfaces. In fact, interior floor concentrations were surprisingly uniform in the two aircraft with residual contamination. This finding, and the observation that the highest residual concentrations were generally found on the floor, indicates that replicate floor samples are likely a conservative indicator of the level of interior aircraft contamination. If additional sampling of the remaining aircraft is planned, sampling could be limited to floor surfaces only to determine the contamination level of each additional plane. Comparison of the current sampling results to herbicide sampling completed in 1996 indicates that there may be as many as eight additional aircraft with either non-detectable or trace levels of Agent Orange constituents.

The sampling results can be used to support the decision to recycle the aircraft through normal migration plan procedures since current levels of contamination do not pose a significant risk to personnel involved in short term recycling activities. The single tank that was tested was found to have higher levels of contamination, but could also be recycled as scrap metal. Conservative estimates of mass loading of dioxins do not approach the land disposal restriction limit of 1 part per billion, so land filling of the aircraft would also be a viable alternative. Aircraft with only trace residues may be considered to be "clean" and could be recycled or reutilized for other purposes.

8.0 REFERENCES

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Appendix A

Aircraft History Summary

Table A-1. **UC-123K aircraft currently stored at AMARG** (based on the AMARG database at http://www.amarcexperience.com/AMARCDB.asp and historical records searches by Mr. Timothy McClaughry at AMARG and Dr. Paul Cecil.) Highlighted aircraft were sampled during Phase I sampling.

Serial	PCN	Type	C/N	History	Notes
54-0583	CP086	Fairchild UC-123K Provider	20032	13 SEP-82/Arrived AMARC	No aircraft records available at AMARG. Combat damage records do not indicate Ranch Hand assignment.
54-0585	CP091	Fairchild UC-123K Provider	20034	15-MAY-70/Arrived AMARC 28-MAY-70/Returned to service with 24th Special Operations Wing, Howard AFB. 6-JUN-70/ Arrived AMARC 12-OCT-70/Returned to service with 4500th Air Base Wing, Langley AFB, VA. 22-SEP-71/Records indicate spray system was installed 11-JUN-86/Arrived AMARC	Aircraft records at AMARG indicate overseas use as a herbicide sprayer. Combat damage records do not indicate Ranch Hand assignment.
54-0586	CP088	Fairchild UC-123K Provider	20035	315th Tactical Airlift Wing, Phan Rang. 22-MAY-70/Arrived AMARC. 05-NOV-71/To Hayes Aircraft, Napier Field, Dothan, AL. 20-SEP-82/Arrived AMARC	Ex. 'Ranch Hand' based on AMARG data base and combat damage records.
54-0605	CP090	Fairchild UC-123K Provider	20054	315th Tactical Airlift Wing, Phan Rang. 12th Air Commando Squadron (ACS) 8 Nov 66 – 9 May 70 8-JUL-70/Arrived AMARC. 30-JUL-71/To Hayes Aircraft, Napier Field, Dothan, AL. 5-JUN-86/Arrived AMARC	Ex. 'Ranch Hand' based on AMARG data base and combat damage records.
54-0607	CP067	Fairchild UC-123K Provider	20056	12 ACS Dec 66-Apr 69/Spray ops in Vietnam as per Paul Cecil 16-FEB-82/Arrived AMARC	Ex. 'Ranch Hand' based on AMARG data base and combat damage records.
54-0618	CP071	Fairchild UC-123K Provider	20067	315th Tactical Airlift Wing, Phan Rang. 12 ACS 5-JUL-70 /Arrived AMARC. 30-JUN-71/To Hayes Aircraft, Napier Field, Dothan, AL. Returned to service with ADTCE, Eglin AFB, FL. 14-APR-82/ Arrived AMARC	Ex. 'Ranch Hand' based on AMARG data base and combat damage records.

Table A-1 (continued). **UC-123K aircraft currently stored at AMARG**

Serial	PCN	Type	C/N	History	Notes
54-0628	CP076	Fairchild UC-123K Provider	20077	315th Tactical Airlift Wing, Phan Rang. 12 ACS 1-JUL-70 /Arrived AMARC. 19-OCT-71/To Hayes Aircraft, Napier Field, Dothan, AL. 4-MAY-82/ Arrived AMARC	Ex. 'Ranch Hand' based on AMARG data base and combat damage records.
54-0635	CP087	Fairchild UC-123K Provider	20084	Westover AFB, MA 13-SEP-82/Arrived AMARC	No AMARG or combat damage records indicate use as herbicide sprayer in SE Asia
54-0685	CP077	Fairchild UC-123K Provider	20134	Lockbourne AFB/Richenbacker ANGB, OH 12-MAY-82/ Arrived AMARC	No AMARG or combat damage records indicate use as herbicide sprayer in SE Asia
54-0693	CP081	Fairchild UC-123K Provider	20142	315th Tactical Airlift Wing, Phan Rang. 12 ACS 6-JUL-70 /Arrived AMARC. 22-MAY-71/To Hayes Aircraft, Napier Field, Dothan, AL. Returned to service with 1st Special Operations Wing, Eglin AFB, FL. 15-JUL-82/Arrived AMARC	Ex. 'Ranch Hand' based on AMARG data base and combat damage records.
54-0701	CP073	Fairchild UC-123K Provider	20150	315th Tactical Airlift Wing, Phan Rang. 12 ACS 22-MAY-70 /Arrived AMARC. 12-OCT-70/Returned to service with 4500th Air Base Wing, Langley AFB, VA. 21-APR-82/Arrived AMARC	Ex. 'Ranch Hand' based on AMARG data base and combat damage records.
55-4520	CP065	Fairchild UC-123K Provider	20181	315th Tactical Airlift Wing, Phan Rang. 12 ACS 1-JUL-70 /Arrived AMARC. 19-APR-71/To Hayes Aircraft, Napier Field, Dothan, AL. Returned to service with 315th Tactical Airlift Wing, Phan Rang. 17-NOV-81/Arrived AMARC	Ex. 'Ranch Hand' based on AMARG data base and combat damage records.

Table A-1 (continued). UC-123K aircraft currently stored at AMARG

Serial	PCN	Type	C/N	History	Notes
55-4532	CP047	Fairchild UC-123K Provider	20193	315th Tactical Airlift Wing, Phan Rang. 15-MAY-70 /Arrived AMARC. 28-MAY-70/Returned to service with 24th Special Operations Wing, Howard AFB. 8-JUN-70/Arrived AMARC. 01-JUL-71/To Hayes Aircraft, Napier Field, Dothan, AL. 29-JUN-80/Arrived AMARC	Ex. 'Ranch Hand' based on AMARG data base and combat damage records.
55-4544	CP056	Fairchild UC-123K Provider	20205	7 ACS, New York and Verigate, Italy 17-JUL-81/Arrived AMARC	No AMARG or combat damage records indicate use as herbicide sprayer in SE Asia
55-4547	CP093	Fairchild UC-123K Provider	20208	315th Tactical Airlift Wing, Phan Rang. 12 ACS 10-JUL-70/Arrived AMARC. 09-OCT-70/Returned to service with 4500th Air Base Wing, Langley AFB, VA. 19-JUL-72/Pesticide spray kit installed 17-JUN-86/Arrived AMARC	Ex. 'Ranch Hand' based on AMARG data base and combat damage records.
55-4571	CP092	Fairchild UC-123K Provider	20232	Sep 68-Apr 69/Spray ops in Vietnam as per Paul Cecil 11-JUN-86/Arrived AMARC	Ex. 'Ranch Hand' based on AMARG data base and combat damage records.
55-4577	CP049	Fairchild UC-123K Provider	20238	315th Tactical Airlift Wing, Phan Rang. 12 ACS 1-JUL-70/Arrived AMARC. Disposition Unknown. 14 JUL-80/Arrived AMARC	Ex. 'Ranch Hand' based on AMARG data base and combat damage records.
56-4371	CP082	Fairchild UC-123K Provider	20255	315th Tactical Airlift Wing, Phan Rang. 6-JUL-70/Arrived AMARC. 30-JUN-71/To Hayes Aircraft, Napier Field, Dothan, AL. Returned to service with 906th Tactical Airlift Group, Lockbourne AFB Jun 1975/To 355th Tactical Airlift Squadron (AFRES), Rickenbacker AFRB OH 27-JUL-82/Arrived AMARC	Ex. 'Ranch Hand' based on AMARG data base

APPENDIX B

Sample List and Summary Results

Table B-1. Analytical results for Dioxin/Furans (represented by a Toxic Equivalence value, TEQ*), 2,4,5-T, and 2,4-D.

Sample #	Aircraft	Analysis	Location	TEQ* (ng/m^2)	2,4,5-T ($\mu g/m^2$)	2,4-D ($\mu g/m^2$)
1	54-0585	dioxin/furan	Wing underside-trailing edge	ND	--	--
2	54-0585	dioxin/furan	Exterior cargo door	ND	--	--
3	54-0585	dioxin/furan	Front Side of exterior fuselage	ND	--	--
4	54-0585	dioxin/furan	Back side of exterior fuselage	ND	--	--
5	54-0585	dioxin/furan	Interior Floor-1	2.2(J)	--	--
6	54-0585	dioxin/furan	Interior Floor-2	2.7 (J)	--	--
7	54-0585	dioxin/furan	Interior Floor-3	3.9	--	--
8	54-0585	dioxin/furan	Interior Floor-4	3.0 (J)	--	--
9	54-0585	dioxin/furan	Front bulkhead wall	ND	--	--
10	54-0585	dioxin/furan	Interior ceiling (between wings)-1	ND	--	--
11	54-0585	dioxin/furan	Interior ceiling (between wings)-2	ND	--	--
12	54-0585	dioxin/furan	Interior ceiling (between wings)-3	ND	--	--
13	54-0585	dioxin/furan	Interior rear frame	ND	--	--
14	54-0585	dioxin/furan	Interior air sample (PUF)	ND	--	--
15	54-0585	dioxin/furan	Interior blank	ND	--	--
16	54-0585	dioxin/furan	Exterior blank	ND	--	--
17	54-0585	Herbicide	Wing underside-trailing edge	Sample Broken-no results		
18	54-0585	Herbicide	Exterior cargo door	--	ND	ND
19	54-0585	Herbicide	Front Side of exterior fuselage	--	ND	ND
20	54-0585	Herbicide	Back side of exterior fuselage	--	ND	ND
21	54-0585	Herbicide	Interior Floor-1	--	51 (J)	ND
22	54-0585	Herbicide	Interior Floor-2	--	92 (J)	ND
23	54-0585	Herbicide	Interior Floor-3	--	ND	ND
24	54-0585	Herbicide	Interior Floor-4	--	230	150(J)
25	54-0585	Herbicide	Front bulkhead wall	--	ND	ND
26	54-0585	Herbicide	Interior ceiling (between wings)-1	--	ND	ND
27	54-0585	Herbicide	Interior ceiling (between wings)-2	--	ND	ND
28	54-0585	Herbicide	Interior ceiling (between wings)-3	--	ND	ND
29	54-0585	Herbicide	Interior rear frame	--	ND	ND
30	54-0585	Herbicide	Interior air sample (filter)	--	ND	ND
31	54-0585	Herbicide	Interior blank	--	ND	ND
32	54-0585	Herbicide	Exterior blank	--	ND	ND

Table B-1 (continued). Analytical results for Dioxin/Furans (represented by a Toxic Equivalence value, TEQ*), 2,4,5-T, and 2,4-D.

Sample #	Aircraft	Analysis	Location	TEQ* (ng/m^2)	2,4,5-T ($\mu g/m^2$)	2,4-D ($\mu g/m^2$)
33	55-4571	dioxin/furan	Wing underside-trailing edge	ND	--	--
34	55-4571	dioxin/furan	Exterior cargo door	ND	--	--
35	55-4571	dioxin/furan	Front Side of exterior fuselage	ND	--	--
36	55-4571	dioxin/furan	Back side of exterior fuselage	ND	--	--
37	55-4571	dioxin/furan	Interior Floor-1	18.42	--	--
38	55-4571	dioxin/furan	Interior Floor-2	27.58	--	--
39	55-4571	dioxin/furan	Interior Floor-3	21.66	--	--
40	55-4571	dioxin/furan	Interior Floor-4	4.65	--	--
41	55-4571	dioxin/furan	Front bulkhead wall	7.72	--	--
42	55-4571	dioxin/furan	Interior ceiling (between wings)	1.3	--	--
43	55-4571	dioxin/furan	Interior rear frame-1	9.78	--	--
44	55-4571	dioxin/furan	Interior rear frame-2	32.22	--	--
45	55-4571	dioxin/furan	Interior rear frame-3	10.3	--	--
46	55-4571	dioxin/furan	Interior air sample (PUF)	ND	--	--
47	55-4571	dioxin/furan	Interior blank	ND	--	--
48	55-4571	dioxin/furan	Exterior blank	ND	--	--
49	55-4571	Herbicide	Wing underside-trailing edge	ND	--	--
50	55-4571	Herbicide	Exterior cargo door	ND	--	--
51	55-4571	Herbicide	Front Side of exterior fuselage	ND	--	--
52	55-4571	Herbicide	Back side of exterior fuselage	ND	--	--
53	55-4571	Herbicide	Interior Floor-1	--	490	540
54	55-4571	Herbicide	Interior Floor-2	--	100	110(J)
55	55-4571	Herbicide	Interior Floor-3	--	360	520
56	55-4571	Herbicide	Interior Floor-4	--	310	250(J)
57	55-4571	Herbicide	Front bulkhead wall	--	260	180(J)
58	55-4571	Herbicide	Interior ceiling (between wings)	--	600	1600
59	55-4571	Herbicide	Interior rear frame-1	--	720	100
60	55-4571	Herbicide	Interior rear frame-2	--	840	780
61	55-4571	Herbicide	Interior rear frame-3	--	980	1200
62	55-4571	Herbicide	Interior air sample (filter)	--	ND	ND
63	55-4571	Herbicide	Interior blank	--	ND	ND
64	55-4571	Herbicide	Exterior blank	--	ND	ND

Table B-1 (continued). Analytical results for Dioxin/Furans (represented by a Toxic Equivalence value, TEQ*), 2,4,5-T, and 2,4-D.

Sample #	Aircraft	Analysis	Location	TEQ* (ng/m^2)	2,4,5-T ($\mu g/m^2$)	2,4-D ($\mu g/m^2$)
65	55-4532	dioxin/furan	Wing underside-trailing edge	ND	--	--
66	55-4532	dioxin/furan	Exterior cargo door-1	ND	--	--
67	55-4532	dioxin/furan	Exterior cargo door-2	ND	--	--
68	55-4532	dioxin/furan	Exterior cargo door-3	ND	--	--
69	55-4532	dioxin/furan	Front Side of exterior fuselage	ND	--	--
70	55-4532	dioxin/furan	Back side of exterior fuselage	ND	--	--
71	55-4532	dioxin/furan	Interior Floor-1	25.72	--	--
72	55-4532	dioxin/furan	Interior Floor-2	26.35	--	--
73	55-4532	dioxin/furan	Interior Floor-3	29.37	--	--
74	55-4532	dioxin/furan	Interior Floor-4	12.96	--	--
75	55-4532	dioxin/furan	Front bulkhead wall	6.4	--	--
76	55-4532	dioxin/furan	Interior ceiling (between wings)	11.66	--	--
77	55-4532	dioxin/furan	Interior rear frame	14.96	--	--
78	55-4532	dioxin/furan	Interior air sample (PUF)	ND	--	--
79	55-4532	dioxin/furan	Interior blank	ND	--	--
80	55-4532	dioxin/furan	Exterior blank	ND	--	--
81	55-4532	Herbicide	Wing underside-trailing edge	--	ND	ND
82	55-4532	Herbicide	Exterior cargo door-1	--	ND	ND
83	55-4532	Herbicide	Exterior cargo door-2	--	ND	ND
84	55-4532	Herbicide	Exterior cargo door-3	--	ND	ND
85	55-4532	Herbicide	Front Side of exterior fuselage	--	ND	ND
86	55-4532	Herbicide	Back side of exterior fuselage	--	ND	ND
87	55-4532	Herbicide	Interior Floor-1	--	1000	810
88	55-4532	Herbicide	Interior Floor-2	--	100	ND
89	55-4532	Herbicide	Interior Floor-3	--	240	140(J)
90	55-4532	Herbicide	Interior Floor-4	--	1100	1200
91	55-4532	Herbicide	Front bulkhead wall	--	650	560
92	55-4532	Herbicide	Interior ceiling (between wings)	--	37(J)	ND
93	55-4532	Herbicide	Interior rear frame	--	390	450(J)
94	55-4532	Herbicide	Interior air sample (filter)	--	ND	ND
95	55-4532	Herbicide	Interior blank	--	ND	ND
96	55-4532	Herbicide	Exterior blank	--	ND	ND

Table B-1 (continued). Analytical results for Dioxin/Furans (represented by a Toxic Equivalence value, TEQ*), 2,4,5-T, and 2,4-D.

Sample #	Aircraft	Analysis	Location	TEQ* (ng/m^2)	2,4,5-T (µg/m^2)	2,4-D (µg/m^2)
97	55-4544	dioxin/furan	Wing underside-trailing edge-1	ND	--	--
98	55-4544	dioxin/furan	Wing underside-trailing edge-2	ND	--	--
99	55-4544	dioxin/furan	Wing underside-trailing edge-3	ND	--	--
100	55-4544	dioxin/furan	Exterior cargo door	ND	--	--
101	55-4544	dioxin/furan	Front Side of exterior fuselage	ND	--	--
102	55-4544	dioxin/furan	Back side of exterior fuselage	ND	--	--
103	55-4544	dioxin/furan	Interior Floor-1	ND	--	--
104	55-4544	dioxin/furan	Interior Floor-2	2.54(J)	--	--
105	55-4544	dioxin/furan	Interior Floor-3	1.48	--	--
106	55-4544	dioxin/furan	Interior Floor-4	1.99 (J)	--	--
107	55-4544	dioxin/furan	Front bulkhead wall	ND	--	--
108	55-4544	dioxin/furan	Interior ceiling (between wings)	ND	--	--
109	55-4544	dioxin/furan	Interior rear frame	ND	--	--
110	55-4544	dioxin/furan	Interior air sample (PUF)	ND	--	--
111	55-4544	dioxin/furan	Interior blank	ND	--	--
112	55-4544	dioxin/furan	Exterior blank	ND	--	--
113	55-4544	Herbicide	Wing underside-trailing edge-1	--	ND	ND
114	55-4544	Herbicide	Wing underside-trailing edge-2	--	ND	ND
115	55-4544	Herbicide	Wing underside-trailing edge-3	--	ND	ND
116	55-4544	Herbicide	Exterior cargo door	--	ND	ND
117	55-4544	Herbicide	Front Side of exterior fuselage		sample lost	
118	55-4544	Herbicide	Back side of exterior fuselage	--	ND	ND
119	55-4544	Herbicide	Interior Floor-1	--	ND	ND
120	55-4544	Herbicide	Interior Floor-2	--	ND	ND
121	55-4544	Herbicide	Interior Floor-3	--	ND	ND
122	55-4544	Herbicide	Interior Floor-4	--	22(J)	ND
123	55-4544	Herbicide	Front bulkhead wall	--	ND	ND
124	55-4544	Herbicide	Interior ceiling (between wings)	--	ND	ND
125	55-4544	Herbicide	Interior rear frame	--	ND	ND
126	55-4544	Herbicide	Interior air sample (filter)	--	ND	ND
127	55-4544	Herbicide	Interior blank	--	ND	ND
128	55-4544	Herbicide	Exterior blank	--	ND	ND

Table B-1 (continued). Analytical results for Dioxin/Furans (represented by a Toxic Equivalence value, TEQ*), 2,4,5-T, and 2,4-D.

Sample #	Aircraft	Analysis	Location	TEQ* (ng/m^2)	2,4,5-T (µg/m^2)	2,4-D (µg/m^2)
129	Tank	dioxin/furan	Inside Spray Tank	111.14	--	--
130	Tank	dioxin/furan	Outside Spray Tank	5.56	--	--
131	Tank	dioxin/furan	On Spray Control Box	ND	--	--
132	Tank	Herbicide	Inside Spray Tank	--	280000	120000
133	Tank	Herbicide	Outside Spray Tank	--	150	ND
134	Tank	Herbicide	On Spray Control Box	--	44(J)	ND
135	n/a	dioxin/furan	Wipe trip blank		not analyzed†	
136	n/a	dioxin/furan	Wipe trip blank duplicate		not analyzed†	
137	n/a	Herbicide	Wipe trip blank		not analyzed†	
138	n/a	Herbicide	Wipe trip blank duplicate		not analyzed†	
139	n/a	dioxin/furan	Air PUF trip blank		not analyzed†	
140	n/a	dioxin/furan	Air PUF field blank	ND	--	--
141	n/a	Herbicide	Air filter trip blank		not analyzed†	
142	n/a	Herbicide	Air filter field blank	--	ND	ND
143	n/a	dioxin/furan	Background air (PUF)	ND	--	--
144	n/a	dioxin/furan	Background air duplicate (PUF)	ND	--	--
145	n/a	Herbicide	Background air (filter)	--	ND	ND
146	n/a	Herbicide	Background air duplicate (filter)	--	ND	ND

* Based on 2005 World Health Organization toxic equivalence factors (TEFs).

†Trip blanks were collected, but analysis was not necessary since internal laboratory banks were deemed sufficient.

J=Estimated value. The result is estimated due to associated QC problems.

ND=Analyte was not detected above the practical quantitation limit specified in Table E-1.

APPENDIX C

Sample Location Grids

Sample areas are outline in red in the following graphics. Actual sample locations are indicated by red numbers in the sample grids that correspond to the sample numbers listed in Appendix B, Table B-1.

Exterior Wing Underside-Trailing Edge

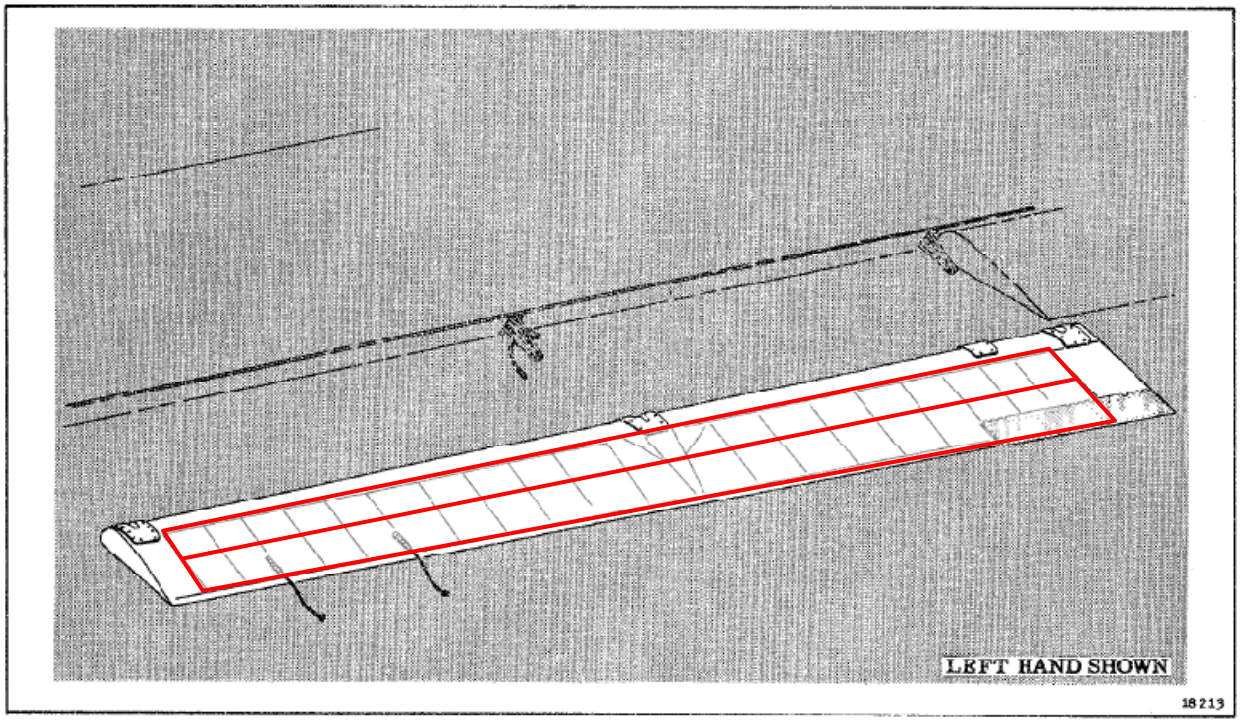


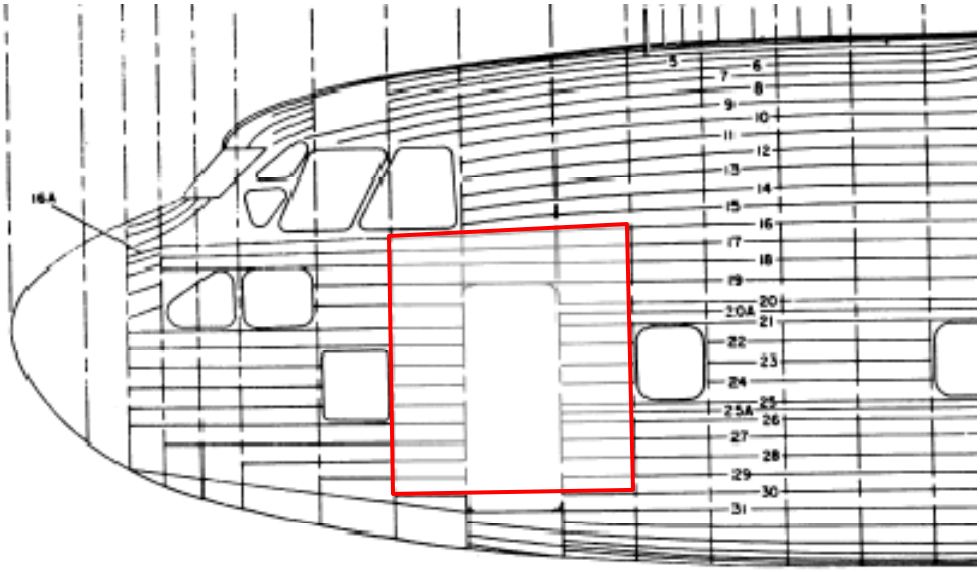
Figure 2-53. Aileron Covered Structure

Row #	Column # (indicated by # in first row)																			
1	1	2 1	3	4	5	6	7 99	8	9	10	11 97	12	13	14 98	15	16	17	18	19	20
2	21	22	23	24	25	26 65	27	28	29	30	31	32	33	34	35	36 33	37	38	39	40

Note: Illustration shows top of aileron. Samples were taken on the bottom side. Cell 1 is located on the left hand trailing edge, while standing under the wing, facing in the same direction as the aircraft. Rows indicate the front or back of the riveted pattern on the aileron. No rivets actually separate the rows on the aircraft surface.

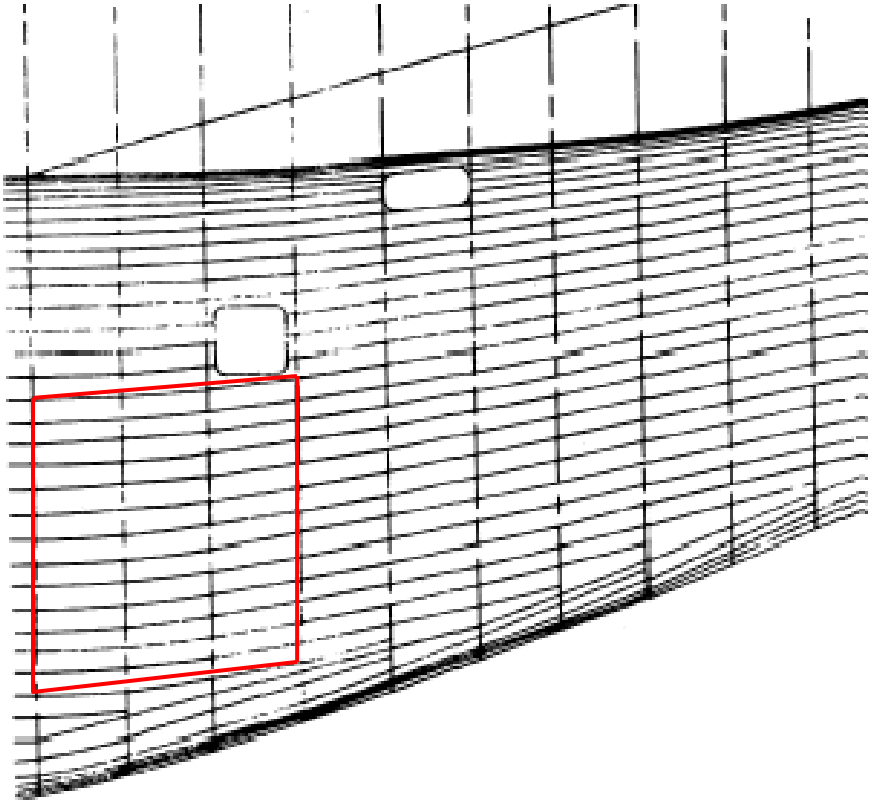
Front Side of Exterior Fuselage

Note: samples were taken on right side of fuselage (without door).



Row #	Column # (indicated by # in first row)		
1	1 top left	2	3
2	4	5 51	6
3	7	8	9 35
4	10	11	12
5	13	14	15
6	16 69	17	18
7	19	20	21 85
8	22	23 117	24
9	25	26	27
10	28	29	30
11	31	32	33
12	34	35 19	36
13	37	38 3	39 101
14	40	41	42

Back Side of Exterior Fuselage

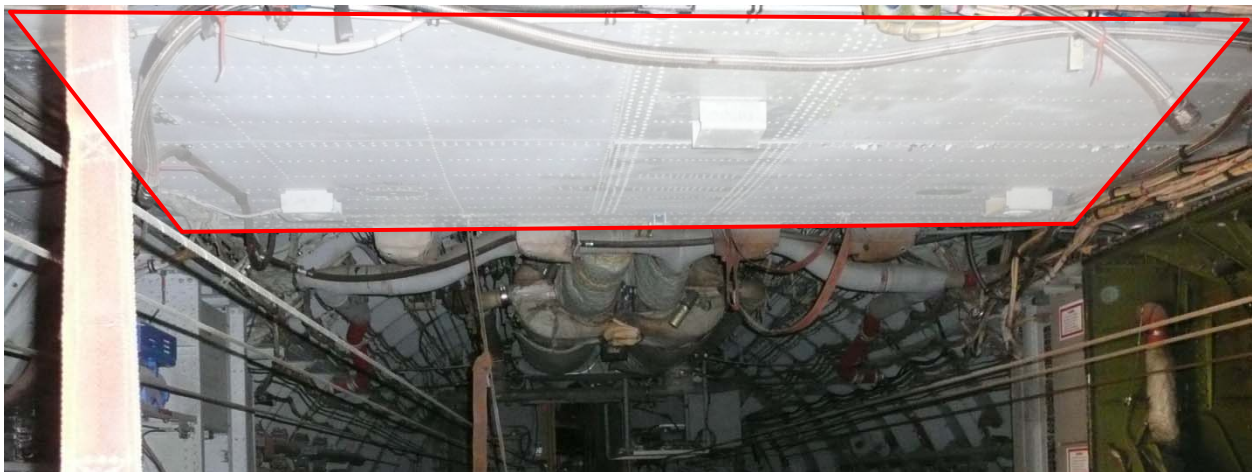


Row #	Column # (indicated by # in first row)		
1	1 top left	2	3
2	4 86	5 118	6
3	7 4	8	9
4	10	11	12
5	13	14	15
6	16 36	17	18 102
7	19	20	21
8	22	23 20	24 70
9	25	26	27
10	28	29	30 52
11	31	32	33
12	34	35	36
13	37	38	39

Exterior Cargo Door

Row #	Column # (indicated by # in first row)													
1	1 top left	2	3	4 2	5	6	7	8	9	10	11 34	12	13	14
2	15	16	17 84	18	19 83	20	21	22	23	24	25	26	27 116	28
3	29	30	31 67	32	33 82 100	34	35 18	36	37	38 66	39	40	41	42
4	43	44	45	46	47	48	49	50	51	52	53	54	55	56
5	57	58	59	60	61	62	63	64	65	66	67	68	69	70 50
6	71	72	73	74	75	76	77	78 68	79	80	81	82	83	84

Interior ceiling (between wings)



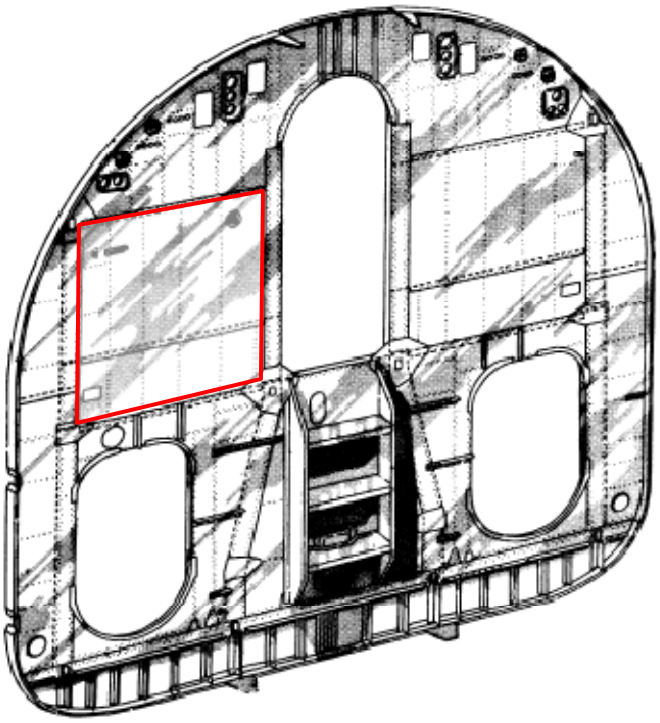
Row #	Column # (indicated by # in first row)						
1	1	2	3	4	5	6	7
2	8	9 12	10	11	12 27	13	14
3	15	16	17	18 10, 76	19	20 42	21
4	22	23 58	24	25	26 124	27	28 11
5	29	30	31	32	33	34	35
6	36 108	37	38	39	40	41	42
7	43	44	45	46	47	48	49
8	50	51	52	53	54	55 26	56
9	57	58	59	60	61	62	63
10	64 28	65 92	66	67	68	69	70
11	71	72	73	74	75	76	77

Interior Floor

Note: Cell one starts at the front left side of the interior fuselage behind the cockpit steps (not pictured). Cells measure 1ft by 1ft square.

Row #	Column # (indicated by # in first row)							
1	1	2 90	3	4 87	5	6	7	8
2	9	10	11	12	13	14	15	16
3	17	18	19	20	21	22	23 54	24
4	25	26	27	28	29	30	31	32
5	33	34	35	36	37	38	39	40
6	41	42	43	44 37	45	46	47	48
7	49	50	51	52	53	54	55	56
8	57	58	59	60	61	62 72	63	64
9	65	66	67	68	69	70	71	72
10	73	74 21	75	76	77	78	79	80
11	81	82	83	84	85	86	87	88
12	89	90	91	92	93	94	95	96
13	97	98 6	99 104	100	101	102	103	104
14	105	106	107	108	109	110	111	112
15	113	114 7	115	116	117	118	119	120
16	121	122	123	124	125	126	127	128
17	129	130	131	132	133	134	135	136
18	137	138	139	140	141	142	143 89	144
19	145	146	147	148	149	150	151	152
20	153	154	155	156	157	158 24	159	160
21	161	162	163	164	165	166	167	168
22	169	170	171	172	173 22	174	175	176 120
23	177	178	179	180	181	182	183	184
24	185 71	186	187	188	189	190	191	192
25	193	194	195	196	197	198	199	200 73
26	201	202	203	204	205	206	207	208
27	209 105	210	211	212	213	214	215 23	216
28	217	218 53	219	220	221	222 55	223 5	224
29	225	226 88	227	228	229	230	231 103	232 74
30	233	234	235	236	237	238	239	240
31	241	242	243	244	245	246	247	248
32	249	250	251	252	253	254	255	256 122
33	257	258	259	260 106	261	262	263	264
34	265	266	267	268	269	270	271	272
35	273	274	275	276	277	278	279	280
36	281	282	283	284	285 39	286	287	288
37	289	290	291	292	293	294	295	296
38	297	298	299	300	301	302	303	304
39	305	306	307	308	309	310	311	312
40	313	314	315	316	317	318	319 56	320
41	321	322	323	324 38, 121	325	326	327	328
42	329	330	331	332	333	334	335 8	336
43	337	338	339	340	341	342	343	344
44	345	346	347 40	348	349	350	351	352
45	353 119	354	355	356	357	358	359	360

Front Bulkhead Wall



VIEW LOOKING FORWARD

Row #	**Column # (indicated by # in first row)**			
1	1 75	2 9	3 25	4
2	5	6 91	7 41	8 123
3	9	10 57	11 107	12
4	13	14	15	16

Note: Upper right corner located at intersection of vertical rivet seam closest to cockpit entrance and the horizontal bracket used to mount internal cables. Cells measure 0.5 ft by 0.5 ft square.

Interior Rear frame

Samples were taken directly above the holes in the rear frame. There are 18 holes, that for the purposes of the sampling, were numbered from 1 to 18 starting on the left side and moving clockwise around the frame as indicated in the picture above.

Area #	Sample #
1	61
2	77, 125
3	
4	
5	109
6	43
7	29, 45
8	93
9	
10	
11	44
12	
13	
14	
15	
16	13, 59
17	60
18	

APPENDIX D

Analytical Reporting Limits

Table D-1. Method, Analytes, and Method Reporting Limits

USEPA Method	Analyte	CAS[a] #	Reporting limit[b] (pg/wipe) method 8290A, (µg/wipe) method 8151A
8290A	2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD)	1746-01-6	1
8290A	1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin (PeCDD)	40321-76-4	5
8290A	1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin (HxCDD)	39227-28-6	5
8290A	1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin (HxCDD)	57653-85-7	5
8290A	1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin (HxCDD)	19408-74-3	5
8290A	1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin (HpCDD)	35822-46-9	5
8290A	1,2,3,4,5,6,7,8-Octachlorodibenzo-*p*-dioxin (OCDD)	3268-87-9	10
8290A	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	1
8290A	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	5
8290A	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	5
8290A	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	5
8290A	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	5
8290A	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	5
8290A	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	5
8290A	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	5
8290A	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	5

8290A	1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	39001-02-0	10
8290A	Total Tetrachlorodibenzo-*p*-dioxin (TCDD)[b]	41903-57-5	1
8290A	Total Pentachlorodibenzo-*p*-dioxin(PeCDD)[b]	36088-22-9	5
8290A	Total Hexachlorodibenzo-*p*-dioxin (HxCDD)[b]	34465-46-8	5
8290A	Total Heptachlorodibenzo-*p*-dioxin (HpCDD)[b]	37871-00-4	5
8290A	Total Tetrachlorodibenzofuran (TCDF)[b]	55722-27-5	1
8290A	Total Pentachlorodibenzofuran (PeCDF)[b]	30402-15-4	5
8290A	Total Hexachlorodibenzofuran (HxCDF)[b]	55684-94-1	5
8290A	Total Heptachlorodibenzofuran (HpCDF)[b]	38998-75-3	5
8151A	2,4-D	94-75-7	5
8151A	4-(2,4-dichlorophenoxy)butyric acid (2,4-DB)	94-82-6	5
8151A	2,4,5-TP (Silvex)	93-72-1	1
8151A	2,4,5-T	93-76-5	1
8151A	Dalapon	75-99-0	3
8151A	Dicamba	1918-00-9	3
8151A	Dinoseb	88-85-7	1
8151A	2-Methyl-4-chlorophenoxyacetic Acid (MCPA)	94-74-6	500
8151A	1-(3-chlorophenyl)piperazine dihydrochloride (MCPP)	93-65-2	500

[a] CAS – Chemical Abstract Service

[b] Reporting limits provided by TestAmerica Laboratory

APPENDIX E

Analytical Results

Table E-1. Analytical Results for Dioxin Furan Analysis (EPA method 8290) with Calculated Toxic Equivalence Values (TEQ). Results of detected compounds are highlighted in yellow.

		Sample #	1	2	3	4	5	6	7	8
		Aircraft	54-0585	54-0585	54-0585	54-0585	54-0585	54-0585	54-0585	54-0585
Analyte	**Units**	**TEF ***								
2,3,7,8-TCDF	pg/100 cm^2	0.1	3.3 U	2.8 U	3.5 U	3 U	3.1 U	3.9 U	3 U	3.6 U
1,2,3,7,8-PeCDF	pg/100 cm^2	0.03	4.5 U	5.3 U	4.9 U	4.5 U	5.6 U	6 U	5.2 U	4.5 U
2,3,4,7,8-PeCDF	pg/100 cm^2	0.3	4.8 U	5.8 U	5.2 U	4.9 U	6 U	6.5 U	5.6 U	4.8 U
1,2,3,4,7,8-HxCDF	pg/100 cm^2	0.1	3.5 U	3.1 U	3.1 U	3.4 U	3.8 U	3.5 U	3.6 U	7.1 U
2,3,4,6,7,8-HxCDF	pg/100 cm^2	0.1	3.3 U	3 U	2.9 U	3.2 U	3.6 U	3.4 U	3.4 U	3 U
1,2,3,7,8,9-HxCDF	pg/100 cm^2	0.1	3.6 U	3.2 U	3.2 U	3.5 U	4 U	3.7 U	3.8 U	3.3 U
1,2,3,4,6,7,8-HpCDF	pg/100 cm^2	0.01	2.7 U	2.6 U	2.5 U	2.8 U	6.3 U	4 U	11 U	39 U
OCDF	pg/100 cm^2	0.0003	7.5 U	6.5 U	7.4 U	7.7 U	8.9 U	9 U	7 U	39 U
Total TCDF	pg/100 cm^2		3.3 U	2.8 U	3.5 U	3 U	3.1 U	3.9 U	3 U	3.6 U
Total PeCDF	pg/100 cm^2		5.7 U	5.8 U	5.9 U	4.9 U	6.3 U	6.6 U	6.1 U	4.8 U
Total HxCDF	pg/100 cm^2		3.6 U	3.2 U	3.2 U	3.5 U	4 U	3.7 U	3.8 U	13 U
Total HpCDF	pg/100 cm^2		3.2 U	3.1 U	2.9 U	3.4 U	6.3 U	4.1 U	11 U	39 U
Total TCDD	pg/100 cm^2		4.8 U	4.8 U	4.9 U	4.8 U	5.7 U	11	24	16
2,3,7,8-TCDD	pg/100 cm^2	1	4.8 U	4.8 U	4.9 U	4.8 U	5.7 U	11 J, JA	24	16 J
Total PeCDD	pg/100 cm^2		8.3 U	8.1 U	9.6 U	8.5 U	9.9 U	9.8 U	8.4 U	7.5 U
1,2,3,7,8-PeCDD	pg/100 cm^2	1	8.3 U	8.1 U	9.6 U	8.5 U	9.9 U	9.8 U	8.4 U	7.5 U
Total HxCDD	pg/100 cm^2		6.6 U	6.5 U	7.3 U	6.7 U	6.9 U	8.1 U	7.7 U	20 U
1,2,3,7,8,9-HxCDD	pg/100 cm^2	0.1	5.2 UJ	5.1 UJ	5.7 UJ	5.3 UJ	5.4 UJ	6.3 UJ	6 UJ	4.5 UJ
Total HpCDD	pg/100 cm^2		5.4 U	6.5 U	6.2 U	5.9 U	20 U	18 U	37 U	200
1,2,3,4,6,7,8-HpCDD	pg/100 cm^2	0.01	5.4 U	6.5 U	6.2 U	5.9 U	20 U	18 U	37 U	110
OCDD	pg/100 cm^2	0.0003	15 U	5.9 U	23 U	7.3 U	150 J	110 J	250	560
1,2,3,6,7,8-HxCDF	pg/100 cm^2	0.1	2.8 U	2.5 U	2.5 U	2.8 U	3.1 U	2.9 U	3 U	3.6 U
1,2,3,4,7,8,9-HpCDF	pg/100 cm^2	0.01	3.2 U	3.1 U	2.9 U	3.4 U	3.6 U	4.1 U	2.7 U	2.9 U
1,2,3,4,7,8-HxCDD	pg/100 cm^2	0.1	6.6 U	6.5 U	7.3 U	6.7 U	6.9 U	8.1 U	7.7 U	5.8 U
1,2,3,6,7,8-HxCDD	pg/100 cm^2	0.1	4.9 U	4.8 U	5.4 U	5 U	5.2 U	6 U	5.8 U	5.6 U
	TEQ (ng/m^2)		< 1.81	< 1.8	< 1.97	< 1.83	2.14 J	2.70 J, JA	3.85	3.04 J

*2005 World Health Organization toxic equivalency factors used to calculate TEQ values

Table E-1 (continued). Analytical Results for Dioxin Furan Analysis (EPA method 8290) with Calculated Toxic Equivalence Values (TEQ*). Results of detected compounds are highlighted in yellow.

		Sample #	9	10	11	12	13	14	15	16
		Aircraft	54-0585	54-0585	54-0585	54-0585	54-0585	54-0585	54-0585	54-0585
Analyte	**Units**	**TEF***								
2,3,7,8-TCDF	pg/100 cm^2	0.1	2.8 U	2.6 U	2.6 U	4.7 U	2.2 U	0.58 U	2.7 U	2.6 U
1,2,3,7,8-PeCDF	pg/100 cm^2	0.03	4.1 U	4.2 U	4.5 U	8.1 U	4.3 U	0.55 U	4.5 U	4.8 U
2,3,4,7,8-PeCDF	pg/100 cm^2	0.3	4.4 U	4.5 U	4.9 U	8.7 U	4.7 U	0.58 U	4.9 U	5.1 U
1,2,3,4,7,8-HxCDF	pg/100 cm^2	0.1	9.1 U	2.9 U	2.7 U	5.2 U	3.1 U	0.52 U	2.8 U	2.5 U
2,3,4,6,7,8-HxCDF	pg/100 cm^2	0.1	4.4 U	2.8 U	2.6 U	5 U	3 U	0.76 U	2.7 U	2.4 U
1,2,3,7,8,9-HxCDF	pg/100 cm^2	0.1	3 U	3.1 U	2.8 U	5.4 U	3.3 U	0.46 U	3 U	2.6 U
1,2,3,4,6,7,8-HpCDF	pg/100 cm^2	0.01	9.9 U	2.8 U	2.6 U	4.4 U	7.6 U	0.43 U	2.4 U	2.6 U
OCDF	pg/100 cm^2	0.0003	5.9 U	7.2 U	6.6 U	15 U	7 U	0.57 U	6.4 U	6.8 U
Total TCDF	pg/100 cm^2		2.8 U	2.6 U	2.6 U	4.7 U	2.2 U	0.58 U	2.7 U	2.6 U
Total PeCDF	pg/100 cm^2		4.4 U	4.5 U	5 U	11 U	5.4 U	0.92 U	4.9 U	5.7 U
Total HxCDF	pg/100 cm^2		9.1 U	3.1 U	2.8 U	5.4 U	3.3 U	0.76 U	3 U	2.6 U
Total HpCDF	pg/100 cm^2		9.9 U	3.4 U	3.1 U	5.3 U	7.6 U	0.53 U	2.8 U	3.1 U
Total TCDD	pg/100 cm^2		3.9 U	5.2 U	4.5 U	8.2 U	4.6 U	0.57 U	4.4 U	4.4 U
2,3,7,8-TCDD	pg/100 cm^2	1	3.9 U	5.2 U	4.5 U	8.2 U	4.6 U	0.57 U	4.4 U	4.4 U
Total PeCDD	pg/100 cm^2		11 U	8.2 U	7.9 U	14 U	7.9 U	1 U	10 U	8.3 U
1,2,3,7,8-PeCDD	pg/100 cm^2	1	7.4 U	7.4 U	7.9 U	14 U	7.9 U	1 U	7.7 U	8.3 U
Total HxCDD	pg/100 cm^2		6 U	7.1 U	5.9 U	10 U	6.6 U	1.2 U	6.5 U	5.8 U
1,2,3,7,8,9-HxCDD	pg/100 cm^2	0.1	4.7 UJ	5.6 UJ	4.6 UJ	8.1 UJ	5.2 UJ	0.62 U	5.1 UJ	4.5 UJ
Total HpCDD	pg/100 cm^2		13 U	5.9 U	8.2 U	11 U	30 U	2.1 U	5.2 U	7 U
1,2,3,4,6,7,8-HpCDD	pg/100 cm^2	0.01	13 U	5.9 U	7.3 U	11 U	16 U	1.2 U	5.2 U	7 U
OCDD	pg/100 cm^2	0.0003	21 U	17 U	20 U	12 U	29 U	6.3 U	4.9 U	7.1 U
1,2,3,6,7,8-HxCDF	pg/100 cm^2	0.1	2.4 U	2.4 U	2.2 U	4.3 U	2.6 U	0.5 U	2.3 U	2 U
1,2,3,4,7,8,9-HpCDF	pg/100 cm^2	0.01	3.1 U	3.4 U	3.1 U	5.3 U	2.8 U	0.53 U	2.8 U	3.1 U
1,2,3,4,7,8-HxCDD	pg/100 cm^2	0.1	6 U	7.1 U	5.9 U	10 U	6.6 U	0.49 U	6.5 U	5.8 U
1,2,3,6,7,8-HxCDD	pg/100 cm^2	0.1	4.5 U	5.3 U	4.4 U	7.8 U	4.9 U	0.57 U	4.9 U	4.3 U
	TEQ (ng/m^2)		< 1.67	< 1.74	< 1.69	< 3.03	< 1.74	< 0.22	< 1.68	< 1.72

*2005 World Health Organization toxic equivalency factors used to calculate TEQ values.

Table E-1 (continued). Analytical Results for Dioxin Furan Analysis (EPA method 8290) with Calculated Toxic Equivalence Values (TEQ*). Results of detected compounds are highlighted in yellow.

		Sample #	33	34	35	36	37	38	39	40
		Aircraft	55-4571	55-4571	55-4571	55-4571	55-4571	55-4571	55-4571	55-4571
Analyte	**Units**	**TEF***								
2,3,7,8-TCDF	pg/100 cm^2	0.1	2.3 U	2.2 U	3.4 U	2 U	4.4 U	9.2 U	6.8 U	3.3 U
1,2,3,7,8-PeCDF	pg/100 cm^2	0.03	0.92 U	1 U	1.1 U	0.7 U	0.8 U	1.5 U	1.1 U	0.79 U
2,3,4,7,8-PeCDF	pg/100 cm^2	0.3	0.86 U	0.91 U	1.1 U	0.72 U	0.83 U	1.7 U	1 U	0.82 U
1,2,3,4,7,8-HxCDF	pg/100 cm^2	0.1	1 U	1.5 U	1.2 U	0.75 U	2.2 U	3.7 U	2.8 U	1 U
2,3,4,6,7,8-HxCDF	pg/100 cm^2	0.1	0.85 U	0.87 U	1.1 U	0.73 U	0.76 U	0.9 U	0.77 U	0.72 U
1,2,3,7,8,9-HxCDF	pg/100 cm^2	0.1	0.99 U	0.96 U	1.3 U	0.85 U	0.89 U	0.93 U	0.9 U	0.84 U
1,2,3,4,6,7,8-HpCDF	pg/100 cm^2	0.01	3 U	4.2 U	2.3 U	2.2 U	7.8 U	8.5 U	9.5 U	5 U
OCDF	pg/100 cm^2	0.0003	2.5 U	6.4 U	4.4 U	2.7 U	26 U	18 U	23 U	8.8 U
Total TCDF	pg/100 cm^2		2.3 U	2.2 U	3.4 U	2 U	4.4 U	9.2 U	6.8 U	3.3 U
Total PeCDF	pg/100 cm^2		1.7 U	4 U	2.6 U	3.5 U	11 U	23 U	14 U	3.4 U
Total HxCDF	pg/100 cm^2		2.1 U	3.6 U	1.3 U	1.8 U	3.1 U	4.8 U	4.7 U	2 U
Total HpCDF	pg/100 cm^2		3 U	4.2 U	2.3 U	2.8 U	13 U	9.4 U	11 U	5 U
Total TCDD	pg/100 cm^2		1.8 U	7.3 U	2.6 U	4 U	180	270	210	43
2,3,7,8-TCDD	pg/100 cm^2	1	1 U	7.3 U	2.6 U	4 U	180	270	210	43
Total PeCDD	pg/100 cm^2		1.8 U	2.3 U	2.7 U	2.1 U	2.6 U	5.2 U	3.8 U	2 U
1,2,3,7,8-PeCDD	pg/100 cm^2	1	1.8 U	2.3 U	2.7 U	1.6 U	1.8 U	2.7 U	3.8 U	2 U
Total HxCDD	pg/100 cm^2		1.3 U	1.8 U	1.9 U	1.8 U	11 U	8.1 U	9.3 U	3.4 U
1,2,3,7,8,9-HxCDD	pg/100 cm^2	0.1	1.1 U	0.93 U	1.5 U	1 U	1.7 U	1.5 U	1.9 U	0.93 U
Total HpCDD	pg/100 cm^2		4.5 U	5.2 U	13 U	3.7 U	46 U	27 U	44 U	18 U
1,2,3,4,6,7,8-HpCDD	pg/100 cm^2	0.01	3.6 U	4.5 U	12 U	3 U	32 U	27 U	44 U	14 U
OCDD	pg/100 cm^2	0.0003	14 U	28 U	66 U	9 U	270	200	370	150 J
1,2,3,6,7,8-HxCDF	pg/100 cm^2	0.1	0.83 U	1.3 U	1.1 U	0.75 U	1.2 U	1.8 U	1.3 U	0.68 U
1,2,3,4,7,8,9-HpCDF	pg/100 cm^2	0.01	1 U	1.3 U	1.7 U	2.8 U	1.3 U	1.3 U	1.8 U	0.72 U
1,2,3,4,7,8-HxCDD	pg/100 cm^2	0.1	1.3 U	1.1 U	1.7 U	1.2 U	0.98 U	1 U	1.1 U	0.95 U
1,2,3,6,7,8-HxCDD	pg/100 cm^2	0.1	1.3 U	1.6 U	1.5 U	1 U	3.7 U	2.1 U	2.5 U	1.2 U
	TEQ (ng/m^2)		< 0.41	< 1.11	< 0.71	< 0.67	18.42	27.58	21.66	4.65

*2005 World Health Organization toxic equivalency factors used to calculate TEQ values.

Table E-1 (continued). Analytical Results for Dioxin Furan Analysis (EPA method 8290) with Calculated Toxic Equivalence Values (TEQ*). Results of detected compounds are highlighted in yellow.

		Sample #	41	42	43	44	45	46	47	48
		Aircraft	55-4571	55-4571	55-4571	55-4571	55-4571	55-4571	55-4571	55-4571
Analyte	**Units**	**TEF***								
2,3,7,8-TCDF	pg/100 cm^2	0.1	2.7 U	1.8 U	3.2 U	8.3 U	2.8 U	0.63 U	0.43 U	0.32 U
1,2,3,7,8-PeCDF	pg/100 cm^2	0.03	0.85 U	0.71 U	0.76 U	0.85 U	0.74 U	0.51 U	0.29 U	0.28 U
2,3,4,7,8-PeCDF	pg/100 cm^2	0.3	0.88 U	0.73 U	1.1 U	3.5 U	0.55 U	0.54 U	0.29 U	0.3 U
1,2,3,4,7,8-HxCDF	pg/100 cm^2	0.1	1.1 U	1 U	2.4 U	10 U	2.4 U	0.84 U	0.27 U	0.18 U
2,3,4,6,7,8-HxCDF	pg/100 cm^2	0.1	0.9 U	0.66 U	0.83 U	1.8 U	0.82 U	0.6 U	0.25 U	0.16 U
1,2,3,7,8,9-HxCDF	pg/100 cm^2	0.1	1 U	0.76 U	0.96 U	3.8 U	0.59 U	0.32 U	0.28 U	0.18 U
1,2,3,4,6,7,8-HpCDF	pg/100 cm^2	0.01	4.2 U	2.4 U	4 U	10 U	3.6 U	0.71 U	0.36 U	0.72 U
OCDF	pg/100 cm^2	0.0003	7.7 U	4.6 U	6.3 U	12 U	5.3 U	0.73 U	0.54 U	0.58 U
Total TCDF	pg/100 cm^2		2.7 U	1.8 U	3.2 U	8.3 U	2.8 U	0.63 U	0.43 U	0.32 U
Total PeCDF	pg/100 cm^2		4 U	1.4 U	5.6 U	14 U	5.4 U	0.82 U	0.46 U	0.42 U
Total HxCDF	pg/100 cm^2		2.2 U	1 U	2.4 U	10 U	2.4 U	0.84 U	0.28 U	0.2 U
Total HpCDF	pg/100 cm^2		4.4 U	2.4 U	4 U	11 U	4 U	0.71 U	0.37 U	0.72 U
Total TCDD	pg/100 cm^2		71	10	93	320	100	2.4 U	0.41 U	0.45 U
2,3,7,8-TCDD	pg/100 cm^2	1	71	10	93	320	100	2.4 U	0.41 U	0.34 U
Total PeCDD	pg/100 cm^2		6.5 U	1.8 U	3.8 U	8.2 U	2.3 U	1.3 U	0.62 U	0.59 U
1,2,3,7,8-PeCDD	pg/100 cm^2	1	4.4 U	1.8 U	2.5 U	6.3 U	1 U	1.3 U	0.62 U	0.59 U
Total HxCDD	pg/100 cm^2		11 U	5.4 U	18 U	21 U	14 U	1.2 U	1.5 U	0.82 U
1,2,3,7,8,9-HxCDD	pg/100 cm^2	0.1	1.5 U	0.92 U	2.4 U	3.3 U	2.2 U	0.86 U	0.36 U	0.48 U
Total HpCDD	pg/100 cm^2		21 U	11 U	28 U	54 U	28 U	2 U	1.9 U	7 U
1,2,3,4,6,7,8-HpCDD	pg/100 cm^2	0.01	18 U	9.1 U	22 U	49 U	26 U	1.4 U	0.99 U	5.8 U
OCDD	pg/100 cm^2	0.0003	120 J	29 U	80 U	170 J	74 U	4.7 U	3.9 U	70 U
1,2,3,6,7,8-HxCDF	pg/100 cm^2	0.1	0.91 U	0.61 U	0.83 U	4.7 U	0.71 U	0.25 U	0.22 U	0.14 U
1,2,3,4,7,8,9-HpCDF	pg/100 cm^2	0.01	0.93 U	0.83 U	1.7 U	2.5 U	0.81 U	0.55 U	0.37 U	0.22 U
1,2,3,4,7,8-HxCDD	pg/100 cm^2	0.1	1.3 U	0.99 U	1.2 U	3.2 U	2 U	0.51 U	0.45 U	0.37 U
1,2,3,6,7,8-HxCDD	pg/100 cm^2	0.1	2.8 U	1.6 U	4.4 U	6.2 U	3.3 U	1.2 U	0.36 U	0.6 U
	TEQ (ng/m^2)		7.72	1.30	9.78	33.22	10.30	< 0.44	< 0.14	< 0.14

*2005 World Health Organization toxic equivalency factors used to calculate TEQ values.

Table E-1 (continued). Analytical Results for Dioxin Furan Analysis (EPA method 8290) with Calculated Toxic Equivalence Values (TEQ*). Results of detected compounds are highlighted in yellow.

		Sample #	65	66	67	68	69	70	71	72
		Aircraft	55-4532	55-4532	55-4532	55-4532	55-4532	55-4532	55-4532	55-4532
Analyte	**Units**	**TEF***								
2,3,7,8-TCDF	pg/100 cm^2	0.1	1.7 U	1.6 U	2.1 U	1.8 U	2.3 U	1.9 U	6.2 U	8.6 U
1,2,3,7,8-PeCDF	pg/100 cm^2	0.03	2.9 U	2.8 U	3.4 U	3 U	4 U	3.4 U	3.7 U	4.3 U
2,3,4,7,8-PeCDF	pg/100 cm^2	0.3	3.1 U	3 U	3.7 U	3.3 U	4.3 U	3.7 U	4 U	4.7 U
1,2,3,4,7,8-HxCDF	pg/100 cm^2	0.1	2.1 U	2.1 U	2.9 U	2.2 U	5.1 U	3.9 U	6.7 U	4.5 U
2,3,4,6,7,8-HxCDF	pg/100 cm^2	0.1	2 U	2 U	2.7 U	2.1 U	2.4 U	2.2 U	2.5 U	2.5 U
1,2,3,7,8,9-HxCDF	pg/100 cm^2	0.1	2.2 U	2.2 U	3 U	2.3 U	2.6 U	2.4 U	2.8 U	2.7 U
1,2,3,4,6,7,8-HpCDF	pg/100 cm^2	0.01	2.2 U	1.9 U	2.3 U	2 U	2.4 U	2.1 U	14 U	12 U
OCDF	pg/100 cm^2	0.0003	5.1 U	4.9 U	5.9 U	5.7 U	6.4 U	6.8 U	18 U	15 U
Total TCDF	pg/100 cm^2		1.7 U	1.6 U	2.1 U	1.8 U	3.4 U	3.6 U	6.2 U	8.6 U
Total PeCDF	pg/100 cm^2		3.6 U	3.4 U	4.1 U	3.6 U	4.3 U	4.3 U	15 U	13 U
Total HxCDF	pg/100 cm^2		2.2 U	2.2 U	3 U	2.3 U	5.1 U	3.9 U	6.7 U	5.9 U
Total HpCDF	pg/100 cm^2		2.6 U	2.2 U	2.8 U	2.4 U	2.8 U	2.5 U	14 U	12 U
Total TCDD	pg/100 cm^2		4 U	3.8 U	4.4 U	4.6 U	4.2 U	4.5 U	240	260
2,3,7,8-TCDD	pg/100 cm^2	1	4 U	3.8 U	4.4 U	4.6 U	4.2 U	4.5 U	240	250
Total PeCDD	pg/100 cm^2		5.3 U	5.3 U	8.7 U	6 U	6 U	11 U	11 U	12 U
1,2,3,7,8-PeCDD	pg/100 cm^2	1	4.7 U	4.8 U	6 U	6 U	6 U	5.4 U	11 U	7 U
Total HxCDD	pg/100 cm^2		4 U	3.8 U	5.2 U	4.4 U	5.6 U	5.5 U	33 U	37 U
1,2,3,7,8,9-HxCDD	pg/100 cm^2	0.1	3.2 UJ	3 UJ	4.1 UJ	3.5 UJ	4.4 UJ	3.9 UJ	5.7 UJ	5.4 UJ
Total HpCDD	pg/100 cm^2		3.2 U	3.1 U	4.1 U	4 U	11 U	10 U	50 U	46 U
1,2,3,4,6,7,8-HpCDD	pg/100 cm^2	0.01	3.2 U	3.1 U	4.1 U	4 U	11 U	10 U	50 U	46 U
OCDD	pg/100 cm^2	0.0003	10 U	9.2 U	9.4 U	13 U	26 U	25 U	270	250
1,2,3,6,7,8-HxCDF	pg/100 cm^2	0.1	1.7 U	1.7 U	2.4 U	1.8 U	2 U	1.9 U	2.8 U	2.1 U
1,2,3,4,7,8,9-HpCDF	pg/100 cm^2	0.01	2.6 U	2.2 U	2.8 U	2.4 U	2.8 U	2.5 U	3.2 U	2.9 U
1,2,3,4,7,8-HxCDD	pg/100 cm^2	0.1	4 U	3.8 U	5.2 U	4.4 U	5.6 U	4.9 U	5.4 U	4.9 U
1,2,3,6,7,8-HxCDD	pg/100 cm^2	0.1	3 U	2.8 U	3.9 U	3.3 U	4.2 U	3.7 U	9.2 U	12 U
	TEQ (ng/m^2)		< 1.18	< 1.16	< 1.43	< 1.39	< 1.46	< 1.37	25.72	26.35

*2005 World Health Organization toxic equivalency factors used to calculate TEQ values.

Table E-1 (continued). Analytical Results for Dioxin Furan Analysis (EPA method 8290) with Calculated Toxic Equivalence Values (TEQ*). Results of detected compounds are highlighted in yellow.

		Sample #	73	74	75	76	77	78	79	80
		Aircraft	55-4532	55-4532	55-4532	55-4532	55-4532	55-4532	55-4532	55-4532
Analyte	**Units**	**TEF***								
2,3,7,8-TCDF	pg/100 cm^2	0.1	5.9 U	8.4 U	2.5 U	3.2 U	5.3 U	0.48 U	0.41 U	0.74 U
1,2,3,7,8-PeCDF	pg/100 cm^2	0.03	1.8 U	2.4 U	0.96 U	0.64 U	1.4 U	0.44 U	0.38 U	0.95 U
2,3,4,7,8-PeCDF	pg/100 cm^2	0.3	2.5 U	2.9 U	0.75 U	1.8 U	2.1 U	0.46 U	0.34 U	0.66 U
1,2,3,4,7,8-HxCDF	pg/100 cm^2	0.1	3.3 U	4.1 U	2.9 U	3.5 U	5.1 U	0.35 U	0.47 U	1.3 U
2,3,4,6,7,8-HxCDF	pg/100 cm^2	0.1	1.2 U	1.6 U	1.1 U	1.6 U	1.9 U	0.24 U	0.18 U	0.45 U
1,2,3,7,8,9-HxCDF	pg/100 cm^2	0.1	0.95 U	0.38 U	0.75 U	0.28 U	0.79 U	0.27 U	0.4 U	0.91 U
1,2,3,4,6,7,8-HpCDF	pg/100 cm^2	0.01	9 U	7.8 U	5.2 U	8.1 U	10 U	0.37 U	0.9 U	0.89 U
OCDF	pg/100 cm^2	0.0003	12 U	6.7 U	5.1 U	7.3 U	11 U	0.82 U	1.3 U	4.2 U
Total TCDF	pg/100 cm^2		23 V	8.4 U	2.5 U	3.2 U	5.3 U	0.48 U	0.44 U	0.74 U
Total PeCDF	pg/100 cm^2		35 U	21 U	4.2 U	8.9 U	11 U	0.66 U	0.48 U	0.95 U
Total HxCDF	pg/100 cm^2		7.2 U	8.5 U	3.4 U	5.5 U	6.2 U	0.83 U	0.47 U	1.3 U
Total HpCDF	pg/100 cm^2		9 U	7.8 U	5.2 U	8.1 U	10 U	0.4 U	0.9 U	1.2 U
Total TCDD	pg/100 cm^2		290	120	48	81	130	2.1 U	0.5 U	0.91 U
2,3,7,8-TCDD	pg/100 cm^2	1	280	120	48	81	130	2.1 U	0.5 U	0.91 U
Total PeCDD	pg/100 cm^2		21 U	15 U	12 U	26 U	13 U	1.3 U	0.59 U	1.2 U
1,2,3,7,8-PeCDD	pg/100 cm^2	1	8.2 U	5.5 U	12 U	26 U	13 U	1.3 U	0.54 U	1.2 U
Total HxCDD	pg/100 cm^2		34 U	22 U	35 U	180	39 U	1 U	0.75 U	1.3 U
1,2,3,7,8,9-HxCDD	pg/100 cm^2	0.1	9 U	3.8 U	6.3 U	18 U	10 U	0.5 U	0.38 U	1.2 U
Total HpCDD	pg/100 cm^2		61	28 U	30 U	190	110	2.1 U	2.2 U	2.2 U
1,2,3,4,6,7,8-HpCDD	pg/100 cm^2	0.01	61 J	23 U	27 U	91 J	56 J	2 U	1.6 U	2.2 U
OCDD	pg/100 cm^2	0.0003	170 J	95 U	53 U	120 J	120 J	4.1 U	5.2 U	8 U
1,2,3,6,7,8-HxCDF	pg/100 cm^2	0.1	1.5 U	1.9 U	1 U	1.4 U	1.8 U	0.83 U	0.41 U	0.7 U
1,2,3,4,7,8,9-HpCDF	pg/100 cm^2	0.01	1.4 U	0.72 U	0.76 U	0.85 U	2 U	0.4 U	0.49 U	1.2 U
1,2,3,4,7,8-HxCDD	pg/100 cm^2	0.1	0.39 U	2.4 U	9.2 U	21 U	11 U	0.64 U	0.43 U	0.58 U
1,2,3,6,7,8-HxCDD	pg/100 cm^2	0.1	17 U	5.8 U	10 U	31 U	16 U	1 U	0.5 U	1.3 U
	TEQ (ng/m^2)		29.37	12.96	6.40	11.66	14.96	< 0.4	< 0.15	< 0.31

*2005 World Health Organization toxic equivalency factors used to calculate TEQ values.

Table E-1 (continued). Analytical Results for Dioxin Furan Analysis (EPA method 8290) with Calculated Toxic Equivalence Values (TEQ*). Results of detected compounds are highlighted in yellow.

		Sample #	97	98	99	100	101	102	103	104
		Aircraft	55-4544	55-4544	55-4544	55-4544	55-4544	55-4544	55-4544	55-4544
Analyte	**Units**	**TEF***								
2,3,7,8-TCDF	pg/100 cm^2	0.1	3.3 U	3.1 U	4.1 U	3.9 U	3.3 U	2.9 U	1.7 U	2 U
1,2,3,7,8-PeCDF	pg/100 cm^2	0.03	5.8 U	4.7 U	6.3 U	5.6 U	4.9 U	4.3 U	2.7 U	3.5 U
2,3,4,7,8-PeCDF	pg/100 cm^2	0.3	6.3 U	5 U	6.8 U	6 U	5.3 U	4.6 U	2.9 U	3.8 U
1,2,3,4,7,8-HxCDF	pg/100 cm^2	0.1	3.8 U	2.8 U	3.9 U	3.7 U	3.2 U	2.4 U	2.1 U	3.7 U
2,3,4,6,7,8-HxCDF	pg/100 cm^2	0.1	3.6 U	2.7 U	3.7 U	3.5 U	3 U	2.3 U	2 U	2.3 U
1,2,3,7,8,9-HxCDF	pg/100 cm^2	0.1	3.9 U	2.9 U	4 U	3.8 U	3.3 U	2.5 U	2.2 U	2.6 U
1,2,3,4,6,7,8-HpCDF	pg/100 cm^2	0.01	3.2 U	3.3 U	4.5 U	6.7 U	3.2 U	2.8 U	2.5 U	15 U
OCDF	pg/100 cm^2	0.0003	8.6 U	7.1 U	8.5 U	7.8 U	7.5 U	7.7 U	4.3 U	30 U
Total TCDF	pg/100 cm^2		3.3 U	3.1 U	4.1 U	3.9 U	3.3 U	2.9 U	1.7 U	2 U
Total PeCDF	pg/100 cm^2		7.3 U	5.9 U	7.4 U	6 U	5.3 U	4.9 U	3.1 U	4.3 U
Total HxCDF	pg/100 cm^2		3.9 U	2.9 U	4 U	7.3 U	3.3 U	2.5 U	2.2 U	5.1 U
Total HpCDF	pg/100 cm^2		3.8 U	3.9 U	4.5 U	6.7 U	3.7 U	3.3 U	2.5 U	17 U
Total TCDD	pg/100 cm^2		5.5 U	5.1 U	6.3 U	5.7 U	4.9 U	4.8 U	2.8 U	15
2,3,7,8-TCDD	pg/100 cm^2	1	5.5 U	5.1 U	6.3 U	5.7 U	4.9 U	4.8 U	2.8 U	15 J
Total PeCDD	pg/100 cm^2		10 U	9.2 U	11 U	8.9 U	8.5 U	7.2 U	5.8 U	5.7 U
1,2,3,7,8-PeCDD	pg/100 cm^2	1	10 U	9.2 U	11 U	8.9 U	8.5 U	7.2 U	3.9 U	5.7 U
Total HxCDD	pg/100 cm^2		7.5 U	6.4 U	7.6 U	5.6 U	7.3 U	6.1 U	4.1 U	9 U
1,2,3,7,8,9-HxCDD	pg/100 cm^2	0.1	5.9 U	5 U	5.9 U	5.2 U	5.7 U	4.8 U	3.2 UJ	4 UJ
Total HpCDD	pg/100 cm^2		4.8 U	4.7 U	6.1 U	6.3 U	5.6 U	5.5 U	10 U	60
1,2,3,4,6,7,8-HpCDD	pg/100 cm^2	0.01	4.8 U	4.7 U	6.1 U	5.1 U	5.6 U	5.5 U	10 U	60 J
OCDD	pg/100 cm^2	0.0003	8.5 U	5.8 U	7.3 U	9.2 U	7.1 U	5.7 U	68 U	430
1,2,3,6,7,8-HxCDF	pg/100 cm^2	0.1	3.1 U	2.3 U	3.2 U	3 U	2.6 U	2 U	1.7 U	2 U
1,2,3,4,7,8,9-HpCDF	pg/100 cm^2	0.01	3.8 U	3.9 U	3.6 U	3.3 U	3.7 U	3.3 U	2.1 U	3 U
1,2,3,4,7,8-HxCDD	pg/100 cm^2	0.1	7.5 U	6.4 U	7.6 U	6.7 U	7.3 U	6.1 U	4.1 U	5.1 U
1,2,3,6,7,8-HxCDD	pg/100 cm^2	0.1	5.6 U	4.8 U	5.7 U	5 U	5.5 U	4.6 U	3.1 U	3.8 U
	TEQ (ng/m^2)		< 2.14	< 1.91	< 2.35	< 2.02	< 1.87	< 1.64	< 0.98	2.54 J

*2005 World Health Organization toxic equivalency factors used to calculate TEQ values.

Table E-1 (continued). Analytical Results for Dioxin Furan Analysis (EPA method 8290) with Calculated Toxic Equivalence Values (TEQ*). Results of detected compounds are highlighted in yellow.

		Sample #	105	106	107	108	109	110	111	112
		Aircraft	55-4544	55-4544	55-4544	55-4544	55-4544	55-4544	55-4544	55-4544
Analyte	**Units**	**TEF***								
2,3,7,8-TCDF	pg/100 cm^2	0.1	2 U	2.4 U	1.7 U	2.1 U	1.7 U	0.56 U	2.6 U	2.4 U
1,2,3,7,8-PeCDF	pg/100 cm^2	0.03	4 U	3.6 U	3 U	3.2 U	3.1 U	0.36 U	4.2 U	4.2 U
2,3,4,7,8-PeCDF	pg/100 cm^2	0.3	4.3 U	3.8 U	3.2 U	3.5 U	3.4 U	0.38 U	4.5 U	4.5 U
1,2,3,4,7,8-HxCDF	pg/100 cm^2	0.1	2.8 U	3.8 U	2.1 U	2.2 U	2.3 U	0.22 U	3.2 U	3 U
2,3,4,6,7,8-HxCDF	pg/100 cm^2	0.1	2.7 U	2.9 U	2 U	2.1 U	2.2 U	0.2 U	3.1 U	2.9 U
1,2,3,7,8,9-HxCDF	pg/100 cm^2	0.1	2.9 U	3.2 U	2.2 U	2.3 U	2.4 U	0.23 U	3.4 U	3.1 U
1,2,3,4,6,7,8-HpCDF	pg/100 cm^2	0.01	7.5 U	16 U	2.8 U	2.7 U	2.7 U	0.5 U	2.3 U	2.3 U
OCDF	pg/100 cm^2	0.0003	15 U	28 U	5 U	4.4 U	9.9 U	1.4 U	7.6 U	6.8 U
Total TCDF	pg/100 cm^2		2 U	2.4 U	1.7 U	2.1 U	1.7 U	0.56 U	2.6 U	2.4 U
Total PeCDF	pg/100 cm^2		4.3 U	4.1 U	3.2 U	3.8 U	3.6 U	0.55 U	4.6 U	4.7 U
Total HxCDF	pg/100 cm^2		2.9 U	5.2 U	2.2 U	2.3 U	2.4 U	0.29 U	3.4 U	3.1 U
Total HpCDF	pg/100 cm^2		7.5 U	17 U	2.8 U	2.7 U	2.7 U	0.5 U	2.8 U	2.8 U
Total TCDD	pg/100 cm^2		5 U	8.7 U	3.4 U	3.1 U	3.2 U	0.55 U	4.8 U	4.6 U
2,3,7,8-TCDD	pg/100 cm^2	1	5 U	8.7 U	3.4 U	3.1 U	3.2 U	0.55 U	4.8 U	4.6 U
Total PeCDD	pg/100 cm^2		5.4 U	6.3 U	4.9 U	6.1 U	5.8 U	0.75 U	8.3 U	7.7 U
1,2,3,7,8-PeCDD	pg/100 cm^2	1	5.4 U	6.3 U	4.8 U	4.9 U	5.4 U	0.75 U	8.3 U	7.7 U
Total HxCDD	pg/100 cm^2		4.9 U	19 U	4.8 U	4 U	4.5 U	1.2 U	5.9 U	5.9 U
1,2,3,7,8,9-HxCDD	pg/100 cm^2	0.1	3.9 UJ	3.8 UJ	3.8 UJ	3.1 UJ	3.5 UJ	0.68 U	4.6 U	4.6 U
Total HpCDD	pg/100 cm^2		27 U	120	10 U	8.2 U	6.9 U	2.1 U	6.1 U	5 U
1,2,3,4,6,7,8-HpCDD	pg/100 cm^2	0.01	27 U	66 J	9.9 U	8.2 U	6.9 U	0.9 U	6.1 U	5 U
OCDD	pg/100 cm^2	0.0003	230	420	57 U	30 U	26 U	3.1 U	7.8 U	5.6 U
1,2,3,6,7,8-HxCDF	pg/100 cm^2	0.1	2.3 U	2.5 U	1.7 U	1.8 U	1.9 U	0.29 U	2.7 U	2.4 U
1,2,3,4,7,8,9-HpCDF	pg/100 cm^2	0.01	2.8 U	3.4 U	2.8 U	2.5 U	2.8 U	0.38 U	2.8 U	2.8 U
1,2,3,4,7,8-HxCDD	pg/100 cm^2	0.1	4.9 U	4.8 U	4.8 U	4 U	4.5 U	0.37 U	5.9 U	5.9 U
1,2,3,6,7,8-HxCDD	pg/100 cm^2	0.1	3.7 U	3.6 U	3.6 U	3 U	3.3 U	0.27 U	4.4 U	4.4 U
	TEQ (ng/m^2)		1.48	1.99 J	< 1.16	< 1.14	< 1.2	< 0.17	< 1.77	< 1.68

*2005 World Health Organization toxic equivalency factors used to calculate TEQ values.

Table E-1 (continued). Analytical Results for Dioxin Furan Analysis (EPA method 8290) with Calculated Toxic Equivalence Values (TEQ*). Results of detected compounds are highlighted in yellow.

		Sample #	129	130	131	140	143	144
		Aircraft	Tank	Tank	Tank			
Analyte	**Units**	**TEF***						
2,3,7,8-TCDF	pg/100 cm^2	0.1	18 J	2.6 U	2.5 U	1.8 U	1.9 U	1.8 U
1,2,3,7,8-PeCDF	pg/100 cm^2	0.03	3 U	4.4 U	4.4 U	3.3 U	3.4 U	3.3 U
2,3,4,7,8-PeCDF	pg/100 cm^2	0.3	3.2 U	4.8 U	4.8 U	3.5 U	3.6 U	3.6 U
1,2,3,4,7,8-HxCDF	pg/100 cm^2	0.1	2.3 U	2.9 U	2.8 U	2.4 U	2.5 U	1.9 U
2,3,4,6,7,8-HxCDF	pg/100 cm^2	0.1	2.2 U	2.8 U	2.7 U	2.3 U	2.4 U	1.8 U
1,2,3,7,8,9-HxCDF	pg/100 cm^2	0.1	2.4 U	3.1 U	2.9 U	2.5 U	2.6 U	2 U
1,2,3,4,6,7,8-HpCDF	pg/100 cm^2	0.01	3.1 U	2.6 U	2.4 U	2.6 U	2.4 U	2.3 U
OCDF	pg/100 cm^2	0.0003	5.8 U	7.9 U	7.5 U	5.6 U	7.1 U	5.8 U
Total TCDF	pg/100 cm^2		170	2.6 U	2.5 U	1.8 U	1.9 U	1.8 U
Total PeCDF	pg/100 cm^2		81	4.8 U	4.8 U	3.9 U	4 U	3.7 U
Total HxCDF	pg/100 cm^2		2.4 U	3.1 U	2.9 U	2.5 U	2.6 U	2 U
Total HpCDF	pg/100 cm^2		3.1 U	3 U	2.8 U	3.1 U	2.8 U	2.7 U
Total TCDD	pg/100 cm^2		1200	44	7.4 U	3.5 U	3.6 U	3.6 U
2,3,7,8-TCDD	pg/100 cm^2	1	1100	44	7.4 U	3.5 U	3.6 U	3.6 U
Total PeCDD	pg/100 cm^2		9.6 U	8 U	7.6 U	5.2 U	5.6 U	4.6 U
1,2,3,7,8-PeCDD	pg/100 cm^2	1	6.2 U	8 U	7.6 U	5.2 U	5.4 U	4.6 U
Total HxCDD	pg/100 cm^2		15 U	7.7 U	6.4 U	5 U	4.7 U	4.1 U
1,2,3,7,8,9-HxCDD	pg/100 cm^2	0.1	3.7 U	4.4 U	5 U	3.9 U	3.7 U	3.2 U
Total HpCDD	pg/100 cm^2		18 U	7.1 U	6.3 U	4.4 U	4.6 U	4.2 U
1,2,3,4,6,7,8-HpCDD	pg/100 cm^2	0.01	18 U	5.6 U	6.3 U	4.4 U	4.6 U	4.2 U
OCDD	pg/100 cm^2	0.0003	53 U	37 U	25 U	11 U	6.5 U	7.7 U
1,2,3,6,7,8-HxCDF	pg/100 cm^2	0.1	1.9 U	2.4 U	2.3 U	2 U	2 U	1.6 U
1,2,3,4,7,8,9-HpCDF	pg/100 cm^2	0.01	2.4 U	3 U	2.8 U	3.1 U	2.8 U	2.7 U
1,2,3,4,7,8-HxCDD	pg/100 cm^2	0.1	4.8 U	5.7 U	6.4 U	5 U	4.7 U	4.1 U
1,2,3,6,7,8-HxCDD	pg/100 cm^2	0.1	3.6 U	4.2 U	4.8 U	3.7 U	3.5 U	3 U
	TEQ (ng/m^2)		111.14	5.65	< 1.96	< 1.23	< 1.26	< 1.14

*2005 World Health Organization toxic equivalency factors used to calculate TEQ values. **U**=Not detected above the practical quantitation limit. **J**=Estimated value. The result is estimated due to associated QC problems. **UJ**=Estimated detection limit. Result is estimated and may be a false negative due to related QC problems. **JA**=The analyte was positively identified, but the quantitation is an estimate.
Note: TEQ values were only flagged if the primary contributor to the calculated value was flagged.

Table E-2. Analytical Results for Herbicide Analysis (EPA method 8151A). Results of detected compounds are highlighted in yellow.

	Sample #	18	19	20	21	22	23	24	25	26
	Aircraft	54-0585	54-0585	54-0585	54-0585	54-0585	54-0585	54-0585	54-0585	54-0585
Analyte	**Units**									
Dinoseb	µg/100 cm^2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCPA*	µg/100 cm^2	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U
Mecoprop (MCPP)	µg/100 cm^2	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U
2,4,5-T	µg/100 cm^2	1 U	1 U	1 U	0.51 J	0.92 J	1 U	2.3 V	1 U	1 U
2,4,5-TP	µg/100 cm^2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2,4-D	µg/100 cm^2	5 U	5 U	5 U	5 U	5 U	5 U	1.5 J	5 U	5 U
Dalapon	µg/100 cm^2	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ
2,4-DB	µg/100 cm^2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dicamba	µg/100 cm^2	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ

*4-Chloro-2-methylphenoxyacetic acid

	Sample #	27	28	29	30	31	32	49	50	51
	Aircraft	54-0585	54-0585	54-0585	54-0585	54-0585	54-0585	55-4571	55-4571	55-4571
Analyte	**Units**									
Dinoseb	µg/100 cm^2	1 U	1 U	1 U	0.6 U	1 U	1 U	1 U	1 U	1 U
MCPA*	µg/100 cm^2	500 U	500 U	500 U	400 U	500 U	500 U	500 U	500 U	500 U
Mecoprop (MCPP)	µg/100 cm^2	500 U	500 U	500 U	400 U	500 U	500 U	500 U	500 U	500 U
2,4,5-T	µg/100 cm^2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2,4,5-TP	µg/100 cm^2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2,4-D	µg/100 cm^2	5 U	5 U	5 U	4 U	5 U	5 U	5 U	5 U	5 U
Dalapon	µg/100 cm^2	3 UJ	3 UJ	3 UJ	2 UJ	3 UJ	3 UJ	3 U	3 U	3 U
2,4-DB	µg/100 cm^2	5 U	5 U	5 U	4 U	5 U	5 U	5 U	5 U	5 U
Dicamba	µg/100 cm^2	3 UJ	3 UJ	3 UJ	2 UJ	3 UJ	3 UJ	3 U	3 U	3 U

*4-Chloro-2-methylphenoxyacetic acid

Table E-2 (continued). Analytical Results for Herbicide Analysis (EPA method 8151A). Results of detected compounds are highlighted in yellow.

	Sample #	52	53	54	55	56	57	58	59	60
	Aircraft	55-4571	55-4571	55-4571	55-4571	55-4571	55-4571	55-4571	55-4571	55-4571
Analyte	**Units**									
Dinoseb	µg/100 cm^2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCPA*	µg/100 cm^2	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U
Mecoprop (MCPP)	µg/100 cm^2	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U
2,4,5-T	µg/100 cm^2	1 U	4.9	1	3.6	3.1	2.6	6	7.2	8.4
2,4,5-TP	µg/100 cm^2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2,4-D	µg/100 cm^2	5 U	5.4	1.1 J	5.2	2.5 J	1.8 J	16	10	7.8
Dalapon	µg/100 cm^2	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
2,4-DB	µg/100 cm^2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dicamba	µg/100 cm^2	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U

*4-Chloro-2-methylphenoxyacetic acid

	Sample #	61	62	63	64	81	82	83	84	85
	Aircraft	55-4571	55-4571	55-4571	55-4571	55-4532	55-4532	55-4532	55-4532	55-4532
Analyte	**Units**									
Dinoseb	µg/100 cm^2	1 U	0.6 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCPA*	µg/100 cm^2	500 U	400 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U
Mecoprop (MCPP)	µg/100 cm^2	500 U	400 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U
2,4,5-T	µg/100 cm^2	9.8	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2,4,5-TP	µg/100 cm^2	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
2,4-D	µg/100 cm^2	12	4 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dalapon	µg/100 cm^2	3 U	2 UJ	3 U	3 U	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ
2,4-DB	µg/100 cm^2	5 U	4 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dicamba	µg/100 cm^2	3 U	2 UJ	3 U	3 U	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ

*4-Chloro-2-methylphenoxyacetic acid

Table E-2 (continued). Analytical Results for Herbicide Analysis (EPA method 8151A). Results of detected compounds are highlighted in yellow.

	Sample #	86	87	88	89	90	91	92	93	94
	Aircraft	55-4532	55-4532	55-4532	55-4532	55-4532	55-4532	55-4532	55-4532	55-4532
Analyte	**Units**									
Dinoseb	µg/100 cm^2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.6 U
MCPA*	µg/100 cm^2	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	400 U
Mecoprop (MCPP)	µg/100 cm^2	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 UJ	400 U
2,4,5-T	µg/100 cm^2	1 U	10	1	2.4	11	6.5	0.37 J	3.9	1 U
2,4,5-TP	µg/100 cm^2	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U
2,4-D	µg/100 cm^2	5 U	8.1	5 U	1.4 J	12	5.6	5 U	4.5 J	4 U
Dalapon	µg/100 cm^2	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 U	2 U
2,4-DB	µg/100 cm^2	5 U	5 U	5 U	5 U	0.77 JJ	5 U	5 U	5 U	4 U
Dicamba	µg/100 cm^2	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 U	2 U

*4-Chloro-2-methylphenoxyacetic acid

	Sample #	95	96	113	114	115	116	118	119	120
	Aircraft	55-4532	55-4532	55-4544	55-4544	55-4544	55-4544	55-4544	55-4544	55-4544
Analyte	**Units**									
Dinoseb	µg/100 cm^2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCPA*	µg/100 cm^2	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U
Mecoprop (MCPP)	µg/100 cm^2	500 UJ	500 UJ	500 UJ	500 UJ	500 UJ	810 JJ	130 J	500 U	500 U
2,4,5-T	µg/100 cm^2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2,4,5-TP	µg/100 cm^2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2,4-D	µg/100 cm^2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dalapon	µg/100 cm^2	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 UJ	3 UJ
2,4-DB	µg/100 cm^2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dicamba	µg/100 cm^2	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 UJ	3 UJ

*4-Chloro-2-methylphenoxyacetic acid

U= Not detected above the practical quantitation limit.

Table E-2 (continued). Analytical Results for Herbicide Analysis (EPA method 8151A). Results of detected compounds are highlighted in yellow.

	Sample #	121	122	123	124	125	126	127	128	132
	Aircraft	55-4544	55-4544	55-4544	55-4544	55-4544	55-4544	55-4544	55-4544	Tank
Analyte	**Units**									
Dinoseb	µg/100 cm^2	1 U	1 U	1 U	1 U	1 U	0.6 U	1 U	1 U	500 U
MCPA*	µg/100 cm^2	500 U	500 U	500 U	500 U	500 U	400 U	500 U	500 U	250000 U
Mecoprop (MCPP)	µg/100 cm^2	500 U	500 U	500 U	500 U	500 U	400 U	500 U	500 UJ	250000 U
2,4,5-T	µg/100 cm^2	1 U	0.22 JJ	1 U	1 U	1 U	1 U	1 U	1 U	2800
2,4,5-TP	µg/100 cm^2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	500 U
2,4-D	µg/100 cm^2	5 U	5 U	5 U	5 U	5 U	4 U	5 U	5 U	1200 J
Dalapon	µg/100 cm^2	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	2 UJ	3 UJ	3 U	1500 UJ
2,4-DB	µg/100 cm^2	5 U	5 U	5 U	5 U	5 U	4 U	5 U	5 U	2500 U
Dicamba	µg/100 cm^2	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	2 UJ	3 UJ	3 U	1500 UJ

*4-Chloro-2-methylphenoxyacetic acid

	Sample #	133	134	142	145	146
	Aircraft	Tank	Tank			
Analyte	**Units**					
Dinoseb	µg/100 cm^2	0.83 JJ	1 U	0.6 U	0.6 U	0.6 U
MCPA*	µg/100 cm^2	500 U	500 U	400 U	400 U	400 U
Mecoprop (MCPP)	µg/100 cm^2	500 U	500 U	400 U	400 U	400 U
2,4,5-T	µg/100 cm^2	1.5	0.44 J	1 U	1 U	1 U
2,4,5-TP	µg/100 cm^2	1 U	1 U	1U	1U	1U
2,4-D	µg/100 cm^2	5 U	5 U	4 U	4 U	4 U
Dalapon	µg/100 cm^2	3 UJ	3 UJ	2 U	2 U	2 U
2,4-DB	µg/100 cm^2	5 U	5 U	4 U	4 U	4 U
Dicamba	µg/100 cm^2	3 UJ	3 UJ	2 U	2 U	2 U

*4-Chloro-2-methylphenoxyacetic acid

J=Estimated result. Result is less than reporting limit

JJ= Estimated result. Agreement between first and second column results is not within +/- 40%

U=Not detected above the practical quantitation limit.

UJ=Estimated detection limit. Result is estimated and may be a false negative due to related QC problems.

Table E-3. Analytical Results for Dioxin Furan Analysis of air samples(EPA method 8290) with Calculated Toxic Equivalence Values (TEQ*). Results are presented in pg/m^3.

	Sample #	14	46	78	110	140	143	144
	Aircraft	54-0585	55-4571	55-4532	55-4544	na	na	na
Analyte	**Units**							
2,3,7,8-TCDF	pg/m^3	< 0.59	< 0.64	< 0.49	< 0.58	na	< 1.95	< 1.85
1,2,3,7,8-PeCDF	pg/m^3	< 0.56	< 0.52	< 0.45	< 0.37	na	< 3.48	< 3.39
2,3,4,7,8-PeCDF	pg/m^3	< 0.59	< 0.55	< 0.47	< 0.39	na	< 3.69	< 3.7
1,2,3,4,7,8-HxCDF	pg/m^3	< 0.53	< 0.86	< 0.36	< 0.23	na	< 2.56	< 1.95
2,3,4,6,7,8-HxCDF	pg/m^3	< 0.77	< 0.61	< 0.25	< 0.21	na	< 2.46	< 1.85
1,2,3,7,8,9-HxCDF	pg/m^3	< 0.47	< 0.33	< 0.28	< 0.24	na	< 2.66	< 2.06
1,2,3,4,6,7,8-HpCDF	pg/m^3	< 0.44	< 0.73	< 0.38	< 0.52	na	< 2.46	< 2.36
OCDF	pg/m^3	< 0.58	< 0.75	< 0.84	< 1.44	na	< 7.28	< 5.96
Total TCDF	pg/m^3	< 0.59	< 0.64	< 0.49	< 0.58	na	< 1.95	< 1.85
Total PeCDF	pg/m^3	< 0.93	< 0.84	< 0.67	< 0.57	na	< 4.1	< 3.8
Total HxCDF	pg/m^3	< 0.77	< 0.86	< 0.85	< 0.3	na	< 2.66	< 2.06
Total HpCDF	pg/m^3	< 0.54	< 0.73	< 0.41	< 0.52	na	< 2.87	< 2.77
Total TCDD	pg/m^3	< 0.58	< 2.45	< 2.15	< 0.57	na	< 3.69	< 3.7
2,3,7,8-TCDD	pg/m^3	< 0.58	< 2.45	< 2.15	< 0.57	na	< 3.69	< 3.7
Total PeCDD	pg/m^3	< 1.02	< 1.33	< 1.33	< 0.77	na	< 5.74	< 4.73
1,2,3,7,8-PeCDD	pg/m^3	< 1.02	< 1.33	< 1.33	< 0.77	na	< 5.53	< 4.73
Total HxCDD	pg/m^3	< 1.22	< 1.23	< 1.02	< 1.24	na	< 4.82	< 4.21
1,2,3,7,8,9-HxCDD	pg/m^3	< 0.63	< 0.88	< 0.51	< 0.7	na	< 3.79	< 3.29
Total HpCDD	pg/m^3	< 2.13	< 2.04	< 2.15	< 2.17	na	< 4.71	< 4.32
1,2,3,4,6,7,8-HpCDD	pg/m^3	< 1.22	< 1.43	< 2.04	< 0.93	na	< 4.71	< 4.32
OCDD	pg/m^3	< 6.4	< 4.81	< 4.19	< 3.2	na	< 6.66	< 7.91
1,2,3,6,7,8-HxCDF	pg/m^3	< 0.51	< 0.26	< 0.85	< 0.3	na	< 2.05	< 1.64
1,2,3,4,7,8,9-HpCDF	pg/m^3	< 0.54	< 0.56	< 0.41	< 0.39	na	< 2.87	< 2.77
1,2,3,4,7,8-HxCDD	pg/m^3	< 0.5	< 0.52	< 0.65	< 0.38	na	< 4.82	< 4.21
1,2,3,6,7,8-HxCDD	pg/m^3	< 0.58	< 1.23	< 1.02	< 0.28	na	< 3.59	< 3.08
TEQ	pg/m^3	< 2.23	< 4.5	< 4.09	< 1.75	na	< 12.91	< 11.71

*2005 World Health Organization toxic equivalency factors used to calculate TEQ values.

Table E-4. Analytical Results for Herbicide Analysis of air samples (EPA method 8151A). Results are presented in µg/m^3.

	Sample #	30	62	94	126	142	145	146
	Aircraft	54-0585	55-4571	55-4532	55-4544	na	na	na
Analyte	**Units**							
Dinoseb	µg/m^3	< 4.8	< 4.8	< 4.8	< 5	na	< 5	< 4.8
MCPA*	µg/m^3	< 3167	< 3193	< 3221	< 3317	na	< 3333	< 3208
Mecoprop (MCPP)	µg/m^3	< 3167	< 3193	< 3221	< 3317	na	< 3333	< 3208
2,4,5-T	µg/m^3	< 7.9	< 8	< 8.1	< 8.3	na	< 8.3	< 8
2,4,5-TP	µg/m^3	< 7.9	< 8	< 8.1	< 8.3	na	< 8.3	< 8
2,4-D	µg/m^3	< 31.7	< 31.9	< 32.2	< 33.2	na	< 33.3	< 32.1
Dalapon	µg/m^3	< 15.8	< 16	< 16.1	< 16.6	na	< 16.7	< 16
2,4-DB	µg/m^3	< 31.7	< 31.9	< 32.2	< 33.2	na	< 33.3	< 32.1
Dicamba	µg/m^3	< 15.8	< 16	< 16.1	< 16.6	na	< 16.7	< 16

*4-Chloro-2-methylphenoxyacetic acid

na=not applicable, field blank.

APPENDIX F

Risk Screening Level Assessment

A primary objective of the sampling of the U123 aircraft is to obtain data that can be used to assess what controls, if any, may be needed to ensure protection of the health and safety of recycling personnel. The proposed surface contamination sampling will provide information on amounts of chemicals present on the surface of the planes. Given the types of contaminants, the primary routes of exposure for the recycling workers will be dermal absorption for herbicides and both dermal absorption and ingestion for dioxins/furans. If any contaminants are present in dust (loose contamination), inhalation is a potential exposure route.

It is important to note that the Occupational Safety and Health Administration (OSHA) has not established surface contamination limits. So the problem is how to relate surface contamination to potential personnel exposure via ingestion or dermal absorption. The contaminants of concern do not have associated inhalation toxicity data, and thus, the inhalation pathway can not be estimated. In order to derive some estimates of risk-based surface contamination limits, the following methodologies were employed:

- Herbicides: Screening levels derived from the methodology based on calculation of risk-based guidance levels for evaluation of surface contamination, Agency for Toxic Substances and Disease Registry (ASTDR) and the Environmental Protection Agency (EPA) Dermal Assessment Guidance.
- Dioxins/Furans: Screening levels derived from the methodology based on calculation of risk-based guidance levels for evaluation of surface contamination, Agency for Toxic Substances and Disease Registry (ASTDR) and the Environmental Protection Agency (EPA) Dermal Assessment Guidance.

Nuisance dust may also be of concern. The surface contamination samples will not be analyzed for total dust; however, air samples will be collected within each plane. The data from the air samples may be compared to the OSHA permissible exposure level (PEL) for nuisance dust as a guide to assess whether respiratory protection may be warranted to protect the health and safety of the recycling personnel.

The attached spreadsheet (found in Appendix I, on the included CD-ROM) provides the derivation of preliminary screening levels that may be appropriate for evaluating the results from the surface contamination swipe samples. The screening levels are also summarized below in Table 1.

Table 1. Preliminary Screening Levels for the Assessment of Surface Contamination and Nuisance

Chemical	Dermal Screening Level (µg/100 cm^2)	Oral Screening Level (µg/100 cm^2)	Total Screening Level (µg/100 cm^2)
1-(3-chlorophenyl)piperazine dihydrochloride (MCPP)	0.206	100	100
2,4,5-TP (Silvex)	1.65		1.65
2,4,5-Trichlorophenoxyacetic acid, (2,4,5-T)	2.06	1000	1000
2,4-Dichlorophenoxyacetic acid, (2,4-D)	2.06	1000	1000
2-Methyl-4-chlorophenoxyacetic Acid, (MCPA)	0.103	51	51.1
3,5-Dichlorobenzoic acid			
4-(2,4-dichlorophenoxy)butyric acid, (2,4-DB)	1.65	820	822
4-Nitrophenol			
5-Hydroxydicamba			
Acifluorfen			
Bentazon	6.18	3100	3110
Chloramben	3.09	1500	1500
Dalapon	6.18	3100	3110
DCPA (Dacthal)	2.06	1400	1400
Dicamba	6.18	3100	3110
Dichloroprop			
Dinoseb	0.206	100	100
Hexane	12.4	6100	6110
Malathion	4.12	2000	2000
Pentachlorophenol	6.18	240	252
Picloram	14.4	7200	7210
Polychlorinated Dibenzodioxins	0.0000111	0.00022	0.000231
Polychlorinated Dibenzofurans	0.0000962	0.00019	0.000286
Nuisance Dust Respirable fraction Total dust	 5 mg/m^3 15 mg/m^3		

For comparisons, the Memorandum for Employee and Public Access to the C-123 Plane ("Patches") dated 26 February 1997 listed a screening level for dioxins of 0.25 ng/100cm^2 (25 ng/m^2). The above screening level for dioxins is equivalent to 0.23 to 0.28 ng/100cm^2 (23 to 28 ng/m^2). Minor differences in the screening levels are most likely attributable to exposure assumptions concerning skin surface areas and exposure contact rates and updates in toxicity data. A paper deriving screening levels resulting from the 9/11 incident (World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential

Concern and Setting Health-Based Benchmarks, May 2003) indicated a screening level of 2 ng/m^2. The conclusion is that the above screening levels are most likely conservative and protective of health.

APPENDIX G

Statistical Calculations

Statistical Output from the USEPA Pro UCL program:

Data File	4571-TEQ
Number of Valid Samples	9
Number of Distinct Samples	9
Minimum	1.3
Maximum	33.22
Mean	14.95889
Median	10.3
Standard Deviation	10.85939
Variance	117.9264
Coefficient of Variation	0.725949
Skewness	0.524475
Shapiro-Wilk Test Statisitic	0.94167
Shapiro-Wilk 5% Critical Value	0.829
Data are normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t	21.69007
Data are normal (0.05)	
Recommended UCL to use:	
Use Student's-t UCL	

Data File	4532-TEQ
Number of Valid Samples	7
Number of Distinct Samples	7
Minimum	6.4
Maximum	29.37
Mean	18.20286
Median	14.96
Standard Deviation	8.82901
Variance	77.95142
Coefficient of Variation	0.485034
Skewness	0.086661
Shapiro-Wilk Test Statisitic	0.90357
Shapiro-Wilk 5% Critical Value	0.803
Data are normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t	24.68735
Data are normal (0.05)	
Recommended UCL to use:	
Use Student's-t UCL	

Data	
File	4571-2,4,5-T
Number of Valid Samples	9
Number of Distinct Samples	9
Minimum	100
Maximum	980
Mean	517.7778
Median	490
Standard Deviation	290.4642
Variance	84369.44
Coefficient of Variation	0.560982
Skewness	0.249652
Shapiro-Wilk Test Statisitic	0.97216
Shapiro-Wilk 5% Critical Value	0.829
Data are normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t	697.8218
Data are normal (0.05)	
Recommended UCL to use:	
Use Student's-t UCL	

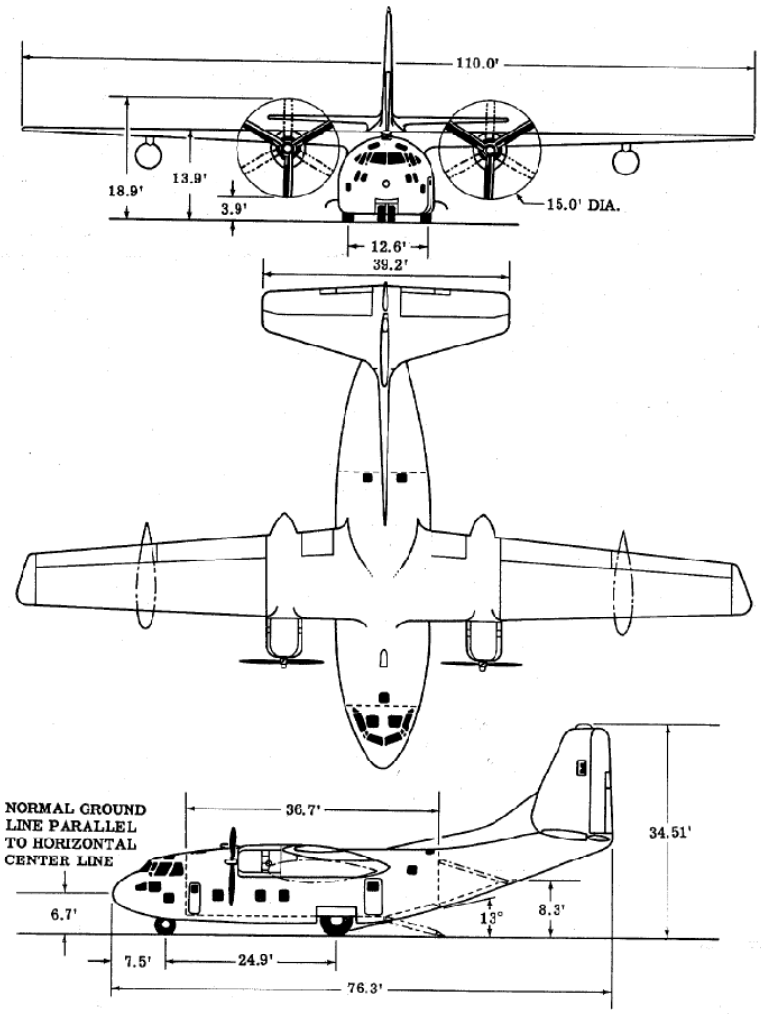
Data	
File	4532-2,4,5-T
Number of Valid Samples	7
Number of Distinct Samples	7
Minimum	37
Maximum	1100
Mean	502.4286
Median	390
Standard Deviation	425.5443
Variance	181088
Coefficient of Variation	0.846975
Skewness	0.467203
Shapiro-Wilk Test Statisitic	0.907156
Shapiro-Wilk 5% Critical Value	0.803
Data are normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t	814.9708
Data are normal (0.05)	
Recommended UCL to use:	
Use Student's-t UCL	

Data	
File	4571-2,4-D
Number of Valid Samples	9
Number of Distinct Samples	9
Minimum	100
Maximum	1600
Mean	586.6667
Median	520
Standard Deviation	523.1873
Variance	273725
Coefficient of Variation	0.891797
Skewness	1.065117
Shapiro-Wilk Test Statisitic	0.873225
Shapiro-Wilk 5% Critical Value	0.829
Data are normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t	910.964
Data are normal (0.05)	
Recommended UCL to use:	
Use Student's-t UCL	

Data	
File	4532-2,4-D
Number of Valid Samples	7
Number of Distinct Samples	6
Minimum	5
Maximum	1200
Mean	452.8571
Median	450
Standard Deviation	446.5223
Variance	199382.1
Coefficient of Variation	0.986011
Skewness	0.664589
Shapiro-Wilk Test Statisitic	0.917531
Shapiro-Wilk 5% Critical Value	0.803
Data are normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t	780.8067
Data are normal (0.05)	
Recommended UCL to use:	
Use Student's-t UCL	

APPENDIX H

Mass Loading Estimates



Surface Area Estimate

	Approx. Dimensions			
	length (ft)	width (ft)	# of sides	area (ft^2)
wings	110	10	2	2200
fuselage exterior sides	45	10	2	900
rear exterior sides	8	20	2	320
top exterior fuselage	12	60	1	720
bottom exterior fuselage	12	60	1	720
fuselage interior sides	45	10	2	900
rear interior sides	8	20	2	320
interior top	12	60	1	720
interior floor	12	60	1	720
under floor area (top and bottom)	12	40	2	960
horizontal stabilizer	40	8	2	640
vertical stabilizer	15	20	2	600
			Total (ft^2)	9720
			Total (m^2)=	903

Calculation of allowable mass on aircraft to meet the 1ppb LDR standard for land disposal

aircraft weight =	35366	lb	
=	16042	kg	
1ppb =	0.000016042	kg	
=	0.016042	g	
=	16.042	mg	total amount allowed on aircraft by LDR standard

Calculation of mass loading assuming all surfaces are contaminated at the screening level

screening level=	23	ng/m^2	=	0.000000023	grams/m^2
			=	0.000023	mg/m^2

641680 m^2 is the surface area to exceed the standard

Estimated surface area of UC-123= **900** **m^2**

Given estimated surface area, mass loading is **0.00129** of the limit= **0.129036** **%**

Mass loading on plane at given concentration= **0.0207** **mg**