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Final
Site Investigation Report

Centredale Manor Restoration Project
North Providence, Rhode Island

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United States Environmental Protection Agency
Region I

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1.0 Introduction

From June 21, 1999 through November 5, 1999 IT Corporation performed sampling and analysis at the Centredale Manor site. This report presents the results of that investigation.

1.1 Site Background

The Centredale Manor site is located in North Providence, Rhode Island just south of Route 44 on the eastern bank of the Woonasquatucket River. The site is currently occupied by two high rise residential buildings. Brookside Village is on the northern part of the property and Centredale Manor (the Manor) is located to the south. Residential properties also abut the site along the eastern and southern boundaries. The site was previously occupied by a chemical company located in the area of Brookside Village and a drum reclamation company formerly located in the vicinity of Brookside Village and Centredale Manor. Much of the property is currently covered by roadways, parking lots, and the two residential buildings. On the eastern portion of this property is a drainage swale that begins in the northern section of the property, extends south behind the Manor building, then curves to the west and discharges into a wooded wetland south of the Manor and eventually into the Woonasquatucket River. Allendale Pond is located several hundred yards south of the site and was formed by the Allendale dam which is located approximately ½ mile downstream of the site. The middle section of the wooden dam is breached and in need of repair.

The primary contaminant of concern at the site is dioxin in soil and sediments. The term "Dioxin" is commonly used to refer to 2,3,7,8-Tetrachlordibenzo-p-dioxin (2,3,7,8-TCDD) which is a bio-accumulator and a potent toxin that has been linked to human pathology. However, dioxins are a family of polychlorinated dibenzodioxin (PCDD) compounds of which 2,3,7,8-TCDD is the most toxic. Related compounds that are closely associated with dioxins in structure and biological activity are the furans or polychlorinated dibenzofurans (PCDFs). Each of the PCDD and PCDF congeners has been assigned an International Toxicity Equivalency Factor (I TEF) relating to 2,3,7,8-TCDD. Most of the PCDD and PCDFs are ten to more than a thousand times less biologically active than 2,3,7,8-TCDD which is given an ITEF of 1.

1.2 Purpose and Goal of Investigation

In support of Task Order 18 under the United States Environmental Protection Agency's (EPA's) Emergency and Rapid Response Region I (ERRS I) contract (no. 68-R1-98-01), IT Corporation's (IT's) objectives were to:

- Investigate, characterize, remove and dispose of any buried drums and associated contaminated soil,
- Further delineate the vertical extent of dioxin contamination at the Centredale Manor site,
- Assess the presence of other organic and/or inorganic contaminants in areas impacted by dioxin,
- Assess the presence of dioxin in surface soils surrounding Allendale Pond,
- Assess the presence and extent of dioxin contamination at Allendale Dam,
- Address dioxin hotspots through excavation, capping or restricting access to these areas (i.e. fence installation).

This report summarizes the investigative and delineation portion of IT's role at the Centredale Manor Site.

1.2 References

IT Corporation, July 1999, Quality Assurance Project Plan, The Centredale Manor Site (USEPA Contract No. 68-R1-98-01, Task Order 18)

IT Corporation, April 1999, ERRS I Program Quality Assurance Project Plan (USEPA Contract No. 68-R1-98-01)

2.0 Sampling

2.1 Sampling Strategy

2.1.1 Previous Investigations

Dioxin was first discovered in fish and eel taken from the Woonasquatucket River. A study conducted by the USEPA (July, 1998), found elevated concentrations of dioxin in Woonasquatucket River sediments. As a result, USEPA Region I conducted soil and sediment sampling on and around the Centredale Manor property in September, 1998. The sampling results indicate the presence of dioxin at concentrations above the action level of 1 part per billion (ppb) in some areas. Additional samples were collected from around the Manor, and off site at the Lee Ramano ballfield, and the Boys and Girls Club. This sampling confirmed the presence of dioxin at concentrations up to 14 ppb on the southern portion of the property, including the drainage swale and in the wooded area south of the Manor.

To further define the extent of dioxin contamination at the site, another sampling event was conducted by EPA/ERT in February 1999. Surface samples, at a depth from 0 to 6 inches below grade, were collected on a grid across the property between Route 44 and Allendale Pond. A 50-foot square sample grid was established in the area of Brook Village, Centredale Manor and the drainage swale to the east. A 100-foot square grid was established in the area of the drainage area south of Centredale Manor. A transect was established along the western bank of the River and samples were collected at 100 foot intervals along this transect. Additional judgmental samples were also collected.

The validated results of this February, 1999 investigation were used as the basis for further investigation by IT as directed by the USEPA's On-Scene coordinator (OSC).

2.1.2 Geophysical Survey

A geophysical survey was also conducted in February 1999 to assess the presence and extent of subsurface debris. The results of the survey indicate the presence of large metallic anomalies in the southern section of the parking lot located to the west of Centredale Manor. These anomalies may be indicative of buried drums or construction debris.

2.1.3 Historical Information

The manufacturing of hexachlorophene is assumed to be the source of dioxin, which was a byproduct of the chemical process. A fire in 1971 destroyed the chemical and drum reclamation facilities located on the property. Buried drums are also present at the site and assumed to be from one or both of these facilities. Aerial photographs from the 1950's and 1960's indicate the presence of drums stored throughout the property.

2.2 Sampling Locations

Sample locations are presented on the site map in Figure 1. A grid locator for each sample location is presented in Table 1. A total of 889 total samples were collected, comprised of 581 field samples and 308 associated quality control samples. Field samples were collected in the following quantities for the described general areas:

424	vicinity of Centredale Manor and Brook Village apartments
12	Allendale Dam (AD-n series)
43	Allendate Pond (CMS-6nn series)
11	River Bank behind Brook Village (CMS-7nn series)
23	Narragansett Electric Company greenway (CMS-019 through CMS-025)
63	Residential Properties (CMS-457 through CMS-508)

2.2.1 Grid Sampling

Sampling was conducted on the square grid previously established to assess dioxin contamination in surface soil at the site by EPA/ERT in February 1999. A 50-foot square grid was established in the area of Brook Village, Centredale Manor and the drainage swale to the east. A 100-foot square grid was established in the area of the drainage area south of the Manor. A transect was established along the western bank of the River and samples were collected at 100-foot intervals along this transect.
IT collected continuous soil samples to groundwater at previous grid sample locations where dioxin was detected at concentrations above 1 ppb during EPA's February, 1999 investigation. The samples were collected at 1 foot depth intervals to assess the vertical extent of contamination.

In the area of the suspected buried drums IT reduced the grid to a 25-foot spacing. Continuous sampling in this area was also performed at 1 foot depth intervals.

2.2.2 Allendale Dam Sampling

Sediment samples were collected adjacent to the Allendale Dam as requested by the United States Army Corps of Engineers (USACE).

2.2.3 Residential Sampling

Sampling was conducted at the residences surrounding Allendale Pond at locations selected by the OSC and generally within the flood plain due to the increased probability that dioxin has migrated to these areas as a result of flooding.

2.3 Sampling Methods

Samples were collected either by hand auger or by geoprobe in discrete one foot depth intervals to the groundwater interface. Two sample teams, comprised of IT and Roy F. Weston (an EPA contractor) personnel, were responsible for sample collection. The specific sampling method employed for each sample is listed in Table 2. Sediment samples from the footprint of Allendale Dam were collected using a split spoon sampler.

Each sample was screened by PID and geologically classified. Boring logs for each location are presented in the appendix to this report.

2.3.1 Field QC Samples

Field QC Samples (blind field duplicates, splits, equipment rinsates, and trip blanks) were collected for each sample delivery group. Additional quantities for matrix spike/matrix spike duplicate analysis were also collected for each sample delivery group.

2.3.2 Decontamination Procedures

Sampling equipment was decontaminated after each interval was collected following the procedures outlined in the QAPP. An equipment blank was collected for each sample delivery group.

2.4 Sample Naming Convention

Samples were named using the convention "CMS-nnn-z" where;

- CMS is an abbreviation for Centredale Manor Site;
- nnn is a three digit sequential number (including any leading zeros) that represents a unique x,y coordinate;

- z is a sequential letter that represents the depth interval, in feet below grade surface. - A represents the depth interval from 0-1 feet, B represents 1-2 feet, C represents 2-3 feet, etc.

For location that were originally sampled in the February sampling event and resampled in this event, the same numerical sampling location identifier was used. New sampling locations (e.g. not sampled in February, 1999) were giving ascending numbers starting at CMS-400.

2.4.1 Matrix Spike and Matrix Spike Duplicates

Additional sample quantity was collected for matrix spike and matrix spike duplicate analysis and placed in their own containers. These samples followed the naming convention of appending a "-MS" and "-SD" to the native sample ID for the matrix spike and matrix spike duplicate samples, respectively (e.g. "CMS-203-B-MS" indicates aliquot of sample CMS-203-B to be used for matrix spike analysis).

2.4.2 Field Duplicates

Field duplicates followed the naming convention of the assigned SDG name followed by "-FD". For example "AP01-FD" is the sample name of the field duplicate for SDG AP01. The field duplicates were single blind, e.g. the laboratory did not know which native sample was used for the field duplicate.

2.4.3 Split Samples

Split samples followed the naming convention of appending a "-QC" to the native sample ID, e.g. "CMS-203-B-QC" is the split sample of "CMS-203-B".

2.4.4 Equipment Rinsate Samples

Equipment rinsate samples followed the naming convention of yymmdd-xx-nn where;

- yy is the two digit year
- mm is the two digit month
- dd is the two digit day
- yymmdd is the date the equipment rinsate was collected
- xx is the type of equipment (HA= hand auger, GP= geoprobe)
- nn is the sequential number of the equipment blank on that date for that type of equipment

For example, the second equipment rinsate from the hand auger decontaminaton collected on June 30, 1999 would be identified as 990630-HA-02.

2.4.5 Sample Delivery Group Naming Conventions

Sample Delivery Groups (SDGs) were named using a two character code indicating the sampling method (GP and HA for geoprobe and hand auger, respectively) following by a sequential number. If necessary, samples from one sampling team were sometimes added to another sampling team's SDG in order to maximize the number of field samples in an SDG shipped to the laboratory. For example, SDG GP04, primarily samples collected by geoprobe also includes one sample collected by hand auger.

SDGs from distinct areas used a two character code (e.g. AD for Allendale Dam, AP for Allendale Pond, and BV for behind the Brook Village apartments) followed by a sequential number.

SDGs of split samples were identified as QCnn, where nn is a sequential number. Due to an oversight, there was no SDG named QC03.

2.4.6 Chain-of-Custody Procedures

Sample information was logged on an on-site chain-of-custody (COC) by each sampling crew. The samples were then transferred to the on-site sample custodian. Samples, including performance evaluation samples, were organized into sample delivery groups (SDGs) and packaged in coolers for shipment to the laboratory. The sample custodian transferred information from the on-site COC form to a single COC form for each SDG. Computer generated labels were then printed that listed the specific analyses to perform on each sample. Samples were held over night, preserved at 4 deg. C, if a SDG was not complete. Exceptions to this were made for VOC analyses, which required preservation by the laboratory within 48 hours of sample collection. These samples were shipped to the laboratory by over-night courier on the day they were collected.

2.4.7 Data Management Software

On-site sample management was performed using the software program Scribe (Field Sample Management System, version 2.2, February 1999, USEPA ERT). In addition, this software was enhanced using ScribeIT, a custom Microsoft Access database program that was compatible with the database created by Scribe. These programs were used to computer generate sample labels and print multipart COC forms on a laser printer.

2.5 Sampling Summary

Summaries of samples collected are presented in alphabetical order in Table 2 and chronological order in Table 3.

3.0 Laboratory Analyses

3.1 Parameter Selection

3.1.1 2,3,7,8-TCDD Analysis by SW846 method 8280

SW846 method 8280 (a low resolution mass spectrometry method) for analysis of 2,3,7,8-TCDD only was chosen as the primary method due to cost efficiency and fast turn-around time. Rapid turn-around time was necessary in order to guide additional sampling activities and provide data when considering emergency remedial alternatives. 2,3,7,8-TCDD was the primary analysis of concern at the site, and all samples were analyzed for this parameter. This dioxin isomer contributed over 98% of the total TEQ in the February, 1999 sampling event and was therefore assumed to be an accurate indicator of the TEQ. Not measuring the other PCDD and PCDF isomers would not bias the actual TEQ value in a significant (e.g. <2%).

3.1.2 PCDD/PCDF Analysis by SW846 method 8290

SW846 method 8290 (a high resolution mass spectrometry method) for analysis of all PCDD and PCDF isomers was chosen to obtain the highest quality data, including lowest possible detection limits, for the samples collected in residential areas. The data from these analyses would also be used to confirm the assumption that the 2,3,7,8-TCDD concentration was a suitable indicator of the PCDD/PCDF TEQ.

3.1.3 Polychlorinated Biphenyls

PCBs were a secondary contaminant of concern at the site, especially in the area of geophysical anomalies. Samples were analyzed for the individual Aroclors by SW846 method 8082. As initial analytical results from the investigation became available it was apparent that PCBs were ubiquitous throughout the site. The sampling and analysis program was revised in progress to include analysis of PCBs for all additional samples collected.

3.1.4 Full Suite

Full Suite analyses (Volatiles by SW846 8260, Semivolatiles by SW846 8280, Pesticides by SW846 8081, Herbicides by SW846 8150, Metals by SW846 6000/7000, and Cyanide by SW846 9012) were performed on a subset of samples to determine if additional contaminants were present at the site. Specific locations were selected based on balancing locations to provide an overall assessment of the site (random locations) and selecting locations that had the most

likely potential of contamination (e.g. historical information, geophyscial survey data, soil discoloration, and PID screening of soil borings).

3.1.5 Allendale Dam Samples

Samples taken from the footprint of Allendale Dam (SDG AD01, Sample IDs starting with AD-) were collected at the request of the United States Army Corps of Engineers (USACE). These samples were analyzed for, as specified by USACE, PCDDs/PCDFs by SW846 8290, PAHs by SW846 8270, Pesticides by SW846 8081, PCBs by SW846 8082, RCRA Metals by SW846 6000/7000, and TOC (in duplicate) by SW846 9060.

3.2 Laboratory Selection

Quanterra Incorporated of West Sacremento, California was selected as the primary laboratory. Paradigm Laboratories of Wilmington, North Carolina was selected as the backup laboratory and QA laboratory for analysis of split samples. Due to laboratory capacity issues, Paradigm was the primary laboratory for the residential samples analyzed by method SW-846 8290 (SDGs HA12 through HA16).

4.0 Analytical Results

Analytical results are presented in full in appendix B of this report. Results are also summarized in additional tables as described in the following:

4.1 Summary Statistics

Summary statistics that present the frequency of detection and concentration range for each measure parameter are presented in Table 4.

4.2 2,3,7,8-TCDD Results

Results for the contaminant of concern 2,3,7,8-TCDD are presented in order of decreasing detected concentration in Table 5. All samples were analyzed for 2,3,7,8-TCDD, either by SW846 methods 8280 or 8290. 2,3,7,8-TCDD was detected above the method detection limit in 74% of the samples.

4.2.1 Toxic Equivalency Values

As discussed in section 1.0, the 2,3,7,8-TCDD isomer is one of the family of related PCDD and PCDF compounds that are used to calculate a total toxic equivalency value (TEQ). Based on the February, 1999 results the assumption was made that since 2,3,7,8-TCDD contributed to 98% of the TEQ, measuring just the 2,3,7,8-TCDD isomer would be an appropriate measurement of the overall dioxin concentration at the site. Since the residential samples were analyzed for all of the PCDD/PCDF congeners, the contribution of 2,3,7,8-TCDD to the total TEQ could be calculated.

The sum of all 2,3,7,8-TCDD measurements compared to the sum of all TEQs (with non-detected congeners set to a value of 0.0) indicates that the average contribution of 2,3,7,8-TCDD to the TEQ is 98.5%. For samples where the 2,3,7,8-TCDD was greater than 1/2 the site action level of 1.0 ppb, the contribution of 2,3,7,8-TCDD to the TEQ averaged 97.8%, with a range of 95.3% to 98.6%. Therefore the conjecture that the risk from the family of PCDDs/PCDFs could be evaluated by measuring only the 2,3,7,8-TCDD concentration has been corroborated.

4.3 Polychlorinated Biphenyl Results

Results for total PCBs are presented in order of decreasing detected concentration in Table 6. Not all samples were analyzed for PCBs. Of samples analyzed for PCBs, PCBs were detected in 79% of the samples. The most predominant PCB detected was Aroclor 1254 (76% of all samples).

4.4 Other Parameters

Results for other parameters that exceeded relevant standards (e.g. Rhode Island residential standards or Toxicity Characteristic Leaching Procedure (TCLP) standards) are summarized in Table 7.

4.5 Graphical Presentation of Results

Maps that display 2,3,7,8-TCDD data incorporate the data from the February, 1999 sampling conducted by USEPA. The results plotted are the TEQ for the PCDD/PCDF data, but since the 2,3,7,8-TCDD isomer makes up over 98% of the TEQ, the TEQ data is representative, within a few percentage points, of the 2,3,7,8-TCDD concentration, and is therefore appropriate to use for comparison to 2,3,7,8-TCDD concentrations in these figures.
Data is presented in graphical format in the following figures:

4.5.1 Figure 2 - Volatile Results

Figure 2 indicates sampling locations where at least one interval (see Table 3) was analyzed for volatiles. Any exceedences of individual parameters above Rhode Island residential standards are listed next to the sample location, along with the sampling interval. If more than one interval had an exceedence, the result of the interval with the highest concentration is listed. If a listed sample point on the map has no parameters listed, then no volatile parameters were detected above the Rhode Island residential standards at that location.

4.5.2 Figure 3 - Semivolatile Results

Figure 3 indicates sampling locations where at least one interval (see Table 3) was analyzed for semivolatiles. Any exceedences of individual parameters above Rhode Island residential standards are listed next to the sample location, along with the sampling interval. If more than one interval had an exceedence, the result of the interval with the highest concentration is listed. If a listed sample point on the map has no parameters listed, then no semivolatile parameters were detected above the Rhode Island residential standards at that location.

4.5.3 Figure 4 - Metals Results

Figure 4 indicates sampling locations where at least one interval (see Table 3) was analyzed for the RCRA set of metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). Any exceedences of individual parameters above Rhode Island residential standards

are listed next to the sample location, along with the sampling interval. If more than one interval had an exceedence, the result of the interval with the highest concentration is listed. If a listed sample point on the map has no parameters listed, then no metals were detected above the Rhode Island residential standards at that location.

4.5.4 Figure 5 - Total VOC Results

Figure 5 presents total VOC results for all samples analyzed for VOCs, where all detected VOC parameters are summed. If no VOC parameters were present, results are listed as Below Detection Limit (BDL).

4.5.5 Figure 6 - Total Semivolatile Results

Figure 6 presents total SVOC results for all samples analyzed for SVOCs, where all detected SVOC parameters are summed. If no SVOC parameters were present, results are listed as Below Detection Limit (BDL).

4.5.6 Figures 7a through 7d - PCB Results for 0-4 ft intervals

Figures 7a, 7b, 7c, 7d shows extrapolated isoconcentration areas of the PCB concentration for the 0-1 ft, 1-2 ft, 2-3 ft, and 3-4 ft intervals, respectively.

4.5.7 Figure 7e - PCB Results for 4-8 ft intervals

Figure 7e shows extrapolated isoconcentration lines of the estimated PCB concentration for the 4-5 ft, 5-6 ft, 6-7 ft, and 7-8 ft intervals. Because of the reduced number of data points for these intervals, the data has been combined for these intervals on a single map.

4.5.8 Figures 8a through 8d - 2,3,7,8-TCDD Results for 0-4 ft intervals

Figures 8a, 8b, 8c, 8d shows extrapolated isoconcentration areas of the 2,3,7,8-TCDD concentration for the 0-1 ft, 1-2 ft, 2-3 ft, and 3-4 ft intervals, respectively. For figure 8a, when data was available for the both the February, 1999 sampling session and IT's sampling for this project, the maximum value is used. For the February, 1999 data, the TEQ value is displayed.

4.5.9 Figure 9 - 2,3,7,8-TCDD/PCB Concentration Summary Map

Figure presents a 'stop light' summary that combines both 2,3,7,8-TCDD and PCB data on the same map. The colored summary symbol represents the highest concentration of the target analytes detected at a particular sampling location, irregardless of depth. The top half represents the 2,3,7,8-TCDD value and the bottom half represents the total PCB value. If the bottom half is not colored, it indicates no PCB analyses were performed at that particular sample location.

5.0 Quality Assurance

5.1 Data Validation

All data was validated according to Region I, EPA-New England Data Validation Functional Guidelines for Evaluating Environmental Analyses (December 1996). The primary data validator was Environmental Data Services, Inc. of Concord, New Hampshire (EDS). Meridian Science & Technology of Annapolis, MD served as the backup validation subcontractor when EDS could not provide fast turn around time for data validation (SDGs GP18, GP19, HA11, QC01, QC02 and QC03). USEPA-Region 1 of Lexington, MA performed the data validation of the residential 8290 dioxin analyses (SDGs HA12, HA13, HA14, HA15, HA16 and QC06).

All data was validated at the Tier II level, with a minimum of 10% validated at the Tier III level. Data qualifiers assigned by the validators have been included in all figures and tables.

5.1.1 Completeness

A total of 19,742 environmental measurement points (not including QC measurements) were generated during IT's sampling and analysis efforts at the Centredale Manor site. Data validation resulted in 529 data points being qualified as 'R' for unusable. Data qualified as 'R' has been included in the data summaries included in the appendix to this report. This results in a completeness of 97.3%, which compares favorably to the project completeness goal of 90%.

5.2 Performance Evaluation Samples

Performance evaluation samples (PEs) were submitted to the laboratory with each SDG. PEs were obtained from and scored by USEPA Region I QA personnel. In instances where PEs were not directly available from USEPA (e.g. for VOCs, SVOCs, Pesticides and Herbicides in soil) PEs were obtained from outside vendors with results scored by IT. The PE results are summarized and presented in Appendix D.

A total of 106 PEs were analyzed during the course of the project. No systematic bias by the laboratory was detected during the course of the project. PEs were within acceptance limits for 103 (97%) of the analyses. Results of the three PEs outside of acceptance limits, and the impact on the data, is summarized as follows:

SDG AD01 - Dioxin PE (method 8290) - Results for parameter 1,2,3,6,7,8-Hexachlorodibenzofuran were outside of acceptance limits. The results for nine samples in this SDG were flagged "R" for this parameter.

SDG AP02 - 2,3,7,8-TCDD PE (method 8280) - Results for 2,3,7,8-TCDD were outside of acceptance limits. The results for three samples in this SDG were flagged "R" for this analysis.

SDG GP17 - Herbicide PE (method 8150) Results for chlordane and methoxychlor were outside of PE acceptance windows and the results of sixteen samples in this SDG were flagged "R" for these two parameters.

5.3 Split Samples

A split sample was collected for each SDG and sent to the referee laboratory for dioxin analysis (either 2,3,7,8-TCDD only by method 8280 or dioxins/dibenzofurans by method 8290, depending on which analysis was being performed on the native sample). The naming convention for SDGs of split samples was QCnn, where "nn" was a sequential number. Due to an oversight, there was no SDG identified as QC03.

Paradigm was the referee lab for split samples except for the residential 8290 samples (SDGs HA12 through HA16). Paradigm was the primary laboratory for these analyses, and Quanterra served as the referee lab for these samples.

The 2,3,7,8-TCDD results for the split samples, with a comparison to the native sample results, are presented in Table 8. All split results are presented in Table C.1 of the appendix. For results where both samples were reported as non-detected, the relative percent difference (RPD) is reported as 0.0%. If one result was detected and the other was non-detected, the RPD is calculated using the reported practical quantitation limit (PQL) of the non-detected result.

No significant bias was seen in the results of the split sample results, and the data from both laboratories should be considered comparable. For results where 2,3,7,8-TCDD was detected in at least one of sample pairs (and the PQL of non-detects was less than the positive result in the related sample) the average relative percent difference (RPD) was -29%, within the project goal of +/- 50%. For individual data pairs meeting the above requirements, 17 of 29 (59%) exceed the project goal of +/- 50%. This information does not indicate any bias, as the same percentage of field duplicate pairs (17 of 31, 59%) exceeded the project goal of +/- 50% for field duplicates. See the discussion about field duplicates for further data analysis.

5.4 Field Duplicates

A single blind field duplicate was collected for each SDG and analyzed for each parameter as its associated native sample. Field duplicate results for all parameters are presented in the appendix in Table C.2.

5.4.1 2,3,7,8-TCDD Results

The 2,3,7,8-TCDD results for field duplicates, with a comparison to the native sample results, are presented in Table 9. For results where both samples were reported as non-detected, the relative percent difference (RPD) is reported as 0.0%. If one result was detected and the other was non-detected, the RPD is calculated using the reported practical quantitation limit (PQL) of the non-detected result.

For results where 2,3,7,8-TCDD was detected in at least one of the sample pairs (and the PQL of non-detects was less than the positive result in the related sample) the average RPD for field duplicates was 70%, which exceeded the project objectives of +/- 50%. For individual data pairs meeting the above requirements, 19 of 32 (59%) exceed the project goal of +/- 50%. The validator assigned a "J" qualifier to the native sample result for instances where the RPD was greater than 50%.

Exceeding the project objective for overall precision with a RPD of less than 50% for field duplicates is most likely attributed to sample matrix issues (e.g. sample inhomogeneity) and not laboratory performance factors. For example, the split samples, analyzed by different laboratories, also had 59% of the field duplicate pairs exceeding the +/- 50% objective. Analysis of the data from the February, 1999 sampling session showed similar results, with an average RPD of 52% and 9 out of 23 (39%) data pairs exceeding a 50% criteria. Therefore, exceeding the +/- 50% objective is not confined to a single laboratory, and is most likely related to the specific characteristics of the samples from the site.

The initial field duplicate result for SDG GP14 (Sample GP14-FD) was identified as an extreme outlier (200% RPD) when compared to the native sample (Sample CMS-426-B) with reported concentrations of 340 ug/kg and 4.8 ug/kg, respectively. The laboratory was requested to reanalyze both samples. The reanalyses yielded results of 8.4 ug/kg for the field duplicate and 3.3 ug/kg for the native sample (85% RPD). Since the initial result for GP14-FD could not be confirmed, only the results of the reanalysis have been reported.

5.4.2 PCB Results

The Aroclor-1254 (the most frequently detected individual PCB) results for field duplicates, with a comparison to the native sample results, are presented in Table 10. For results where both samples were reported as non-detected, the relative percent difference (RPD) is reported as 0.0%. If one result was detected and the other was non-detected, the RPD is calculated using the reported practical quantitation limit (PQL) of the non-detected result.

The Aroclor-1254 results for field duplicates, with a comparison to the native sample results, are presented in Table 10. For results where both samples were reported as non-detected, the relative percent difference (RPD) is reported as 0.0%. If one result was detected and the other

was non-detected, the RPD is calculated using the reported practical quantitation limit (PQL) of the non-detected result.

For results where Aroclor was detected in at least one of the sample pairs (and the PQL of non-detects was less than the positive result in the related sample) the average RPD for field duplicates was 70%, which exceeded the project objectives of +/- 50%. For individual data pairs meeting the above requirements, 13 of 25 (52%) exceed the project goal of +/- 50%. The validator assigned a "J" qualifier to the native sample result for instances where the RPD was greater than 50%.

Exceeding the project objective for overall precision with a RPD of less than 50% for field duplicates appears to be sample matrix related, not a laboratory issue. The results for Aroclor-1254 are similar to those for 2,3,7,8-TCDD discussed previously.

5.5 Field Blanks

5.5.1 Equipment Rinsates

An equipment rinsate was collected for each SDG and analyzed for the same parameters as the field samples. The project objective for elimination accuracy/bias due to contamination was no target compounds above the PQL. This goal was exceeded for eight individual measurements;

- 1,2,3,4,6,7,8-Heptachlorodibenzodioxin was detected in sample 990812-HA-01 (SDG HA16) at a concentration of 0.0537 ng/L (PQL = 0.00976)
- Chromium was detected in sample 990707-GP-01 (SDG 13) at a concentration of 0.019 mg/L (PQL = 0.010)
- Iron was detected in samples 990630-HA-01 (SDG GP09), 990707-GP-01 (SDG GP13), 990623-GP-01 (SDG GP04) and 990720-GP-01 (SDG GP17) at concentrations of 0.13, 2.0, 0.16 and 0.67 mg/L, respectively (PQL=0.10)
- Methylene Chloride was was detected in samples 990720-GP-01 (SDG GP17) and 990707-GP-01 (SDG GP13) at concentrations of 2.4 and 1.7 ug/L, respectively (PQL = 1.0).

5.5.2 Trip Blanks

Everytime samples were shipped for volatile analyses, a trip blank accompanied the samples. A total of eight trip blanks were analyzed for volatile parameters for this project. The project objective for elimination accuracy/bias due to contamination was no target compounds above the PQL. This goal was exceeded for only one parameter in one sample (TB990701 in SDG GP09) where toluene was detected at 1.7 ug/L (with a PQL of 1.0 ug/L).

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5.6 Matrix Spike/Matrix Spike Duplicates

A minimum of one matrix spike (MS) and matrix spike duplicate (MSD) pair of samples were analyzed for each SDG. IT collected additional sample quantity and indicated on the chain-of-custody which sample should be used.

Data was qualified "J" by the validator if the MS/MSD analyses were outside of control limits. Data that was qualified "R" through validation because of low MS and/or MSD recovery for the following analyses;

- Dinoseb and MCPA (method 8150-Herbicides) for sample CMS-405-A (SDG GP04)
- Antimony (method 6010B) for samples CMS-060-A, -C, -D, -E, CMS-118-A, -E, CMS-418-A, -B, and GP09-FD.

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