Sampling and Quality Assurance/Quality Control Project Plan

For

Food Products in the Vicinity of the Tooele Chemical Agent Disposal Facility

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Introduction

The Utah Division of Solid and Hazardous Waste (Division) has proposed to sample and analyze homegrown animal food products in the vicinity of the Tooele Chemical Agent Disposal Facility (TOCDF). The results of the sampling and analysis will assist the Division in making risk management decisions to meet the goal of protecting human health and the environment. Since the TOCDF began treating chemical warfare agents by incineration in August 1997, the public has expressed concern regarding potential adverse impacts to the environment from emissions. The Division concluded in the Screening Risk Assessment (ATK, 1996) that the TOCDF would not adversely affect human health or the environment if operated in accordance with the operating permit.

The Screening Risk Assessment (ATK, 1996) estimated exposures (and the corresponding health risks) to incinerator chemicals for different types of lifestyles based on USEPA guidance and site-specific surveys. Lifestyles evaluated included: adult and child resident, subsistence fisher, and three local farmer scenarios identified as Farmer A, Farmer B, and Farmer C. The lifestyle with the highest estimated risk (the risks are below levels of concern) was Farmer C, a hypothetical resident who raises and consumes livestock in the vicinity of the TOCDF (ATK, 1996). The exposures to over 100 chemicals potentially emitted from the TOCDF were evaluated. Exposure pathways for Farmer C included ingestion of contaminated beef, ingestion of contaminated soil, and inhalation of contaminated air. Of the multiple chemicals and exposure pathways evaluated, ingestion of homegrown beef potentially contaminated with dioxin-like[1] chemicals (dioxins) was the predominant source of the health risks. The Division's policy is to update the risk assessment as new information becomes available. Periodically, the updates will be compiled and released as a document.

In 1998, the Division learned that human consumption of homegrown goat's milk was occurring in the vicinity of TOCDF. Exposure via ingestion of homegrown dairy products was not evaluated in the Screening Risk Assessment (ATK, 1996). Potential exposures from consumption of homegrown dairy products is an exposure pathway recommended for evaluation by USEPA guidance (USEPA, 1994b) but a 1995 site-specific survey concluded that the local populace was not consuming homegrown dairy products (Shilton and Ng, 1995).

The Division recalculated the health risks for Farmer C by adding exposure from ingesting milk contaminated with dioxins and using preliminary estimates of emissions collected during trial burns. Other chemicals were not evaluated because they did not significantly contribute to the total risk[2]. Over 99 percent of the excess-lifetime-cancer-risk (cancer risk) is attributable to exposure to chemicals ingested from contaminated homegrown animal products (e.g., homegrown beef). A summary of the revised cancer risks for Farmer C are presented in Table 1.

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[1] Dioxin-like chemicals (dioxins) are those dioxin and furan congeners that cause toxic effects similar to 2,3,7,8-tetrachlorodibenzo(p)dioxin and have a USEPA toxicity equivalency factor (TEF).

[2] An early draft of the Screening Risk Assessment estimated the exposure and corresponding risks from consumption of homegrown contaminated milk. The contribution of chemicals other than dioxin-like chemicals was insignificant.

The results of the revised estimates indicate that the cancer risks to Farmer C are below levels of concern. If an additional significant source of dioxins, such as the dunnage incinerator is added or an additional exposure pathway, the cancer risks may exceed the standard of 1×10^{-5} (USEPA, 1994b).

The risk assessment methodology (USEPA 1994b; 1998) evaluates the risk for an individual facility. When the target risk level was established, the USEPA considered that there might be additional sources of exposure for the chemicals emitted from the incinerator. The presumption is that if the risks from an individual facility are less than the recommended limits (1×10^{-5} cancer risk and a hazard index of 0.25), the total risk from all sources of exposure will be in the acceptable range. For dioxins, limited data exists on ambient levels of exposure (sometimes called background) for the United States. Little information for estimating background dioxin exposures is available for the area around the TOCDF.

In addition to ongoing risk assessments, a monitoring program is being conducted to identify trends for chemical concentrations in the environment around the TOCDF. In July 1997, baseline samples of soil, water, sediment, and vegetation were collected from locations around the TOCDF and analyzed for chemicals that could potentially be emitted from the incinerator (Dames & Moore, 1997; DSHW, 1998). These sample locations will be periodically resampled to monitor trends in environmental concentrations of contaminants. Of special concern are the chemicals that may bioaccumulate because these chemicals are persistent and can contaminate the food chain.

Bioaccumulation occurs when the concentration of a chemical in an organism is greater than the exposure concentration (Lewis, 1998). All dioxins are bioaccumulative. Based on trial burn data, dioxins are emitted in very low concentrations from the TOCDF. Because of bioaccumulation and the toxicity of some congeners, unacceptable health risks could occur even if dioxins are emitted to the air at low concentrations. The model used to predict dioxin concentrations in soil, plants, and animal tissues from concentrations measured at the TOCDF stack is highly uncertain. In addition to the model uncertainty, the concentration of dioxins emitted from the stack is uncertain because many of the dioxin congeners were not detected which indicates that either they were not present, or they were present at concentrations below the detection limit. The methodology used to predict dioxin concentrations in the environment is anticipated to overestimate concentrations. However, because of the uncertainties involved, there is a small chance that concentrations could be underestimated.

TABLE 1
TOCDF EXCESS LIFETIME CANCER RISK FOR FARMER C BASED ON HOMEGROWN DAIRY EXPOSURES ADDED TO SCREENING RISK ASSESSMENT EXPOSURE SCENARIO

Operating Scenario[1]		Farmer C Excess Lifetime Cancer Risk[2]	Notes
1.	All TOCDF and CAMDS Sources	1×10^{-5}	February 1996 Screening Risk Assessment
2.	Same as Scenario 1	2×10^{-5}	Homegrown milk consumption added to Screening Risk Assessment
3.	Same as Scenario 1 excluding Dunnage Incinerator	6×10^{-6}	Homegrown milk consumption added to Screening Risk Assessment
4.	Scenario 3 with TOCDF trial burn data[3]	6×10^{-7}	Homegrown milk consumption added to Screening Risk Assessment

[1]Assumes 10 years of operation
[2] The Division adopted the USEPA guidance (1994) recommended excess lifetime cancer risk of 1×10^{-5} as the level of concern.
[3]Estimates are based on preliminary trial burn data

Purpose

To reduce the uncertainty with estimating the concentrations of dioxins in the environment, the Division proposes to sample homegrown animal products in the vicinity of the TOCDF as part of the long-term monitoring program. The data collected for the monitoring program will be used for three purposes:

1. To verify that the risk assessment model is protective,
2. To monitor for trends in concentration over time,
3. To provide an indicator of background concentrations of dioxins in Rush Valley.

Analyzing for dioxins in homegrown animal products was selected because:

- Of all the chemicals and exposure pathways potentially associated with the TOCDF, ingestion of animal products contaminated with dioxins has the highest potential health risks.
- Residents in the vicinity of TOCDF are actually consuming animal products. A potential exposure pathway that is complete (e.g., consumption of homegrown animal products) elicits a higher degree of concern than an exposure pathway that is only potentially complete (e.g., soil ingestion).

- Measuring dioxin concentrations in animal products has less uncertainty than predicting concentrations with modeling.
- Assuming similar deposition, animal products should provide a more sensitive indicator of long-term trends than soil monitoring (Riss et al. 1990).
- The site-specific background concentrations of dioxins in animal products (the main source of ambient exposure) will be measured instead of being estimated using the limited national database (USEPA, 1994).

In addition to sampling and analyzing homegrown beef and dairy products, the Division proposes to sample and analyze homegrown pork and eggs. Ingestion of potentially contaminated pork and eggs was not evaluated in the Screening Risk Assessment (ATK, 1996) in accordance with USEPA guidance (1994b). Based on anticipated USEPA guidance (USEPA, 1998) and that homegrown pork and eggs are consumed by residents in the vicinity of TOCDF, an evaluation of exposure from consumption of these products will be included in future risk assessments for the TOCDF. Therefore, these animal products will also be sampled and analyzed for dioxins.

Data Quality Objectives

To meet the purposes of the study, the samples must be representative. Random sampling will not be conducted because of the limited number of residents with homegrown animal products (e.g., only one resident is known to consume homegrown dairy products). The average concentration is the statistic of interest because this is the value used to estimate long-term exposures. Composite samples will be analyzed to make the most efficient use of laboratory resources.

The analytical methods should be sensitive enough to compare to existing data on ambient concentrations. The proposed detection limits are adequate and are compared to other existing data on ambient concentrations in North America in Table 2. Most commercial laboratories contacted were unable to achieve the target detection limits because laboratory contamination was anticipated to interfere with the results.

The analytical methods should also be sensitive enough to determine if dioxin concentrations are below USEPA target levels for health effects. USEPA (1998) methods were used to calculate the excess lifetime cancer risk assuming that dioxins are present at one-half the detection limit in homegrown beef, pork, eggs and milk (Table 3). The calculated excess lifetime cancer risks are between the USEPA target risk levels of 1 in 10,000 and 1 in 1,000,000. Therefore, the sensitivity of the proposed analytical methods is adequate.

TABLE 2
PROPOSED TOCDF DETECTION LIMITS COMPARED TO DIOXIN AND FURAN CONCENTRATIONS MEASURED IN NORTH AMERICA

Study	Limit of Detection (ng/kg FW)	Average[1] Concentrations Observed (ng/kg TEQs)	Notes
Beaudoin et al. 1997	0.005-1	Beef = 0.21 Milk = 0.035 Poultry = 0.054 Pork = 0.045	Canada; Sample weight was up to 8 g of fat or 100 g tissue
Lorber et al. 1997	0.1	Pork = 0.78[2]	Analyzed fat then reported based on lipid.
Ferrario et al. 1997	0.05	Chicken = 0.48[3]	Analyzed fat then reported based on lipid.
USEPA, 1994		Meat = 0.48 Milk = 0.07 Pork = 0.26 Chicken = 0.19 Eggs = 0.14	
Proposed for TOCDF, 1998	Beef = 0.05 Eggs = 1 Milk = 0.008	Beef = 0.25 Milk = 0.04 Pork = 0.25 Eggs = 0.5	Assumes no detections

[1] One-half of the limit of detection substituted for nondetects
[2] assumes 60% lipid
[3] assumes 75% lipid

TABLE 3

TOCDF PROPOSED DETECTION LIMITS FOR DIOXINS AND FURANS IN ANIMAL PRODUCTS WITH CORRESPONDING CANCER RISKS

Congener	USEPA TEFs	Detection Limit Beef (ng/kg)	Detection Limit Pork (ng/kg)	Detection Limit Egg (ng/kg)	Detection Limit Milk (ng/kg)	TEQs Beef (mg/kg)	TEQs Pork (mg/kg)	TEQs Egg Yolk (mg/kg)	TEQs Milk (mg/kg)
2,3,7,8-TCDD	1	0.05	0.05	0.1	0.008	5.0E-08	5.0E-08	1.0E-07	8.0E-09
1,2,3,7,8-PeCDD	0.5	0.25	0.25	0.5	0.04	1.3E-07	1.3E-07	2.5E-07	2.0E-08
1,2,3,4,7,8-HxCDD	0.1	0.25	0.25	0.5	0.04	2.5E-08	2.5E-08	5.0E-08	4.0E-09
1,2,3,6,7,8-HxCDD	0.1	0.25	0.25	0.5	0.04	2.5E-08	2.5E-08	5.0E-08	4.0E-09
1,2,3,7,8,9-HxCDD	0.1	0.25	0.25	0.5	0.04	2.5E-08	2.5E-08	5.0E-08	4.0E-09
1,2,3,4,6,7,8-HpCDD	0.01	0.25	0.25	0.5	0.04	2.5E-09	2.5E-09	5.0E-09	4.0E-10
OCDD	0.001	0.5	0.5	1	0.08	5.0E-10	5.0E-10	1.0E-09	8.0E-11
2,3,7,8-TCDF	0.1	0.05	0.05	0.1	0.008	5.0E-09	5.0E-09	1.0E-08	8.0E-10
1,2,3,7,8-PeCDF	0.05	0.25	0.25	0.5	0.04	1.3E-08	1.3E-08	2.5E-08	2.0E-09
2,3,4,7,8-PeCDF	0.5	0.25	0.25	0.5	0.04	1.3E-07	1.3E-07	2.5E-07	2.0E-08
1,2,3,4,7,8-HxCDF	0.1	0.25	0.25	0.5	0.04	2.5E-08	2.5E-08	5.0E-08	4.0E-09
1,2,3,6,7,8-HxCDF	0.1	0.25	0.25	0.5	0.04	2.5E-08	2.5E-08	5.0E-08	4.0E-09
2,3,4,6,7,8-HxCDF	0.1	0.25	0.25	0.5	0.04	2.5E-08	2.5E-08	5.0E-08	4.0E-09
1,2,3,7,8,9-HxCDF	0.1	0.25	0.25	0.5	0.04	2.5E-08	2.5E-08	5.0E-08	4.0E-09
1,2,3,4,6,7,8-HpCDF	0.01	0.25	0.25	0.5	0.04	2.5E-09	2.5E-09	5.0E-09	4.0E-10
1,2,3,4,7,8,9-HpCDF	0.01	0.25	0.25	0.5	0.04	2.5E-09	2.5E-09	5.0E-09	4.0E-10
OCDF	0.001	0.5	0.5	1	0.08	5.0E-10	5.0E-10	1.0E-09	8.0E-11
TOTAL						5.0E-07	5.0E-07	1.0E-06	8.0E-08
Intake (TCDD TEQs mg/day) at one-half the detection limit[1]						1.4E-08	4.3E-09	7.6E-09	1.5E-08
Excess Lifetime Cancer Risk for Adult Farmer[2]						2E-05	5E-06	9E-06	2E-05

NOTES:

TEFs are Toxicity Equivalence Factor; TEQs are Toxic Equivalents

All concentrations on fresh weight basis

Assumes that detection limits of penta- through hepta- congeners are 5 times and octa congeners are 10 times tetra- congener

[1] Assumes eggs 33% yolk by weight; Assumes that the average fat content of consumed beef and pork product is one-half of tested product

[2] Exposure duration = 40 yrs; Exposure frequency = 350 days/yr; Body weight = 70 kg; Averaging Time = 70 yrs; 2,3,7,8-TCDD slope factor = 156000 kg-day/mg;
Beef Ingestion rate = 0.057 kg/day fresh weight; Egg ingestion rate = 0.023 kg/day fresh weight; Milk ingestion rate = 0.181 kg/day fresh weight;
Pork Ingestion rate = 0.017 kg/day fresh weight

Sampling Protocol

Overview of Food Products Selection

The selection of food products for sampling was based on prevalence (e.g., common versus uncommon stock animal, prevalence in the local diet) and potential for contamination (e.g., location of farm relative to the TOCDF, source of feed). Based on information provided by the Tooele County Agricultural Extension Service, the survey conducted by the Division, and other sources of local information (Bitner, 1995; Shilton and Ng, 1995; Lee, 1998), beef, pork, goats milk, and eggs were selected as the desired sampling media.

Beef

Beef is the most common homegrown animal product in Tooele County. Three discrete samples will comprise one composite sample from ranchers in the potentially impacted area. If enough sources are not available, individual samples will be analyzed. Up to three composite samples will be analyzed per sampling event. The laboratory will fabricate composites of the entire samples. Discrete samples will be selected from the homegrown beef slaughtered during a specific year. The samples are anticipated to be frozen. Ground beef will be preferentially selected over other cuts because of the higher fat content (up to 20 percent) and the tendency for dioxins to accumulate in fat.

Pork

Pork samples will be collected because they have different food sources than cows. Pork that have been fed animal products (e.g., excess milk) have the potential to have a higher dioxin concentrations than animals fed vegetable products. Three discrete samples will comprise one composite sample. If enough sources are not available, individual samples will be taken. Up to three composite samples will be analyzed per sampling event. The laboratory will fabricate composites of the entire sample. Samples will be selected from the homegrown pork slaughtered during a specific year. The samples are anticipated to be frozen. Sausage will be preferentially selected over other cuts because of the higher fat content (up to 20 percent) and the tendency for dioxins to accumulate in fat.

Goat’s Milk

Goat’s milk has been identified as the only dairy product potentially being used for human consumption in the vicinity of the TOCDF. Three discrete samples will comprise one composite sample. If enough sources are not available, individual samples will be analyzed. Up to three composite samples will be analyzed per sampling event. The laboratory will fabricate composites of the entire sample. Samples will be selected from the available goat’s milk, which may be fresh and/or canned milk. Separate samples will be composited if both canned and fresh samples are available.

Eggs

Little information exists on the contamination of eggs from free-ranging chickens. Three discrete samples will be analyzed. Three to twelve eggs will comprise one composite sample. Amount of eggs will be determined by detection limit requirements. The laboratory will fabricate composites. Eggs will be selected from the available eggs. The yolk, as opposed to the yolk and egg white, will be analyzed.

Quality Assurance /Quality Control

Field Quality Control/Quality Assurance

Field duplicates, field blanks, equipment blanks, trip blanks, and rinsate samples will not be collected for this project. These quality control samples are used when the sample collector performs actual sampling. The beef and pork samples will be collected maintained in their original wrapping, and kept frozen by immediately placing on blue ice[3]. Milk and eggs will be collected and immediately be placed on ice and maintained at less than 4°C. All bottles used for the sampling will be certified clean by the vendor.

Eggs will be placed in an egg carton and bubble wrapped. Fresh milk samples will be placed in 250-ml amber sample bottle. See Appendix A for summary of sample analysis requirements. A temperature control sample will be provided in the cooler during sampling and shipment. A measurement will be taken before and after shipment and documented on the chain of custody form. Since no sampling tools are required for this sampling event, no additional QC samples will be provided. The quality control samples associated with sampling would not apply to this project since the samples are provided from area residents.

Appendix A lists all data quality objectives in table format (Table A-1 and A-2).

Laboratory Quality Control/Quality Assurance

All method quality control requirements e.g., tuning, method blanks will be adhered to. Additional sample will be provided for matrix spikes/matrix spike duplicates (MS/MSD) for the first sampling event for all matrices. Appendix A lists all data quality objectives in table format. See Tables A-1 and A-2.

Chain of Custody

The sample labels will contain the following information.

1. Facility Name
2. DSHW Sample Tracking Number
3. Type of sample and condition. (Beef hamburger, pork sausage, Egg, Goat Milk, fresh, canned, or frozen)
4. Location of sample. (Residence street address)

[3] Dry ice would maintain the sample in a frozen condition more reliably than blue ice but there are concerns that the dry ice could be a source of volatilized dioxins.

5. Original collection/slaughter date
6. Date and Time sample received by DSHW
7. Preservation (Cool 4°C or frozen)
8. Analysis requested (8290 modified.)
9. Laboratory

Samples will remain in the original container provided. Butcher-paper is a potential source of dioxins to the wrapped meat. The laboratory will be instructed not to sample the outside layer of meat that was in contact with the paper. All wrapped samples will be placed in a ziplock$^{@}$ bags (beef, pork,). Milk and eggs will be bubble wrapped for shipment. The sample labels will be placed on the original container and on the outside of the ziplock$^{@}$ bag or bubble wrap. Chain of custody tags will be place over the cooler to verify security. The samples will be shipped via overnight delivery to the laboratory. Laboratory personnel must be available to receive the chain of custody samples the next day.

Results

Data Validation

All quality control samples and quality control elements will be qualified if they exceed the ranges specified in the method or in Appendix. A, whichever is more stringent. The data will be flagged and an explanation of the usability/impact of the data provided. The laboratory and DSHW will internally review all data for meeting the DQOs.

Data Interpretation

Dioxins detected cannot be conclusively attributed to the TOCDF or any other source. Some researchers have observed that the proportion of individual congeners may provide a signature that suggests a combustion source (e.g., Alcock and Jones, 1996). However, no information on interpreting these signatures in tissue has been found. Potential doses will be calculated assuming both zero and the detection limits for congeners that are not detected.

Analytical results will be reported on an as received basis and on a lipid content basis. Full data package (Level III Plus) will be provided for the first sampling event. Additionally, an electronic copy will also be provided in DSHW format.

Animal Exposures

Information regarding the typical life expectancy of the stock and the source of the feed will be collected by interview. This information is useful for judging the potential for contamination. For instance, animals that graze downwind and in close proximity to the TOCDF have a higher potential for contamination (attributable to the TOCDF) than stock that is fed commercial feed. Older animals are more likely to have higher concentrations than younger animals.

Human Exposures

Information regarding the food consumption habits of the ranchers will be collected by interview. Information such as estimates of average daily consumption rates, length of residence, and ages of household members.

Future Sampling

Samples will be collected periodically to analyze for trends. The frequency will be based on the concentrations observed during the first sampling round and the availability of resources. If an increasing trend is observed, sampling may be extended beyond the life of the facility. The proposed frequency is a minimum of once every five years for the life of the facility. The risk assessment model did not predict significant increases between 10 and 30 years of operations (ATK, 1996) suggesting that sampling every five years would be protective. If dioxin concentrations are high (i.e., health effects are possible), additional locations, that will be controls for TOCDF, may be sampled as part of future efforts. These samples would be intended to determine if dioxins are attributable to the TOCDF.

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Acronym List

CAMDS	Chemical Agent Munitions Disposal System
Division	Division of Solid and Hazardous Waste (Utah)
DQO	Data Quality Objectives
EPA	Environmental Protection Agency
ml	milliliters
MS/MSD	Matrix Spike/Matrix Spike Duplicate
QA	Quality Assurance
QC	Quality Control
TEF	Toxicity Equivalency Factor
TOCDF	Tooele Chemical Disposal Facility
USEPA	United States Environmental Protection Agency

Appendix A

Table A1
Sample Requirements

Sample Matrix	**Min. Sample Size Requirements**	**Holding Time**	**Sample Container**	**Preservatives**	**Analysis Requested***
Egg (Yolk)	12 eggs (4 eggs per sampling location)	30 days to extraction, 45 days to analysis	Egg carton, bubble wrapped	Cool <4°C	Method 8290 + lipids content
Beef (hamburger)	0.5 pound per sampling location	30 days to extraction, 45 days to analysis	Foil or original plastic wrap + ziplock baggie	Frozen <0°C	Method 8290+ lipids content
Pork (sausage)	0.5 pound per sampling location	30 days to extraction, 45 days to analysis	Foil or original plastic wrap + ziplock baggie	Frozen <0°C	Method 8290+ lipids content
Milk-Goat (Fresh or Canned)	250 milliliters per sampling location	30 days to extraction, 45 days to analysis	250ml amber glass bottle w/Teflon lid liner. Or the canned container it came in.**	Cool <4°C	Method 8290+ lipids content

*Method 8290 has been modified. The modifications were to the increase sample size amount and incorporate additional QC requirements during clean up and extraction. This method does not address beef, egg, milk or pork; the method was developed and validated to incorporate these additional matrices.
**The canned milk will not be opened and placed in a separate container. The samples will be shipped as received. Fresh milk will be placed in a 250-ml amber container.

Table A2
Quality Control Requirements Modified Method 8290

Extraction Standards (Sample Fortification Spike)	**Percent Recovery Range**	
$^{13}C_{12}$-2,3,7,8-TCDD	40-135%	
$^{13}C_{12}$-1,2,3,7,8-PeCDD	40-135%	
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	40-135%	
$^{13}C_{12}$-1,2,3,4,6,7,8,-HpCDD	40-135%	
$^{13}C_{12}$-OCDD	40-135%	
$^{13}C_{12}$-2,3,7,8-TCDF	40-135%	
$^{13}C_{12}$-1,2,3,7,8-PeCDF	40-135%	
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	40-135%	
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	40-135%	
Clean Up Standards		
$^{37}C_{4}$-2,3,7,8-TCDD	40-135%	
$^{13}C_{12}$-2,3,4,7,8-PeCDF	40-135%	
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	40-135%	
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	40-135%	
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	40-135%	
Injection Standards (Recovery Standard Spike)		
$^{13}C_{12}$-1,2,3,4,-TCDD		
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD		
Matrix Spikes/Matrix Spike Duplicate	**Percent Recovery**	**Relative Percent Difference (RPD)**
2,3,7,8-TCDD	65-135%	<20%
2,3,7,8-TCDF	65-135%	<20%
1,2,3,7,8-PeCDD	65-135%	<20%
1,2,3,7,8-PeCDF	65-135%	<20%
2,3,4,7,8-PeCDF	65-135%	<20%
1,2,3,4,7,8-HxCDD	65-135%	<20%
1,2,3,6,7,8-HxCDD	65-135%	<20%
1,2,3,7,8,9-HxCDD	65-135%	<20%
1,2,3,4,7,8-HxCDF	65-135%	<20%
1,2,3,6,7,8-HxCDF	65-135%	<20%
1,2,3,7,8,9-HxCDF	65-135%	<20%
2,3,4,6,7,8-HxCDF	65-135%	<20%
1,2,3,4,6,7,8-HpCDD	65-135%	<20%
1,2,3,4,6,7,8-HpCDF	65-135%	<20%
1,2,3,4,7,8,9-HpCDF	65-135%	<20%
OCDD	65-135%	<20%
OCDF	65-135%	<20%