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APPENDIX 2

001463

CARLISLE CONSULTING, INC.

AIR SAMPLING SURVEY

for

**CHLORINE
&
CHLORINE DIOXIDE**

FOR

Alcide Corporation

At

Alcide Sanova Site 1

on

September 28-29, 1999

October 22, 1999

001464

I. Executive Summary

Carlisle Consulting, Inc. was contracted to perform air sampling services in the evisceration/chiller room of the facility, for the purpose of determining if chlorine or chlorine dioxide was present, and if so, to establish whether the air concentrations found were less than established OSHA permissible exposure limits (PELs) or ACGIH Threshold Limit Values (TLVs).

Samples were collected on September 28th and 29th, 1999 and submitted to DataChem Laboratories, in Salt Lake City, Utah, an AIHA (American Industrial Hygiene Association) accredited laboratory, for analysis. The sampling strategy for this survey was to collect two 15-minute samples and two 4-hour samples at two workplace sample locations, for chlorine dioxide analysis. Also, five 75-90 minute samples and two 15-minute samples were collected for chlorine analysis at these locations.

The Occupational Safety and Health Administration (OSHA) enforces compliance with permissible exposure limits (PELs) for many air contaminants. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends allowable air concentrations for many chemicals, which are called threshold limit values (TLVs). The air concentrations of concern for chlorine dioxide are:

OSHA PEL - .1 ppm (as an 8-hour time-weighted average air concentration, or TWA),
ACGIH TLV - .1 ppm (as an 8-hour time-weighted average air concentration, or TWA), and
ACGIH TLV - .3 ppm (as a 15 minute short term exposure limit, or STEL).

Air concentrations of concern for chlorine are:

OSHA PEL - 1 ppm (as an ceiling concentration),
ACGIH TLV - .5 ppm (as an 8-hour time-weighted average air concentration, or TWA), and
ACGIH TLV - 1 ppm (as a 15 minute short-term exposure limit, or STEL).

Air concentrations calculated from the analytical results were combined in a formula, resulting in an 8-hour time-weighted average air concentration for each sample location, which was then compared to applicable 8-hour employee exposure limits (OSHA PELs and ACGIH TLVs). The 15-minute sample results were used to calculate air concentrations which were compared directly with short-term (15-minute) PELs and TLVs.

The locations sampled were: at the USDA inspection station, and by the entrance end of the chiller. Chlorine dioxide was not detected at these locations. The detection limit was 2 μ g, which resulted in

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detection limit air concentrations ranging from 0.097 ppm, for the short-term samples and from 0.0064-0.0066 ppm, for the four-hour samples. Detection limit concentrations vary inversely with air sample volumes, i.e. - the short-term air sample (lower air sample volume) detection limits are greater than the longer term air sample detection limits.

Chlorine was detected in most of the samples analyzed (at low concentrations). The results ranged from undetected to 0.170 ppm, well below applicable occupational exposure limits.

II. Air Sampling and Analytical Methods

Air samples were collected for chlorine dioxide analysis by bubbling air at a known flow rate through approximately 15 ml of an impinger solution (0.02% potassium iodide in a sodium carbonate/sodium bicarbonate buffer) in a standard glass midget impinger. The analytical method (OSHA ID-202) specified the use of special "fritted" impinger nozzles. Sintered glass "frits" allow greater contact between the sampled air and the solution in the impinger. Personal air sampling pumps were calibrated to sample the air at a flow rate of approximately .5 liters per minute. This air sampling pump calibration was performed before and after each sample was collected by using a Gilian Instruments "Giliblator", a primary (NIST-traceable) standard air flow measurement device, with the impinger to be used for sampling in-line. The flow rates measured before and after sampling were averaged. The resulting average flow rate was multiplied by the duration of the sampling period in order to get an air sample volume. The analytical result (reported by the laboratory in micrograms) was divided by the air sample volume (in cubic meters) in order to calculate the air concentration.

Samples were collected for chlorine analysis in a similar manner, using a filter cassette (loaded with a silver membrane filter and teflon prefilter), as specified in the NIOSH (National Institute for Occupational Safety and Health) Analytical Method #6011, at a flow rate of approximately 1 liter per minute.

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Samples were collected for comparison with the OSHA and ACGIH 8-hour time-weighted average exposure limits (for chlorine dioxide - two 4 hour samples at two locations, for chlorine - five 75-90 minute samples at two locations) as well as the short-term/ceiling exposure limits (2- 15 minute samples at each of those locations, for chlorine and chlorine dioxide). The two sample locations were chosen based on proximity to the source and potentially exposed workers. The inlet to the sampling device was placed as closely as possible to breathing zone height. The sampling pump, tubing, and impinger (or filter cassette) were placed in a plastic container, before carrying into the processing area and during sampling, in order to alleviate concern about potential breakage.

The analytical method used for the analysis of the chlorine dioxide samples was the OSHA ID-202 method; the liquid impinger solution is analyzed with an ion chromatograph equipped with a conductivity detector and gradient pump. The chlorine analytical method (NIOSH 6011) also uses ion chromatography with a conductivity detector.

III. Discussion of Results

Chlorine dioxide was not detected in the samples collected during this survey (from the entry end of the chiller and at the USDA inspection station).

Chlorine was detected in all but four of the fourteen samples collected on September 28, and all but three of the fourteen samples collected on September 29. The short-term (15-minute) sample results ranged from <0.023 ppm - 0.075 ppm. The time-weighted average chlorine concentrations found were all well below the occupational exposure limits, as shown in the following table:

Location	September 28	September 29
Chiller	0.016 ppm	0.022 ppm
FSIS inspection station	0.014 ppm	0.010 ppm

It should be noted that the OSHA PELs and ACGIH TLVs are personal exposure limits, and are based on the air concentrations in any given worker's breathing zone. Personal exposure to an air contaminant is best estimated by placing the inlet to the sampling device (in this case, the impinger inlet) in the worker's breathing zone, and attaching the air sampling pump (which draws air through the impinger) to the worker's belt or pocket. Because of the possibility for breakage of the glass impingers or sample collection solution spilling in the vicinity of the product, area air monitoring (with the entire sampling apparatus contained) was chosen as the most feasible alternative.

IV. Conclusions

The 8-hr. time weighted average chlorine and chlorine dioxide air concentrations detected on September 28th and 29th at the chiller and drip pan sample locations were low (undetectable amounts of chlorine dioxide and 2-4.4% of the chlorine eight hour ACGIH threshold limit value (.5 ppm TWA).

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The short-term (15 minute) samples also resulted in undetectable amounts of chlorine dioxide. The highest chlorine concentration found in the short-term samples collected at these locations was only .075 ppm (7.5% of the OSHA ceiling and ACGIH STEL of 1 ppm.

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**Table 1
Alcide Sanova site 1
Area Air Monitoring
Chlorine Dioxide Results**

OSHA PEL - .1 ppm (8 hr. TWA)
ACGIH TLV - .1 ppm (8 hr. TWA)
- .3 ppm (15 min. STEL)

Samples collected: 9/28/99 (am shift) & 9/29/99 (pm shift)

Sample Number	Area	Total Time (min.)	Average Flow Rate (Lpm)	Sample Volume (m ³)	Mass Found/ Sample ClO ₂ (µg)	Air Concentration ClO ₂ (mg/m ³)	Air Concentration ClO ₂ (ppm)
92802	Chiller, entrance end	226	.50	.11	<	<0.018	<0.0066
92803	USDA station	228	.50	.11	<	<0.018	<0.0065
92808	Chiller, entrance end	15	.50	.0075	<	<0.27	<0.097
92809	USDA station	15	.50	.0075	<	<0.27	<0.097
92820	Chiller, entrance end	225	.50	.11	<	<0.018	<0.0064
92821	USDA station	222	.50	.11	<	<0.018	<0.0065
92832	Chiller, entrance end	15	.50	.0075	<	<0.27	<0.097
92833	USDA station	15	.50	.0075	<	<0.27	<0.097
92834	Blank	-	-	-	<	-	-
92902	Chiller, entrance end	225	.50	.11	<	<0.018	<0.0064
92903	USDA station	225	.50	.11	<	<0.018	<0.0064
92908	Chiller, entrance end	15	.50	.0075	<	<0.27	<0.097
92909	USDA station	15	.50	.0075	<	<0.27	<0.097
92920	Chiller, entrance end	225	.50	.11	<	<0.018	<0.0064
92921	USDA station	225	.50	.11	<	<0.018	<0.0064
92932	Chiller, entrance end	15	.50	.0075	<	<0.27	<0.097
92933	USDA station	15	.50	.0075	<	<0.27	<0.097
92934	Blank	-	-	-	<	-	-

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**Table 2
Alcide Sanova site 1
Area Air Monitoring
Chlorine Results**

OSHA PEL - 1 ppm (ceiling)
ACGIH TLV - .5 ppm (8 hr. TWA)
- 1 ppm (15 min. STEL)

Samples collected: 9/28/99 (am shift)

Sample Number	Area	Total Time (min.)	Average Flow Rate (Lpm)	Sample Volume (m ³)	Mass Found/ Sample Cl ₂ (µg)	Air Concentration Cl ₂ (mg/m ³)	Air Concentration Cl ₂ (ppm)
92805	Chiller, entrance end	82	1.0	.082	4.2	0.051	0.018
92806	USDA station	82	1.0	.082	3.4	0.041	0.014
92811	Chiller, entrance end	15	1.0	.015	2.6	0.173	0.059
92812	USDA station	15	1.0	.015	2.2	0.147	0.050
92814	Chiller, entrance end	90	1.0	.090	10	0.111	0.039
92815	USDA station	90	1.0	.090	9.1	0.101	0.035
92817	Chiller, entrance end	98	1.0	.098	1.4	0.014	0.0051
92818	USDA station	98	1.0	.098	<1	<0.010	<0.0035
92823	Chiller, entrance end	90	1.0	.090	1.2	0.013	0.0047
92824	USDA station	90	1.0	.090	<1	<0.011	<0.0044
92826	Chiller, entrance end	90	1.0	.090	<1	0.60	<0.0038
92827	USDA station	90	1.0	.090	1.5	<0.011	0.0059
92829	Chiller, entrance end	15	1.0	.015	1.1	0.073	0.025
92830	USDA station	15	1.0	.015	<1	<0.067	<0.023
92835	Blank	-	-	-	2.3	-	-

8 Hr. TWAs - conservatively calculated (results of "non-detect" included at the detection limit)

Chiller - (Sample numbers - 92805, 11, 14, 17, 23, 26, & 29)

$$[(82 \text{ min.} \times .018 \text{ ppm}) + (15 \times .059) + (90 \times .039) + (98 \times .0051) + (90 \times .0047) + (90 \times .0038) + (15 \times .025)] / 480 \text{ min.} = 0.016 \text{ ppm}$$

USDA station - (Sample numbers - 92806, 12, 15, 18, 24, 27, & 30)

$$[(82 \text{ min.} \times .014 \text{ ppm}) + (15 \times .050) + (90 \times .035) + (98 \times .0035) + (90 \times .0044) + (90 \times .0059) + (15 \times .023)] / 480 \text{ min.} = 0.014 \text{ ppm}$$

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**Table 2
Alcide Sanova site 1
Area Air Monitoring
Chlorine Results**

OSHA PEL - 1 ppm (ceiling)
ACGIH TLV - .5 ppm (8 hr. TWA)
- 1 ppm (15 min. STEL)

Samples collected: 9/29/99 (pm shift)

Sample Number	Area	Total Time (min.)	Average Flow Rate (Lpm)	Sample Volume (m ³)	Mass Found/ Sample Cl ₂ (ug)	Air Concentration Cl ₂ (mg/m ³)	Air Concentration Cl ₂ (ppm)
92905	Chiller, entrance end	75	1.0	.1125	8.9	0.079	0.041
92906	USDA station	75	1.0	.1125	1.2	0.011	0.0054
92911	Chiller, entrance end	15	1.0	.015	<1	<0.067	<0.023
92912	USDA station	15	1.0	.015	3.3	0.22	0.075
92914	Chiller, entrance end	90	1.0	.090	9.6	0.11	0.037
92915	USDA station	90	1.0	.090	2.8	0.031	0.011
92917	Chiller, entrance end	90	1.0	.090	5.3	0.059	0.020
92918	USDA station	90	1.0	.090	2.7	0.03	0.010
92923	Chiller, entrance end	75	1.0	.075	3.9	0.052	0.018
92924	USDA station	75	1.0	.075	1.5	0.020	0.0069
92926	Chiller, entrance end	15	1.0	.015	1.1	0.073	0.024
92927	USDA station	15	1.0	.015	<1	<0.067	<0.023
92929	Chiller, entrance end	90	1.0	.090	<1	<0.011	<0.0038
92930	USDA station	90	1.0	.090	1.4	0.016	0.0053
92935	Blank	-	-	-	<1	-	-

8 Hr. TWAs - conservatively calculated (results of "non-detect" included at the detection limit)

Chiller - (Sample numbers - 92905, 11, 14, 17, 23, 26, & 29)

$$[(75 \text{ min.} \times 0.041 \text{ ppm}) + (15 \times 0.023) + (90 \times 0.037) + (90 \times 0.02) + (75 \times 0.018) + (15 \times 0.024) + (90 \times 0.0038)] / 480 \text{ min.} = 0.022 \text{ ppm}$$

USDA station - (Sample numbers - 92906, 12, 15, 18, 24, 27, & 30)

$$[(75 \text{ min.} \times 0.0054 \text{ ppm}) + (15 \times 0.075) + (90 \times 0.011) + (90 \times 0.01) + (75 \times 0.0069) + (15 \times 0.023) + (90 \times 0.0053)] / 480 \text{ min.} = 0.010 \text{ ppm}$$

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CARLISLE CONSULTING, INC.

AIR SAMPLING SURVEY

for

**CHLORINE
&
CHLORINE DIOXIDE**

FOR

Alcide Corporation

at

Alcide Sanova Site 2

on

October 5, 1999

October 22, 1999

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I. Executive Summary

Carlisle Consulting, Inc. was contracted to perform air sampling services in the evisceration/chiller room of the facility, for the purpose of determining if chlorine or chlorine dioxide was present, and if so, to establish whether the air concentrations found were less than established OSHA permissible exposure limits (PELs) or ACGIH Threshold Limit Values (TLVs).

Samples were collected on October 5, 1999 and submitted to DataChem Laboratories, in Salt Lake City, Utah, an AIHA (American Industrial Hygiene Association) accredited laboratory, for analysis. The sampling strategy for this survey was to collect two 15-minute samples and two 4-hour samples at each of three sample locations, for chlorine dioxide analysis. Also, five 75-90 minute samples and two 15-minute samples were collected for chlorine analysis at these locations.

The Occupational Safety and Health Administration (OSHA) enforces compliance with permissible exposure limits (PELs) for many air contaminants. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends allowable air concentrations for many chemicals, which are called threshold limit values (TLVs). The air concentrations of concern for chlorine dioxide are:

OSHA PEL - .1 ppm (as an 8-hour time-weighted average air concentration, or TWA),

ACGIH TLV - .1 ppm (as an 8-hour time-weighted average air concentration, or TWA), and

ACGIH TLV - .3 ppm (as a 15 minute short term exposure limit, or STEL).

Air concentrations of concern for chlorine are:

OSHA PEL - 1 ppm (as an ceiling concentration),

ACGIH TLV - .5 ppm (as an 8-hour time-weighted average air concentration, or TWA), and

ACGIH TLV - 1 ppm (as a 15 minute short-term exposure limit, or STEL).

Air concentrations calculated from the analytical results were combined in a formula, resulting in an 8-hour time-weighted average air concentration for each sample location, which was then compared to applicable 8-hour employee exposure limits (OSHA PELs and ACGIH TLVs). The 15-minute sample results were used to calculate air concentrations which were compared directly with short-term (15-minute) PELs and TLVs.

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The locations sampled were: near the spray cabinet entrance, at the USDA inspection station, and by the entrance end of the chiller. Chlorine dioxide was not detected in any of the samples. The detection limit was 2 µg, which resulted in a detection limit air concentration of 0.097 ppm, for the short-term samples and from 0.0064 ppm, for the four-hour samples.

Detection limit concentrations vary inversely with air sample volumes, i.e. - the short-term air sample (lower air sample volume) detection limits are greater than the longer term air sample detection limits.

Chlorine was detected in most of the samples analyzed (at low concentrations). The results ranged from undetected to 0.093 ppm, well below applicable occupational exposure limits.

II. Air Sampling and Analytical Methods

Air samples were collected for chlorine dioxide analysis by bubbling air at a known flow rate through approximately 15 ml of an impinger solution (0.02% potassium iodide in a sodium carbonate/sodium bicarbonate buffer) in a standard glass midget impinger. The analytical method (OSHA ID-202) specified the use of special "fritted" impinger nozzles. Sintered glass "frits" allow greater contact between the sampled air and the solution in the impinger. Personal air sampling pumps were calibrated to sample the air at a flow rate of approximately .5 liters per minute. This air sampling pump calibration was performed before and after each sample was collected by using a Gilian Instruments "Giliberator", a primary (NIST-traceable) standard air flow measurement device, with the impinger to be used for sampling in-line. The flow rates measured before and after sampling were averaged. The resulting average flow rate was multiplied by the duration of the sampling period in order to get an air sample volume. The analytical result (reported by the laboratory in micrograms) was divided by the air sample volume (in cubic meters) in order to calculate the air concentration.

Samples were collected for chlorine analysis in a similar manner, using a filter cassette (loaded with a silver membrane filter and teflon prefilter), as specified in the NIOSH (National Institute for Occupational Safety and Health) Analytical Method #6011, at a flow rate of approximately 1 liter per minute.

Samples were collected for comparison with the OSHA and ACGIH 8-hour time-weighted average exposure limits (for chlorine dioxide - two 4-hour samples at three locations, for chlorine - five 75-90 minute samples at three locations) as well as the short-term/ceiling exposure limits (2 - 15 minute samples at each of those locations, for chlorine and chlorine dioxide). The three sample locations were chosen based on proximity to the source and potentially exposed workers. The inlet to the sampling device was placed as closely as possible to breathing zone height. The sampling pump, tubing, and impinger (or filter cassette) were placed in a plastic container, before carrying into the processing area and during sampling, in order to alleviate concern about potential breakage.

The analytical method used for the analysis of the chlorine dioxide samples was the OSHA ID-202 method; the liquid impinger solution is analyzed with an ion chromatograph equipped with a conductivity detector and gradient pump. The chlorine analytical method (NIOSH 6011) also uses ion chromatography with a conductivity detector.

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III. Discussion of Results

Chlorine dioxide was not detected in any of the samples.

Chlorine was detected in all but two of the twenty-one samples collected. The initial sample collected at the chiller location could not be analyzed, because the filter cassette seal opened as the sample was retrieved. The time-weighted average calculated for this sample location assumed that the air concentration during this period was the same as during the second sample period (0.039 ppm). The short-term (15-minute) sample results ranged from <0.067 ppm- 0.093 ppm. The time-weighted average chlorine concentrations found were all well below the occupational exposure limits, as shown in the following table:

Location	
Spray cabinet	0.021 ppm
Chiller	0.023 ppm
FSIS inspection station	0.022 ppm

It should be noted that the OSHA PELs and ACGIH TLVs are personal exposure limits, and are based on the air concentrations in any given worker's breathing zone. Personal exposure to an air contaminant is best estimated by placing the inlet to the sampling device (in this case, the impinger inlet) in the worker's breathing zone, and attaching the air sampling pump (which draws air through the impinger) to the worker's belt or pocket. Because of the possibility for breakage of the glass impingers or sample collection solution spilling in the vicinity of the product, area air monitoring (with the entire sampling apparatus contained) was chosen as the most feasible alternative.

IV. Conclusions

Chlorine dioxide was not detected in any of the samples. The sample results for chlorine were well below applicable occupational exposure limits.

The highest chlorine concentration found in the short-term samples collected was only 0.093 ppm (9.3% of the OSHA ceiling and ACGIH STEL of 1 ppm. Time-weighted average chlorine concentrations were also very low (0.021 ppm- 0.023 ppm).

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**Table 1
Alcide Sanova site 2
Area Air Monitoring
Chlorine Dioxide Results**

OSHA PEL - .1 ppm (8 hr. TWA)
ACGIH TLV - .1 ppm (8 hr. TWA)
- .3 ppm (15 min. STEL)

Samples collected: 10/5/99 (am shift)

Sample Number	Area	Total Time (min.)	Average Flow Rate (Lpm)	Sample Volume (m ³)	Mass Found/ Sample ClO ₂ (ug)	Air Concentration ClO ₂ (mg/m ³)	Air Concentration ClO ₂ (ppm)
10501	by spray cabinet	225	.5	.1125	<2	<0.018	<0.0064
10502	Chiller, entrance end	225	.5	.1125	<2	<0.018	<0.0064
10503	USDA station	225	.5	.1125	<2	<0.018	<0.0064
10507	by spray cabinet	15	.5	.0075	<2	<0.27	<0.097
10508	Chiller, entrance end	15	.5	.0075	<2	<0.27	<0.097
10509	USDA station	15	.5	.0075	<2	<0.27	<0.097
10519	By spray cabinet	225	.5	.1125	<2	<0.018	<0.0064
10520	Chiller, entrance end	225	.5	.1125	<2	<0.018	<0.0064
10521	USDA	225	.5	.1125	<2	<0.018	<0.0064
10531	By spray cabinet	15	.5	.0075	<2	<0.27	<0.097
10532	Chiller, entrance end	15	.5	.0075	<2	<0.27	<0.097
10533	USDA	15	.5	.0075	<2	<0.27	<0.097
10534	Blank	-	-	-	<2	-	-

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**Table 2
Alcide Sanova Site 2
Area Air Monitoring
Chlorine Results**

OSHA PEL - 1 ppm (ceiling)
ACGIH TLV - .5 ppm (8 hr. TWA)
- 1 ppm (15 min. STEL)

Samples collected: 10/5/99 (am shift)

Sample Number	Area	Total Time (min.)	Average Flow Rate (Lpm)	Sample Volume (m ³)	Mass Found/ Sample Cl ₂ (µg)	Air Concentration Cl ₂ (mg/m ³)	Air Concentration Cl ₂ (ppm)
10504	by spray cabinet	75	1.0	75	7.0	0.093	0.032
10505	Chiller, entrance end		VOID		-	-	-
10506	USDA station	75	1.0	75	9.8	0.13	0.045
10510	by spray cabinet	15	1.0	15	3.4	0.22	0.077
10511	Chiller, entrance end	15	1.0	15	1.8	0.12	0.041
10512	USDA station	15	1.0	15	4.1	0.27	0.093
10513	by spray cabinet	90	1.0	90	12	0.13	0.046
10514	Chiller, entrance end	90	1.0	90	10	0.11	0.039
10515	USDA station	90	1.0	90	7.4	0.081	0.028
10516	by spray cabinet	90	1.0	90	1.5	0.016	0.0056
10517	Chiller, entrance end	90	1.0	90	3.7	0.041	0.014
10518	USDA station	90	1.0	90	2.6	0.028	0.0098
10522	by spray cabinet	75	1.0	75	2.1	0.027	0.0094
10523	Chiller, entrance end	75	1.0	75	2.1	0.027	0.0094
10524	USDA station	75	1.0	75	1.9	0.025	0.0087
10525	by spray cabinet	15	1.0	15	<1	<0.067	<0.023
10526	Chiller, entrance end	15	1.0	15	1.4	0.096	0.033
10527	USDA station	15	1.0	15	<1	<0.067	<0.023
10528	By spray cabinet	90	1.0	90	1.8	0.020	0.0068
10529	Chiller, entrance end	90	1.0	90	3.7	0.041	0.014
10530	USDA station	90	1.0	90	2.5	0.028	0.0096
10535	Blank	-	-	-	<1	-	-

8 Hr. TWAs - conservatively calculated (results of "non-detect" included at the detection limit)

Spray cabinet - (Sample numbers - 10504, 10, 13, 16, 22, 25 & 28), unsampled 30 min. period assumed equal to last sampled period)
[75 min. (.032ppm) + 15(.077) + 90(.046) + 90(.0056) + 75(.0094) + 15(<0.023) + 90(.0068) + 30(.0068)] / 480 min. = 0.021 ppm

Chiller - (Sample numbers - 10511, 14, 17, 23, 26, & 29) [75 min. (.039 ppm) + 15(.041ppm) + 90(.039) + 90(.014) + 75(.0094) + 15(.033) + 90(.014) + 30(.014)] / 480 min. = 0.023 ppm

USDA station - (Sample numbers - 10506, 12, 15, 18, 24, 27, & 30) [75 min.(.045 ppm) + 15(.093) + 90(.028) + 90(.0098) + 75(.0098) + 15(<.023) + 90(.0096) + 30(.0096)] / 480 min. = 0.022 ppm

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