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OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM (CONFIDENTIAL)

Subject: Determination of Polychlorinated Dibenzo-p-Dioxins/Dibenzofurans in Technical 2,4-D. Response to DCI. I. D. No. 15440-15. DP Barcode D172230. MRID/Accession Nos. 41799501, 41799502, 41874301, 41874300, 42050600 - 42050607. CBRS No. 9069.

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Background

In response to a 06/87 DCI, A. H. Marks and Company Limited, Wyke, England, previously submitted data for CDD's and CDF's in technical 2,4-D Acid, or 2-(2,4-dichlorophenoxy)acetic acid. The submission was reviewed, and 13 deficiencies were noted (06/13/90 Memorandum, S. Funk, DEB No. 6330). Only a summary table of results with no supporting documentation was presented. The registrant has responded (03/01/91, revised 10/10/91,) with a detailed analytical report. The analyses were performed by Chemserv Industrie Service Ges.m.b.H., Linz, Austria, using Method 40288.

Discussion

Seven samples of 2,4-D were collected, prepared, and analyzed according to the following schedule:

Table 1: Collection and Analysis Schedule of 2,4-D Samples

A.H. Marks Lot No.	Lab Sample No.	Date Collected	Date Prepared	Date Analyzed
117	2954365	02/14/89	04/25/89	06/20/89
139	2954366	02/25/89	04/25/89	06/20/89
141	2954367	02/26/89	04/25/89	06/20/89
146	2954368	03/01/89	04/25/89	06/20/89
148	2954369	03/02/89	04/25/89	06/20/89
149	2954370	03/03/89	04/25/89	06/20/89
153	2954371	03/05/89	04/25/89	06/20/89

Each sample was prepared and analyzed in duplicate (A and B). Additionally, four samples (2954365, 2954367, 2954368, and 2954370) were spiked with all 15 target analytes at or below the EPA LOQ's, prepared, and analyzed. Each sample and each spike sample were fortified with a solution of $^{13}C_{12}$-labeled CDD's/CDF's before extraction and workup. Results, including raw data, and chromatograms are presented for all samples and spiked samples. No results or chromatograms are presented for the blank. Results are summarized in Table 2.

All $^{13}C_{12}$-internal standard recoveries are within the DCI-required limits of 50% - 150%. All (natural abundance) spike analyte recoveries are within the 50% - 150% limits. The DCI requires that one sample fortified in duplicate with the internal standards yields a RPD $\leq$ 20% for each $^{13}C_{12}$-compound in the sample and its duplicate. This condition is met for sample no. 2954367A/B (Table 2). Although not specifically required by the DCI, data were submitted proving similar precision for sample nos. 2954368A/B and 2954370A/B.

Five-point calibrations were made for each analyte, from 0.1 to 1 ng/g for 2,3,7,8-TCDD, from 0.5 to 5 ng/g for 1,2,3,7,8-PCDD, from 1.0 to 10 ng/g for 2,3,7,8-TCDF, from 2.5 to 25 ng/g for HxCDD's, and from 5 to 50 ng/g for all remaining target analytes. A response factor at each concentration level for each analyte was determined relative to the corresponding $^{13}C_{12}$-labeled compound, except for 2,3,4,6,7,8-HxCDF. The response factor for the latter was determined relative to $^{13}C_{12}$-1,2,3,7,8,9-HxCDF. Response factors for the internal standards were determined relative to the recovery standards $^{13}C_{12}$-1,2,3,4-TCDD (or $^{37}Cl_4$-2,3,7,8-TCDD ?, 0.1 ng/g) and

$^{13}C_6$-1,2,3,4,6,7,8-HpCDF (2.5 ng/g). A mean relative response factor was calculated for each target analyte. The RSD was < 10% for all analytes. The DCI and the Guidelines for the Determination of Halogenated Dibenzo-p-Dioxins and Dibenzofurans in Commercial Products (EPA-560/5-87/007) do not establish acceptable deviations for the initial calibration, but EPA method 1613 specifies a maximum RSD ≤ 20% for isotope dilution techniques. The < 10% achieved by the registrant is acceptable. The date(s) of the initial calibration cannot be ascertained from the data presented. No calibration chromatograms were supplied.

Table 2: Analysis Results Summary for CDD/CDF in 2,4-D

Analyte	$^{13}C_{12}$-CDD/CDF Concentration and/or CDD/CDF Spike Concentration (ng/g) and (EPA LOQ, ng/g)	$^{13}C_{12}$-CDD/CDF Recovery Range (%)[1]	Target Analyte Recovery Range (%)[2]	Maximum CDD/CDF Concentration (ng/g)[3]	RPD for $^{13}C_{12}$-Internal Standards in Nos. 2954367A and B (%)
2,3,7,8-TCDD	0.1 (0.1)	91 - 114	89 - 128	0.02	2.1
1,2,3,7,8-PCDD	0.5 (0.5)	79 - 111	84 - 97	0.01	9.8
1,2,3,4,7,8-HxCDD	2.5 (2.5)	82 - 105	85 - 89	0.03	4.5
1,2,3,6,7,8-HxCDD	2.5 (2.5)	99 - 132	92 - 103	0.08	4.0
1,2,3,7,8,9-HxCDD	2.5 (2.5)	102 - 138	90 - 94	0.03	0.01
1,2,3,4,6,7,8-HpCDD	5 (100)	99 - 109	110 - 123	0.45	1.9
2,3,7,8-TCDF	1 (1)	75 - 101	80 - 98	0.12	8.8
1,2,3,7,8-PCDF	5 (5)	75 - 96	92 - 98	0.07	8.2
2,3,4,7,8-PCDF	5 (5)	71 - 97	94 - 98	0.03	9.3
1,2,3,4,7,8-HxCDF	5 (25)	77 - 96	93 - 99	0.08	0.0
1,2,3,6,7,8-HxCDF	5 (25)	92 - 128	94 - 98	0.02	4.9
1,2,3,7,8,9-HxCDF	5 (25)	93 - 123	95 - 99	<0.01[4]	2.5
2,3,4,6,7,8-HxCDF	5 (25)	Not Spiked	95 - 102	0.06	Not Spiked
1,2,3,4,6,7,8-HpCDF	5 (1000)	100 - 131	94 - 100	0.1	3.2
1,2,3,4,7,8,9-HpCDF	5 (1000)	97 - 132	94 - 100	<0.01[4]	9.5

[1] Includes seven samples in duplicate and four native analyte spiked samples. These values cannot be verified (see text).
[2] Four samples fortified with target analytes.
[3] Maximum concentration found in the seven lots analyzed. Values are substantially less than the $^{13}C_{12}$-internal standard concentration (and the lowest standard) and are semi-quantitative only.
[4] Not detected at the indicated estimated detection limit.

No data are presented for the two recovery standards. The response factors used for calculating internal standard recoveries in the

samples and controls cannot, therefore, be verified. As a result, the internal standard recoveries cannot be verified.

Calculations for the sample analyte concentrations have been checked and found valid. Chromatograms show no potential target analyte peaks for any sample other than those identified by the registrant. All identified peaks have concentrations < EPA LOQ. Chromatograms for the samples spiked with target analytes at or below the LOQ's have analyte peaks with signal-to-noise ratios significantly above 10 to 1, e.g., about 20 to 1 for 1 ppb 2,3,7,8-TCDF. Likewise, internal standard peaks in all samples display signal-to-noise ratios greater than or equal to 10 to 1, except the $^{13}C_{12}$-2,3,7,8-TCDD peaks (0.1 ppb) signal-to-noise ratios of 2:1 in samples 2954366, 2954367, 2954368, and 2954371 and ratios of 5:1 in samples 2954369 and 2954370. This violates the requirements of the DCI and the Guidelines. The 0.1 ppb labeled TCDD peak is readily detected, however, and the samples spiked with 2,3,7,8-TCDD at 0.1 ppb gave excellent recoveries. Chromatorgrams for spiked sample 2954370S clearly show the peaks (m/z 320, m/z 322) for 2,3,7,8-TCDD (0.1 ng/g) with a signal-to-noise ratio > 10:1. Any 2,3,7,8-TCDD at levels $\geq$ 0.1 ppb would have been detected.

Analyses were conducted on a DB-5 capillary column (50 m) with a Finnigan/MAT 311A mass spectrometer operating in the multiple ion mode. Ions monitored correspond to those recommended by the Guidelines. No chromatograms were submitted to show adequate peak resolution, e.g., 2,3,7,8-TCDD separation from other TCDD isomers. No confirmatory analyses are reported, but none are required because no target analyte was found at an apparent concentration $\geq$ EPA LOQ.

The registrant has submitted a new CSF incorporating upper and lower limits for the dioxins/dibenzofurans. The CSF is summarized in Table 3. Lower limits are not appropriate for impurities. The upper limits are the concentrations of the internal standard spiking compounds, the concentration of the lowest standard, and the concentration of the natural abundance sample fortified samples. Accuracy and precision have been demonstrated at these concentrations, and the subject CDD's and CDF's are clearly not present in the seven lots analyzed at these levels. These values are, therefore, acceptable upper limit concentrations.

Table 3: Revised Confidential Statement of Formula Certified Limits for Technical 2,4-D (15440-15), 10/19/90.

[redacted]

Conclusion

CBRS concludes that none of the 15 2,3,7,8-substituted tetra- to hepta- chlorinated dibenzo-p-dioxins and dibenzofurans are present at or above the EPA LOQ's in any of the 7 lots of technical 2,4-D Acid analyzed. The registrant demonstrated via analysis of four samples fortified with the target analytes the ability to generate accurate results at the required levels of quantitation (LOQ). The RPD's < 20% for $^{13}C_{12}$-internal standard recoveries in a sample and its duplicate establish adequate precision.

The report contains several substantial deficiencies, but none alter the conclusion that the samples did not contain polychlorinated dibenzo-p-dioxins and/or dibenzofurans at levels

above the EPA LOQ's. Deficiencies include:

1. Raw data were not supplied for the calibration standard recovery standard compounds. Therefore, the response factors for the internal standards and the per cent recoveries for the internal standards could not be verified. It also appears that $^{13}C_{12}$-1,2,3,4-TCDD was used as a recovery standard, rather than $^{37}Cl_4$-2,3,7,8-TCDD specified in Method 40288.

2. Chromatograms were not supplied for the standards.

3. Date(s) of generation of the initial calibration was (were) not supplied. It is assumed that calibration was performed on the date of sample analyses (06/20/89). Were this not the case, continuing calibration data and chromatograms should have been supplied for 06/20/89.

4. No data, chromatograms, or results were supplied for the method blank. This is not critical because no interference/contamination was noted in any sample.

5. Chromatograms and/or data were not presented to demonstrate adequate gc column resolution. Inadequate resolution could cause exaggerated values for target analytes.

6. The internal standard $^{13}C_{12}$-2,3,7,8-TCDD (0.1 ppb) generally had a signal-to-noise ratio < 10:1 in the samples. The DCI requires a $\geq$ 10:1 ratio. The ratio was in the 2 to 5:1 range, adequate to identify any 2,3,7,8-TCDD present at 0.1 ppb. Also, four samples spiked with 2,3,7,8-TCDD at 0.1 ppb gave adequate recoveries.

Recommendation

A.H. Marks Co. Limited has complied with the DCI for the analysis of technical 2,4-D Acid for chlorinated dibenzo-p-dioxins and dibenzofurans. CBRS recommends that the registrant be requested to submit a new CSF without lower certified limits for the dioxin/dibenzofuran impurities and the other impurities. Also, the registrant should be informed of the deficiencies (nos. 1 - 6) noted in the Conclusion. This will prevent the reoccurrence in related submissions for other technical chemicals. No additional analytical work is required for technical 2,4-D Acid.

cc: RF, Dioxin SF, 2,4-D Reg. Standard File, 2,4-D Subject File, S. Funk, P. Deschamp (Update File), C. Furlow/J. Burrell (PIB, FOD).

RDI:A. Rathman:01/08/92:D. Edwards:01/08/92:E. Zager:01/09/92:.

H7509C:CBRS:S.Funk:305-5430:CM#2:RM803-A:SF(DIOX.140):01/03/92.