ATTACHMENT IV

MRI REPORT

Polychlorinated Dibenzo-*p*-Dioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) Analysis of Chlorinated PVC Samples

For The BF Goodrich Company
Technical Center
Moore and Walker Road
P.O. Box 122
Avon Lake, OH 44012

Attn: Dr. John Nikora

MRI Project No. 6415-A

December 17, 1991

SPI-01397

MIDWEST RESEARCH INSTITUTE 425 Volker Boulevard, Kansas City, MO 64110-2299 • (816) 753-7600

PREFACE

This report provides the polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) results from the analysis of five chlorinated PVC samples. The results for corresponding quality control samples including a laboratory method blank and duplicate matrix spikes are also presented.

The samples were prepared for analysis by Mr. Mark Clapp under the direction of Ms. Kathy Boggess, and the HRGC/HRMS analyses were performed by Mr. Mark Horrigan. Ms. Boggess performed the data reduction and prepared this report.

MIDWEST RESEARCH INSTITUTE

Kathy E. Boggess
Chemist

John S. Stanley, Ph.D.
Head
Analytical Chemistry Section

Approved:

John E. Going, Ph.D.
Director
Chemical Sciences Department

CONTENTS

Preface ii
Tables iv

1. Introduction 1
2. Sample Receipt 2
3. Experimental Approach 3
   - Particle size reduction 3
   - Solvent compatibility studies 3
   - Sample preparation 4
   - HRGC/HRMS analysis 5
   - Data reduction 5
4. Results 7

LIST OF TABLES

Number		Page
1	Internal quantitation standard spiking solution	8
2	Native standard spiking solution	9
3	PCDD and PCDF calibration standards	10
4	Concentrations (pg/g) of PCDDs and PCDFs in chlorinated PVC samples	11
5	Quality control sample results	12
6	Absolute recoveries (%) of $^{13}C_{12}$- internal quantitation standards	13

SECTION 1

INTRODUCTION

Midwest Research Institute (MRI) was contracted by the BF Goodrich Company to determine the levels of 2,3,7,8-substituted tetra- through octachlorinated polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) in five chlorinated PVC samples. The samples included bar stock, compound cubes, pipe, and two chlorinated PVC resins.

This report presents the sample receipt, experimental approach, and results of the PCDDs and PCDFs analysis of the chlorinated PVC samples and corresponding quality control samples.

SECTION 2

SAMPLE RECEIPT

MRI received the five chlorinated PVC samples on August 27, 1991, enclosed in a cardboard shipping container at ambient temperature. The samples were stored at room temperature in a locked facility until sample preparation was initiated.

The samples were designated as follows, as described in a letter to Kathy Boggess from Dr. John Nikora, dated August 22, 1991.

Sample Code	Description
163-90-86-1	Bar Stock (grey color)
163-90-86-2	Compound Cubes (grey color)
163-90-86-3	Chlorinated PVC Resin (white)
163-90-86-4	Pipe (ivory color)
163-90-86-5	Chlorinated PVC Resin (white)

SECTION 3

EXPERIMENTAL APPROACH

This section of the report describes the experimental approach used to prepare and analyze the samples for PCDDs and PCDFs. The analytical procedures used for sample preparation included particle size reduction of the bar stock and pipe samples. Solvent compatibility studies were conducted to determine the most appropriate solvent for extracting the PCDDs and PCDFs from the various matrices.

Hexane was chosen as the most appropriate solvent and the five chlorinated PVC samples were Soxhlet-extracted with hexane. The subsequent extract cleanup procedures and high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS) analysis procedures were modifications of EPA Method 8290.

PARTICLE SIZE REDUCTION

Particle size reduction of the bar stock (163-90-86-1) and pipe (163-90-82-4) samples was necessary before the samples were extracted. These samples were received in three sections with lengths from 3 to 4 in. The resin samples (163-90-86-3 and 163-90-86-5) were a powder consistency and required no further size reduction prior to their extraction. The particle sizes of the compound cubes (163-90-86-2) were approximately 3 mm x 3 mm x 3 mm, and further particle size reduction was not necessary.

The bar stock and pipe samples were reduced on a lathe and shaved particles were collected in a plastic bag. The metal parts of the lathe were precleaned with hexane before contact with the samples. The approximate size of the shaved particles was 1 mm x 5 mm.

SOLVENT COMPATIBILITY STUDIES

Before samples were prepared for PCDDs and PCDFs analyses, solvent compatibility studies were conducted. The objective of these studies was to identify an extraction solvent that would accomplish a slight swelling of the

material without dissolving the material in the sample extract. Ideally, a solvent that met this objective would accomplish a more exhaustive extraction than if only the surface areas of the various materials were extracted.

At ambient temperatures, methylene chloride and toluene appeared to be appropriate extraction solvents. However, initial attempts to extract the five chlorinated PVC samples with a mixture of toluene and methylene chloride proved unsuccessful. The resins were partially dissolved by the solvent, and attempts to solvent-exchange the extracts to hexane for extract cleanup resulted in precipitation of a white solid mass. This observation was attributed to the presence of methylene chloride which was used to promote swelling of the materials. Subsequent attempts to extract the resin samples with toluene and with hexane/methylene chloride mixtures were also unsuccessful. The resin material fused into a solid mass in the extraction thimble.

The first steps of the cleanup procedures, including partitioning with concentrated sulfuric acid and concentrated base solutions, did not remove the precipitated material from the sample extracts.

Extraction of the samples with hexane was then evaluated and no problems were encountered with the matrix. MRI's plans to extract the samples with hexane were discussed with Dr. John Nikora on October 24, 1991. Dr. Nikora suggested an evaluation of a mixture of isopropyl alcohol and hexane. The swelling potential of a hexane and isopropyl alcohol mixture was evaluated with a cube of sample 163-90-86-2 and no swelling was observed. Because the hexane/isopropyl mixture appeared to have no advantages over hexane, the samples were prepared for analysis using hexane as the extraction solvent.

SAMPLE PREPARATION

Sample aliquots (10 g weighed to the nearest 0.0001 g) of the bar stock and pipe- shaved particles, the compound cubes, and the resin samples were mixed with 10 g quartz sand and transferred to Soxhlet extraction thimbles. The samples were spiked with an internal quantitation standard (IQS) spiking solution containing 15 $^{13}C_{12}$-labeled PCDDs and PCDFs at the concentrations shown in Table 1. For matrix spike samples, duplicate aliquots of resin sample 163-90-86-3 were prepared and spiked with native 2,3,7,8-substituted PCDDs and PCDFs at the concentrations shown in Table 2 in addition to the IQS spiking solution.

The samples were Soxhlet-extracted for 24 hr with hexane. The hexane extracts were concentrated, and matrix interferences were removed by partitioning against 20% (w/v) aqueous KOH and concentrated sulfuric acid followed by

elution through a series of chromatography columns including acid/neutral silica gel, neutral alumina, and Carbopack C/Celite.

After the final cleanup, each extract was concentrated under prepurified nitrogen to 100 µl, and 10 µl of a recovery standard (RS) was added that contained $^{13}C_{12}$-1,2,3,4-TCDD and 1,2,3,7,8,9-HxCDD at concentrations of 10 pg/µl in tridecane. The evaporation was continued until a final volume of 10 µl was reached. The extracts were transferred to refrigerated storage until ready for HRGC/HRMS analysis.

Matrix interferences were observed during the preliminary analysis of the bar stock sample and additional cleanup was necessary. The sample extract was put through a second Carbopack C/Celite column cleanup for reanalysis by HRGC/HRMS.

HRGC/HRMS ANALYSIS

The sample extracts were analyzed using a 60-m DB-5 fused silica chromatography column and VG70 250S HRMS with mass resolution > 10,000. The day that samples were analyzed began with mass calibration of the mass spectrometer followed by the analysis of a window-defining mix which was used to set appropriate retention times for the PCDD and PCDF analytes and to calculate the separation of the 2,3,7,8-TCDD isomer from other closely eluting TCDD isomers. The 2,3,7,8 isomer was resolved from other TCDD isomers with a valley of < 25%.

The initial calibration of the instrument consisted of a series of seven standards over the concentration ranges shown in Table 3. The criterion for an acceptable calibration curve was a relative standard deviation of < 20%. The criterion for continuing daily calibration was that the daily response factor (RF) must be within ±20% of the mean from the initial calibration curve. The initial calibration curve and continuing calibration criteria were met.

After the analysis of the daily calibration standard, a tridecane solvent blank was analyzed to ensure a clean system. The chlorinated PVC samples and quality control samples were then analyzed followed by an end-of-the-day calibration standard to ensure instrument stability.

DATA REDUCTION

The data reduction procedures for the analysis of the chlorinated PVC samples included qualitative criteria for identification of a peak as a 2,3,7,8-substituted PCDD or PCDF isomer and quantitation procedures for peaks positively

identified. The quantitation ions, theoretical ion abundance ratio criteria, and calculation formulas are specified in EPA Method 8290.

An automatic data reduction program was used to calculate the responses of analytes in the appropriate mass windows with ion abundance ratios within ±15% of the theoretical ratios. Detected peaks were also required to be within relative retention time windows established from the analysis of the calibration standards. The retention times of the native 2,3,7,8-substituted PCDD or PCDF analytes were required to be within ±3 sec of the corresponding $^{13}C_{12}$-2,3,7,8 substituted internal quantitation standards.

For peaks that passed the qualitative criteria, the computer program calculated an extract concentration, and then sample weights and extract volumes were taken into account to arrive at a final sample concentration.

For compounds not positively identified, a calculated detection limit (cdl) was determined based on the concentration of the lowest instrument calibration standard. In some cases responses were noted at retention times characteristic of 2,3,7,8- substituted PCDDs or PCDFs, but the qualitative ratio criteria were not met. For these situations, a detection limit was determined based on the maximum possible concentration (MPC) for the observed peak.

SECTION 4

RESULTS

The preliminary results from the analysis of the resin samples, the compound cubes, and the pipe samples were discussed with Dr. John Nikora on November 12, 1991. During that discussion, the results for the bar stock sample were not available because the bar stock sample required additional cleanup. Additional cleanup was performed for the bar stock sample, and the results for this sample and the other chlorinated PVC samples are summarized in Table 4. The 2,3,7,8-substituted PCDDs and PCDFs are presented first followed by the total homolog concentrations. Resin sample 163-099-86-3 contained higher concentrations of PCDFs than the other samples, and concentrations of PCDDs were much lower than the PCDFs.

Quality control (QC) samples prepared and analyzed with the chlorinated PVC samples including a laboratory method blank and duplicate resin matrix spikes samples are summarized in Table 5. Background levels of 1,2,3,4,6,7,8-HpCDD and OCDD were detected in the method blank at concentrations slightly above the calculated detection limits.

The accuracy and precision of the duplicate matrix spike samples are also summarized in Table 5. The spike levels, concentrations in unspiked samples, and concentrations found in matrix spike samples are shown followed by the percent accuracy and relative percent difference precision. The accuracy of the matrix spike was determined by subtracting the amount found in the unspiked sample from the amount found in the spiked sample and then dividing the difference by the theoretical amount spiked. For some of the analytes, including 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, and 1,2,3,6,7,8-HxCDF, the amounts found in the unspiked sample were significantly higher than the amount spiked by a factor ranging from 3 to 30 and these results are footnoted. For the remaining analytes, the accuracy and precision results were very good.

An additional quality control activity included monitoring the absolute method recoveries of the $^{13}C_{12}$-labeled IQSs that were added to the samples before extraction. The IQS recoveries shown in Table 6 indicate very good precision for the analytical method (14% to 27% relative standard deviation), and recoveries were generally within the Method 8290 suggested range of 40% to 120%. Some recoveries were slightly outside the 40% to 120% range, and these data are footnoted in Table 6.

Table 1. INTERNAL QUANTITATION STANDARD SPIKING SOLUTION

Compound	Concentration[a] (pg/µL)	Amount spiked (total pg)
$^{13}C_{12}$-2,3,7,8-TCDF	0.5	100
$^{13}C_{12}$-2,3,7,8-TCDD	0.5	100
$^{13}C_{12}$-1,2,3,7,8-PeCDF	0.5	100
$^{13}C_{12}$-2,3,4,7,8-PeCDF	0.5	100
$^{13}C_{12}$-1,2,3,7,8-PeCDD	0.5	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	0.5	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	0.5	100
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	0.5	100
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	0.5	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	0.5	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	0.5	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	0.5	100
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	0.5	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	0.5	100
$^{13}C_{12}$-OCDD	1.0	200

[a] Prepared in isooctane, 200 µL was added to each sample before extraction.

Table 2. NATIVE STANDARD SPIKING SOLUTION

Compound	Concentration[a] (pg/µL)	Amount spiked (total pg)
2,3,7,8-TCDF	0.77	31
2,3,7,8-TCDD	0.76	30
1,2,3,7,8-PeCDF	0.70	28
2,3,4,7,8-PeCDF	0.57	23
1,2,3,7,8-PeCDD	0.75	30
1,2,3,4,7,8-HxCDF	1.9	76
1,2,3,6,7,8-HxCDF	1.7	66
2,3,4,6,7,8-HxCDF	1.8	73
1,2,3,7,8,9-HxCDF	2.0	79
1,2,3,4,7,8-HxCDD	2.0	79
1,2,3,6,7,8-HxCDD	1.8	71
1,2,3,7,8,9-HxCDD	1.9	75
1,2,3,4,6,7,8-HpCDF	1.8	74
1,2,3,4,7,8,9-HpCDF	1.9	75
1,2,3,4,6,7,8-HpCDD	1.8	71
1,2,3,4,6,7,8,9-OCDF	3.5	140
1,2,3,4,6,7,8,9-OCDD	3.6	145

[a] Prepared in isooctane, 40 µL was added to method spike sample before extraction.

Table 3. PCDD AND PCDF CALIBRATION STANDARDS

Compound	Concentration (pg/µL)						
Native analytes							
2,3,7,8-TCDF	0.1	0.25	0.5	2.5	10	25	50
2,3,7,8-TCDD	0.1	0.25	0.5	2.5	10	25	50
1,2,3,7,8-PeCDF	0.1	0.25	0.5	2.5	10	25	50
2,3,4,7,8-PeCDF	0.1	0.25	0.5	2.5	10	25	50
1,2,3,7,8-PeCDD	0.1	0.25	0.5	2.5	10	25	50
1,2,3,4,7,8-HxCDF	0.25	0.625	1.25	6.25	25	62.5	125
1,2,3,6,7,8-HxCDF	0.25	0.625	1.25	6.25	25	62.5	125
2,3,4,6,7,8-HxCDF	0.25	0.625	1.25	6.25	25	62.5	125
1,2,3,7,8,9-HxCDF	0.25	0.625	1.25	6.25	25	62.5	125
1,2,3,4,7,8-HxCDD	0.25	0.625	1.25	6.25	25	62.5	125
1,2,3,6,7,8-HxCDD	0.25	0.625	1.25	6.25	25	62.5	125
1,2,3,7,8,9-HxCDD	0.25	0.625	1.25	6.25	25	62.5	125
1,2,3,4,6,7,8-HpCDF	0.25	0.625	1.25	6.25	25	62.5	125
1,2,3,4,7,8,9-HpCDF	0.25	0.625	1.25	6.25	25	62.5	125
1,2,3,4,6,7,8-HpCDD	0.25	0.625	1.25	6.25	25	62.5	125
OCDF	0.5	1.25	2.5	12.5	50	125	250
OCDD	0.5	1.25	2.5	12.5	50	125	250
Internal Quantitation Standards							
^{13}C-2,3,7,8-TCDF	10	10	10	10	10	10	10
^{13}C-2,3,7,8-TCDD	10	10	10	10	10	10	10
^{13}C-1,2,3,7,8-PeCDF	10	10	10	10	10	10	10
^{13}C-2,3,4,7,8-PeCDF	10	10	10	10	10	10	10
^{13}C-1,2,3,7,8-PeCDD	10	10	10	10	10	10	10
^{13}C-1,2,3,4,7,8-HxCDF	10	10	10	10	10	10	10
^{13}C-1,2,3,6,7,8-HxCDF	10	10	10	10	10	10	10
^{13}C-2,3,4,6,7,8-HxCDF	10	10	10	10	10	10	10
^{13}C-1,2,3,7,8,9-HxCDF	10	10	10	10	10	10	10
^{13}C-1,2,3,4,7,8-HxCDD	10	10	10	10	10	10	10
^{13}C-1,2,3,6,7,8-HxCDD	10	10	10	10	10	10	10
^{13}C-1,2,3,4,6,7,8-HpCDF	10	10	10	10	10	10	10
^{13}C-1,2,3,4,7,8,9-HpCDF	10	10	10	10	10	10	10
^{13}C-1,2,3,4,6,7,8-HpCDD	10	10	10	10	10	10	10
^{13}C-OCDD	20	20	20	20	20	20	20
Recovery Standards							
^{13}C-1,2,3,4-TCDD	10	10	10	10	10	10	10
^{13}C-1,2,3,7,8,9-HxCDD	10	10	10	10	10	10	10

Table 4. CONCENTRATIONS (PG/G) OF PCDDs AND PCDFs IN CHLORINATED PVC SAMPLES

COMPOUND	Sample ID Matrix	Method Blank a	163-90-86-1 Barstock	163-90-86-2 Compound cubes	163-90-86-3 Resin	163-90-86-4 Pipe	163-90-86-5 Resin
2378TCDF		ND(.10 cdl) b	14.2	0.725	91.7	ND(.10 cdl)	ND(.10 cdl)
2378TCDD		ND(.11 cdl)	5.31	ND(.093 cdl)	ND(.11 cdl)	ND(.12)	ND(.14 mpc)
12378PECDF		ND(.093 cdl)	8.42	0.215	24.7	ND(.25 mpc)	ND(.098 cdl)
23478PECDF		ND(.089cdl)	5.10	ND(.14 mpc) c	16.2	0.356	2.9
12378PECDD		ND(.11 cdl)	ND(.28 cdl)	ND(.10 cdl)	ND(.11 cdl)	ND(.15)	0.14
123478HXCDF		ND(.25 cdl)	14.1	ND(.23 cdl)	19.1	0.661	8.11
123678HXCDF		ND(.25 cdl)	3.32	ND(.24 cdl)	3.72	ND(.21cdl)	2.1
234678HXCDF		ND(.25 cdl)	ND(.97 cdl)	ND(.24 cdl)	2.52	ND(.23 cdl)	2.3
123789HXCDF		ND(.25cdl)	ND(1.05 cdl)	ND(.25 cdl)	ND(.25 cdl)	ND(.29 mpc)	ND(.26 cdl)
123478HXCDD		ND(.22 cdl)	ND(.90 cdl)	ND(.22 cdl)	ND(.22 cdl)	ND(.26 cdl)	ND(.24 cdl)
123678HXCDD		ND(.26 cdl)	ND(.85cdl)	ND(.25 cdl)	ND(.25 cdl)	ND(.22 cdl)	ND(.26 cdl)
123789HXCDD		ND(.22 cdl)	ND(.90 cdl)	ND(.22 cdl)	ND(.22 cdl)	ND(.26 cdl)	ND(.24cdl)
1234678HPCDF		ND(.30 cdl)	3.26	ND(.30 cdl)	4.00	0.454	11.6
1234789HPCDF		ND(.28 cdl)	2.20	ND(.30 cdl)	1.61	ND(.28 cdl)	2.29
1234678HPCDD		0.373	1.65	0.39	0.404	0.781	ND(.50 mpc)
12346789OCDF		ND(.60 cdl)	7.65	ND(.66 cdl)	2.85	1.2	13.3
12346789OCDD		1.70	10.9	1.91	3.60	ND(3.62 mpc)	2.15
Homologs							
TCDF		ND(.10 cdl)	52.0	1.35	133	4.24	2.73
TCDD		ND(.11 cdl)	6.24	ND(.093 cdl)	0.223	ND(.12)	0.136
PeCDF		ND(.093 cdl)	48.3	0.713	110	2.42	49.6
PeCDD		ND(.089 cdl)	0.372	ND(.10cdl)	ND(.11 cdl)	ND(.15)	0.14
HxCDF		ND(.25 cdl)	30.2	ND(.23 cdl)	35.8	0.976	34.7
HxCDD		ND(.26 cdl)	1.97	ND(.25 cdl)	ND(.25cdl)	ND(.22 cdl)	ND(.26cdl)
HpCDF		ND(.30 cdl)	8.37	ND(.30 cdl)	9.86	0.911	25.9
HpCDD		0.373	3.09	0.646	0.695	1.32	0.326

a- For comparison to samples concentrations in method blank were based on a10 g sample size.
b- Compound not detected. Value in parenthesis is calculated detection limit (cdl) based on lowest calibration standard.
c- Compound not detected. Value in parenthesis is maximum possible concentration (mpc) for a peak that did not meet the qualitative ratio criteria.

Table 5. QUALITY CONTROL SAMPLE RESULTS

COMPOUND	Field ID Extract ID	Blank pg/g (a)	163-90-86-3 Unspiked Resin pg/g	Nominal Spike Level pg/g	163-90-86-3 Resin Matrix Spike pg/g	163-90-86-3 Resin Matrix Spike Duplicate pg/g	163-90-86-3 Resin Matrix Spike % Accuracy (c)	163-90-86-3 Resin Matrix Spike Duplicate % Accuracy	RPD (e)
2378TCDF		ND(.10 cdl) b	91.7	3.1	95.0	71.2	NC(d)	NC(d)	29
2378TCDD		ND(.11 cdl)	ND(.11 cdl)	3.1	2.57	2.79	88.8	93.2	4.8
12378PECDF		ND(.093 cdl)	24.7	2.8	26.4	25.4	NC(d)	NC(d)	3.9
23478PECDF		ND(.089 cdl)	16.2	2.3	18.2	17.4	NC(d)	NC(d)	4.5
12378PECDD		ND(.11 cdl)	ND(.11 cdl)	3.0	2.38	3.16	83.1	107	25
123478HXCDF		ND(.25 cdl)	19.1	7.6	24.0	22.0	NC(d)	NC(d)	8.7
123678HXCDF		ND(.25 cdl)	3.72	6.6	10.2	9.94	103	95.4	7.5
234678HXCDF		ND(.25 cdl)	2.52	7.3	8.89	8.91	91.6	88.9	3.0
123789HXCDF		ND(.26cdl)	ND(.25 cdl)	7.9	5.89	6.23	78.0	79.8	2.3
123478HXCDD		ND(.22 cdl)	ND(.22 cdl)	7.9	6.47	7.38	86.5	95.5	9.9
123678HXCDD		ND(.26 cdl)	ND(.25 cdl)	7.1	6.07	6.62	89.6	94.5	5.3
123789HXCDD		ND(.22 cdl)	ND(.22 cdl)	7.5	5.70	6.28	80.1	85.3	6.3
1234678HPCDF		ND(.30 cdl)	4.00	7.4	10.9	10.4	98.7	88.6	11
1234789HPCDF		ND(.28 cdl)	1.61	7.5	7.72	7.75	85.6	83.2	2.8
1234678HPCDD		0.373	0.404	7.1	6.59	7.03	91.4	94.7	3.5
12346789OCDF		ND(.60 cdl)	2.85	14	14.0	14.6	83.8	85.4	1.9
12346789OCDD		1.70	3.60	15	13.7	14.6	73.2	77.1	5.2

a- For comparison to samples concentrations in method blank were based on 10 g sample size.
b- Compound not detected. Value in parenthesis is calculated detection limit based on lowest calibration standard.
c- % Accuracy = ((Amount found in spiked sample- amount in unspiked resin)/Amount Spiked) X 100 %
d-Not calculated. The accuracy of the matrix spike sample was affected by high concentrations in the unspiked sample
e- RPD= Relative Percent Difference of Duplicate Matrix Spike Samples. Where accuracy was not calculated due to high concentrations in the unspiked sample, the precision was calculated based on the the total amount found.

Table 6. ABSOLUTE RECOVERIES (%) OF $^{13}C_{12}$- INTERNAL QUANTIFICATION STANDARDS

COMPOUND	Field ID / Extract ID	Method Blank	163-90-86-1 Barstock	163-90-86-2 Compound cube	163-90-86-3 Resin	163-90-86-4 Pipe	163-90-86-5 Resin	163-90-86-3 Resin-MS	163-90-86-3 Resin-MSD	Mean (b)	% RSD (c)
13C2378TCDF		99.8	60.8	108	101	96.9	91.1	116	99.6	96.2	18
13C2378TCDD		92.6	58.7	105	90.7	84.3	87.3	99.1	98.8	89.1	17
13C12378PeCDF		108	63.7	105	103	89.1	95.1	120	99.6	96.5	18
13C23478PeCDF		112	69.1	122 (a)	110	89.0	98.1	132 (a)	113	105	20
13C12378PeCDD		89.5	87.3	92.9	88.9	68.8	76.8	120	83.0	88.2	18
13C123478HxCDF		101	56.5	105	112	113	95.9	94.3	111	98.2	20
13C123678HxCDF		100	57.0	102	103	118	92.1	97.1	107	96.6	20
13C234678HxCDF		99.1	62.8	103	107	106	92.0	106	101	96.8	16
13C123789HxCDF		97.7	58.5	97.1	100	106	89.2	104	98.5	93.3	17
13C123478HxCDD		114	68.2	112	114	96.0	96.0	120	108	102	17
13C123678HxCDD		97.5	71.7	98.5	99.7	114	87.3	104	95.8	95.9	14
13C1234678HpCDF		83.1	53.8	81.1	81.9	109	81.6	83.1	81.5	81.7	20
13C1234789HpCDF		90.2	37.2 (a)	82.7	84.8	89.2	80.3	84.6	84.1	77.6	23
13C1234678HpCDD		100	43.9	97.4	95.1	106	92.4	97.0	91.1	89.0	23
13C12OCDD		82.8	26 (a)	74.0	68.0	76.7	63.1	70.0	65.5	63.3	27

a- Recovery outside Method 8290 suggested range of 40-120% Recovery
b- Method Blank Recoveries not included in Mean
c- RSD= Relative Standard Deviation

fax to RTG

note ↓ Revised copy

October 4, 1991

Chuck Bush

SUBJECT: VCM CANCER RISK ASSESSMENT PROPOSAL

The proposal from Peter Voytex (Clement International) is exactly the direction we need to go. However, the elements of this proposal needs to be reordered and supplemented as follows:

1. Review the pharmacokinetic data on VCM.

2. Review the animal data on VCM which indicates that the young (fetus) is more sensitive than adults.

3. Determine whether a PB-PK model can be developed for VCM based on existing data.

4. recommend what additional pharmacokinetic studies are needed (if appropriate).

5. Develop risk assessment based on PB-PK model. Revision

6. Review epidemiology data, compare it with animal data.

7. Assess the feasibility, and if possible, develop a risk assessment based on a combination of human and animal data.

I think this group can do the job. The only question I would ask them is whether they feel that they will need to identify additional resources (add another person) to cover the additional items. Furthermore, I don't know whether the EH&S Committee has addressed the value of getting a competitive bid. However, I don't feel strongly that one is needed.

Bob Hinderer

0924-6/mn

SPI-01414

OCT 8 1991