# DIOXIN/FURAN

# ANALYSIS REPORT

# NUMBER D7910

1181

This analysis is based on Northumbrian Water Scientific Services Organics Laboratory method O-36 which is accredited under the **UKAS** accreditation scheme.

# DIOXIN/FURAN

# ANALYSIS REPORT

# NUMBER D7910

**Laboratory Address:**

Northumbrian Water Scientific Services
Northumberland Dock Road
Howdon
Wallsend
Tyne & Wear
NE28 0QD

**Report Ref:** D7910

**Client Address:**

Victoria Smith
Hanson Cement
Padeswood
Mold
Flintshire
CH7 4HB

**Prepared by:** Sophie Wright **Signed:** **Date:**18/05/16

**Issued under the authority of Steve Wilson – Laboratory Manager (Howdon Organics)**

**CONTENTS**

# SECTION 1

## SUMMARY

One sample taken on behalf of Hanson Cement was analysed for dioxin and furan contamination. Analysis of the sample gave the following TEQ values on an air dried basis (to 2 significant figures).-

| | Toxic Equivalent Results ng/kg | | | | |
|---|---|---|---|---|---|
| **Sample** | **NATO/CCMS ITEQ** | **WHO (1998) HUMANS TEQ** | **WHO (2005) HUMANS TEQ** | **WHO (1998) FISH TEQ** | **WHO (1998) BIRDS TEQ** |
| BYPASS DUST | 6.9 | 6.6 | 6.5 | 7.5 | 6.4 |

The total (tetra to octa chlorinated) dioxin/furan content of the sample is indicated below on an air dried basis (to 2 significant figures):-

| **Sample** | **Total Results ng/kg** |
|---|---|
| BYPASS DUST | 770 |

Full results for individual congeners and homologue group totals together with information on any deviations from methodology/quality systems is shown in section 2.

## INTRODUCTION

One sample was submitted to Northumbrian Water Scientific Services by Hanson Cement for analysis to determine the levels of polychlorinated dibenzo-p-dioxins (PCDD's) and polychlorinated dibenzofurans (PCDF's) present.

The analysis covered the 17 PCDD and PCDF congeners containing chlorine substitution at the 2,3,7 and 8 positions so that Toxicity Equivalents could be calculated based on the NATO/CCMS and WHO systems.

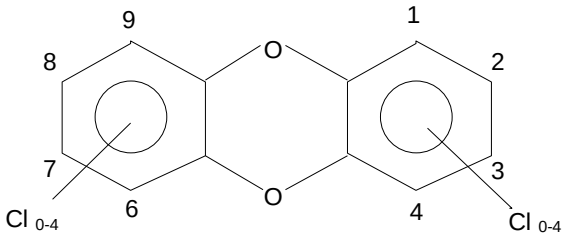
The sample was received on 25/05/16. Details of the sample are shown below.

**CONTRACT** - HANSONCEM-00244

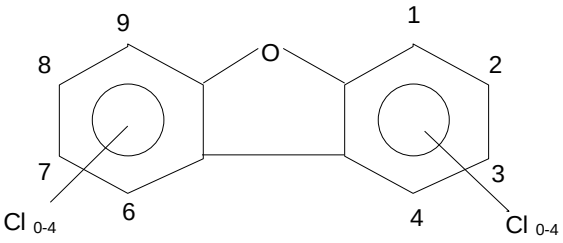
| DATE REC'D | SAMPLE | LAB N$^{o}$ | REF |
|---|---|---|---|
| 25/05/16 | BYPASS DUST | 1208210 | D7910 |

**DIOXINS AND FURANS**

PCDDs and PCDFs form a group of 210 closely related substances. The structural formulae are shown below. A dioxin or furan molecule can have as few as one or as many as eight chlorine atoms attached to the molecule at any of eight locations. The combination of number and position of the chlorine atoms gives rise to 75 possible dioxins and 135 furans.

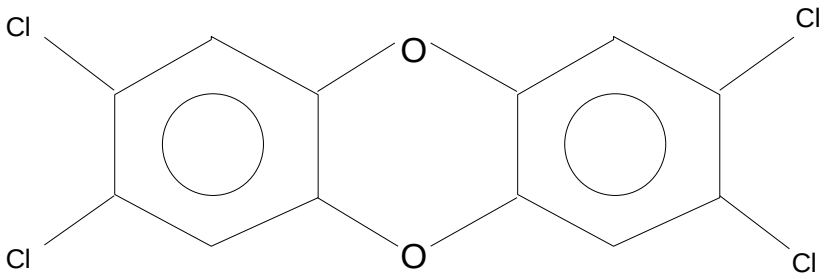



A Dioxin Molecule




A Furan Molecule

It is both the number of chlorine atoms and position in the molecule that determines the physical and chemical properties, as well as the toxicity of a given dioxin or furan. The most hazardous dioxin has chlorine substitution at the 2,3,7 and 8 positions and is therefore called 2,3,7,8-tetrachlorodibenzo-p-dioxin.




2,3,7,8-Tetrachlorodibenzo-p-dioxin

## TOXIC EQUIVALENTS

In order to assess the toxicity of complex mixtures of PCDDs, PCDFs and PCBs the concept of toxic equivalents was devised. Toxic Equivalent Factors (TEF) are assigned to individual dioxins, furans and PCBs on the basis of how toxic they are in comparison with 2,3,7,8-TCDD, the most potent dioxin which has been assigned a value of 1.0. By comparison, animal and cell tests show that 2,3,7,8-TCDF is approximately one-tenth as toxic as 2,3,7,8-TCDD. Consequently its toxic equivalent factor is 0.1.

Of the 210 dioxins and furans, 17 contribute most to the toxicity of a complex mixture and are of most concern. Of the 209 PCBs 12 contribute most to the toxicity of a complex mixture and are of most concern. `Therefore it is these 29 compounds that have TEFs assigned shown in the table below for various schemes.

| **TEF tables** | **NATO/CCMS** | **WHO (1998)** | **WHO (2005)** | **WHO (1998)** | **WHO (1998)** |
|---|---|---|---|---|---|
| **Congener** | | **Humans/ mammals** | **Humans/ mammals** | **Fish** | **Birds** |
| 2,3,7,8-TCDF | 0.1 | 0.1 | 0.1 | 0.05 | 1 |
| 2,3,7,8-TCDD | 1.0 | 1 | 1 | 1 | 1 |
| 1,2,3,7,8-PeCDF | 0.05 | 0.05 | 0.03 | 0.05 | 0.1 |
| 2,3,4,7,8-PeCDF | 0.5 | 0.5 | 0.3 | 0.5 | 1 |
| 1,2,3,7,8-PeCDD | 0.5 | 1 | 1 | 1 | 1 |
| 1,2,3,4,7,8-HxCDF | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 1,2,3,6,7,8-HxCDF | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 2,3,4,6,7,8-HxCDF | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 1,2,3,7,8,9-HxCDF | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 1,2,3,4,7,8-HxCDD | 0.1 | 0.1 | 0.1 | 0.5 | 0.05 |
| 1,2,3,6,7,8-HxCDD | 0.1 | 0.1 | 0.1 | 0.01 | 0.01 |
| 1,2,3,7,8,9-HxCDD | 0.1 | 0.1 | 0.1 | 0.01 | 0.1 |
| 1,2,3,4,6,7,8-HpCDF | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 1,2,3,4,7,8,9-HpCDF | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 1,2,3,4,6,7,8-HpCDD | 0.01 | 0.01 | 0.01 | 0.001 | <0.001* |
| OCDF | 0.001 | 0.0001 | 0.0003 | 0.0001 | 0.0001 |
| OCDD | 0.001 | 0.0001 | 0.0003 | <0.0001* | 0.0001 |
| PCB BZ 81 | - | 0.0001 | 0.0003 | 0.0005 | 0.1 |
| PCB BZ 77 | - | 0.0001 | 0.0001 | 0.0001 | 0.05 |
| PCB BZ 123 | - | 0.0001 | 0.00003 | <0.000005* | 0.00001 |
| PCB BZ 118 | - | 0.0001 | 0.00003 | <0.000005* | 0.00001 |
| PCB BZ 114 | - | 0.0005 | 0.00003 | <0.000005* | 0.0001 |
| PCB BZ 105 | - | 0.0001 | 0.00003 | <0.000005* | 0.0001 |
| PCB BZ 126 | - | 0.1 | 0.1 | 0.005 | 0.1 |
| PCB BZ 167 | - | 0.00001 | 0.00003 | <0.000005* | 0.00001 |
| PCB BZ 156 | - | 0.0005 | 0.00003 | <0.000005* | 0.0001 |
| PCB BZ 157 | - | 0.0005 | 0.00003 | <0.000005* | 0.0001 |
| PCB BZ 169 | - | 0.01 | 0.03 | 0.00005 | 0.001 |
| PCB BZ 189 | - | 0.0001 | 0.00003 | <0.000005* | 0.00001 |

*** NB** Where < figure is quoted for TEF the actual figure is used in all calculations in this report giving a worst case scenario.

## METHOD

The analytical method used for the analysis is based on the American EPA Method 1613.

SPIKING AND EXTRACTION

Air dried soil samples are ground, spiked with a mixture of 16 stable isotopically labelled standards, (see following page for spiking scheme), mixed and allowed to equilibrate. The samples are then soxhlet extracted for a minimum of 16 hours with toluene. Ash samples are pre-treated with hydrochloric acid before being spiked and extracted as above.

CLEANUP AND ANALYSIS

The extracts are washed with concentrated sulphuric acid and aqueous potassium hydroxide if particularly dirty before being dried and concentrated. Impurities are removed from the extracts by column chromatography using silica and alumina columns.

The resulting extracts are concentrated and solvent exchanged to give a final volume of 10 µl in nonane.

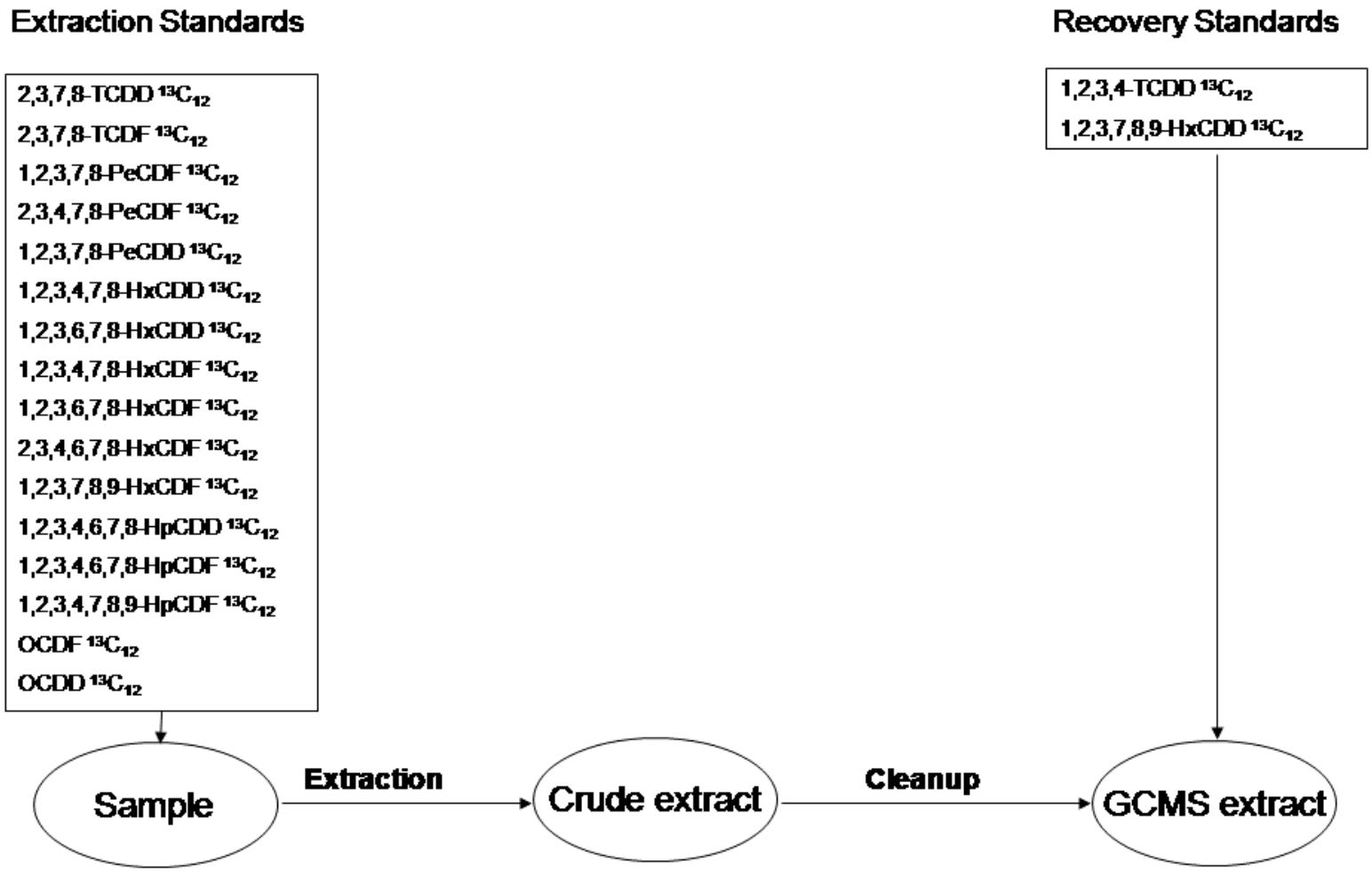
Two isotopically labelled internal standards are added before analysis by high resolution gas chromatography- high resolution mass spectrometry (HRGC-HRMS) using an isotope dilution method for those 2,3,7,8 isomers for which labelled analogues are available and an internal standard method for the non 2,3,7,8 substituted isomers and totals.

Identification of the dioxins and furans is based on comparison of GC retention time ranges and the ion abundance ratios of the m/z's with the corresponding retention time ranges of authentic standards and the theoretical ion abundance ratios of the exact m/z's.

If results for individual targeted dioxins/furans (i.e. 2,3,7,8 substituted) exceed the calibration range of the instrument then these results are flagged in the analytical report.

The mass spectrometer is operated at a resolution of >=10000 to minimize the potential for interference. Selected ions characteristic of the PCDDs and PCDFs are monitored together with ions characteristic of polychlorinated diphenyl ethers which may interfere with the PCDFs. The mass spectrometer is continuously calibrated during acquisition to correct for any mass drift by allowing a reference compound FC43 to bleed into the system.

# EPA 1613 LABELLED STANDARD ADDITIONS (AES O36)



# SECTION 2

## RESULTS

The following pages contain the detailed analytical results for the isomer specific analysis for each sample and blank along with homologue group totals and recovery information for the labelled standards.

A matrix blank is analysed alongside the samples to show any possible contamination. This is normally a sample of dioxin-free quartz sand for solid samples.

The following points should be noted.

- All results are on a dry weight basis.
- Results have not been blank corrected. Results have not been rounded. This is to permit further processing if necessary and does not imply the level of accuracy. Summary results on page 5 have been rounded to two significant figures.
- n.d. - not detected – Detection limits for the analysis are calculated on a sample specific basis by the GCMS software, and are based on a signal to noise value of 2.5 to 1
- Results marked * are over the normal calibration limit of the method.
- The total results for TCDD and TCDF homologue groups do not include the 1,2,8,9 isomers due to the fact that these components elute prior to the first of the PeCDFs on the DB5-MS column used. Acquisition windows have been set up to acquire the first eluting PeCDF in preference to the two tetrachlorinated isomers identified above.
- All quality criteria in the method O36 have been met with any deviations outlined below.

**Deviations from methodology/quality criteria/comments: -none.**

## DIOXIN-FURAN RESULTS

**CLIENT** HANSON CEMENT **CONTRACT** HANSONCEM-00244

**SAMPLE** LABORATORY BLANK

**LAB NO** N/A **REF** D7910

| | | NATO | WHO TEQ | | | |
|---|---|---|---|---|---|---|
| **CONGENER** | **ng/kg** | **I-TEQ** | **Humans[a]** | **Humans[b]** | **Fish[a]** | **Birds[a]** |
| 2,3,7,8-TCDF | <0.082 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2,3,7,8-TCDD | <0.064 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,7,8-PeCDF | <0.127 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2,3,4,7,8-PeCDF | <0.132 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,7,8-PeCDD | <0.138 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,4,7,8-HxCDF | <0.132 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,6,7,8-HxCDF | <0.125 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2,3,4,6,7,8-HxCDF | <0.128 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,7,8,9-HxCDF | <0.17 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,4,7,8-HxCDD | <0.179 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,6,7,8-HxCDD | <0.186 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,7,8,9-HxCDD | <0.18 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,4,6,7,8-HpCDF | <0.069 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,4,7,8,9-HpCDF | <0.104 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,4,6,7,8-HpCDD | <0.253 | n.d. | n.d. | n.d. | n.d. | n.d. |
| OCDF | <0.093 | n.d. | n.d. | n.d. | n.d. | n.d. |
| OCDD | <0.217 | n.d. | n.d. | n.d. | n.d. | n.d. |
| | **TOTAL** | **0.0000** | **0.0000** | **0.0000** | **0.0000** | **0.0000** |

| **TOTALS** | **ng/kg** |
|---|---|
| TCDFs | 0.1452 |
| TCDDs | n.d. |
| PeCDFs | n.d. |
| PeCDDs | n.d. |
| HxCDFs | 0.3007 |
| HxCDDs | n.d. |
| HpCDFs | n.d. |
| HpCDDs | n.d. |
| OCDF | n.d. |
| OCDD | n.d. |
| **TOTAL** | **0.4459** |

[a] WHO 1998 TEQ values, [b] WHO 2005 TEQ values

## LABELLED STANDARD RECOVERIES

**CLIENT** HANSON CEMENT **CONTRACT** HANSONCEM-00244

**SAMPLE** LABORATORY BLANK

**LAB NO** N/A **REF** D7910

| EXTRACTION STANDARDS | RECOVERY % |
|---|---|
| $^{13}C_{12}$ 2378 TCDF | 79 |
| $^{13}C_{12}$ 2378 TCDD | 81 |
| $^{13}C_{12}$ 12378 PeCDF | 111 |
| $^{13}C_{12}$ 23478 PeCDF | 116 |
| $^{13}C_{12}$ 12378 PeCDD | 113 |
| $^{13}C_{12}$ 123478 HxCDF | 85 |
| $^{13}C_{12}$ 123678 HxCDF | 86 |
| $^{13}C_{12}$ 234678 HxCDF | 88 |
| $^{13}C_{12}$ 123789 HxCDF | 87 |
| $^{13}C_{12}$ 123478 HxCDD | 88 |
| $^{13}C_{12}$ 123678 HxCDD | 88 |
| $^{13}C_{12}$ 1234678 HpCDF | 86 |
| $^{13}C_{12}$ 1234789 HpCDF | 73 |
| $^{13}C_{12}$ 1234678 HpCDD | 72 |
| $^{13}C_{12}$ OCDF | 57 |
| $^{13}C_{12}$ OCDD | 56 |

All of the recoveries quoted above are within the acceptance limits of method O36.

## DIOXIN-FURAN RESULTS

**CLIENT** HANSON CEMENT **CONTRACT** HANSONCEM-00244

**SAMPLE** BYPASS DUST

**LAB NO** 1208210 **REF** D7910

| | | NATO | WHO TEQ | | | |
|---|---|---|---|---|---|---|
| **CONGENER** | **ng/kg** | **I-TEQ** | **Humans[a]** | **Humans[b]** | **Fish[a]** | **Birds[a]** |
| 2,3,7,8-TCDF | <0.243 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2,3,7,8-TCDD | <0.169 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,7,8-PeCDF | 8.2672 | 0.4134 | 0.4134 | 0.2480 | 0.4134 | 0.8267 |
| 2,3,4,7,8-PeCDF | <0.44 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,7,8-PeCDD | <0.342 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,4,7,8-HxCDF | 10.9635 | 1.0964 | 1.0964 | 1.0964 | 1.0964 | 1.0964 |
| 1,2,3,6,7,8-HxCDF | <0.365 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2,3,4,6,7,8-HxCDF | 21.7016 | 2.1702 | 2.1702 | 2.1702 | 2.1702 | 2.1702 |
| 1,2,3,7,8,9-HxCDF | 8.6329 | 0.8633 | 0.8633 | 0.8633 | 0.8633 | 0.8633 |
| 1,2,3,4,7,8-HxCDD | 4.4881 | 0.4488 | 0.4488 | 0.4488 | 2.2441 | 0.2244 |
| 1,2,3,6,7,8-HxCDD | <0.511 | n.d. | n.d. | n.d. | n.d. | n.d. |
| 1,2,3,7,8,9-HxCDD | 5.7771 | 0.5777 | 0.5777 | 0.5777 | 0.0578 | 0.5777 |
| 1,2,3,4,6,7,8-HpCDF | 38.4134 | 0.3841 | 0.3841 | 0.3841 | 0.3841 | 0.3841 |
| 1,2,3,4,7,8,9-HpCDF | 15.2912 | 0.1529 | 0.1529 | 0.1529 | 0.1529 | 0.1529 |
| 1,2,3,4,6,7,8-HpCDD | 50.3583 | 0.5036 | 0.5036 | 0.5036 | 0.0504 | 0.0504 |
| OCDF | 68.3346 | 0.0683 | 0.0068 | 0.0205 | 0.0068 | 0.0068 |
| OCDD | 188.5525 | 0.1886 | 0.0189 | 0.0566 | 0.0189 | 0.0189 |
| | **TOTAL** | **6.8672** | **6.6360** | **6.5220** | **7.4581** | **6.3717** |

| **TOTALS** | **ng/kg** |
|---|---|
| TCDFs | 33.6136 |
| TCDDs | 28.1149 |
| PeCDFs | 76.1072 |
| PeCDDs | 54.4221 |
| HxCDFs | 73.5758 |
| HxCDDs | 73.8426 |
| HpCDFs | 81.0017 |
| HpCDDs | 95.4772 |
| OCDF | 68.3346 |
| OCDD | 188.5525 |
| **TOTAL** | **773.0422** |

[a] WHO 1998 TEQ values, [b] WHO 2005 TEQ values

## LABELLED STANDARD RECOVERIES

**CLIENT** HANSON CEMENT **CONTRACT** HANSONCEM-00244

**SAMPLE** BYPASS DUST

**LAB NO** 1208210 **REF** D7910

| EXTRACTION STANDARDS | RECOVERY % |
|---|---|
| $^{13}C_{12}$ 2378 TCDF | 85 |
| $^{13}C_{12}$ 2378 TCDD | 74 |
| $^{13}C_{12}$ 12378 PeCDF | 98 |
| $^{13}C_{12}$ 23478 PeCDF | 94 |
| $^{13}C_{12}$ 12378 PeCDD | 99 |
| $^{13}C_{12}$ 123478 HxCDF | 101 |
| $^{13}C_{12}$ 123678 HxCDF | 96 |
| $^{13}C_{12}$ 234678 HxCDF | 94 |
| $^{13}C_{12}$ 123789 HxCDF | 88 |
| $^{13}C_{12}$ 123478 HxCDD | 100 |
| $^{13}C_{12}$ 123678 HxCDD | 100 |
| $^{13}C_{12}$ 1234678 HpCDF | 93 |
| $^{13}C_{12}$ 1234789 HpCDF | 75 |
| $^{13}C_{12}$ 1234678 HpCDD | 80 |
| $^{13}C_{12}$ OCDF | 51 |
| $^{13}C_{12}$ OCDD | 54 |

All of the recoveries quoted above are within the acceptance limits of method O36.

# SECTION 3

## EXPLANATION OF APPENDICES

**APPENDIX 1** CHAIN OF CUSTODY FORMS/EXTRACTION/AUTOSAMPLER LISTS

These pages show copies of forms that document the progress of the sample from the sampling stage through all analysis stages.

The chain of custody form documents the date that the sample was taken and contains sample identification information together with records of the transfer of the sample prior to analysis.

The extraction log shows the dates of all extraction and cleanup processes, including details of the spiking standards used for analysis. The final extract volume after addition of internal standards is also shown.

The autosampler list shows the run order of the samples GCMS analysis together with the datafile names under which data is stored.

**APPENDIX 2** GLOSSARY

This is a list of abbreviations used in this report.

# APPENDIX 1

PAGE No. 1/3

# NWSS AIR EMISSIONS SAMPLE SUBMISSION SHEET

NORTHUMBRIAN WATER Scientific Services

| | | | |
|---|---|---|---|
| **CLIENT:** MANSON CEMENT<br>**SITE:** PADESWOOD | **NWSS CONTRACT REF:** MANSONCEM-00244 | | |
| **CLIENT PROJECT MANAGER:** VICTORIA SMITH<br>**TEL:** | **NWSS PROJECT MANAGER (+ MOBEX):** JOHN McBRIDE (73567) | **AGREED TURNROUND:** (No of working days): | Howdon (0191) 2968500<br>Cwmbran (01633) 862950 |

| MATRIX | | | | STACK, TEST & RUN NUMBER | SAMPLER | COMMENTS / SOLUTION / FILTER | ANALYSIS / TEST SCHEDULE REQUIRED | DATE SAMPLED | TIME SAMPLED | NWSS LAB NO |
|---|---|---|---|---|---|---|---|---|---|---|
| Liquid | Sludge | Soil | Gas | | | | | | | |
| | | | ✓ | COOLER STACK DUST BLANK | JM/MD | FILTER 16LD080 | CEN PARTICULATES | 18/04/16 | 13.00 | 1208178 |
| | | | ✓ | COOLER STACK DUST BLANK | JM/MD | ACETONE / $H_2O$ | CEN PARTICULATES | 18/04/16 | 13.00 | 1208179 |
| | | | ✓ | COOLER STACK DUST RUN 1 | JM/MD | FILTER 16LD089 | CEN PARTICULATES | 18/04/16 | 13.20 | 1208180 |
| | | | ✓ | COOLER STACK DUST RUN 1 | JM/MD | ACETONE / $H_2O$ | CEN PARTICULATES | 18/04/16 | 13.20 | 1208181 |
| | | | ✓ | COOLER STACK DUST RUN 2 | JM/MD | FILTER 16LD081 | CEN PARTICULATES | 19/04/16 | 08.36 | 1208182 |
| | | | ✓ | COOLER STACK DUST RUN 2 | JM/MD | ACETONE / $H_2O$ | CEN PARTICULATES | 19/04/16 | 08.36 | 1208183 |
| | | | ✓ | COOLER STACK PM10 BLANK | JM/MD | STAGE 1 FILTER 16LD ~~118~~ 117 JM | CEN PARTICULATES | 19/04/16 | 09.45 | 1208184 |
| | | | ✓ | COOLER STACK PM10 BLANK | JM/MD | STAGE 2 FILTER 16LD ~~121~~ 118 JM | CEN PARTICULATES | 19/04/16 | 09.45 | 1208185 |
| | | | ✓ | COOLER STACK PM10 BLANK | JM/MD | BACK UP FILTER 16LD ~~122~~ 119 JM | CEN PARTICULATES | 19/04/16 | 09.45 | 1208186 |
| | | | ✓ | COOLER STACK PM10 RUN 1 | JM/MD | STAGE 1 FILTER 16LD120 | CEN PARTICULATES | 19/04/16 | 10.00 | 1208187 |
| | | | ✓ | COOLER STACK PM10 RUN 1 | JM/MD | STAGE 2 FILTER 16LD121 | CEN PARTICULATES | 19/04/16 | 10.00 | 1208188 |
| | | | ✓ | COOLER STACK PM10 RUN 1 | JM/MD | BACK UP FILTER 16LD122 | CEN PARTICULATES | 19/04/16 | 10.00 | 1208189 |
| | | ✓ | | BYPASS DUST | SITE | | WILSA 00409 | 19/04/16 | 09.30 | 1208210 |
| | | | ✓ | CEMENT MILL 2 BLANK | JM/MD | FILTER 16LD078 | CEN PARTICULATES | 19/04/16 | 12.30 | 1208190 |
| | | | ✓ | CEMENT MILL 2 BLANK | JM/MD | ACETONE / $H_2O$ | CEN PARTICULATES | 19/04/16 | 12.30 | 1208191 |
| | | | ✓ | CEMENT MILL 2 RUN 1 | JM/MD | FILTER 16LD084 | CEN PARTICULATES | 19/04/16 | 13.05 | 1208192 |

**CHAIN OF CUSTODY**

| Relinquished By | Date | Received By |
|---|---|---|
| [signature] | 22/4/16 | [signature] |
| Relinquished By | Date | Received By |
| Relinquished By | Date | Received By |

**ADDITIONAL INFORMATION\HAZARD DATA**

| | | |
|---|---|---|
| **ENTERED BY:** | [signature] | |
| **ON (DATE):** | 25/4/16 | |
| **NO. OF SAMPLES CORRECT?** | ✓ | |
| **IF NO THEN REPORTED TO:** | | |
| **COMPLETED FORM TO BE SENT TO:** | **TICK BOX** | **ACTIONED BY** |
| **JOHN McBRIDE** | ✓ | [signature] |
| **CWMBRAN OFFICE (FAX 01633 865087)** | | |

## SAMPLE EXTRACTION LOG

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| LAB NO | — | 1208210 | 1208587 | 1208588 | 1208589 | 1208590 | 1208591 |
| PCBs REQD ? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| SAMPLE ID | LAB BLANK | BYPASS DUST | WS 2061 | WS 2062 | WS 2063 | WS 2064 | WS 2065 |
| WT/VOL/TRAP | 1.015g | 1.910g | 1.029g | 1.030g | 1.028g | 1.002g | 1.030g |
| SIGN | | | | | | | |

**$^{13}C_{12}$ STD ADDITIONS**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE/TIME | 11.5.16 / 17:00 | | | | | | |
| STD | LS21802 16 / PCBES1110214 | | | | | | |
| VOL | 20ul / 20ul | | | | | | |
| SIGN | | | | | | | |

**EXTRACTION**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EXT DATES & TIMES | 11.5.16 17:30 → | 12.5.16 09:00 | | | | | |
| GLASSWARE N$^{O}$ | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**ALUMINA CLEANUP**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE | 12.5.16 | | | | | | |
| SIGN | | | | | | | |
| PCB KEEP? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**MIXED SILICA CLEANUP**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE | 12.5.16 | | | | | | |
| SIGN | / Blee | | | | | | |

**OTHER CLEANUPS 1**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TYPE | | | | | | | |
| DATE | N/A | | | | | | |
| SIGN | | | | | | | |

**OTHER CLEANUPS 2**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TYPE | | | | | | | |
| DATE | N/A | | | | | | |
| SIGN | | | | | | | |

**CONCENTRATION INTO NONANE**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE | 15.5.16 | | | | | | |
| VOL | 10ul | | | | | | |
| SIGN | | | | | | | |

**RECOVERY STD ADDITION**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE/TIME | 15.5.16 / 14:00 | | | | | | |
| STD | 1821205 16 | | | | | | |
| VOL | 10ul | | | | | | |
| Final VOL | 20ul | | | | | | |
| SIGN | | | | | | | |

# SAMPLE EXTRACTION LOG

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| LAB NO | 1208592 | — | | | | | |
| PCBs REQD ? | ✓ | ✓ | | | | | |
| SAMPLE ID | WS 2066 | DX3 | | | | | |
| WT/VOL/TRAP | 1.030g | 1.0806g (sw) | | | | | |
| SIGN | | | | | | | |

**$^{13}C_{12}$ STD ADDITIONS**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE/TIME | 11.5.16 / 17:00 | | | | | | |
| STD | LS2180216/PCBES1110214 | | | | | | |
| VOL | 20µl / 20µl | | | | | | |
| SIGN | | | | | | | |

**EXTRACTION**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EXT DATES & TIMES | 11.5.16 17:30 → | 12.5.16 09:00 | | | | | |
| GLASSWARE N$^{O}$ | 8 | 9 | | | | | |

**ALUMINA CLEANUP**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE | 12.5.16 | | | | | | |
| SIGN | | | | | | | |
| PCB KEEP? | ✓ | ✓ | | | | | |

**MIXED SILICA CLEANUP**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE | 12.5.16 | | | | | | |
| SIGN | | | | | | | |

**OTHER CLEANUPS 1**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TYPE | | | | | | | |
| DATE | N/A → | | | | | | |
| SIGN | | | | | | | |

**OTHER CLEANUPS 2**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TYPE | | | | | | | |
| DATE | N/A → | | | | | | |
| SIGN | | | | | | | |

**CONCENTRATION INTO NONANE**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE | 15.5.16 | | | | | | |
| VOL | 10µl | | | | | | |
| SIGN | | | | | | | |

**RECOVERY STD ADDITION**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE/TIME | 15.5.16 / 16:00 | | | | | | |
| STD | IS2120516 | | | | | | |
| VOL | 10µl | | | | | | |
| Final VOL | 20µl | | | | | | |
| SIGN | | | | | | | |

AUTOSAMPLER RUN LIST

Date of Run. 16/5/16

| A/S POSITION | DATA FILE NAME | LAB NUMBER | SAMPLE DETAILS | NOTES |
|---|---|---|---|---|
| 1 | gec001 | — | 60AUD2 COLUMN CHECK | |
| 2 | 02 | | CS1 | |
| 3 | 03 | | CS2 | |
| 4 | 04 | | CS3 | |
| 5 | 05 | | CS4 | |
| 6 | 06 | | CS5 | |
| 7 | 07 | | N | |
| 8 | 08 | | N | |
| 9 | 09 | | N | |
| 10 | 10 | | LAB BLANK 11.5.16 | |
| 11 | 11 | 1208210 | BYPASS DUST | |
| 12 | 12 | — | N | |
| 13 | 13 | 1208587 | WS 2061 | |
| 14 | 14 | — | N | |
| 15 | 15 | 1208588 | WS 2062 | |
| 16 | 16 | — | N | |
| 17 | 17 | 1208589 | WS 2063 | |
| 18 | 18 | — | N | |
| 19 | 19 | 1208590 | WS 2064 | |
| 20 | 20 | — | N | |
| 21 | 21 | 1208591 | WS 2065 | |
| 22 | 22 | — | N | |
| 23 | 23 | 1208592 | WS 2066 | |
| 24 | 24 | — | N | |
| 25 | 25 | | DX3 11.5.16 | |
| 26 | 26 | | N | |
| 4 | 27 | | CS3 | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

COMMENTS N = NONANE WASH

# APPENDIX 2

## GLOSSARY

The following terms and abbreviations are used throughout this report.

| | |
|---|---|
| PCDD | Polychlorinated dibenzo-p-dioxin |
| PCDF | Polychlorinated dibenzofuran |
| TCDD | Tetrachlorodibenzo-p-dioxin |
| TCDF | Tetrachlorodibenzofuran |
| PeCDD | Pentachlorodibenzo-p-dioxin |
| PeCDF | Pentachlorodibenzofuran |
| HxCDD | Hexachlorodibenzo-p-dioxin |
| HxCDF | Hexachlorodibenzofuran |
| HpCDD | Heptachlorodibenzo-p-dioxin |
| HpCDF | Heptachlorodibenzofuran |
| OCDD | Octachlorodibenzo-p-dioxin |
| OCDF | Octachlorodibenzofuran |
| HxCDPE | Hexachlorodiphenyl ether |
| HpCDPE | Heptachlorodiphenyl ether |
| OCDPE | Octachlorodiphenyl ether |
| NCDPE | Nonachlorodiphenyl ether |
| DCDPE | Decachlorodiphenyl ether |
| TEF | Toxic Equivalent Factor |
| TEQ | Toxic Equivalent |
| I-TEF | International Toxic Equivalent Factor (NATO/CCMS) |
| I-TEQ | International Toxic Equivalent (NATO/CCMS) |