

Dioxin Assessment

Noosa River Catchment

Prepared by: Science and Technology Division,, Department of Environment and Science

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December 2020

Executive Summary

Dioxins are ubiquitous persistent organic pollutants (POPs) that are formed by combustion processes such as bushfires, as by-products of manufacturing (including the manufacture of pesticides), and are found in kaolinitic clays where they are thought to be produced by natural processes. Concerns have been raised by members of the Noosa community that historical usage of the pesticides 2,4,5-T and 2,4-D in the forestry industry have contaminated the Noosa Catchment with 2,3,7,8- tetrachlorodibenzo para dioxin (TCDD). TCDD is considered to be the most toxic of the dioxin family.

In response to these concerns the Queensland Government undertook a sediment, water and biota survey for dioxins in the Noosa catchment in 2020. Sediment samples were collected from six lakes in the Noosa Catchment—Lake Cootharaba, Lake Cooroibah, Doonella Lake, Lake Weyba, and Lake Poona and Lake Coolamara in the Cooloola National Park. Lakes were chosen as they are likely to be sinks for sediments. Water was sampled at lakes Cootharaba, Cooroibah and Weyba.

TCDD was reported in sediment at two sites - one site in the north of Lake Cootharaba and one site in Lake Weyba, with other dioxins being measured in sediment at every site. This is consistent with national studies where dioxins were measured in every sediment sample collected. Dioxins were not detected above the limit of reporting (LoR) in any of the water samples.

As dioxins were present in the sediment, and because there are no dioxin guidelines for sediment that would permit an assessment of risk, a biota sampling program was initiated. This was to assess the potential health risk to recreational fishers from the consumption of seafood caught in the lakes. Biota was collected in lakes Cootharaba, Cooroibah and Weyba. An assessment by Queensland Health found that the dioxins present in seafood posed a low risk to recreational fishers. Commercial fisheries were not assessed in this study and this will be undertaken in the first quarter 2021, in addition to further sediment sampling.

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Introduction

Dioxins are ubiquitous persistent organic pollutants (POPs). The term 'dioxins' is often used as a short hand to refer to the family of related compounds polychlorinated dibenzo para dioxins (PCDDs or dioxins) and polychlorinated dibenzofurans (PCDFs or furans). Dioxins are formed by a combustion process (e.g. bushfires, sugar cane burns and motor vehicle emissions) (Gatehouse 2004), as by-products of manufacturing (such as the production of pesticides) (Hoogenboom et al. 2020), and have been found to be present in kaolinitic clays where they are thought to be produced through natural processes (Schmitz et al. 2011; Hoogenboom et al. 2020). Dioxins have low solubility in water and bind strongly to particulate organic matter (Gatehouse 2004), are highly persistent in the environment and bioaccumulate in the lipids of animals. As part of the 2004 National Dioxin Program, dioxins were measured in every sediment and fish sample collected (Müller et al. 2004).

Concerns have been raised by members of the Noosa community that historical usage of the pesticide 2,4,5-T and 2,4-D in the forestry industry has contaminated the Noosa Catchment with 2,3,7,8- tetrachlorodibenzo para dioxin (TCDD). TCDD is a contaminant in the production of 2,4,5-T (Office of Chemical Safety 2005 and references therein), and is considered to be the most toxic of the dioxin family (Müller et al. 2004). 2,4,5-T was withdrawn for use in Australia in the late 1980s. In response to the community concern, the Department of Environment and Science undertook a sediment, water and biota survey in the Noosa River area in order to assess the dioxin levels in the Noosa Catchment.

Site Selection

All sites selected for study were lakes in the Noosa Catchment. Lakes were chosen as they are likely to be sinks for sediments transported by flows. Five sites downstream of forestry, or downstream of lakes where historic forestry is known to have occurred in the Noosa Catchment, were chosen for sediment sampling (Figure 1):

- Two sites in Lake Cootharaba (Lake Cootharaba North, Lake Cootharaba South)
- One site in Lake Cooroibah
- One site at Doonella Lake
- One site at Lake Weyba.

Two sites in the Coolool National Park were also selected (Figure 2) as control sites representing sub-catchments unlikely to have received any applications of 2,4-D or 2,4,5-T.

Sampling Methodology

Sediment

Sediment sampling occurred in February 2020. Ten samples were collected at each site using a standardised coring device comprised of an aluminium tube (15cm length, 2.8cm diameter) attached to the corer. The ten samples were collected in a triangular formation and were approximately 25m apart. After collection the samples were combined to form a composite sample. At three sites the composite samples were split into three, with blind duplicates sent to the main analytical laboratory, Australian Laboratory Services (ALS), and a triplicate sample sent to a secondary laboratory, National Measurement Institute (NMI), as part of quality control measures (see Appendix A for a summary of quality control results). Both these laboratories are National Association of Testing Authorities (NATA) accredited for dioxin analysis in sediment. As well as dioxins, particle size distribution and total organic carbon analyses were undertaken on each sample through the Chemistry Centre, Department of Environment and Science. Analysis results from ALS and NMI are presented in Appendix B and Appendix C, respectively.

Water

Water samples were collected between the 17 and 19 November 2020 at Lake Weyba, Lake Cooroibah and Lake Cootharaba. Water was collected directly into the bottles provided by the laboratory and were delivered to the laboratory on 20 December 2020. The analytical laboratory for the water samples was ALS. Results are displayed in Appendix D.

Biota

Biota were collected in June 2020. Mullet, oyster and mud crab were collected at a number of sites (Table 1). As dioxins are stable and accumulate in the food chain, edible portions of fish, oysters and mud crab were prepared

for analysis. For fish, this is fillets with scales removed but skin retained, for crabs it is the white meat and for oysters it is the whole soft tissues. For each site, the biota samples were composited prior to sending to NMI for analysis (Table 1). Lipid concentrations were measured in all samples other than oysters, as there was not enough oyster sample to undertake both dioxin and lipid analysis. Results from biota sampling are presented in Appendix E.

Table 1: Biota species, location and composite numbers collected during the June 2020 biota survey

Species	Location	Composite numbers
Mullet	Lake Weyba	Five fillets
Mullet	Lake Cootharaba	Four fillets
Oyster	Lake Cooroibah	Seven oysters
Oyster	Lake Weyba	Nine oysters
Mud crab	Lake Cootharaba	Flesh of two crabs

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Figure 1: Sites in the Noosa River Catchment downstream of historical forestry.

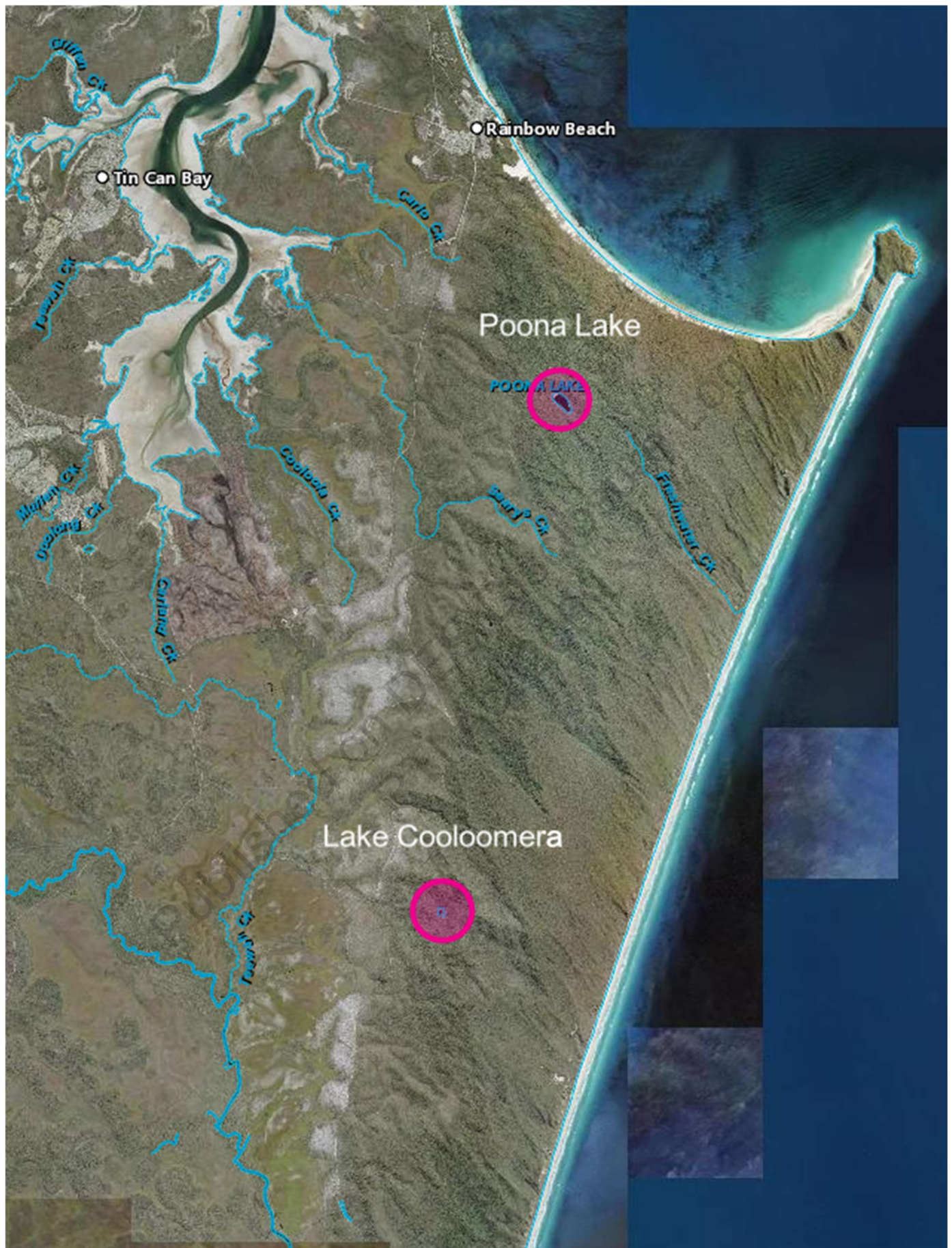


Figure 2: Control sites in the Coolool National Park

Results

Sediment

TCDD was reported at two sites, at Lake Cootharaba - North (duplicate sample results were <0.5 and 0.7 pg/g dw) and at Lake Weyba (duplicate sample results were 2.7 and 4.4 pg/g dw) (Table 2). Dioxins were reported in sediments in all lakes sampled in the Noosa Catchment. This is consistent with results from the National Dioxins Program, where dioxins were measured in every sediment sample collected (Müller et al. 2004).

Table 2: Dioxin concentrations (pg/g dw) in sediments collected in the Noosa Catchment in February 2020

Dioxins	Lake Poona	Lake Coolamerra	Lake Cootharaba NTH	Lake Cootharaba NTH Duplicate	Lake Cootharaba STH	Lake Cootharaba STH Duplicate	Lake Cooribah	Doonella Lake	Lake Weyba	Lake Weyba Duplicate
2378-TCDD	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	2.7	4.4
12378-PeCDD	<2.4	<2.4	<2.5	3.6	7.7	6.4	5.7	<2.5	19	44.6
123478-HxCDD	<2.4	<2.4	<2.5	3.9	7.2	5.9	5.6	<2.5	20.4	34.7
123678-HxCDD	<2.4	<2.4	4.4	5.5	13.4	11.4	11.4	2.6	29	44.2
123789-HxCDD	2.5	4.7	11.7	14.6	34.2	28.2	27.6	5.5	66.9	114
1234678-HpCDD	83.4	62.7	142	188	286	285	270	60.3	321	589
OCDD	2210	3050	4530	6080	4230	3640	4930	1210	4410	6410
2378-TCDF	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12378-PeCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
23478-PeCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
123478-HxCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
123678-HxCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
234678-HxCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
123789-HxCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
1234678-HpCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
1234789-HpCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
OCDF	<4.9	<4.9	<5.0	<5.0	<5.0	<5.0	<4.9	<4.9	<5.0	<5.0
Total TEQ ^{1 A}	1.75	2.01	4.39	10.44	17.31	14.86	14.43	1.77	37.81	76.06

^A WHO²⁰⁰⁵ excluding LOD data (pg/g dry weight)

Water

No dioxins were detected above the limit of reporting (LoR) in the water samples.

¹ Toxic Equivalents (TEQs) are a way of expressing the overall toxicity of a mixture of dioxins. A set of weighting factors (toxicity equivalence factors - TEFs) were developed by the World Health Organisation (Van den Berg et al. 2006) that express the toxicity of a specific dioxin as an equivalent mass of TCDD. The concentration of the dioxin is multiplied by the weighting factor and then all results are summed as a measure of overall toxicity.

Biota

The concentrations of TCDD and total dioxins were normalised to lipid concentration (Table 3). The concentrations of TCDD and total dioxins in oysters from Lake Cooroibah were in the same order of magnitude as that measured in Lake Weyba, and the concentrations of TCDD and total dioxins in mullet were the same order of magnitude in Lake Cootharaba and Lake Weyba (Table 3).

Table 3: Concentration of TCDD and Total Dioxins in oysters, mullet and mudcrabs from lakes Cootharaba, Cooroibah and Weyba normalised to lipid concentration.

	TCDD (pg/g lipid)	Total dioxins (pg/g lipid)
Cooroibah Oysters ^a	3913	57739
Weyba Oysters ^a	3008	44513
Weyba Mullet	134	439
Cootharaba Mullet	221	342
Cootharaba Mudcrab	65	1363

^a As lipid content was not obtained in this study, the lipid weight used for the calculation was the average of pacific oyster and pearl oyster as reported in (Matthews, Pöpke, and Gaus 2008)

Queensland Health assessed the risk of consumption of biota collected from Lake Cootharaba, Lake Weyba and Lake Cooroibah. The detailed assessment is presented in Appendix F. In summary they found that:

Consumption of fish from the Noosa area sampled by DES is unlikely to result in an unacceptable risk to public health. Recreational fishers consuming relatively significant amounts over extended seasons may approach the recommended Tolerable Monthly Intake TMI. Seasonal consumption patterns, lifetime patterns of activity, and locality changes mitigate against the possibility of exceeding the dioxin tolerable intake guideline value.

This assessment has not considered the risks associated with commercial fishing. As the concentration in fish is below the FSANZ limit of 6 pg TEQ/g, the risk is not expected to be a concern. However, this may need to be further investigated with Department of Agriculture and Fisheries if there is significant commercial fishing in the area.

Further assessment of the potential of risks associated with commercial fisheries will be conducted in the first quarter 2021.

Conclusions

TCDD was reported in sediment at two of the seven sites sampled. Dioxins were measured in sediment at all sites, including national park sites. No dioxins were detected above the limit of reporting (LoR) in water. Biota was collected in lakes Cootharaba, Cooroibah and Weyba. An assessment of risks of the dioxins present in the biota to recreational fishers/consumers undertaken by Queensland Health indicated a low risk. Further assessment of the risks associated with commercial fisheries will be conducted in the first quarter 2021, and will include an additional round of sediment sampling.

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Appendix A – Quality Control Results

All samples passed the quality control acceptance criteria of a relative percentage difference of 50% (DES 2018) apart from samples collected at Lake Weyba (Table A1), which has the highest percentage of clays. This may indicate a difficulty in extraction due to matrix interference. The variability in results was found in both the blind duplicates sent to a single laboratory, and between different laboratories at this site.

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Table A1: Quality Control results (blind laboratory duplicates and inter-laboratory results). Red highlighted cells indicated exceedance of acceptance criteria.

				Dioxins																
Lab Name	Field ID	Date	Sample Type	1,2,3,4,6,7,8- Heptachlorooxanthrene	1,2,3,4,6,7,8- Heptachlorodibenzofuran	1,2,3,4,7,8,9- Heptachlorodibenzofuran	1,2,3,4,7,8- Hexachlorooxanthrene	1,2,3,4,7,8- Hexachlorodibenzofuran	1,2,3,6,7,8- Hexachlorooxanthrene	1,2,3,6,7,8- Hexachlorodibenzofuran	1,2,3,7,8,9- Hexachlorooxanthrene	1,2,3,7,8,9- Hexachlorodibenzofuran	2,3,7,8-Tetrachlorooxanthrene	1,2,3,7,8- Pentachlorooxanthrene	1,2,3,7,8- Pentachlorodibenzofuran	2,3,4,6,7,8- Hexachlorodibenzofuran	2,3,4,7,8- Pentachlorodibenzofuran	2,3,7,8- Tetrachlorodibenzofuran	1,2,3,4,6,7,8,9- Octachlorooxanthrene	1,2,3,4,6,7,8,9- Octachlorodibenzofuran
				pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g
ALSE-Brisbane	CTH - 0220 - S	24/02/2020	Normal	286	<2.5	<2.5	7.2	<2.5	13.4	<2.5	34.2	<2.5	<0.5	7.7	<2.5	<2.5	<2.5	<0.5	4,230.00	<5.0
ALSE-Brisbane	LRB - 0220	24/02/2020	Field_D	285	<2.5	<2.5	5.9	<2.5	11.4	<2.5	28.2	<2.5	<0.5	6.4	<2.5	<2.5	<2.5	<0.5	3,640.00	<4.9
RPD				0	0	0	20	0	16	0	19	0	0	18	0	0	0	0	15	0
ALSE-Brisbane	CTH - 0220 - S	24/02/2020	Normal	286	<2.5	<2.5	7.2	<2.5	13.4	<2.5	34.2	<2.5	<0.5	7.7	<2.5	<2.5	<2.5	<0.5	4,230.00	<5.0
NMI	CTH-0220-S	24/02/2020	Interlab_D	330	<0.2	<0.04	4.9	<0.08	12	<0.08	26	<0.07	<0.4	2.6	0.11	<0.1	0.07	0.16	4,870	0.24
RPD				14	0	0	38	0	11	0	27	0	0	99	0	0	0	0	14	0
ALSE-Brisbane	NSA - 0220	25/02/2020	Normal	142	<2.5	<2.5	<2.5	<2.5	4.4	<2.5	11.7	<2.5	<0.5	<2.5	<2.5	<2.5	<2.5	<0.5	4,530.00	<5.0
ALSE-Brisbane	AES - 0220	25/02/2020	Field_D	188	<2.5	<2.5	3.9	<2.5	5.5	<2.5	14.6	<2.5	0.7	3.6	<2.5	<2.5	<2.5	0.5	6,080.00	<5.0
RPD				28	0	0	44	0	22	0	22	0	33	36	0	0	0	0	29	0
ALSE-Brisbane	NSA - 0220	25/02/2020	Normal	142	<2.5	<2.5	<2.5	<2.5	4.4	<2.5	11.7	<2.5	<0.5	<2.5	<2.5	<2.5	<2.5	<0.5	4,530.00	<5.0
NMI	NSA-0220	25/02/2020	Interlab_D	160	0.21	<0.04	1.6	<0.06	3.7	<0.06	9.2	<0.08	<0.3	0.77	<0.05	<0.06	<0.03	<0.06	5,540	0.39
RPD				12	0	0	0	0	17	0	24	0	0	0	0	0	0	0	20	0
ALSE-Brisbane	WEY - 0220	25/02/2020	Normal	321	<2.5	<2.5	20.4	<2.5	29	<2.5	66.9	<2.5	2.7	19	<2.5	<2.5	<2.5	<0.5	4,410.00	<5.0
ALSE-Brisbane	BEB - 0220	25/02/2020	Field_D	589	<2.5	<2.5	34.7	<2.5	44.2	<2.5	114	<2.5	4.4	44.6	<2.5	<2.5	<2.5	<0.5	6,410.00	<4.9
RPD				59	0	0	52	0	42	0	52	0	48	81	0	0	0	0	37	0
ALSE-Brisbane	WEY - 0220	25/02/2020	Normal	321	<2.5	<2.5	20.4	<2.5	29	<2.5	66.9	<2.5	2.7	19	<2.5	<2.5	<2.5	<0.5	4,410.00	<5.0
NMI	WEY-0220	25/02/2020	Interlab_D	730	0.3	0.06	27	<0.09	44	<0.08	110	<0.08	4	27	0.13	<0.08	0.07	0.15	9,070	0.31
				78	0	0	28	0	41	0	49	0	39	35	0	0	0	0	69	0

Appendix B – Sediment results from ALS

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CERTIFICATE OF ANALYSIS

Client	QLD DEPT OF ENVIRONMENT & SCIENCE	Laboratory :	Environmental Division Brisbane	1 of 11
Contact	SUZANNE VARDY	Contact	CUSTOMER.SERVICES.EB	Work Order: EB2090018
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Project	NSA_DIO	Quote #	BNBQ/082/14	Received: 5 Mar 2020
Order #	- Not provided -			Issued 18 Mar 2020
C-O-C #	- Not provided -			
Site	- Not provided -			
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Notes

LOR = Limit of reporting

I-TEF = International toxic equivalency factor

I-TEQ = International toxic equivalence

WHO-TEF = World Health Organisation toxic equivalency factor

WHO-TEQ = World Health Organisation toxic equivalence

Samples analysed 'as received', results reported on 'dry weight' basis.

- 1 I -TEQ_(zero) and WHO-TEQ_(zero) calculated treating <LOR as zero concentration
- 2 I -TEQ_(0.5 LOR) and WHO-TEQ_(0.5 zero) calculated treating <LOR as 0.5 LoR concentration
- 3 I-TEQ_(LOR) and WHO-TEQ_(LOR) calculated treating <LOR as LoR concentration
- 4 Totals LORs are calculated by multiplying the number of peaks by the individual LOR per compound
- 5 13C12 Rec(%) = The absolute recovery of Isotopically labelled compound added by the Laboratory to both quantitate and measure extraction efficiency.

T = tetra
Pe = penta
Hx = hexa
Hp =hepta
O = octa
CDD, dioxin = chlorinated dibenzo-p-dioxin
CDF, furan = chlorinated dibenzofuran

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Signatory	Position	Department
Peter Blow	HRMS Chemist	GC/HR-MS - NATA 825 (818 - Brisbane)

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300 Laboratory Sample ID: EB2090018001 Qc Lot Number: 4540532 Date Sampled: 24-Feb-2020
Client Sample ID: WEY - 0220 Sample Matrix: SOIL Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	2.7	0.5	1	2.65	2.65	2.65	1	2.65	2.65	2.65	89.7
12378-PeCDD	19.0	2.5	1	19.00	19.00	19.00	0.5	9.50	9.50	9.50	92.8
123478-HxCDD	20.4	2.5	0.1	2.04	2.04	2.04	0.1	2.04	2.04	2.04	60.8
123678-HxCDD	29.0	2.5	0.1	2.90	2.90	2.90	0.1	2.90	2.90	2.90	82.2
123789-HxCDD	66.9	2.5	0.1	6.69	6.69	6.69	0.1	6.69	6.69	6.69	-
1234678-HpCDD	321.0	2.5	0.01	3.21	3.21	3.21	0.01	3.21	3.21	3.21	81.4
OCDD	4410.0	9.9	0.0003	1.32	1.32	1.32	0.001	4.41	4.41	4.41	82.9
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	59.2
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	72.6
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.75	0.5	0.00	0.62	1.24	72.2
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	48.9
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	70.9
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	64.3
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	73.0
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	49.8
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	70.9
OCDF	<5.0	5.0	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	37.81	38.77	39.73	-	31.40	32.63	33.87	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	356.0	5.5	11
Penta-Dioxins	609.0	19.9	8
Hexa-Dioxins	2150.0	17.4	7
Hepta-Dioxins	1260.0	5.0	2
Octa-Dioxin	4410.0	9.9	1
Tetra-Furans	8.7	7.0	14
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<5.0	5.0	1
S PCDD/Fs	8793.7		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300

Laboratory Sample ID: EB2090018002
Client Sample ID: BEB - 0220

Qc Lot Number: 4540531
Sample Matrix: SOIL

Date Sampled: 24-Feb-2020
Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	4.4	0.5	1	4.36	4.36	4.36	1	4.36	4.36	4.36	85.4
12378-PeCDD	44.6	2.5	1	44.60	44.60	44.60	0.5	22.30	22.30	22.30	85.3
123478-HxCDD	34.7	2.5	0.1	3.47	3.47	3.47	0.1	3.47	3.47	3.47	51.9
123678-HxCDD	44.2	2.5	0.1	4.42	4.42	4.42	0.1	4.42	4.42	4.42	79.3
123789-HxCDD	114.0	2.5	0.1	11.40	11.40	11.40	0.1	11.40	11.40	11.40	-
1234678-HpCDD	589.0	2.5	0.01	5.89	5.89	5.89	0.01	5.89	5.89	5.89	73.2
OCDD	6410.0	9.9	0.0003	1.92	1.92	1.92	0.001	6.41	6.41	6.41	67.1
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	52.7
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	59.7
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.74	0.5	0.00	0.62	1.23	63.4
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	39.6
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	62.5
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	56.9
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	61.7
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	41.6
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	62.9
OCDF	<4.9	4.9	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	76.06	77.01	77.96	-	58.25	59.47	60.70	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	478.0	6.4	13
Penta-Dioxins	979.0	19.7	8
Hexa-Dioxins	4030.0	17.3	7
Hepta-Dioxins	2280.0	4.9	2
Octa-Dioxin	6410.0	9.9	1
Tetra-Furans	11.8	6.9	14
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<4.9	4.9	1
S PCDD/Fs	14188.8		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300

Laboratory Sample ID: EB2090018003
Client Sample ID: NSA - 0220

Qc Lot Number: 4540532
Sample Matrix: SOIL

Date Sampled: 24-Feb-2020
Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.25	0.50	1	0.00	0.25	0.50	88.7
12378-PeCDD	<2.5	2.5	1	0.00	1.25	2.50	0.5	0.00	0.62	1.25	92.4
123478-HxCDD	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	54.8
123678-HxCDD	4.4	2.5	0.1	0.44	0.44	0.44	0.1	0.44	0.44	0.44	77.1
123789-HxCDD	11.7	2.5	0.1	1.17	1.17	1.17	0.1	1.17	1.17	1.17	-
1234678-HpCDD	142.0	2.5	0.01	1.42	1.42	1.42	0.01	1.42	1.42	1.42	78.4
OCDD	4530.0	10.0	0.0003	1.36	1.36	1.36	0.001	4.53	4.53	4.53	73.5
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	58.2
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	67.1
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.75	0.5	0.00	0.62	1.25	70.2
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	40.7
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	59.4
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	55.8
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	65.4
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	44.6
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	63.1
OCDF	<5.0	5.0	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	4.39	6.97	9.55	-	7.56	9.79	12.03	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	56.7	5.5	11
Penta-Dioxins	102.0	15.0	6
Hexa-Dioxins	670.0	17.5	7
Hepta-Dioxins	602.0	5.0	2
Octa-Dioxin	4530.0	10.0	1
Tetra-Furans	<0.5	0.5	1
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<5.0	5.0	1
S PCDD/Fs	5960.7		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300 Laboratory Sample ID: EB2090018004 Qc Lot Number: 4540532 Date Sampled: 24-Feb-2020
Client Sample ID: AES - 0220 Sample Matrix: SOIL Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	0.7	0.5	1	0.72	0.72	0.72	1	0.72	0.72	0.72	69.5
12378-PeCDD	3.6	2.5	1	3.57	3.57	3.57	0.5	1.79	1.79	1.79	75.7
123478-HxCDD	3.9	2.5	0.1	0.39	0.39	0.39	0.1	0.39	0.39	0.39	44.6
123678-HxCDD	5.5	2.5	0.1	0.55	0.55	0.55	0.1	0.55	0.55	0.55	60.9
123789-HxCDD	14.6	2.5	0.1	1.46	1.46	1.46	0.1	1.46	1.46	1.46	-
1234678-HpCDD	188.0	2.5	0.01	1.88	1.88	1.88	0.01	1.88	1.88	1.88	61.1
OCDD	6080.0	10.0	0.0003	1.82	1.82	1.82	0.001	6.08	6.08	6.08	60.9
2378-TCDF	0.5	0.5	0.1	0.05	0.05	0.05	0.1	0.05	0.05	0.05	46.8
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	54.7
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.75	0.5	0.00	0.62	1.25	54.8
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	34.2
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	50.1
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	45.0
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	52.0
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	36.6
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	51.8
OCDF	<5.0	5.0	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	10.44	11.38	12.31	-	12.91	14.12	15.33	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	84.4	6.0	12
Penta-Dioxins	143.0	19.9	8
Hexa-Dioxins	863.0	17.4	7
Hepta-Dioxins	818.0	5.0	2
Octa-Dioxin	6080.0	10.0	1
Tetra-Furans	9.3	7.0	14
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<5.0	5.0	1
S PCDD/Fs	7997.7		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300 Laboratory Sample ID: EB2090018005 Qc Lot Number: 4540531 Date Sampled: 23-Feb-2020
Client Sample ID: TWN - 0220 Sample Matrix: SOIL Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.25	0.49	1	0.00	0.25	0.49	92.6
12378-PeCDD	<2.5	2.5	1	0.00	1.23	2.46	0.5	0.00	0.61	1.23	106.1
123478-HxCDD	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	55.9
123678-HxCDD	2.6	2.5	0.1	0.26	0.26	0.26	0.1	0.26	0.26	0.26	79.0
123789-HxCDD	5.5	2.5	0.1	0.55	0.55	0.55	0.1	0.55	0.55	0.55	-
1234678-HpCDD	60.3	2.5	0.01	0.60	0.60	0.60	0.01	0.60	0.60	0.60	78.1
OCDD	1210.0	9.8	0.0003	0.36	0.36	0.36	0.001	1.21	1.21	1.21	67.6
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	70.8
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	82.0
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.74	0.5	0.00	0.61	1.23	85.1
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	44.4
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	61.2
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	57.1
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	68.6
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	45.5
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	66.7
OCDF	<4.9	4.9	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	1.77	4.32	6.86	-	2.62	4.82	7.02	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	33.2	5.4	11
Penta-Dioxins	58.0	19.7	8
Hexa-Dioxins	302.0	19.7	8
Hepta-Dioxins	245.0	4.9	2
Octa-Dioxin	1210.0	9.8	1
Tetra-Furans	<0.5	0.5	1
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<4.9	4.9	1
S PCDD/Fs	1848.2		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300 Laboratory Sample ID: EB2090018006 Qc Lot Number: 4540532 Date Sampled: 23-Feb-2020
Client Sample ID: CRB - 0220 Sample Matrix: SOIL Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.25	0.49	1	0.00	0.25	0.49	91.1
12378-PeCDD	5.7	2.5	1	5.70	5.70	5.70	0.5	2.85	2.85	2.85	86.4
123478-HxCDD	5.6	2.5	0.1	0.56	0.56	0.56	0.1	0.56	0.56	0.56	57.6
123678-HxCDD	11.4	2.5	0.1	1.14	1.14	1.14	0.1	1.14	1.14	1.14	73.7
123789-HxCDD	27.6	2.5	0.1	2.76	2.76	2.76	0.1	2.76	2.76	2.76	-
1234678-HpCDD	270.0	2.5	0.01	2.70	2.70	2.70	0.01	2.70	2.70	2.70	75.9
OCDD	4930.0	9.9	0.0003	1.48	1.48	1.48	0.001	4.93	4.93	4.93	71.2
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	58.4
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	62.8
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.74	0.5	0.00	0.62	1.24	66.7
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	41.9
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	59.8
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	56.8
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	63.8
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	42.4
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	65.1
OCDF	<4.9	4.9	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	14.34	15.54	16.74	-	14.94	16.41	17.89	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	177.0	5.4	11
Penta-Dioxins	289.0	19.8	8
Hexa-Dioxins	1440.0	17.3	7
Hepta-Dioxins	1160.0	4.9	2
Octa-Dioxin	4930.0	9.9	1
Tetra-Furans	<6.9	6.9	14
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<4.9	4.9	1
S PCDD/Fs	7996.0		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300 Laboratory Sample ID: EB2090018007 Qc Lot Number: 4540532 Date Sampled: 23-Feb-2020
Client Sample ID: CTH - 0220 - S Sample Matrix: SOIL Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.25	0.50	1	0.00	0.25	0.50	89.6
12378-PeCDD	7.7	2.5	1	7.70	7.70	7.70	0.5	3.85	3.85	3.85	91.6
123478-HxCDD	7.2	2.5	0.1	0.72	0.72	0.72	0.1	0.72	0.72	0.72	59.1
123678-HxCDD	13.4	2.5	0.1	1.34	1.34	1.34	0.1	1.34	1.34	1.34	79.4
123789-HxCDD	34.2	2.5	0.1	3.42	3.42	3.42	0.1	3.42	3.42	3.42	-
1234678-HpCDD	286.0	2.5	0.01	2.86	2.86	2.86	0.01	2.86	2.86	2.86	79.9
OCDD	4230.0	9.9	0.0003	1.27	1.27	1.27	0.001	4.23	4.23	4.23	78.6
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	63.0
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	69.5
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.74	0.5	0.00	0.62	1.24	69.6
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	43.2
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	63.4
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	61.7
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	69.0
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	45.3
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	69.4
OCDF	<5.0	5.0	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	17.31	18.51	19.71	-	16.42	17.89	19.37	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	245.0	5.4	11
Penta-Dioxins	391.0	19.8	8
Hexa-Dioxins	1940.0	17.3	7
Hepta-Dioxins	1370.0	5.0	2
Octa-Dioxin	4230.0	9.9	1
Tetra-Furans	<6.4	6.4	13
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<5.0	5.0	1
S PCDD/Fs	8176.0		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300

Laboratory Sample ID: EB2090018008
Client Sample ID: LRB - 0220

Qc Lot Number: 4540532
Sample Matrix: SOIL

Date Sampled: 23-Feb-2020
Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.25	0.49	1	0.00	0.25	0.49	77.7
12378-PeCDD	6.4	2.5	1	6.36	6.36	6.36	0.5	3.18	3.18	3.18	82.4
123478-HxCDD	5.9	2.5	0.1	0.59	0.59	0.59	0.1	0.59	0.59	0.59	54.9
123678-HxCDD	11.4	2.5	0.1	1.14	1.14	1.14	0.1	1.14	1.14	1.14	73.1
123789-HxCDD	28.2	2.5	0.1	2.82	2.82	2.82	0.1	2.82	2.82	2.82	-
1234678-HpCDD	285.0	2.5	0.01	2.85	2.85	2.85	0.01	2.85	2.85	2.85	70.4
OCDD	3640.0	9.8	0.0003	1.09	1.09	1.09	0.001	3.64	3.64	3.64	72.0
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	53.1
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	61.1
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.74	0.5	0.00	0.61	1.23	63.9
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	40.1
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	59.8
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	55.9
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	63.4
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	41.7
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	59.4
OCDF	<4.9	4.9	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	14.86	16.05	17.24	-	14.22	15.69	17.15	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	194.0	5.4	11
Penta-Dioxins	334.0	14.7	6
Hexa-Dioxins	1670.0	17.2	7
Hepta-Dioxins	1190.0	4.9	2
Octa-Dioxin	3640.0	9.8	1
Tetra-Furans	<6.4	6.4	13
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<4.9	4.9	1
S PCDD/Fs	7028.0		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300 Laboratory Sample ID: EB2090018009 Qc Lot Number: 4540531 Date Sampled: 25-Feb-2020
Client Sample ID: POO - 0220 Sample Matrix: SOIL Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.24	0.49	1	0.00	0.24	0.49	93.0
12378-PeCDD	<2.4	2.4	1	0.00	1.22	2.45	0.5	0.00	0.61	1.22	100.6
123478-HxCDD	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	58.5
123678-HxCDD	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	83.3
123789-HxCDD	2.5	2.4	0.1	0.25	0.25	0.25	0.1	0.25	0.25	0.25	-
1234678-HpCDD	83.4	2.4	0.01	0.83	0.83	0.83	0.01	0.83	0.83	0.83	82.5
OCDD	2210.0	9.8	0.0003	0.66	0.66	0.66	0.001	2.21	2.21	2.21	51.1
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	66.9
12378-PeCDF	<2.4	2.4	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	81.6
23478-PeCDF	<2.4	2.4	0.3	0.00	0.37	0.73	0.5	0.00	0.61	1.22	81.4
123478-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	43.9
123678-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	68.5
234678-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	62.9
123789-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	74.7
1234678-HpCDF	<2.4	2.4	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	48.0
1234789-HpCDF	<2.4	2.4	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	69.2
OCDF	<4.9	4.9	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	1.75	4.41	7.07	-	3.30	5.61	7.93	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	40.0	5.9	12
Penta-Dioxins	26.6	17.1	7
Hexa-Dioxins	123.0	19.6	8
Hepta-Dioxins	216.0	4.9	2
Octa-Dioxin	2210.0	9.8	1
Tetra-Furans	<7.8	7.8	16
Penta-Furans	<2.4	2.4	1
Hexa-Furans	<2.4	2.4	1
Hepta-Furans	<2.4	2.4	1
Octa-Furan	<4.9	4.9	1
S PCDD/Fs	2615.6		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300 Laboratory Sample ID: EB2090018010 Qc Lot Number: 4540532 Date Sampled: 25-Feb-2020
Client Sample ID: CDO - 0220 Sample Matrix: SOIL Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.24	0.49	1	0.00	0.24	0.49	85.5
12378-PeCDD	<2.4	2.4	1	0.00	1.22	2.44	0.5	0.00	0.61	1.22	114.0
123478-HxCDD	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	57.3
123678-HxCDD	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	76.1
123789-HxCDD	4.7	2.4	0.1	0.47	0.47	0.47	0.1	0.47	0.47	0.47	-
1234678-HpCDD	62.7	2.4	0.01	0.63	0.63	0.63	0.01	0.63	0.63	0.63	73.3
OCDD	3050.0	9.8	0.0003	0.92	0.92	0.92	0.001	3.05	3.05	3.05	54.2
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	73.0
12378-PeCDF	<2.4	2.4	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	82.4
23478-PeCDF	<2.4	2.4	0.3	0.00	0.37	0.73	0.5	0.00	0.61	1.22	86.2
123478-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	43.2
123678-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	64.1
234678-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	62.2
123789-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	66.2
1234678-HpCDF	<2.4	2.4	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	42.0
1234789-HpCDF	<2.4	2.4	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	63.5
OCDF	<4.9	4.9	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	2.01	4.66	7.31	-	4.15	6.46	8.77	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	34.7	4.9	10
Penta-Dioxins	26.3	22.0	9
Hexa-Dioxins	98.2	19.5	8
Hepta-Dioxins	182.0	4.9	2
Octa-Dioxin	3050.0	9.8	1
Tetra-Furans	14.6	4.9	10
Penta-Furans	<2.4	2.4	1
Hexa-Furans	<2.4	2.4	1
Hepta-Furans	<2.4	2.4	1
Octa-Furan	<4.9	4.9	1
S PCDD/Fs	3405.8		

QUALITY CONTROL REPORT

Client	QLD DEPT OF ENVIRONMENT & SCIE	Laboratory :	Environmental Division Brisbane	1 of 5
Contact	SUZANNE VARDY	Contact	CUSTOMER.SERVICES.EB	
Address:	GPO BOX 2771 BRISBANE QLD, AUSTRALIA 4001	Address:	Stafford QLD 4053 Australia	Work Order: EB2090018

Project	NSA_DIO	Quote #	BNBQ/082/14	Received:	5 Mar 2020
Order #	- Not provided -			Issued	18 Mar 2020
C-O-C #	- Not provided -				
Site	- Not provided -				
E-mail	suzanne.vardy@des.qld.gov.au	E-mail	ALSEnviro.Brisbane@alsglobal.	Number of Samples	
Phone	32258402	Phone	+61-7-3243 7222	Received:	10
Fax	32258723	Fax	+61-7-3243 7218	Analysed:	11

Samples analysed 'as received', results reported on 'dry weight' basis.

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This document has been digitally signed by those names that appear on this report and are the authorised signatories. Digital signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Position	Department
Peter Blow	HRMS Chemist	GC/HR-MS - NATA 825 (818 - Brisbane)



Quality Control Report

Laboratory Duplicates (DUP)

Original Result		Duplicate Result	
Laboratory Sample Id :	EB2090018001	5595604-007	
Client Sample Id :	WEY - 0220	WEY - 0220	
Sample Mass (g) :	10.0	10.0	
Qc Lot Number :	4540532	4540532	
Moisture Content (%) :			

Compound	Conc pg/g	LOR pg/g	Conc pg/g	LOR pg/g	RPD (%)
2378-TCDD	2.7	0.5	2.1	0.5	25.0
12378-PeCDD	19.0	2.5	15.6	2.5	19.7
123478-HxCDD	20.4	2.5	16.5	2.5	21.1
123678-HxCDD	29.0	2.5	28.4	2.5	2.1
123789-HxCDD	66.9	2.5	62.8	2.5	6.3
1234678-HpCDD	321.0	2.5	311.0	2.5	3.2
OCDD	4410.0	9.9	4690.0	10.0	6.2
2378-TCDF	<0.5	0.5	<0.5	0.5	-
12378-PeCDF	<2.5	2.5	<2.5	2.5	-
23478-PeCDF	<2.5	2.5	<2.5	2.5	-
123478-HxCDF	<2.5	2.5	<2.5	2.5	-
123678-HxCDF	<2.5	2.5	<2.5	2.5	-
234678-HxCDF	<2.5	2.5	<2.5	2.5	-
123789-HxCDF	<2.5	2.5	<2.5	2.5	-
1234678-HpCDF	<2.5	2.5	<2.5	2.5	-
1234789-HpCDF	<2.5	2.5	<2.5	2.5	-
OCDF	<5.0	5.0	<5.0	5.0	-

Group Totals	Conc pg/g	LOR pg/g	Conc pg/g	LOR pg/g	RPD (%)
Tetra-Dioxins	356.0	5.5	322.0	8.0	10.0
Penta-Dioxins	609.0	19.9	509.0	22.4	17.9
Hexa-Dioxins	2150.0	17.4	1780.0	17.4	18.8
Hepta-Dioxins	1260.0	5.0	1220.0	5.0	3.2
Octa-Dioxin	4410.0	9.9	4690.0	10.0	6.2
Tetra-Furans	8.7	7.0	6.3	6.0	32.0
Penta-Furans	<2.5	2.5	<2.5	2.5	-
Hexa-Furans	<2.5	2.5	<2.5	2.5	-
Hepta-Furans	<2.5	2.5	<2.5	2.5	-
Octa-Furan	<5.0	5.0	<5.0	5.0	-
Σ PCDD/Fs	8793.7		8527.3		3.1

Notes

LOR = Limit of reporting

T = tetra

Pe = penta

Hx = hexa

Hp = hepta

O = octa

CDD, dioxin = chlorinated debenzo-p-dioxin

CDF, furan = chlorinated debenzofuran

RPD = relative per cent difference

Permitted ranges for RPD are dependant upon the magnitude of the result in comparison to the LOR.

Result < 10x LOR - no limit - result between 10x and 20x LOR - 50% - result > 20x LOR - 20%



Quality Control Report

Laboratory Duplicates (DUP)

		Original Result		Duplicate Result	
Laboratory Sample Id :		ES2090002001		5595604-026	
Client Sample Id :		Anonymous		Anonymous	
Sample Mass (g) :		10.0		10.0	
Qc Lot Number :		4540532		4540532	
Moisture Content (%) :					
Compound	Conc pg/g	LOR pg/g	Conc pg/g	LOR pg/g	RPD (%)
2378-TCDD	<0.5	0.5	<0.5	0.5	-
12378-PeCDD	<2.5	2.5	<2.5	2.5	-
123478-HxCDD	<2.5	2.5	<2.5	2.5	-
123678-HxCDD	<2.5	2.5	<2.5	2.5	-
123789-HxCDD	<2.5	2.5	<2.5	2.5	-
1234678-HpCDD	<2.5	2.5	<2.5	2.5	-
OCDD	68.6	9.9	76.9	9.9	11.4
2378-TCDF	<0.5	0.5	<0.5	0.5	-
12378-PeCDF	<2.5	2.5	<2.5	2.5	-
23478-PeCDF	<2.5	2.5	<2.5	2.5	-
123478-HxCDF	<2.5	2.5	<2.5	2.5	-
123678-HxCDF	<2.5	2.5	<2.5	2.5	-
234678-HxCDF	<2.5	2.5	<2.5	2.5	-
123789-HxCDF	<2.5	2.5	<2.5	2.5	-
1234678-HpCDF	2.6	2.5	3.7	2.5	34.9
1234789-HpCDF	<2.5	2.5	<2.5	2.5	-
OCDF	5.3	5.0	6.7	5.0	23.3

Group Totals	Conc pg/g	LOR pg/g	Conc pg/g	LOR pg/g	RPD (%)
Tetra-Dioxins	<0.5	0.5	<0.5	0.5	-
Penta-Dioxins	<2.5	2.5	<2.5	2.5	-
Hexa-Dioxins	<2.5	2.5	<2.5	2.5	-
Hepta-Dioxins	<5.0	5.0	<5.0	5.0	-
Octa-Dioxin	68.6	9.9	76.9	9.9	11.4
Tetra-Furans	12.0	8.0	7.8	7.4	42.4
Penta-Furans	<2.5	2.5	<2.5	2.5	-
Hexa-Furans	<2.5	2.5	<2.5	2.5	-
Hepta-Furans	<7.5	7.5	<5.0	5.0	-
Octa-Furan	5.3	5.0	6.7	5.0	23.3
Σ PCDD/Fs	85.9		91.4		6.2

Notes

LOR = Limit of reporting

T = tetra

Pe = penta

Hx = hexa

Hp = hepta

O = octa

CDD, dioxin = chlorinated debenzo-p-dioxin

CDF, furan = chlorinated debenzofuran

RPD = relative per cent difference

Permitted ranges for RPD are dependant upon the magnitude of the result in comparison to the LOR.

Result < 10x LOR - no limit - result between 10x and 20x LOR - 50% - result > 20x LOR - 20%

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



Quality Control Results

Laboratory Control Samples(LCS)

Laboratory Sample Id : 5595604-010
QC Lot Number : 4540532
Sample Name : BCR 529 Sandy soil

Compound	Conc pg/g	Lower 1 pg/g	Upper 1 pg/g	¹³ C ¹² Rec(%)	Lower 2 (%)	Upper 2 (%)
2378-TCDD	4020.0	3900	5100	53.4	25	164
12378-PeCDD	456.0	390	490	80.2	25	181
123478-HxCDD	1460.0	900	1500	71.7	32	141
123678-HxCDD	5210.0	4500	6300	75.3	28	130
123789-HxCDD	3280.0	2600	3400	-	-	-
2378-TCDF	72.4	65	91	44.0	24	169
12378-PeCDF	166.0	110	170	66.0	24	185
23478-PeCDF	412.0	290	430	64.0	21	178
123478-HxCDF	3020.0	2900	3900	61.0	26	152
123678-HxCDF	1070.0	940	1240	72.1	26	123
234678-HxCDF	385.0	330	410	72.9	28	136
123789-HxCDF	546.0	12	32	87.2	29	147

Notes

- Acceptable concentration limits are as quoted on the analytical certificate for the certified reference material
- Acceptable recovery limits are derived from EPA1613 Revision B

T = tetra

Pe = penta

Hx = hexa

Hp = hepta

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



Quality Control Report Method Blank (MB)

Laboratory Sample ID: 5595604-001
Qc Lot Number : 4540532

Sample Matrix: SOIL
Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ 1	WHO-TEQ 2	WHO-TEQ 3	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.25	0.50	1	0.00	0.25	0.50	85.8
12378-PeCDD	<2.5	2.5	1	0.00	1.25	2.50	0.5	0.00	0.63	1.25	97.0
123478-HxCDD	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	55.1
123678-HxCDD	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	80.5
123789-HxCDD	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	-
1234678-HpCD	<2.5	2.5	0.01	0.00	0.01	0.03	0.01	0.00	0.01	0.03	77.9
OCDD	<10.0	10.0	0.0003	0.00	0.00	0.00	0.001	0.00	0.01	0.01	65.7
2378-TCDF	<0.5	0.5	0.1	0.00	0.03	0.05	0.1	0.00	0.03	0.05	59.0
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.08	0.05	0.00	0.06	0.13	72.2
23478-PeCDF	<2.5	2.5	0.3	0.00	0.38	0.75	0.5	0.00	0.63	1.25	73.3
123478-HxCDF	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	43.5
123678-HxCDF	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	64.0
234678-HxCDF	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	59.2
123789-HxCDF	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	68.2
1234678-HpCD	<2.5	2.5	0.01	0.00	0.01	0.03	0.01	0.00	0.01	0.03	46.1
1234789-HpCD	<2.5	2.5	0.01	0.00	0.01	0.03	0.01	0.00	0.01	0.03	64.6
OCDF	<5.0	5.0	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.01	-
Σ TEQ _(WHO)				0.00	2.89	5.72	Σ TEQ _(I)	0.00	2.55	5.04	

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	<0.5	0.5	1
Penta-Dioxins	<2.5	2.5	1
Hexa-Dioxins	<2.5	2.5	1
Hepta-Dioxins	<2.5	2.5	1
Octa-Dioxin	<10.0	10.0	1
Tetra-Furans	<0.5	0.5	1
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<5.0	5.0	1
Σ PCDD/Fs	0.00		

Notes

LOR = Limit of reporting

I-TEF = International toxic equivalency factor

I-TEQ = International toxic equivalence (pg/g)

WHO-TEF = World Health Organisation toxic equivalency factor

WHO-TEQ = World Health Organisation toxic equivalence (pg/g)

T = tetra

Pe = penta

Hx = hexa

Hp =hepta

O = octa

CDD, dioxin = chlorinated dibenzo-p-dioxin

CDF, furan = chlorinated dibenzofuran

1 I - TEQ_(zero) and WHO-TEQ_(zero) calculated treating <LOR as zero concentration (pg/g)

2 I-TEQ_(0.5 LOR) and WHO-TEQ_(0.5 LOR) calculated treating <LOR as 50% LoR concentration (pg/g)

3 I-TEQ_(LOR) and WHO-TEQ_(LOR) calculated treating <LOR as LoR concentration (pg/g)

4 Totals LORs are calculated by multiplying the number of peaks by the individual LOR per compound

Appendix C – Sediment Results from NMI

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CERTIFICATE OF ANALYSIS # DAU20_074

Client	Department of Environment and Science Chemistry Centre Level 3 East, Block A, Ecosciences Precinct 41 Boggo Rd, Dutton Park QLD 4102	Job No.	DEPT82/200309
		Sampled by	Client
		Date Sampled	24 & 25-Feb-2020
		Date Received	9-Mar-20
Contact	Susi Vardy	The results relate only to the sample(s) as received and tested.	

Method | AUTL_01 | **Date Reported** | 3-Apr-20

Details | The method is for determination of tetra- through octa-chlorinated dibenzo-p-dioxins (PCDDs) & dibenzofurans (PCDFs) in solid samples by high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS). This method provides data on all toxic 2,3,7,8-PCDD (seven) and PCDF (ten) isomers. PCDD and PCDF totals for each homologue group (tetra to octa) are also reported. The dioxin toxicity equivalent ($WHO_{05}\text{-TEQ}_{DF}$) in each sample is calculated using World Health Organization toxic equivalency factors ($WHO_{05}\text{-TEFs}$). All results are corrected for labelled surrogate recoveries and are reported on a dry weight basis.

After sampling, the solid is spiked with a range of isotopically labelled surrogate standards and exhaustively extracted. Clean up is effected by partitioning with sulphuric acid then distilled water. Further purification is performed using column chromatography on acid and base modified silica gels, basic alumina and carbon dispersed on celite.

Immediately prior to injection, internal standards are added to each extract, and an aliquot of the extract is injected into the GC. The analytes are separated by the GC and detected by a high-resolution (>10,000) mass spectrometer.

Authorisation

sch4p4(6) Personal information

Nino Piro
Senior Chemist
Australian Ultra Trace Laboratory

sch4p4(6) Personal information

Dr Alan Yates
Senior Analyst
Australian Ultra Trace Laboratory

Accreditation



NATA Accreditation Number : 198

Accredited for compliance with ISO/IEC 17025 - Testing.

This report shall not be reproduced, except in full.
Measurement uncertainty is available upon request.

Sample Details : Job No. DEPT82/200309			
Laboratory Reg. No.	Client Sample Ref.	Matrix	Description
N20/005111/X	WEY-0220	Solid	Sediment 25/02/2020
N20/005112/X	CTH-0220-S	Solid	Sediment 24/02/2020
N20/005113/X	NSA-0220	Solid	Sediment 25/02/2020

Project Details

Project Name	Not specified
Project Number	Not specified

Key

Analytes			
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
Units & Abbreviations			
pg/g	picograms per gram		
<	level less than limit of detection (LOD)		
WHO ₀₅ -TEF [†]	World Health Organization toxic equivalency factor		
WHO ₀₅ -TEQ _{DF} [†]	World Health Organization toxic equivalents (Dioxins & Furans)		
[†] as defined by Van den Berg et al., <i>Toxicol. Sci.</i> 93 (2), pp. 223–241 (2006)			
TEQs are calculated by multiplying the quantified level for each individual dioxin and furan congener reported by the corresponding TEF value and summing the result:			
$\text{WHO}_{05}\text{-TEQ}_{\text{DF}} = \sum_{i=1}^7 [\text{PCDD}_i \times \text{TEF}_i] + \sum_{j=1}^{10} [\text{PCDF}_j \times \text{TEF}_j]$		i = PCDD congener index (1 - 7) j = PCDF congener index (1 - 10)	
Lower Bound TEQ	defines all congener values reported below the LOD as equal to zero.		
Middle Bound TEQ	defines all congener values reported below the LOD as equal to half the LOD.		
Upper Bound TEQ	defines all congener values reported below the LOD as equal to the LOD.		
Surrogate Recovery	percentage recovery for ¹³ C ₁₂ labelled surrogate standard		
☞	Laboratory surrogate recovery outside normal acceptance criteria:		
	Solid and liquid matrices 25 - 125%		

Results : Job No. DEPT82/200309**Laboratory Reg. No.** N20/005111/X**Date Extracted** 19-Mar-20**Client Sample Ref.** WEY-0220**DB5 Analysis** 30-Mar-20**Matrix** Solid**DB-Dioxin Analysis** 2-Apr-20**Description** Sediment 25/02/2020

PCDD/F Congeners	Level pg/g	WHO ₀₅ -TEF	WHO ₀₅ -TEQ contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	0.15	0.1	0.015	68	
2,3,7,8-TCDD	4.0	1	4.0	72	
1,2,3,7,8-PeCDF	0.13	0.03	0.0039	85	
2,3,4,7,8-PeCDF	0.070	0.3	0.021	84	
1,2,3,7,8-PeCDD	27	1	27	97	
1,2,3,4,7,8-HxCDF	<0.09	0.1	0.0045	63	
1,2,3,6,7,8-HxCDF	<0.08	0.1	0.004	59	
2,3,4,6,7,8-HxCDF	<0.08	0.1	0.004	65	
1,2,3,7,8,9-HxCDF	<0.08	0.1	0.004	76	
1,2,3,4,7,8-HxCDD	27	0.1	2.7	71	
1,2,3,6,7,8-HxCDD	44	0.1	4.4	65	
1,2,3,7,8,9-HxCDD	110	0.1	11		
1,2,3,4,6,7,8-HpCDF	0.30	0.01	0.0030	63	
1,2,3,4,7,8,9-HpCDF	0.060	0.01	0.00060	77	
1,2,3,4,6,7,8-HpCDD	730	0.01	7.3	82	
OCDF	0.31	0.0003	0.000093		
OCDD	9070	0.0003	2.7	56	

PCDD/F Homologue Groups	Level pg/g
Total TCDF isomers	3.2
Total TCDD isomers	240
Total PeCDF isomers	1.4
Total PeCDD isomers	650
Total HxCDF isomers	1.6
Total HxCDD isomers	1860
Total HpCDF isomers	1.6
Total HpCDD isomers	3030

Summary Results**Sum of PCDD and PCDF congeners**

Excluding LOD values 14900 pg/g

WHO₀₅-TEQ_{DF}

Lower Bound [excluding LOD values] 59 pg/g

Middle Bound [including half LOD values] 59 pg/g

Upper Bound [including LOD values] 59 pg/g

Results : Job No. DEPT82/200309**Laboratory Reg. No.** N20/005112/X**Date Extracted** 19-Mar-20**Client Sample Ref.** CTH-0220-S**DB5 Analysis** 30-Mar-20**Matrix** Solid**DB-Dioxin Analysis** 2-Apr-20**Description** Sediment 24/02/2020

PCDD/F Congeners	Level pg/g	WHO ₀₅ -TEF	WHO ₀₅ -TEQ contribution	Labelled Surrogate recovery
2,3,7,8-TCDF	0.16	0.1	0.016	70
2,3,7,8-TCDD	<0.4	1	0.2	80
1,2,3,7,8-PeCDF	0.11	0.03	0.0033	82
2,3,4,7,8-PeCDF	0.070	0.3	0.021	84
1,2,3,7,8-PeCDD	2.6	1	2.6	93
1,2,3,4,7,8-HxCDF	<0.08	0.1	0.004	65
1,2,3,6,7,8-HxCDF	<0.08	0.1	0.004	59
2,3,4,6,7,8-HxCDF	<0.1	0.1	0.005	65
1,2,3,7,8,9-HxCDF	<0.07	0.1	0.0035	82
1,2,3,4,7,8-HxCDD	4.9	0.1	0.49	66
1,2,3,6,7,8-HxCDD	12	0.1	1.2	67
1,2,3,7,8,9-HxCDD	26	0.1	2.6	
1,2,3,4,6,7,8-HpCDF	<0.2	0.01	0.001	70
1,2,3,4,7,8,9-HpCDF	<0.04	0.01	0.0002	80
1,2,3,4,6,7,8-HpCDD	330	0.01	3.3	88
OCDF	0.24	0.0003	0.000072	
OCDD	4870	0.0003	1.5	65

PCDD/F Homologue Groups	Level pg/g
Total TCDF isomers	1.4
Total TCDD isomers	130
Total PeCDF isomers	0.45
Total PeCDD isomers	240
Total HxCDF isomers	0.68
Total HxCDD isomers	1070
Total HpCDF isomers	1.1
Total HpCDD isomers	1600

Summary Results**Sum of PCDD and PCDF congeners**

Excluding LOD values 7910 pg/g

WHO₀₅-TEQ_{DF}

Lower Bound [excluding LOD values] 12 pg/g

Middle Bound [including half LOD values] 12 pg/g

Upper Bound [including LOD values] 12 pg/g

Results : Job No. DEPT82/200309**Laboratory Reg. No.** N20/005113/X**Date Extracted** 19-Mar-20**Client Sample Ref.** NSA-0220**DB5 Analysis** 30-Mar-20**Matrix** Solid**DB-Dioxin Analysis** 2-Apr-20**Description** Sediment 25/02/2020

PCDD/F Congeners	Level pg/g	WHO ₀₅ -TEF	WHO ₀₅ -TEQ contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	<0.06	0.1	0.003	73	
2,3,7,8-TCDD	<0.3	1	0.15	76	
1,2,3,7,8-PeCDF	<0.05	0.03	0.00075	77	
2,3,4,7,8-PeCDF	<0.03	0.3	0.0045	79	
1,2,3,7,8-PeCDD	0.77	1	0.77	90	
1,2,3,4,7,8-HxCDF	<0.06	0.1	0.003	71	
1,2,3,6,7,8-HxCDF	<0.06	0.1	0.003	66	
2,3,4,6,7,8-HxCDF	<0.06	0.1	0.003	69	
1,2,3,7,8,9-HxCDF	<0.08	0.1	0.004	88	
1,2,3,4,7,8-HxCDD	1.6	0.1	0.16	76	
1,2,3,6,7,8-HxCDD	3.7	0.1	0.37	72	
1,2,3,7,8,9-HxCDD	9.2	0.1	0.92		
1,2,3,4,6,7,8-HpCDF	0.21	0.01	0.0021	64	
1,2,3,4,7,8,9-HpCDF	<0.04	0.01	0.0002	81	
1,2,3,4,6,7,8-HpCDD	160	0.01	1.6	78	
OCDF	0.39	0.0003	0.00012		
OCDD	5540	0.0003	1.7	69	

PCDD/F Homologue Groups	Level pg/g
Total TCDF isomers	1.2
Total TCDD isomers	30
Total PeCDF isomers	0.17
Total PeCDD isomers	55
Total HxCDF isomers	0.5
Total HxCDD isomers	320
Total HpCDF isomers	0.8
Total HpCDD isomers	740

Summary Results**Sum of PCDD and PCDF congeners**

Excluding LOD values 6690 pg/g

WHO₀₅-TEQ_{DF}

Lower Bound [excluding LOD values] 5.5 pg/g

Middle Bound [including half LOD values] 5.7 pg/g

Upper Bound [including LOD values] 5.9 pg/g

Appendix D – Water results from ALS

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CERTIFICATE OF ANALYSIS

Work Order	: PR20B9622	Issue Date	: 16-Dec-2020
Amendment	: 1		
Customer	: ALS Australia	Laboratory	: ALS Czech Republic, s.r.o.
Contact	: results address	Contact	: Client Service
Address	: 2 Byth Street 4051 Stafford QLD Australia	Address	: Na Harfe 336/9 Prague 9 - Vysocany 190 00 Czech Republic
E-mail	: subresults.bri@alsglobal.com	E-mail	: customer.support@alsglobal.com
Telephone	: ----	Telephone	: +420 226 226 228
Project	: EB2090109	Page	: 1 of 2
Order number	: ----	Date Samples	: 02-Dec-2020
		Received	
		Quote number	: PR2015ALSEN-AU0002 (CZ-251-15-0965)
Site	: ----	Date of test	: 02-Dec-2020 - 14-Dec-2020
Sampled by	: Client	QC Level	: ALS CR Standard Quality Control Schedule

General Comments

This report shall not be reproduced except in full, without prior written approval from the laboratory.

The laboratory declares that the test results relate only to the listed samples. If the section "Sampled by" of the Certificate of analysis states: "Sampled by Customer" then the results relate to the sample as received.

Amendment No. 1: Sample name change, client request. This Amendment No.1 replaces the original report issued on 14.12.2020.

Responsible for accuracy

Testing Laboratory No. 1163
Accredited by CAI according to
CSN EN ISO/IEC 17025:2018

Signatories

Zdeněk Jiráček

sch4p4(6) Personal information

Position

Environmental Business Unit
Manager



The company is certified according to ČSN EN ISO 14001 (Environmental management systems) and ČSN ISO 45001 (Occupational health and safety management systems)



Analytical Results

Sub-Matrix: WATER

Client sample ID
Laboratory sample ID
Client sampling date / time

				WEY - 1120		NSA - 1120		CRB - 1120	
				PR20B9622-001		PR20B9622-002		PR20B9622-003	
				02-Dec-2020		02-Dec-2020		02-Dec-2020	
Parameter	Method	LOR	Unit	Result	MU	Result	MU	Result	MU
PCDDs and PCDFs (Dioxins and Furans)									
2378-TCDD	W-DFHMS01	-	pg/L	<1.3	---	<1	---	<0.99	---
12378-PeCDD	W-DFHMS01	-	pg/L	<1.7	---	<1.3	---	<1.5	---
123478-HxCDD	W-DFHMS01	-	pg/L	<1.7	---	<2.3	---	<2	---
123678-HxCDD	W-DFHMS01	-	pg/L	<1.7	---	<2.3	---	<2	---
123789-HxCDD	W-DFHMS01	-	pg/L	<1.7	---	<2.3	---	<2	---
1234678-HpCDD	W-DFHMS01	-	pg/L	<3	---	<3.5	---	<1.2	---
OCDD	W-DFHMS01	-	pg/L	<3.5	---	<3.8	---	<1.5	---
2378-TCDF	W-DFHMS01	-	pg/L	<1.6	---	<1.9	---	<1.3	---
12378-PeCDF	W-DFHMS01	-	pg/L	<2	---	<2.2	---	<1.7	---
23478-PeCDF	W-DFHMS01	-	pg/L	<2	---	<2.2	---	<1.7	---
123478-HxCDF	W-DFHMS01	-	pg/L	<2.1	---	<2.4	---	<2.5	---
123678-HxCDF	W-DFHMS01	-	pg/L	<2.1	---	<2.4	---	<2.5	---
123789-HxCDF	W-DFHMS01	-	pg/L	<2.1	---	<2.4	---	<2.5	---
234678-HxCDF	W-DFHMS01	-	pg/L	<2.1	---	<2.4	---	<2.5	---
1234678-HpCDF	W-DFHMS01	-	pg/L	<3.9	---	<3.1	---	<1.5	---
1234789-HpCDF	W-DFHMS01	-	pg/L	<3.9	---	<3.1	---	<1.5	---
OCDF	W-DFHMS01	-	pg/L	<5.1	---	<3	---	<1.9	---
TEQ-Lowerbound	W-DFHMS01	-	pg/L	0	---	0	---	0	---
TEQ-Upperbound	W-DFHMS01	-	pg/L	5.2	---	5	---	4.8	---

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes. Measurement uncertainty is expressed as expanded measurement uncertainty with coverage factor $k = 2$, representing 95% confidence level.

Key: LOR = Limit of reporting; MU = Measurement Uncertainty. The MU does not include sampling uncertainty.

The end of result part of the certificate of analysis

Brief Method Summaries

Analytical Methods	Method Descriptions
Location of test performance: V Raji 906 Pardubice - Zelene Predmesti Czech Republic 530 02	
W-DFHMS01	<p>CZ_SOP_D06_06_175 - except chap. 10.2.3.2-10.2.3.8, 10.2.4, 10.2.5 (US EPA 1613B, CSN EN 16190):</p> <p>Determination of tetra- to octa-chlorinated dioxins and furanes by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values.</p> <p>The samples were stored in laboratory in the darkness and under temperature $<4^{\circ}\text{C}$.</p> <p>Actual LOQ are noticed in the annex.</p>

A ``\*`` symbol preceding any method indicates laboratory or subcontractor non-accredited test. In the case when a procedure belonging to an accredited method was used for non-accredited matrix, would apply that the reported results are non-accredited. Please refer to General Comment section on front page for information. If the report contains subcontracted analysis, those are made in a subcontracted laboratory outside the laboratories ALS Czech Republic, s.r.o.

The calculation methods of summation parameters are available on request in the client service.

Appendix E - Biota results from NMI

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CERTIFICATE OF ANALYSIS # DAU20_189

Client	Department of Environment and Science Science Division Level 3 East, Block A, Ecosciences Precinct 41 Boggo Rd, Dutton Park QLD 4102	Job No.	DEPT82/200616
		Sampled by	Client
		Date Sampled	May-2020
		Date Received	16-Jun-20
Contact	Susanne Vardy		

The results relate only to the sample(s) as received and tested.

Method | AUTL_01 | **Date Reported** | 30-Jul-20

Details | The method is for determination of tetra- through octa-chlorinated dibenzo-p-dioxins (PCDDs) & dibenzofurans (PCDFs) in biota samples by high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS). This method provides data on all toxic 2,3,7,8-PCDD (seven) and PCDF (ten) isomers. PCDD and PCDF totals for each homologue group (tetra to octa) are also reported. The dioxin toxicity equivalent (WHO₀₅-TEQ_{DF}) in each sample is calculated using World Health Organization toxic equivalency factors (WHO₀₅-TEFs). All results are corrected for labelled surrogate recoveries and are reported on a fresh weight basis.

The sample is spiked with a range of isotopically labelled surrogate standards and exhaustively extracted. Clean up is effected by partitioning with sulphuric acid then distilled water. Further purification is performed using column chromatography on acid and base modified silica gels, basic alumina and carbon dispersed on celite.

Immediately prior to injection, internal standards are added to each extract, and an aliquot of the extract is injected into the GC. The analytes are separated by the GC and detected by a high-resolution (>10,000) mass spectrometer.

Authorisation | sch4p4(6) Personal information

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Sample Details : Job No. DEPT82/200616

Laboratory Reg. No.	Client Sample Ref.	Matrix	Description
N20/014288	WEY-MUL-28520	Biota	Composite sample (5 fillets)
N20/014289	COO-MUL-29520	Biota	Composite sample (4 fillets)
N20/014290	COI-OYS-27520	Biota	Composite sample (7 pieces)
N20/014291	WEY-OYS-27520	Biota	Composite sample (9 pieces)
N20/014292	COO-MUD-00520	Biota	Composite sample (flesh of 2 crabs)

Project Details

Project Name	Not specified
Project Number	Not specified

Key

Analytes

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

Units & Abbreviations

pg/g	picograms per gram
<	level less than limit of detection (LOD)
WHO ₀₅ -TEF [†]	World Health Organization toxic equivalency factor
WHO ₀₅ -TEQ _{DF} [†]	World Health Organization toxic equivalents (Dioxins & Furans)
[†] as defined by Van den Berg et al., <i>Toxicol. Sci.</i> 93 (2), pp. 223–241 (2006)	
TEQs are calculated by multiplying the quantified level for each individual dioxin and furan congener reported by the corresponding TEF value and summing the result:	
$\text{WHO}_{05}\text{-TEQ}_{\text{DF}} = \sum_{i=1}^7 [\text{PCDD}_i \times \text{TEF}_i] + \sum_{j=1}^{10} [\text{PCDF}_j \times \text{TEF}_j]$ <div style="display: flex; justify-content: space-between; margin-top: 5px;"> i = PCDD congener index (1 - 7) j = PCDF congener index (1 - 10) </div>	
Lower Bound TEQ	defines all congener values reported below the LOD as equal to zero.
Middle Bound TEQ	defines all congener values reported below the LOD as equal to half the LOD.
Upper Bound TEQ	defines all congener values reported below the LOD as equal to the LOD.
Surrogate Recovery	percentage recovery for ¹³ C ₁₂ labelled surrogate standard
	Laboratory surrogate recovery outside normal acceptance criteria:
	Solid and liquid matrices 25 - 125%

Results : Job No. DEPT82/200616**Laboratory Reg. No.** N20/014288**Date Extracted** 10-Jul-20**Client Sample Ref.** WEY-MUL-28520**DB5 Analysis** 24-Jul-20**Matrix** Biota**DB-Dioxin Analysis** 28-Jul-20**Description** Composite sample (5 fillets)

PCDD/F Congeners	Level pg/g	WHO ₀₅ -TEF	WHO ₀₅ -TEQ contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	0.14	0.1	0.014	69	
2,3,7,8-TCDD	0.22	1	0.22	74	
1,2,3,7,8-PeCDF	0.019	0.03	0.00056	79	
2,3,4,7,8-PeCDF	0.031	0.3	0.0094	85	
1,2,3,7,8-PeCDD	1.2	1	1.2	99	
1,2,3,4,7,8-HxCDF	<0.006	0.1	0.0003	91	
1,2,3,6,7,8-HxCDF	<0.006	0.1	0.0003	78	
2,3,4,6,7,8-HxCDF	<0.006	0.1	0.0003	82	
1,2,3,7,8,9-HxCDF	<0.006	0.1	0.0003	92	
1,2,3,4,7,8-HxCDD	0.52	0.1	0.052	88	
1,2,3,6,7,8-HxCDD	0.99	0.1	0.099	84	
1,2,3,7,8,9-HxCDD	0.63	0.1	0.063		
1,2,3,4,6,7,8-HpCDF	<0.004	0.01	0.00002	76	
1,2,3,4,7,8,9-HpCDF	<0.002	0.01	0.00001	78	
1,2,3,4,6,7,8-HpCDD	1.5	0.01	0.015	73	
OCDF	<0.002	0.0003	0.0000003		
OCDD	3.5	0.0003	0.0010	64	

PCDD/F Homologue Groups	Level pg/g
Total TCDF isomers	0.36
Total TCDD isomers	5.5
Total PeCDF isomers	0.12
Total PeCDD isomers	2.3
Total HxCDF isomers	<0.04
Total HxCDD isomers	4.8
Total HpCDF isomers	<0.008
Total HpCDD isomers	1.9

Summary Results**Sum of PCDD and PCDF congeners**

Excluding LOD values 18 pg/g

WHO₀₅-TEQ_{DF}

Lower Bound [excluding LOD values] 1.7 pg/g

Middle Bound [including half LOD values] 1.7 pg/g

Upper Bound [including LOD values] 1.7 pg/g

Results : Job No. DEPT82/200616**Laboratory Reg. No.** N20/014289**Date Extracted** 10-Jul-20**Client Sample Ref.** COO-MUL-29520**DB5 Analysis** 24-Jul-20**Matrix** Biota**DB-Dioxin Analysis** 28-Jul-20**Description** Composite sample (4 fillets)

PCDD/F Congeners	Level pg/g	WHO ₀₅ -TEF	WHO ₀₅ -TEQ contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	0.27	0.1	0.027	69	
2,3,7,8-TCDD	0.23	1	0.23	75	
1,2,3,7,8-PeCDF	0.023	0.03	0.00068	78	
2,3,4,7,8-PeCDF	0.046	0.3	0.014	79	
1,2,3,7,8-PeCDD	0.87	1	0.87	91	
1,2,3,4,7,8-HxCDF	<0.006	0.1	0.0003	92	
1,2,3,6,7,8-HxCDF	<0.007	0.1	0.00035	79	
2,3,4,6,7,8-HxCDF	<0.007	0.1	0.00035	80	
1,2,3,7,8,9-HxCDF	<0.006	0.1	0.0003	88	
1,2,3,4,7,8-HxCDD	0.29	0.1	0.029	90	
1,2,3,6,7,8-HxCDD	0.56	0.1	0.056	85	
1,2,3,7,8,9-HxCDD	0.30	0.1	0.030		
1,2,3,4,6,7,8-HpCDF	<0.002	0.01	0.00001	77	
1,2,3,4,7,8,9-HpCDF	<0.003	0.01	0.000015	73	
1,2,3,4,6,7,8-HpCDD	0.82	0.01	0.0082	73	
OCDF	<0.002	0.0003	0.0000003		
OCDD	2.0	0.0003	0.00060	63	

PCDD/F Homologue Groups	Level pg/g
Total TCDF isomers	0.84
Total TCDD isomers	19
Total PeCDF isomers	0.14
Total PeCDD isomers	3.4
Total HxCDF isomers	<0.04
Total HxCDD isomers	3.9
Total HpCDF isomers	<0.005
Total HpCDD isomers	1.1

Summary Results**Sum of PCDD and PCDF congeners**

Excluding LOD values 30 pg/g

WHO₀₅-TEQ_{DF}

Lower Bound [excluding LOD values] 1.3 pg/g

Middle Bound [including half LOD values] 1.3 pg/g

Upper Bound [including LOD values] 1.3 pg/g

Results : Job No. DEPT82/200616**Laboratory Reg. No.** N20/014290**Date Extracted** 10-Jul-20**Client Sample Ref.** COI-OYS-27520**DB5 Analysis** 24-Jul-20**Matrix** Biota**DB-Dioxin Analysis** 28-Jul-20**Description** Composite sample (7 pieces)

PCDD/F Congeners	Level pg/g	WHO ₀₅ -TEF	WHO ₀₅ -TEQ contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	0.13	0.1	0.013	75	
2,3,7,8-TCDD	<0.3	1	0.15	82	
1,2,3,7,8-PeCDF	<0.08	0.03	0.0012	82	
2,3,4,7,8-PeCDF	<0.04	0.3	0.006	83	
1,2,3,7,8-PeCDD	0.71	1	0.71	96	
1,2,3,4,7,8-HxCDF	<0.03	0.1	0.0015	96	
1,2,3,6,7,8-HxCDF	<0.04	0.1	0.002	80	
2,3,4,6,7,8-HxCDF	<0.04	0.1	0.002	86	
1,2,3,7,8,9-HxCDF	<0.03	0.1	0.0015	96	
1,2,3,4,7,8-HxCDD	0.94	0.1	0.094	99	
1,2,3,6,7,8-HxCDD	1.9	0.1	0.19	94	
1,2,3,7,8,9-HxCDD	1.8	0.1	0.18		
1,2,3,4,6,7,8-HpCDF	<0.02	0.01	0.0001	79	
1,2,3,4,7,8,9-HpCDF	<0.02	0.01	0.0001	74	
1,2,3,4,6,7,8-HpCDD	28	0.01	0.28	76	
OCDF	<0.03	0.0003	0.0000045		
OCDD	340	0.0003	0.10	65	

PCDD/F Homologue Groups	Level pg/g
Total TCDF isomers	2.8
Total TCDD isomers	45
Total PeCDF isomers	<0.4
Total PeCDD isomers	39
Total HxCDF isomers	<0.2
Total HxCDD isomers	120
Total HpCDF isomers	<0.08
Total HpCDD isomers	120

Summary Results**Sum of PCDD and PCDF congeners**

Excluding LOD values 670 pg/g

WHO₀₅-TEQ_{DF}

Lower Bound [excluding LOD values] 1.6 pg/g

Middle Bound [including half LOD values] 1.7 pg/g

Upper Bound [including LOD values] 1.9 pg/g

Results : Job No. DEPT82/200616**Laboratory Reg. No.** N20/014291**Date Extracted** 10-Jul-20**Client Sample Ref.** WEY-OYS-27520**DB5 Analysis** 24-Jul-20**Matrix** Biota**DB-Dioxin Analysis** 28-Jul-20**Description** Composite sample (9 pieces)

PCDD/F Congeners	Level pg/g	WHO ₀₅ -TEF	WHO ₀₅ -TEQ contribution	Labelled Surrogate recovery
2,3,7,8-TCDF	<0.1	0.1	0.005	81
2,3,7,8-TCDD	0.35	1	0.35	86
1,2,3,7,8-PeCDF	<0.06	0.03	0.0009	88
2,3,4,7,8-PeCDF	<0.06	0.3	0.009	87
1,2,3,7,8-PeCDD	1.9	1	1.9	102
1,2,3,4,7,8-HxCDF	<0.04	0.1	0.002	95
1,2,3,6,7,8-HxCDF	<0.04	0.1	0.002	81
2,3,4,6,7,8-HxCDF	<0.04	0.1	0.002	84
1,2,3,7,8,9-HxCDF	<0.04	0.1	0.002	95
1,2,3,4,7,8-HxCDD	1.5	0.1	0.15	95
1,2,3,6,7,8-HxCDD	2.8	0.1	0.28	89
1,2,3,7,8,9-HxCDD	2.1	0.1	0.21	
1,2,3,4,6,7,8-HpCDF	<0.02	0.01	0.0001	76
1,2,3,4,7,8,9-HpCDF	<0.03	0.01	0.00015	74
1,2,3,4,6,7,8-HpCDD	23	0.01	0.23	73
OCDF	<0.03	0.0003	0.0000045	
OCDD	240	0.0003	0.071	65

PCDD/F Homologue Groups	Level pg/g
Total TCDF isomers	2.5
Total TCDD isomers	34
Total PeCDF isomers	<0.4
Total PeCDD isomers	47
Total HxCDF isomers	<0.2
Total HxCDD isomers	98
Total HpCDF isomers	<0.05
Total HpCDD isomers	84

Summary Results**Sum of PCDD and PCDF congeners**

Excluding LOD values 510 pg/g

WHO₀₅-TEQ_{DF}

Lower Bound [excluding LOD values] 3.2 pg/g

Middle Bound [including half LOD values] 3.2 pg/g

Upper Bound [including LOD values] 3.2 pg/g

Results : Job No. DEPT82/200616**Laboratory Reg. No.** N20/014292**Date Extracted** 10-Jul-20**Client Sample Ref.** COO-MUD-00520**DB5 Analysis** 24-Jul-20**Matrix** Biota**Description** Composite sample (flesh of 2 crabs)

PCDD/F Congeners	Level pg/g	WHO ₀₅ -TEF	WHO ₀₅ -TEQ contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	<0.005	0.1	0.00025	67	
2,3,7,8-TCDD	<0.02	1	0.01	77	
1,2,3,7,8-PeCDF	<0.003	0.03	0.000045	81	
2,3,4,7,8-PeCDF	<0.003	0.3	0.00045	85	
1,2,3,7,8-PeCDD	<0.02	1	0.01	99	
1,2,3,4,7,8-HxCDF	<0.004	0.1	0.0002	88	
1,2,3,6,7,8-HxCDF	<0.004	0.1	0.0002	76	
2,3,4,6,7,8-HxCDF	<0.004	0.1	0.0002	80	
1,2,3,7,8,9-HxCDF	<0.004	0.1	0.0002	88	
1,2,3,4,7,8-HxCDD	0.029	0.1	0.0029	92	
1,2,3,6,7,8-HxCDD	0.044	0.1	0.0044	87	
1,2,3,7,8,9-HxCDD	0.051	0.1	0.0051		
1,2,3,4,6,7,8-HpCDF	<0.001	0.01	0.000005	73	
1,2,3,4,7,8,9-HpCDF	<0.001	0.01	0.000005	72	
1,2,3,4,6,7,8-HpCDD	0.16	0.01	0.0016	71	
OCDF	<0.002	0.0003	0.0000003		
OCDD	0.84	0.0003	0.00025	62	

PCDD/F Homologue Groups	Level pg/g
Total TCDF isomers	0.11
Total TCDD isomers	0.39
Total PeCDF isomers	<0.02
Total PeCDD isomers	1.5
Total HxCDF isomers	<0.02
Total HxCDD isomers	4.7
Total HpCDF isomers	<0.004
Total HpCDD isomers	0.75

Summary Results**Sum of PCDD and PCDF congeners**

Excluding LOD values 8.3 pg/g

WHO₀₅-TEQ_{DF}

Lower Bound [excluding LOD values] 0.014 pg/g

Middle Bound [including half LOD values] 0.036 pg/g

Upper Bound [including LOD values] 0.057 pg/g



REPORT OF ANALYSIS

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Report No. RN1282348

Client	: DEPARTMENT OF ENVIRONMENT AND SCIENCE WATER QUALITY AND INVESTIGATIONS, ENVIRONMENTAL MONITORING AND ASSESSMENT SCIENCES DUTTON PARK QLD 4102	Job No.	: DEPT82/200616
Attention	: SUZANNE VARDY	Quote No.	: QT-02018
Project Name	:	Order No.	:
Your Client Services Manager	: Tony Lattari	Date Received	: 16-JUN-2020
		Sampled By	: CLIENT
		Phone	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N20/014288	WEY-MUL-28520	BIOTA 28/05/2020
N20/014289	COO-MUL-29520	BIOTA 29/05/2020
N20/014290	COI-OYS-27520	BIOTA 27/05/2020
N20/014291	WEY-OYS-27520	BIOTA 27/05/2020

Lab Reg No.		N20/014288	N20/014289	N20/014290	N20/014291	
Date Sampled		28-MAY-2020	29-MAY-2020	27-MAY-2020	27-MAY-2020	
Sample Reference		WEY-MUL-28520	COO-MUL-29520	COI-OYS-27520	WEY-OYS-27520	
	Units					Method
Total TEQ						
Total TEQ		DAU20_189	DAU20_189	DAU20_189	DAU20_189	AUTL_01

sch4p4(6) Personal information

Alan Yates, Analyst
Australian Ultra Trace Laboratory
Accreditation No. 198

30-JUL-2020

Lab Reg No.		N20/014288	N20/014289	N20/014290	N20/014291	
Date Sampled		28-MAY-2020	29-MAY-2020	27-MAY-2020	27-MAY-2020	
Sample Reference		WEY-MUL-28520	COO-MUL-29520	COI-OYS-27520	WEY-OYS-27520	
	Units					Method
Proximates						
Fat (Mojonnier extraction)	g/100g	4.1	8.6	Not Tested	Not Tested	VL302

sch4p4(6) Personal information

Paul Adorno, Section Manager
Food Composition - Vic
Accreditation No. 89

30-JUL-2020

REPORT OF ANALYSIS

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Report No. RN1282348

Client :	DEPARTMENT OF ENVIRONMENT AND SCIENCE WATER QUALITY AND INVESTIGATIONS, ENVIRONMENTAL MONITORING AND ASSESSMENT SCIENCES DUTTON PARK QLD 4102	Job No. :	DEPT82/200616
Attention :	SUZANNE VARDY	Quote No. :	QT-02018
Project Name :		Order No. :	
Your Client Services Manager :	Tony Lattari	Date Received :	16-JUN-2020
		Sampled By :	CLIENT
		Phone :	02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N20/014292	COO-MUD-00520	BIOTA 01/05/2020

Lab Reg No.		N20/014292				
Date Sampled		01-MAY-2020				
Sample Reference		COO-MUD-0052				
	Units					Method
Total TEQ						
Total TEQ		DAU20_189				AUTL_01

sch4p4(6) Personal information

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Accreditation No. 198

30-JUL-2020

Lab Reg No.		N20/014292				
Date Sampled		01-MAY-2020				
Sample Reference		COO-MUD-0052				
	Units					Method
Proximates						
Fat (Mojonnier extraction)	g/100g	0.6				VL302

sch4p4(6) Personal information

Paul Adorno, Section Manager
Food Composition - Vic
Accreditation No. 89

30-JUL-2020

105 Delhi Road, North Ryde NSW 2113 Tel: +61 2 9449 0111 www.measurement.gov.au

National Measurement Institute

REPORT OF ANALYSIS

Page: 3 of 3
Report No. RN1282348



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Published on DES Disclosure Log
RTI Act 2009

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N a t i o n a l M e a s u r e m e n t I n s t i t u t e

Appendix F – Assessment of dioxins for human consumption – Noosa Lakes.

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Assessment of dioxin in biota for human consumption – Noosa Lakes

August 2020

Published on DES Disclosure Log
PTI Act 2009



Background

Queensland Health assessed the data provided by Department of Environment and Science (DES) on biota samples for human consumption collected in the Noosa lakes. Biota sampling was undertaken following detection of dioxins and dioxin-like compounds in lake sediments. In this assessment, dioxin means dioxin and dioxin-like compounds as selected by DES in their analysis and report. All values are Toxic Equivalents (TEQ) for these compounds.

Results

Dioxin analysis results of biota samples (Table 1) collected from Lake Weyba, Lake Cootharaba and Lake Cooroibah in the Noosa area were used in this assessment. As the difference between the two fish samples was small and not expected to make a substantive difference to the calculation, 1.7 pg TEQ/g value was selected for the initial exposure calculation. For the oysters, a 100 g serve (approximately 6 oysters) at the mean of both samples and a 200 g serve (approximately 12 oysters) of Lake Weyba oysters were chosen for the calculations. The latter option was to provide reassurance around the higher concentration of the dioxin in the Lake Weyba sample. No calculation was made for the crab meat, as the concentration of dioxins was very low.

Table 1 Results reported by Department of Environment and Science of dioxin analysis of biota for human consumption in Noosa

Sample ID	Matrix	Location	FAT (%)	TEQ _{DF} (pg/g)	Sample
WEY-MUL-28520	Mullet	Lake Weyba	4.1	1.7	Composite Sample (5 Fillets)
COO-MUL-29520	Mullet	Lake Cootharaba	8.6	1.3	Composite Sample (4 Fillets)
COI-OYS-2752	Oyster	Lake Coolibah	ND	1.7	Composite Sample (7 pieces)
WEY-OYS-27520	Oyster	Lake Weyba	ND	3.2	Composite Sample (9 pieces)
COO-MUD-00520	Mud Crab	Lake Cootharaba	0.6	0.036 (0.014 - 0.057)	Composite Sample (flesh of 2 crabs)

ND = not determined

Guideline Value

The NHMRC established a Tolerable Monthly Intake (TMI) guideline value (GV) for dioxins of 70 pg TEQ/month (NHMRC, 2002). By taking into account background exposures and consumption data, FSANZ estimated the limit for dioxins in fish and seafood for human consumption was 6 pg TEQ/g (pg of dioxin toxicity equivalence per g fresh weight of fish) (FSANZ, 2007). The FSANZ assessment is based on a single serve of fish from the contaminated area per week.

Exposure

Exposure values (Equation 1) and hazard quotients (Equation 2) have been calculated for consumption of 1, 2 and 3 serves of fish per week, or one serve of oysters per week. If an adult were to consume up to 3 serves per week of fish from the Noosa area as sampled, the intake could reach around 60% of the TMI - approximately 44 pg TEQ/Kg bw per day (Table 2). Exposure values for children are not reported

separately. If exposure as a child (6 years of a total 70 year lifetime) and exposure as an adult (balance of 70 year lifespan) is considered, the risk is not significantly different.

$$\text{Intake (dioxin)} = \frac{\text{Conc} \times (\text{portion size} \times \text{frequency})}{\text{Body weight}} \quad \text{Equation 1}$$

Where

Intake is intake of dioxin in pg TEQ/kg

Conc is the concentration of dioxin in fish

Portion size is the weight in g of fish consumed in a meal

Frequency is the number of meals consumed per month

Body weight is the default body weight for a child or adult in kg.

$$\text{HQ} = \frac{\text{Intake}}{\text{Guideline}} \quad \text{Equation 2}$$

Where

HQ is the hazard quotient

Intake is the intake of dioxin from Equation 1

Table 2 Calculated exposure and hazard quotient for consumption of fish and oysters sampled from Noosa lakes.

Parameter	Units	1 meal per week	2 meals per week	3 meals per week	Oysters (all)	Oysters (Weyba)
Concentration	pg/g	1.70	1.70	1.70	2.50	3.20
Portion size (fish)	g/meal	150.00	150.00	150.00	100.00	200.00
Frequency	meals/month	4.00	8.00	12.00	4.00	4.00
Ingestion Rate (fish)	g/month	600.00	1200.00	1800.00	400.00	800.00
Body weight	kg	70	70	70	70	70
Intake (dioxin)	pg/kg bw month	1.46E+01	2.91E+01	4.37E+01	1.43E+01	3.66E+01
GV (NHMRC)	pg/kg bw month	70	70	70	70	70
HQ		0.21	0.42	0.62	0.20	0.52

Uncertainties

As the sample size is very small, and collected over a short time frame, the result may not be representative of all biota in the area that may be consumed. The extent of recreational fishing, and the amount of catch kept and consumed for the specific area is not known but is assumed to reflect general patterns in Queensland.

Conclusion

Consumption of fish from the Noosa area sampled by DES is unlikely to result in an unacceptable risk to public health. Recreational fishers consuming relatively significant amounts over extended seasons may approach the recommended TMI. Seasonal consumption patterns, lifetime patterns of activity, and locality changes mitigate against the possibility of exceeding the dioxin tolerable intake guideline value. This assessment has not considered the risks associated with commercial fishing. As the concentration in fish is below the FSANZ limit of 6 pg TEQ/g, the risk is not expected to be a concern. However, this may need to be further investigated with Department of Agriculture and Fisheries if there is significant commercial fishing in the area.

Recommendation

No specific advice on the consumption of fish due to dioxins in the Noosa area is required. If public concerns are noted, media reminders of the recommendations of consumption of fish with respect to mercury could be issued, as these guidelines would also be protective of exposure to dioxins.

References

- FSANZ. (2007). *Dioxins in Seafood from Sydney Harbour A Revised Assessment of the Public Health and Safety Risk. Technical Series Report No: 32. Food Standards Australia and New Zealand. Canberra*
- NHMRC. (2002). *Dioxins: Recommendation for a Tolerable Monthly Intake for Australians. Environmental Health Monograph 26. National Health and Medical Research Council. Canberra:*

Date : 8/12/2020 4:00:44 PM

From : "VARDY Suzanne"

To : "SALE Ben"

Subject : FW: Noosa Dioxin Survey_8December2020

Attachment : Appendix B part 1.pdf;Appendix B part 2.pdf;Appendix C.pdf;Appendix D.pdf;Appendix E.pdf;Noosa Dioxin Survey_8December2020.docx;

From: VARDY Suzanne

Sent: Tuesday, 8 December 2020 3:55 PM

To: FEWINGS James

Cc: MANN Reinier

Subject: RE: Noosa Dioxin Survey_8December2020

Hi Jim,

All attached.

Susi.

From: FEWINGS James <James.Fewings@des.qld.gov.au>

Sent: Tuesday, 8 December 2020 3:44 PM

To: VARDY Suzanne

Cc: MANN Reinier

Subject: Noosa Dioxin Survey_8December2020

Importance: High

Hi Susi

Can you please insert the Appendices B, C, D and E—and return.

Thanks

Jim F

Published on DES Disclosure Log
RTI Act 2009

CERTIFICATE OF ANALYSIS

Client	QLD DEPT OF ENVIRONMENT & SCIENCE	Laboratory :	Environmental Division Brisbane	1 of 11
Contact	SUZANNE VARDY	Contact	CUSTOMER.SERVICES.EB	Work Order: EB2090018
Address:	GPO BOX 2771 BRISBANE QLD, AUSTRALIA 4001	Address:	2 Byth Street Stafford QLD 4053 Australia	
Project	NSA_DIO	Quote #	BNBQ/082/14	Received: 5 Mar 2020
Order #	- Not provided -			Issued 18 Mar 2020
C-O-C #	- Not provided -			
Site	- Not provided -			
E-mail	suzanne.vardy@des.qld.gov.au	E-mail	ALSEnviro.Brisbane@alsglobal.com	Number of Samples
Phone	32258402	Phone	+61-7-3243 7222	Received: 10
Fax	32258723	Fax	+61-7-3243 7218	Analysed: 11

Notes

LOR = Limit of reporting

I-TEF = International toxic equivalency factor

I-TEQ = International toxic equivalence

WHO-TEF = World Health Organisation toxic equivalency factor

WHO-TEQ = World Health Organisation toxic equivalence

Samples analysed 'as received', results reported on 'dry weight' basis.

- 1 I -TEQ_(zero) and WHO-TEQ_(zero) calculated treating <LOR as zero concentration
- 2 I -TEQ_(0.5 LOR) and WHO-TEQ_(0.5 zero) calculated treating <LOR as 0.5 LoR concentration
- 3 I-TEQ_(LOR) and WHO-TEQ_(LOR) calculated treating <LOR as LoR concentration
- 4 Totals LORs are calculated by multiplying the number of peaks by the individual LOR per compound
- 5 13C12 Rec(%) = The absolute recovery of Isotopically labelled compound added by the Laboratory to both quantitate and measure extraction efficiency.

T = tetra
Pe = penta
Hx = hexa
Hp =hepta
O = octa
CDD, dioxin = chlorinated dibenzo-p-dioxin
CDF, furan = chlorinated dibenzofuran

ALSE - Excellence in Analytical Testing



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This document has been digitally signed by those names that appear on this report and are the authorised signatories. Digital signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Position	Department
Peter Blow	HRMS Chemist	GC/HR-MS - NATA 825 (818 - Brisbane)

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300

Laboratory Sample ID: EB2090018001
Client Sample ID: WEY - 0220

Qc Lot Number: 4540532
Sample Matrix: SOIL

Date Sampled: 24-Feb-2020
Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	2.7	0.5	1	2.65	2.65	2.65	1	2.65	2.65	2.65	89.7
12378-PeCDD	19.0	2.5	1	19.00	19.00	19.00	0.5	9.50	9.50	9.50	92.8
123478-HxCDD	20.4	2.5	0.1	2.04	2.04	2.04	0.1	2.04	2.04	2.04	60.8
123678-HxCDD	29.0	2.5	0.1	2.90	2.90	2.90	0.1	2.90	2.90	2.90	82.2
123789-HxCDD	66.9	2.5	0.1	6.69	6.69	6.69	0.1	6.69	6.69	6.69	-
1234678-HpCDD	321.0	2.5	0.01	3.21	3.21	3.21	0.01	3.21	3.21	3.21	81.4
OCDD	4410.0	9.9	0.0003	1.32	1.32	1.32	0.001	4.41	4.41	4.41	82.9
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	59.2
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	72.6
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.75	0.5	0.00	0.62	1.24	72.2
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	48.9
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	70.9
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	64.3
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	73.0
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	49.8
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	70.9
OCDF	<5.0	5.0	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	37.81	38.77	39.73	-	31.40	32.63	33.87	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	356.0	5.5	11
Penta-Dioxins	609.0	19.9	8
Hexa-Dioxins	2150.0	17.4	7
Hepta-Dioxins	1260.0	5.0	2
Octa-Dioxin	4410.0	9.9	1
Tetra-Furans	8.7	7.0	14
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<5.0	5.0	1
S PCDD/Fs	8793.7		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300

Laboratory Sample ID: EB2090018002
Client Sample ID: BEB - 0220

Qc Lot Number: 4540531
Sample Matrix: SOIL

Date Sampled: 24-Feb-2020
Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	4.4	0.5	1	4.36	4.36	4.36	1	4.36	4.36	4.36	85.4
12378-PeCDD	44.6	2.5	1	44.60	44.60	44.60	0.5	22.30	22.30	22.30	85.3
123478-HxCDD	34.7	2.5	0.1	3.47	3.47	3.47	0.1	3.47	3.47	3.47	51.9
123678-HxCDD	44.2	2.5	0.1	4.42	4.42	4.42	0.1	4.42	4.42	4.42	79.3
123789-HxCDD	114.0	2.5	0.1	11.40	11.40	11.40	0.1	11.40	11.40	11.40	-
1234678-HpCDD	589.0	2.5	0.01	5.89	5.89	5.89	0.01	5.89	5.89	5.89	73.2
OCDD	6410.0	9.9	0.0003	1.92	1.92	1.92	0.001	6.41	6.41	6.41	67.1
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	52.7
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	59.7
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.74	0.5	0.00	0.62	1.23	63.4
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	39.6
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	62.5
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	56.9
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	61.7
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	41.6
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	62.9
OCDF	<4.9	4.9	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	76.06	77.01	77.96	-	58.25	59.47	60.70	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	478.0	6.4	13
Penta-Dioxins	979.0	19.7	8
Hexa-Dioxins	4030.0	17.3	7
Hepta-Dioxins	2280.0	4.9	2
Octa-Dioxin	6410.0	9.9	1
Tetra-Furans	11.8	6.9	14
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<4.9	4.9	1
S PCDD/Fs	14188.8		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300 Laboratory Sample ID: EB2090018003 Qc Lot Number: 4540532 Date Sampled: 24-Feb-2020
Client Sample ID: NSA - 0220 Sample Matrix: SOIL Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.25	0.50	1	0.00	0.25	0.50	88.7
12378-PeCDD	<2.5	2.5	1	0.00	1.25	2.50	0.5	0.00	0.62	1.25	92.4
123478-HxCDD	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	54.8
123678-HxCDD	4.4	2.5	0.1	0.44	0.44	0.44	0.1	0.44	0.44	0.44	77.1
123789-HxCDD	11.7	2.5	0.1	1.17	1.17	1.17	0.1	1.17	1.17	1.17	-
1234678-HpCDD	142.0	2.5	0.01	1.42	1.42	1.42	0.01	1.42	1.42	1.42	78.4
OCDD	4530.0	10.0	0.0003	1.36	1.36	1.36	0.001	4.53	4.53	4.53	73.5
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	58.2
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	67.1
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.75	0.5	0.00	0.62	1.25	70.2
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	40.7
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	59.4
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	55.8
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	65.4
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	44.6
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	63.1
OCDF	<5.0	5.0	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	4.39	6.97	9.55	-	7.56	9.79	12.03	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	56.7	5.5	11
Penta-Dioxins	102.0	15.0	6
Hexa-Dioxins	670.0	17.5	7
Hepta-Dioxins	602.0	5.0	2
Octa-Dioxin	4530.0	10.0	1
Tetra-Furans	<0.5	0.5	1
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<5.0	5.0	1
S PCDD/Fs	5960.7		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300

Laboratory Sample ID: EB2090018004
Client Sample ID: AES - 0220

Qc Lot Number: 4540532
Sample Matrix: SOIL

Date Sampled: 24-Feb-2020
Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	0.7	0.5	1	0.72	0.72	0.72	1	0.72	0.72	0.72	69.5
12378-PeCDD	3.6	2.5	1	3.57	3.57	3.57	0.5	1.79	1.79	1.79	75.7
123478-HxCDD	3.9	2.5	0.1	0.39	0.39	0.39	0.1	0.39	0.39	0.39	44.6
123678-HxCDD	5.5	2.5	0.1	0.55	0.55	0.55	0.1	0.55	0.55	0.55	60.9
123789-HxCDD	14.6	2.5	0.1	1.46	1.46	1.46	0.1	1.46	1.46	1.46	-
1234678-HpCDD	188.0	2.5	0.01	1.88	1.88	1.88	0.01	1.88	1.88	1.88	61.1
OCDD	6080.0	10.0	0.0003	1.82	1.82	1.82	0.001	6.08	6.08	6.08	60.9
2378-TCDF	0.5	0.5	0.1	0.05	0.05	0.05	0.1	0.05	0.05	0.05	46.8
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	54.7
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.75	0.5	0.00	0.62	1.25	54.8
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	34.2
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	50.1
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	45.0
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	52.0
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	36.6
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	51.8
OCDF	<5.0	5.0	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	10.44	11.38	12.31	-	12.91	14.12	15.33	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	84.4	6.0	12
Penta-Dioxins	143.0	19.9	8
Hexa-Dioxins	863.0	17.4	7
Hepta-Dioxins	818.0	5.0	2
Octa-Dioxin	6080.0	10.0	1
Tetra-Furans	9.3	7.0	14
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<5.0	5.0	1
S PCDD/Fs	7997.7		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300 Laboratory Sample ID: EB2090018005 Qc Lot Number: 4540531 Date Sampled: 23-Feb-2020
Client Sample ID: TWN - 0220 Sample Matrix: SOIL Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.25	0.49	1	0.00	0.25	0.49	92.6
12378-PeCDD	<2.5	2.5	1	0.00	1.23	2.46	0.5	0.00	0.61	1.23	106.1
123478-HxCDD	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	55.9
123678-HxCDD	2.6	2.5	0.1	0.26	0.26	0.26	0.1	0.26	0.26	0.26	79.0
123789-HxCDD	5.5	2.5	0.1	0.55	0.55	0.55	0.1	0.55	0.55	0.55	-
1234678-HpCDD	60.3	2.5	0.01	0.60	0.60	0.60	0.01	0.60	0.60	0.60	78.1
OCDD	1210.0	9.8	0.0003	0.36	0.36	0.36	0.001	1.21	1.21	1.21	67.6
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	70.8
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	82.0
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.74	0.5	0.00	0.61	1.23	85.1
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	44.4
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	61.2
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	57.1
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	68.6
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	45.5
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	66.7
OCDF	<4.9	4.9	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	1.77	4.32	6.86	-	2.62	4.82	7.02	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	33.2	5.4	11
Penta-Dioxins	58.0	19.7	8
Hexa-Dioxins	302.0	19.7	8
Hepta-Dioxins	245.0	4.9	2
Octa-Dioxin	1210.0	9.8	1
Tetra-Furans	<0.5	0.5	1
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<4.9	4.9	1
S PCDD/Fs	1848.2		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300

Laboratory Sample ID: EB2090018006
Client Sample ID: CRB - 0220

Qc Lot Number: 4540532
Sample Matrix: SOIL

Date Sampled: 23-Feb-2020
Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.25	0.49	1	0.00	0.25	0.49	91.1
12378-PeCDD	5.7	2.5	1	5.70	5.70	5.70	0.5	2.85	2.85	2.85	86.4
123478-HxCDD	5.6	2.5	0.1	0.56	0.56	0.56	0.1	0.56	0.56	0.56	57.6
123678-HxCDD	11.4	2.5	0.1	1.14	1.14	1.14	0.1	1.14	1.14	1.14	73.7
123789-HxCDD	27.6	2.5	0.1	2.76	2.76	2.76	0.1	2.76	2.76	2.76	-
1234678-HpCDD	270.0	2.5	0.01	2.70	2.70	2.70	0.01	2.70	2.70	2.70	75.9
OCDD	4930.0	9.9	0.0003	1.48	1.48	1.48	0.001	4.93	4.93	4.93	71.2
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	58.4
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	62.8
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.74	0.5	0.00	0.62	1.24	66.7
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	41.9
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	59.8
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	56.8
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	63.8
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	42.4
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	65.1
OCDF	<4.9	4.9	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	14.34	15.54	16.74	-	14.94	16.41	17.89	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	177.0	5.4	11
Penta-Dioxins	289.0	19.8	8
Hexa-Dioxins	1440.0	17.3	7
Hepta-Dioxins	1160.0	4.9	2
Octa-Dioxin	4930.0	9.9	1
Tetra-Furans	<6.9	6.9	14
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<4.9	4.9	1
S PCDD/Fs	7996.0		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300 Laboratory Sample ID: EB2090018007 Qc Lot Number: 4540532 Date Sampled: 23-Feb-2020
Client Sample ID: CTH - 0220 - S Sample Matrix: SOIL Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.25	0.50	1	0.00	0.25	0.50	89.6
12378-PeCDD	7.7	2.5	1	7.70	7.70	7.70	0.5	3.85	3.85	3.85	91.6
123478-HxCDD	7.2	2.5	0.1	0.72	0.72	0.72	0.1	0.72	0.72	0.72	59.1
123678-HxCDD	13.4	2.5	0.1	1.34	1.34	1.34	0.1	1.34	1.34	1.34	79.4
123789-HxCDD	34.2	2.5	0.1	3.42	3.42	3.42	0.1	3.42	3.42	3.42	-
1234678-HpCDD	286.0	2.5	0.01	2.86	2.86	2.86	0.01	2.86	2.86	2.86	79.9
OCDD	4230.0	9.9	0.0003	1.27	1.27	1.27	0.001	4.23	4.23	4.23	78.6
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	63.0
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	69.5
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.74	0.5	0.00	0.62	1.24	69.6
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	43.2
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	63.4
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	61.7
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	69.0
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	45.3
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	69.4
OCDF	<5.0	5.0	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	17.31	18.51	19.71	-	16.42	17.89	19.37	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	245.0	5.4	11
Penta-Dioxins	391.0	19.8	8
Hexa-Dioxins	1940.0	17.3	7
Hepta-Dioxins	1370.0	5.0	2
Octa-Dioxin	4230.0	9.9	1
Tetra-Furans	<6.4	6.4	13
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<5.0	5.0	1
S PCDD/Fs	8176.0		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300 Laboratory Sample ID: EB2090018008 Qc Lot Number: 4540532 Date Sampled: 23-Feb-2020
Client Sample ID: LRB - 0220 Sample Matrix: SOIL Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.25	0.49	1	0.00	0.25	0.49	77.7
12378-PeCDD	6.4	2.5	1	6.36	6.36	6.36	0.5	3.18	3.18	3.18	82.4
123478-HxCDD	5.9	2.5	0.1	0.59	0.59	0.59	0.1	0.59	0.59	0.59	54.9
123678-HxCDD	11.4	2.5	0.1	1.14	1.14	1.14	0.1	1.14	1.14	1.14	73.1
123789-HxCDD	28.2	2.5	0.1	2.82	2.82	2.82	0.1	2.82	2.82	2.82	-
1234678-HpCDD	285.0	2.5	0.01	2.85	2.85	2.85	0.01	2.85	2.85	2.85	70.4
OCDD	3640.0	9.8	0.0003	1.09	1.09	1.09	0.001	3.64	3.64	3.64	72.0
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	53.1
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	61.1
23478-PeCDF	<2.5	2.5	0.3	0.00	0.37	0.74	0.5	0.00	0.61	1.23	63.9
123478-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	40.1
123678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	59.8
234678-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	55.9
123789-HxCDF	<2.5	2.5	0.1	0.00	0.12	0.25	0.1	0.00	0.12	0.25	63.4
1234678-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	41.7
1234789-HpCDF	<2.5	2.5	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	59.4
OCDF	<4.9	4.9	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	14.86	16.05	17.24	-	14.22	15.69	17.15	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	194.0	5.4	11
Penta-Dioxins	334.0	14.7	6
Hexa-Dioxins	1670.0	17.2	7
Hepta-Dioxins	1190.0	4.9	2
Octa-Dioxin	3640.0	9.8	1
Tetra-Furans	<6.4	6.4	13
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<4.9	4.9	1
S PCDD/Fs	7028.0		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300 Laboratory Sample ID: EB2090018009 Qc Lot Number: 4540531 Date Sampled: 25-Feb-2020
Client Sample ID: POO - 0220 Sample Matrix: SOIL Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.24	0.49	1	0.00	0.24	0.49	93.0
12378-PeCDD	<2.4	2.4	1	0.00	1.22	2.45	0.5	0.00	0.61	1.22	100.6
123478-HxCDD	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	58.5
123678-HxCDD	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	83.3
123789-HxCDD	2.5	2.4	0.1	0.25	0.25	0.25	0.1	0.25	0.25	0.25	-
1234678-HpCDD	83.4	2.4	0.01	0.83	0.83	0.83	0.01	0.83	0.83	0.83	82.5
OCDD	2210.0	9.8	0.0003	0.66	0.66	0.66	0.001	2.21	2.21	2.21	51.1
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	66.9
12378-PeCDF	<2.4	2.4	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	81.6
23478-PeCDF	<2.4	2.4	0.3	0.00	0.37	0.73	0.5	0.00	0.61	1.22	81.4
123478-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	43.9
123678-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	68.5
234678-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	62.9
123789-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	74.7
1234678-HpCDF	<2.4	2.4	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	48.0
1234789-HpCDF	<2.4	2.4	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	69.2
OCDF	<4.9	4.9	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	1.75	4.41	7.07	-	3.30	5.61	7.93	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	40.0	5.9	12
Penta-Dioxins	26.6	17.1	7
Hexa-Dioxins	123.0	19.6	8
Hepta-Dioxins	216.0	4.9	2
Octa-Dioxin	2210.0	9.8	1
Tetra-Furans	<7.8	7.8	16
Penta-Furans	<2.4	2.4	1
Hexa-Furans	<2.4	2.4	1
Hepta-Furans	<2.4	2.4	1
Octa-Furan	<4.9	4.9	1
S PCDD/Fs	2615.6		

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



ANALYTICAL RESULTS FOR DIOXINS AND FURANS

Method Code EP300 Laboratory Sample ID: EB2090018010 Qc Lot Number: 4540532 Date Sampled: 25-Feb-2020
Client Sample ID: CDO - 0220 Sample Matrix: SOIL Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ ₁ (zero)	WHO-TEQ ₂ (0.5 LOR)	WHO-TEQ ₃ (LOR)	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.24	0.49	1	0.00	0.24	0.49	85.5
12378-PeCDD	<2.4	2.4	1	0.00	1.22	2.44	0.5	0.00	0.61	1.22	114.0
123478-HxCDD	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	57.3
123678-HxCDD	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	76.1
123789-HxCDD	4.7	2.4	0.1	0.47	0.47	0.47	0.1	0.47	0.47	0.47	-
1234678-HpCDD	62.7	2.4	0.01	0.63	0.63	0.63	0.01	0.63	0.63	0.63	73.3
OCDD	3050.0	9.8	0.0003	0.92	0.92	0.92	0.001	3.05	3.05	3.05	54.2
2378-TCDF	<0.5	0.5	0.1	0.00	0.02	0.05	0.1	0.00	0.02	0.05	73.0
12378-PeCDF	<2.4	2.4	0.03	0.00	0.04	0.07	0.05	0.00	0.06	0.12	82.4
23478-PeCDF	<2.4	2.4	0.3	0.00	0.37	0.73	0.5	0.00	0.61	1.22	86.2
123478-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	43.2
123678-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	64.1
234678-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	62.2
123789-HxCDF	<2.4	2.4	0.1	0.00	0.12	0.24	0.1	0.00	0.12	0.24	66.2
1234678-HpCDF	<2.4	2.4	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	42.0
1234789-HpCDF	<2.4	2.4	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	63.5
OCDF	<4.9	4.9	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.00	-
Total TEQ	-	-	-	2.01	4.66	7.31	-	4.15	6.46	8.77	-

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	34.7	4.9	10
Penta-Dioxins	26.3	22.0	9
Hexa-Dioxins	98.2	19.5	8
Hepta-Dioxins	182.0	4.9	2
Octa-Dioxin	3050.0	9.8	1
Tetra-Furans	14.6	4.9	10
Penta-Furans	<2.4	2.4	1
Hexa-Furans	<2.4	2.4	1
Hepta-Furans	<2.4	2.4	1
Octa-Furan	<4.9	4.9	1
S PCDD/Fs	3405.8		

QUALITY CONTROL REPORT

Client	QLD DEPT OF ENVIRONMENT & SCIE	Laboratory :	Environmental Division Brisbane	1 of 5
Contact	SUZANNE VARDY	Contact	CUSTOMER.SERVICES.EB	
Address:	GPO BOX 2771 BRISBANE QLD, AUSTRALIA 4001	Address:	Stafford QLD 4053 Australia	Work Order: EB2090018

Project	NSA_DIO	Quote #	BNBQ/082/14	Received:	5 Mar 2020
Order #	- Not provided -			Issued	18 Mar 2020
C-O-C #	- Not provided -				
Site	- Not provided -				
E-mail	suzanne.vardy@des.qld.gov.au	E-mail	ALSEnviro.Brisbane@alsglobal.	Number of Samples	
Phone	32258402	Phone	+61-7-3243 7222	Received:	10
Fax	32258723	Fax	+61-7-3243 7218	Analysed:	11

Samples analysed 'as received', results reported on 'dry weight' basis.

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This document has been digitally signed by those names that appear on this report and are the authorised signatories. Digital signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Position	Department
Peter Blow	HRMS Chemist	GC/HR-MS - NATA 825 (818 - Brisbane)



Quality Control Report

Laboratory Duplicates (DUP)

	Original Result		Duplicate Result		
	Conc pg/g	LOR pg/g	Conc pg/g	LOR pg/g	
Laboratory Sample Id :	EB2090018001		5595604-007		
Client Sample Id :	WEY - 0220		WEY - 0220		
Sample Mass (g) :	10.0		10.0		
Qc Lot Number :	4540532		4540532		
Moisture Content (%) :					
Compound	Conc pg/g	LOR pg/g	Conc pg/g	LOR pg/g	RPD (%)
2378-TCDD	2.7	0.5	2.1	0.5	25.0
12378-PeCDD	19.0	2.5	15.6	2.5	19.7
123478-HxCDD	20.4	2.5	16.5	2.5	21.1
123678-HxCDD	29.0	2.5	28.4	2.5	2.1
123789-HxCDD	66.9	2.5	62.8	2.5	6.3
1234678-HpCDD	321.0	2.5	311.0	2.5	3.2
OCDD	4410.0	9.9	4690.0	10.0	6.2
2378-TCDF	<0.5	0.5	<0.5	0.5	-
12378-PeCDF	<2.5	2.5	<2.5	2.5	-
23478-PeCDF	<2.5	2.5	<2.5	2.5	-
123478-HxCDF	<2.5	2.5	<2.5	2.5	-
123678-HxCDF	<2.5	2.5	<2.5	2.5	-
234678-HxCDF	<2.5	2.5	<2.5	2.5	-
123789-HxCDF	<2.5	2.5	<2.5	2.5	-
1234678-HpCDF	<2.5	2.5	<2.5	2.5	-
1234789-HpCDF	<2.5	2.5	<2.5	2.5	-
OCDF	<5.0	5.0	<5.0	5.0	-

Group Totals	Conc pg/g	LOR pg/g	Conc pg/g	LOR pg/g	RPD (%)
Tetra-Dioxins	356.0	5.5	322.0	8.0	10.0
Penta-Dioxins	609.0	19.9	509.0	22.4	17.9
Hexa-Dioxins	2150.0	17.4	1780.0	17.4	18.8
Hepta-Dioxins	1260.0	5.0	1220.0	5.0	3.2
Octa-Dioxin	4410.0	9.9	4690.0	10.0	6.2
Tetra-Furans	8.7	7.0	6.3	6.0	32.0
Penta-Furans	<2.5	2.5	<2.5	2.5	-
Hexa-Furans	<2.5	2.5	<2.5	2.5	-
Hepta-Furans	<2.5	2.5	<2.5	2.5	-
Octa-Furan	<5.0	5.0	<5.0	5.0	-
Σ PCDD/Fs	8793.7		8527.3		3.1

Notes

LOR = Limit of reporting

T = tetra

Pe = penta

Hx = hexa

Hp = hepta

O = octa

CDD, dioxin = chlorinated debenzo-p-dioxin

CDF, furan = chlorinated debenzofuran

RPD = relative per cent difference

Permitted ranges for RPD are dependant upon the magnitude of the result in comparison to the LOR.

Result < 10x LOR - no limit, result between 10x and 20x LOR - 50%, result > 20x LOR - 20%



Quality Control Report

Laboratory Duplicates (DUP)

Original Result		Duplicate Result	
Laboratory Sample Id :	ES2090002001	5595604-026	
Client Sample Id :	Anonymous	Anonymous	
Sample Mass (g) :	10.0	10.0	
Qc Lot Number :	4540532	4540532	
Moisture Content (%) :			

Compound	Conc pg/g	LOR pg/g	Conc pg/g	LOR pg/g	RPD (%)
2378-TCDD	<0.5	0.5	<0.5	0.5	-
12378-PeCDD	<2.5	2.5	<2.5	2.5	-
123478-HxCDD	<2.5	2.5	<2.5	2.5	-
123678-HxCDD	<2.5	2.5	<2.5	2.5	-
123789-HxCDD	<2.5	2.5	<2.5	2.5	-
1234678-HpCDD	<2.5	2.5	<2.5	2.5	-
OCDD	68.6	9.9	76.9	9.9	11.4
2378-TCDF	<0.5	0.5	<0.5	0.5	-
12378-PeCDF	<2.5	2.5	<2.5	2.5	-
23478-PeCDF	<2.5	2.5	<2.5	2.5	-
123478-HxCDF	<2.5	2.5	<2.5	2.5	-
123678-HxCDF	<2.5	2.5	<2.5	2.5	-
234678-HxCDF	<2.5	2.5	<2.5	2.5	-
123789-HxCDF	<2.5	2.5	<2.5	2.5	-
1234678-HpCDF	2.6	2.5	3.7	2.5	34.9
1234789-HpCDF	<2.5	2.5	<2.5	2.5	-
OCDF	5.3	5.0	6.7	5.0	23.3

Group Totals	Conc pg/g	LOR pg/g	Conc pg/g	LOR pg/g	RPD (%)
Tetra-Dioxins	<0.5	0.5	<0.5	0.5	-
Penta-Dioxins	<2.5	2.5	<2.5	2.5	-
Hexa-Dioxins	<2.5	2.5	<2.5	2.5	-
Hepta-Dioxins	<5.0	5.0	<5.0	5.0	-
Octa-Dioxin	68.6	9.9	76.9	9.9	11.4
Tetra-Furans	12.0	8.0	7.8	7.4	42.4
Penta-Furans	<2.5	2.5	<2.5	2.5	-
Hexa-Furans	<2.5	2.5	<2.5	2.5	-
Hepta-Furans	<7.5	7.5	<5.0	5.0	-
Octa-Furan	5.3	5.0	6.7	5.0	23.3
Σ PCDD/Fs	85.9		91.4		6.2

Notes

LOR = Limit of reporting

T = tetra

Pe = penta

Hx = hexa

Hp = hepta

O = octa

CDD, dioxin = chlorinated debenzo-p-dioxin

CDF, furan = chlorinated debenzofuran

RPD = relative per cent difference

Permitted ranges for RPD are dependant upon the magnitude of the result in comparison to the LOR.

Result < 10x LOR - no limit - result between 10x and 20x LOR - 50% - result > 20x LOR - 20%

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



Quality Control Results

Laboratory Control Samples(LCS)

Laboratory Sample Id : 5595604-010
QC Lot Number : 4540532
Sample Name : BCR 529 Sandy soil

Compound	Conc pg/g	Lower 1 pg/g	Upper 1 pg/g	¹³ C ¹² Rec(%)	Lower 2 (%)	Upper 2 (%)
2378-TCDD	4020.0	3900	5100	53.4	25	164
12378-PeCDD	456.0	390	490	80.2	25	181
123478-HxCDD	1460.0	900	1500	71.7	32	141
123678-HxCDD	5210.0	4500	6300	75.3	28	130
123789-HxCDD	3280.0	2600	3400	-	-	-
2378-TCDF	72.4	65	91	44.0	24	169
12378-PeCDF	166.0	110	170	66.0	24	185
23478-PeCDF	412.0	290	430	64.0	21	178
123478-HxCDF	3020.0	2900	3900	61.0	26	152
123678-HxCDF	1070.0	940	1240	72.1	26	123
234678-HxCDF	385.0	330	410	72.9	28	136
123789-HxCDF	546.0	12	32	87.2	29	147

Notes

- Acceptable concentration limits are as quoted on the analytical certificate for the certified reference material
- Acceptable recovery limits are derived from EPA1613 Revision B

T = tetra

Pe = penta

Hx = hexa

Hp = hepta

Client : QLD DEPT OF ENVIRONMENT & SCIENC
Project : NSA_DIO

Work Order : EB2090018
ALS Quote Reference : BNBQ/082/14



Quality Control Report Method Blank (MB)

Laboratory Sample ID: 5595604-001
Qc Lot Number : 4540532

Sample Matrix: SOIL
Date Extracted: 16-Mar-2020
Date Analysed: 16-Mar-2020

Compound	Conc pg/g	LOR pg/g	WHO-TEF	WHO-TEQ 1	WHO-TEQ 2	WHO-TEQ 3	I-TEF	I-TEQ ₁ (zero)	I-TEQ ₂ (0.5 LOR)	I-TEQ ₃ (LOR)	¹³ C ₁₂ Rec(%)
2378-TCDD	<0.5	0.5	1	0.00	0.25	0.50	1	0.00	0.25	0.50	85.8
12378-PeCDD	<2.5	2.5	1	0.00	1.25	2.50	0.5	0.00	0.63	1.25	97.0
123478-HxCDD	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	55.1
123678-HxCDD	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	80.5
123789-HxCDD	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	-
1234678-HpCD	<2.5	2.5	0.01	0.00	0.01	0.03	0.01	0.00	0.01	0.03	77.9
OCDD	<10.0	10.0	0.0003	0.00	0.00	0.00	0.001	0.00	0.01	0.01	65.7
2378-TCDF	<0.5	0.5	0.1	0.00	0.03	0.05	0.1	0.00	0.03	0.05	59.0
12378-PeCDF	<2.5	2.5	0.03	0.00	0.04	0.08	0.05	0.00	0.06	0.13	72.2
23478-PeCDF	<2.5	2.5	0.3	0.00	0.38	0.75	0.5	0.00	0.63	1.25	73.3
123478-HxCDF	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	43.5
123678-HxCDF	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	64.0
234678-HxCDF	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	59.2
123789-HxCDF	<2.5	2.5	0.1	0.00	0.13	0.25	0.1	0.00	0.13	0.25	68.2
1234678-HpCD	<2.5	2.5	0.01	0.00	0.01	0.03	0.01	0.00	0.01	0.03	46.1
1234789-HpCD	<2.5	2.5	0.01	0.00	0.01	0.03	0.01	0.00	0.01	0.03	64.6
OCDF	<5.0	5.0	0.0003	0.00	0.00	0.00	0.001	0.00	0.00	0.01	-
Σ TEQ _(WHO)				0.00	2.89	5.72	Σ TEQ _(I)	0.00	2.55	5.04	

Group Totals	Conc pg/g	LOR ₄ pg/g	No. of Peaks
Tetra-Dioxins	<0.5	0.5	1
Penta-Dioxins	<2.5	2.5	1
Hexa-Dioxins	<2.5	2.5	1
Hepta-Dioxins	<2.5	2.5	1
Octa-Dioxin	<10.0	10.0	1
Tetra-Furans	<0.5	0.5	1
Penta-Furans	<2.5	2.5	1
Hexa-Furans	<2.5	2.5	1
Hepta-Furans	<2.5	2.5	1
Octa-Furan	<5.0	5.0	1
Σ PCDD/Fs	0.00		

Notes

LOR = Limit of reporting

I-TEF = International toxic equivalency factor

I-TEQ = International toxic equivalence (pg/g)

WHO-TEF = World Health Organisation toxic equivalency factor

WHO-TEQ = World Health Organisation toxic equivalence (pg/g)

T = tetra

Pe = penta

Hx = hexa

Hp =hepta

O = octa

CDD, dioxin = chlorinated dibenzo-p-dioxin

CDF, furan = chlorinated dibenzofuran

1 I - TEQ_(zero) and WHO-TEQ_(zero) calculated treating <LOR as zero concentration (pg/g)

2 I-TEQ_(0.5 LOR) and WHO-TEQ_(0.5 LOR) calculated treating <LOR as 50% LoR concentration (pg/g)

3 I-TEQ_(LOR) and WHO-TEQ_(LOR) calculated treating <LOR as LoR concentration (pg/g)

4 Totals LORs are calculated by multiplying the number of peaks by the individual LOR per compound



CERTIFICATE OF ANALYSIS # DAU20_074

Client	Department of Environment and Science Chemistry Centre Level 3 East, Block A, Ecosciences Precinct 41 Boggo Rd, Dutton Park QLD 4102	Job No.	DEPT82/200309
		Sampled by	Client
		Date Sampled	24 & 25-Feb-2020
		Date Received	9-Mar-20
Contact	Susi Vardy	The results relate only to the sample(s) as received and tested.	

Method | AUTL_01 **Date Reported** | 3-Apr-20

Details | The method is for determination of tetra- through octa-chlorinated dibenzo-p-dioxins (PCDDs) & dibenzofurans (PCDFs) in solid samples by high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS). This method provides data on all toxic 2,3,7,8-PCDD (seven) and PCDF (ten) isomers. PCDD and PCDF totals for each homologue group (tetra to octa) are also reported. The dioxin toxicity equivalent ($WHO_{05}\text{-TEQ}_{DF}$) in each sample is calculated using World Health Organization toxic equivalency factors ($WHO_{05}\text{-TEFs}$). All results are corrected for labelled surrogate recoveries and are reported on a dry weight basis.

After sampling, the solid is spiked with a range of isotopically labelled surrogate standards and exhaustively extracted. Clean up is effected by partitioning with sulphuric acid then distilled water. Further purification is performed using column chromatography on acid and base modified silica gels, basic alumina and carbon dispersed on celite.

Immediately prior to injection, internal standards are added to each extract, and an aliquot of the extract is injected into the GC. The analytes are separated by the GC and detected by a high-resolution (>10,000) mass spectrometer.

Authorisation | sch4p4(6) Personal information

Nino Piro
Senior Chemist
Australian Ultra Trace Laboratory

sch4p4(6) Personal information

Dr Alan Yates
Senior Analyst
Australian Ultra Trace Laboratory

Accreditation | NATA Accreditation Number : 198



Accredited for compliance with ISO/IEC 17025 - Testing.

This report shall not be reproduced, except in full.
Measurement uncertainty is available upon request.

Sample Details : Job No. DEPT82/200309			
Laboratory Reg. No.	Client Sample Ref.	Matrix	Description
N20/005111/X	WEY-0220	Solid	Sediment 25/02/2020
N20/005112/X	CTH-0220-S	Solid	Sediment 24/02/2020
N20/005113/X	NSA-0220	Solid	Sediment 25/02/2020

Project Details

Project Name	Not specified
Project Number	Not specified

Key

Analytes			
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
Units & Abbreviations			
pg/g	picograms per gram		
<	level less than limit of detection (LOD)		
WHO ₀₅ -TEF [†]	World Health Organization toxic equivalency factor		
WHO ₀₅ -TEQ _{DF} [†]	World Health Organization toxic equivalents (Dioxins & Furans)		
[†] as defined by Van den Berg et al., <i>Toxicol. Sci.</i> 93 (2), pp. 223–241 (2006)			
TEQs are calculated by multiplying the quantified level for each individual dioxin and furan congener reported by the corresponding TEF value and summing the result:			
$\text{WHO}_{05}\text{-TEQ}_{\text{DF}} = \sum_{i=1}^7 [\text{PCDD}_i \times \text{TEF}_i] + \sum_{j=1}^{10} [\text{PCDF}_j \times \text{TEF}_j]$		i = PCDD congener index (1 - 7) j = PCDF congener index (1 - 10)	
Lower Bound TEQ	defines all congener values reported below the LOD as equal to zero.		
Middle Bound TEQ	defines all congener values reported below the LOD as equal to half the LOD.		
Upper Bound TEQ	defines all congener values reported below the LOD as equal to the LOD.		
Surrogate Recovery	percentage recovery for ¹³ C ₁₂ labelled surrogate standard		
☞	Laboratory surrogate recovery outside normal acceptance criteria:		
	Solid and liquid matrices 25 - 125%		

Results : Job No. DEPT82/200309**Laboratory Reg. No.** N20/005111/X**Date Extracted** 19-Mar-20**Client Sample Ref.** WEY-0220**DB5 Analysis** 30-Mar-20**Matrix** Solid**DB-Dioxin Analysis** 2-Apr-20**Description** Sediment 25/02/2020

PCDD/F Congeners	Level pg/g	WHO ₀₅ -TEF	WHO ₀₅ -TEQ contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	0.15	0.1	0.015	68	
2,3,7,8-TCDD	4.0	1	4.0	72	
1,2,3,7,8-PeCDF	0.13	0.03	0.0039	85	
2,3,4,7,8-PeCDF	0.070	0.3	0.021	84	
1,2,3,7,8-PeCDD	27	1	27	97	
1,2,3,4,7,8-HxCDF	<0.09	0.1	0.0045	63	
1,2,3,6,7,8-HxCDF	<0.08	0.1	0.004	59	
2,3,4,6,7,8-HxCDF	<0.08	0.1	0.004	65	
1,2,3,7,8,9-HxCDF	<0.08	0.1	0.004	76	
1,2,3,4,7,8-HxCDD	27	0.1	2.7	71	
1,2,3,6,7,8-HxCDD	44	0.1	4.4	65	
1,2,3,7,8,9-HxCDD	110	0.1	11		
1,2,3,4,6,7,8-HpCDF	0.30	0.01	0.0030	63	
1,2,3,4,7,8,9-HpCDF	0.060	0.01	0.00060	77	
1,2,3,4,6,7,8-HpCDD	730	0.01	7.3	82	
OCDF	0.31	0.0003	0.000093		
OCDD	9070	0.0003	2.7	56	

PCDD/F Homologue Groups	Level pg/g
Total TCDF isomers	3.2
Total TCDD isomers	240
Total PeCDF isomers	1.4
Total PeCDD isomers	650
Total HxCDF isomers	1.6
Total HxCDD isomers	1860
Total HpCDF isomers	1.6
Total HpCDD isomers	3030

Summary Results**Sum of PCDD and PCDF congeners**

Excluding LOD values 14900 pg/g

WHO₀₅-TEQ_{DF}

Lower Bound [excluding LOD values] 59 pg/g

Middle Bound [including half LOD values] 59 pg/g

Upper Bound [including LOD values] 59 pg/g

Results : Job No. DEPT82/200309**Laboratory Reg. No.** N20/005112/X**Date Extracted** 19-Mar-20**Client Sample Ref.** CTH-0220-S**DB5 Analysis** 30-Mar-20**Matrix** Solid**DB-Dioxin Analysis** 2-Apr-20**Description** Sediment 24/02/2020

PCDD/F Congeners	Level pg/g	WHO ₀₅ -TEF	WHO ₀₅ -TEQ contribution	Labelled Surrogate recovery
2,3,7,8-TCDF	0.16	0.1	0.016	70
2,3,7,8-TCDD	<0.4	1	0.2	80
1,2,3,7,8-PeCDF	0.11	0.03	0.0033	82
2,3,4,7,8-PeCDF	0.070	0.3	0.021	84
1,2,3,7,8-PeCDD	2.6	1	2.6	93
1,2,3,4,7,8-HxCDF	<0.08	0.1	0.004	65
1,2,3,6,7,8-HxCDF	<0.08	0.1	0.004	59
2,3,4,6,7,8-HxCDF	<0.1	0.1	0.005	65
1,2,3,7,8,9-HxCDF	<0.07	0.1	0.0035	82
1,2,3,4,7,8-HxCDD	4.9	0.1	0.49	66
1,2,3,6,7,8-HxCDD	12	0.1	1.2	67
1,2,3,7,8,9-HxCDD	26	0.1	2.6	
1,2,3,4,6,7,8-HpCDF	<0.2	0.01	0.001	70
1,2,3,4,7,8,9-HpCDF	<0.04	0.01	0.0002	80
1,2,3,4,6,7,8-HpCDD	330	0.01	3.3	88
OCDF	0.24	0.0003	0.000072	
OCDD	4870	0.0003	1.5	65

PCDD/F Homologue Groups	Level pg/g
Total TCDF isomers	1.4
Total TCDD isomers	130
Total PeCDF isomers	0.45
Total PeCDD isomers	240
Total HxCDF isomers	0.68
Total HxCDD isomers	1070
Total HpCDF isomers	1.1
Total HpCDD isomers	1600

Summary Results**Sum of PCDD and PCDF congeners**

Excluding LOD values 7910 pg/g

WHO₀₅-TEQ_{DF}

Lower Bound [excluding LOD values] 12 pg/g

Middle Bound [including half LOD values] 12 pg/g

Upper Bound [including LOD values] 12 pg/g

Results : Job No. DEPT82/200309

Laboratory Reg. No. N20/005113/X

Date Extracted 19-Mar-20

Client Sample Ref. NSA-0220

DB5 Analysis 30-Mar-20

Matrix Solid

DB-Dioxin Analysis 2-Apr-20

Description Sediment 25/02/2020

PCDD/F Congeners	Level pg/g	WHO ₀₅ -TEF	WHO ₀₅ -TEQ contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	<0.06	0.1	0.003	73	
2,3,7,8-TCDD	<0.3	1	0.15	76	
1,2,3,7,8-PeCDF	<0.05	0.03	0.00075	77	
2,3,4,7,8-PeCDF	<0.03	0.3	0.0045	79	
1,2,3,7,8-PeCDD	0.77	1	0.77	90	
1,2,3,4,7,8-HxCDF	<0.06	0.1	0.003	71	
1,2,3,6,7,8-HxCDF	<0.06	0.1	0.003	66	
2,3,4,6,7,8-HxCDF	<0.06	0.1	0.003	69	
1,2,3,7,8,9-HxCDF	<0.08	0.1	0.004	88	
1,2,3,4,7,8-HxCDD	1.6	0.1	0.16	76	
1,2,3,6,7,8-HxCDD	3.7	0.1	0.37	72	
1,2,3,7,8,9-HxCDD	9.2	0.1	0.92		
1,2,3,4,6,7,8-HpCDF	0.21	0.01	0.0021	64	
1,2,3,4,7,8,9-HpCDF	<0.04	0.01	0.0002	81	
1,2,3,4,6,7,8-HpCDD	160	0.01	1.6	78	
OCDF	0.39	0.0003	0.00012		
OCDD	5540	0.0003	1.7	69	

PCDD/F Homologue Groups	Level pg/g
Total TCDF isomers	1.2
Total TCDD isomers	30
Total PeCDF isomers	0.17
Total PeCDD isomers	55
Total HxCDF isomers	0.5
Total HxCDD isomers	320
Total HpCDF isomers	0.8
Total HpCDD isomers	740

Summary Results**Sum of PCDD and PCDF congeners**

Excluding LOD values 6690 pg/g

WHO₀₅-TEQ_{DF}

Lower Bound [excluding LOD values] 5.5 pg/g

Middle Bound [including half LOD values] 5.7 pg/g

Upper Bound [including LOD values] 5.9 pg/g



REPORT OF ANALYSIS

Page: 1 of 3

Report No. RN1282348

Client :	DEPARTMENT OF ENVIRONMENT AND SCIENCE WATER QUALITY AND INVESTIGATIONS, ENVIRONMENTAL MONITORING AND ASSESSMENT SCIENCES DUTTON PARK QLD 4102	Job No. :	DEPT82/200616
Attention :	SUZANNE VARDY	Quote No. :	QT-02018
Project Name :		Order No. :	
Your Client Services Manager :	Tony Lattari	Date Received :	16-JUN-2020
		Sampled By :	CLIENT
		Phone :	02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N20/014288	WEY-MUL-28520	BIOTA 28/05/2020
N20/014289	COO-MUL-29520	BIOTA 29/05/2020
N20/014290	COI-OYS-27520	BIOTA 27/05/2020
N20/014291	WEY-OYS-27520	BIOTA 27/05/2020

Lab Reg No.		N20/014288	N20/014289	N20/014290	N20/014291	
Date Sampled		28-MAY-2020	29-MAY-2020	27-MAY-2020	27-MAY-2020	
Sample Reference		WEY-MUL-28520	COO-MUL-29520	COI-OYS-27520	WEY-OYS-27520	
	Units					Method
Total TEQ						
Total TEQ		DAU20_189	DAU20_189	DAU20_189	DAU20_189	AUTL_01

sch4p4(6) Personal information

Alan Yates, Analyst
 Australian Ultra Trace Laboratory
 Accreditation No. 198

30-JUL-2020

Lab Reg No.		N20/014288	N20/014289	N20/014290	N20/014291	
Date Sampled		28-MAY-2020	29-MAY-2020	27-MAY-2020	27-MAY-2020	
Sample Reference		WEY-MUL-28520	COO-MUL-29520	COI-OYS-27520	WEY-OYS-27520	
	Units					Method
Proximates						
Fat (Mojonnier extraction)	g/100g	4.1	8.6	Not Tested	Not Tested	VL302

sch4p4(6) Personal information

Paul Adorno, Section Manager
 Food Composition - Vic
 Accreditation No. 89

30-JUL-2020

REPORT OF ANALYSIS

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Report No. RN1282348

Client	: DEPARTMENT OF ENVIRONMENT AND SCIENCE WATER QUALITY AND INVESTIGATIONS, ENVIRONMENTAL MONITORING AND ASSESSMENT SCIENCES DUTTON PARK QLD 4102	Job No.	: DEPT82/200616
Attention	: SUZANNE VARDY	Quote No.	: QT-02018
Project Name	:	Order No.	:
Your Client Services Manager	: Tony Lattari	Date Received	: 16-JUN-2020
		Sampled By	: CLIENT
		Phone	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N20/014292	COO-MUD-00520	BIOTA 01/05/2020

Lab Reg No.		N20/014292				
Date Sampled		01-MAY-2020				
Sample Reference		COO-MUD-0052				
	Units					Method
Total TEQ						
Total TEQ		DAU20_189				AUTL_01

sch4p4(6) Personal information

Alan Yates, Analyst
Australian Ultra Trace Laboratory
Accreditation No. 198

30-JUL-2020

Lab Reg No.		N20/014292				
Date Sampled		01-MAY-2020				
Sample Reference		COO-MUD-0052				
	Units					Method
Proximates						
Fat (Mojonnier extraction)	g/100g	0.6				VL302

sch4p4(6) Personal information

Paul Adorno, Section Manager
Food Composition - Vic
Accreditation No. 89

30-JUL-2020

105 Delhi Road, North Ryde NSW 2113 Tel: + 61 2 9449 0111 www.measurement.gov.au

National Measurement Institute

REPORT OF ANALYSIS

Page: 3 of 3
Report No. RN1282348



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N a t i o n a l M e a s u r e m e n t I n s t i t u t e

Assessment of dioxin in biota for human consumption – Noosa Lakes

August 2020

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Background

Queensland Health assessed the data provided by Department of Environment and Science (DES) on biota samples for human consumption collected in the Noosa lakes. Biota sampling was undertaken following detection of dioxins and dioxin-like compounds in lake sediments. In this assessment, dioxin means dioxin and dioxin-like compounds as selected by DES in their analysis and report. All values are Toxic Equivalents (TEQ) for these compounds.

Results

Dioxin analysis results of biota samples (Table 1) collected from Lake Weyba, Lake Cootharaba and Lake Cooroibah in the Noosa area were used in this assessment. As the difference between the two fish samples was small and not expected to make a substantive difference to the calculation, 1.7 pg TEQ/g value was selected for the initial exposure calculation. For the oysters, a 100 g serve (approximately 6 oysters) at the mean of both samples and a 200 g serve (approximately 12 oysters) of Lake Weyba oysters were chosen for the calculations. The latter option was to provide reassurance around the higher concentration of the dioxin in the Lake Weyba sample. No calculation was made for the crab meat, as the concentration of dioxins was very low.

Table 1 Results reported by Department of Environment and Science of dioxin analysis of biota for human consumption in Noosa

Sample ID	Matrix	Location	FAT (%)	TEQ _{DF} (pg/g)	Sample
WEY-MUL-28520	Mullet	Lake Weyba	4.1	1.7	Composite Sample (5 Fillets)
COO-MUL-29520	Mullet	Lake Cootharaba	8.6	1.3	Composite Sample (4 Fillets)
COI-OYS-2752	Oyster	Lake Coolibah	ND	1.7	Composite Sample (7 pieces)
WEY-OYS-27520	Oyster	Lake Weyba	ND	3.2	Composite Sample (9 pieces)
COO-MUD-00520	Mud Crab	Lake Cootharaba	0.6	0.036 (0.014 - 0.057)	Composite Sample (flesh of 2 crabs)

ND = not determined

Guideline Value

The NHMRC established a Tolerable Monthly Intake (TMI) guideline value (GV) for dioxins of 70 pg TEQ/month (NHMRC, 2002). By taking into account background exposures and consumption data, FSANZ estimated the limit for dioxins in fish and seafood for human consumption was 6 pg TEQ/g (pg of dioxin toxicity equivalence per g fresh weight of fish) (FSANZ, 2007). The FSANZ assessment is based on a single serve of fish from the contaminated area per week.

Exposure

Exposure values (Equation 1) and hazard quotients (Equation 2) have been calculated for consumption of 1, 2 and 3 serves of fish per week, or one serve of oysters per week. If an adult were to consume up to 3 serves per week of fish from the Noosa area as sampled, the intake could reach around 60% of the TMI - approximately 44 pg TEQ/Kg bw per day (Table 2). Exposure values for children are not reported

separately. If exposure as a child (6 years of a total 70 year lifetime) and exposure as an adult (balance of 70 year lifespan) is considered, the risk is not significantly different.

$$\text{Intake (dioxin)} = \frac{\text{Conc} \times (\text{portion size} * \text{frequency})}{\text{Body weight}} \quad \text{Equation 1}$$

Where

Intake is intake of dioxin in pg TEQ/kg

Conc is the concentration of dioxin in fish

Portion size is the weight in g of fish consumed in a meal

Frequency is the number of meals consumed per month

Body weight is the default body weight for a child or adult in kg.

$$\text{HQ} = \frac{\text{Intake}}{\text{Guideline}} \quad \text{Equation 2}$$

Where

HQ is the hazard quotient

Intake is the intake of dioxin from Equation 1

Table 2 Calculated exposure and hazard quotient for consumption of fish and oysters sampled from Noosa lakes.

Parameter	Units	1 meal per week	2 meals per week	3 meals per week	Oysters (all)	Oysters (Weyba)
Concentration	pg/g	1.70	1.70	1.70	2.50	3.20
Portion size (fish)	g/meal	150.00	150.00	150.00	100.00	200.00
Frequency	meals/month	4.00	8.00	12.00	4.00	4.00
Ingestion Rate (fish)	g/week	600.00	1200.00	1800.00	400.00	800.00
Body weight	kg	70	70	70	70	70
Intake (dioxin)	pg/kg bw month	1.46E+01	2.91E+01	4.37E+01	1.43E+01	3.66E+01
GV (NHMRC)	pg/g bw month	70	70	70	70	70
HQ		0.21	0.42	0.62	0.20	0.52

Uncertainties

As the sample size is very small, and collected over a short time frame, the result may not be representative of all biota in the area that may be consumed. The extent of recreational fishing, and the amount of catch kept and consumed for the specific area is not known but is assumed to reflect general patterns in Queensland.

Conclusion

Consumption of fish from the Noosa area sampled by DES is unlikely to result in an unacceptable risk to public health. Recreational fishers consuming relatively significant amounts over extended seasons may approach the recommended TMI. Seasonal consumption patterns, lifetime patterns of activity, and locality changes mitigate against the possibility of exceeding the dioxin tolerable intake guideline value. This assessment has not considered the risks associated with commercial fishing. As the concentration in fish is below the FSANZ limit of 6 pg TEQ/g, the risk is not expected to be a concern. However, this may need to be further investigated with Department of Agriculture and Fisheries if there is significant commercial fishing in the area.

Recommendation

No specific advice on the consumption of fish due to dioxins in the Noosa area is required. If public concerns are noted, media reminders of the recommendations of consumption of fish with respect to mercury could be issued, as these guidelines would also be protective of exposure to dioxins.

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Dioxin Assessment

Noosa River Catchment

Prepared by: Science and Technology Division, Department of Environment and Science

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December 2020

Executive Summary

Dioxins are ubiquitous persistent organic pollutants (POPs) that are formed by combustion process such as bushfires, as byproducts of manufacturing (including the manufacture of pesticides), and have been found in clays from around the world. Concerns have been raised by members of the Noosa community that historical usage of the pesticides 2,4,5-T and 2,4-D in the forestry industry have contaminated the Noosa Catchment with 2,3,7,8-tetrachlorodibenzo para dioxin (TCDD). TCDD is considered to be the most toxic of the dioxin family.

In response to these concerns the Queensland Government undertook a sediment and biota survey in the Noosa catchment in 2020 to assess dioxins in the Noosa Catchment. Sediment samples were collected from six lakes in the Noosa Catchment—Lake Cootharaba, Lake Cooloomirah, Doonella Lake, Lake Weyba, and Lake Poona and Lake Coolamara in the Coolool National Park. Lakes were chosen as they are likely to be sinks for sediments.

TCDD was reported in sediment at two sites - one site in the north of Lake Cootharaba and one site in Lake Weyba. The highest concentrations of dioxins were measured in the sediment of Lake Weyba. The detection of dioxins at every site is consistent with national studies where dioxins were measured in every sediment sample collected.

As dioxins were present in the sediment, and because there are no dioxin guidelines for sediment that would permit an assessment of risk, a biota sampling program was initiated. This was to assess the health risk to recreational fishers from the consumption of seafood caught in the lakes. Biota was collected in lakes Cootharaba, Cooroibah and Weyba. An assessment was undertaken by Queensland Health and they found there was a low risk posed by the dioxins in seafood to recreational fishers. Commercial fisheries were not assessed in this study and this will be undertaken in the first quarter 2021 and will include an additional round of sediment sampling.

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1 Introduction

Dioxins are ubiquitous persistent organic pollutants (POPs). The term 'dioxins' is often used as short hand to refer to the family of related compounds polychlorinated dibenzo para dioxins (PCDDs or dioxins) and polychlorinated dibenzofurans (PCDFs or furans). Dioxins are formed by combustion process (e.g. bushfires, sugar cane burns and motor vehicle emissions) (Gatehouse 2004), as bi-products of manufacturing (such as the production of pesticides) (Hoogenboom et al. 2020), and have been found to be present in clays and are thought to be produced through natural formation processes (Schmitz et al. 2011; Hoogenboom et al. 2020). Dioxins have low solubility in water and bind strongly to particulate organic matter (Gatehouse 2004), are highly persistent in the environment and bioaccumulate in the lipids of animals. In the 2004 National Dioxin Program, dioxins were measured in every sediment and fish sample collected (Müller et al. 2004).

Concerns have been raised by members of the Noosa community that historical usage of the pesticide 2,4,5-T and 2,4-D in the forestry industry has contaminated the Noosa Catchment with 2,3,7,8- tetrachlorodibenzo para dioxin (TCDD). TCDD is a contaminant in the production of 2,4,5-T (Office of Chemical Safety 2005 and references therein), and is considered to be the most toxic of the dioxin family (Müller et al. 2004). 2,4,5-T was withdrawn for use in Australia in the late 1980s. In response to the community concern the Department of Environment and Science undertook a sediment and biota survey in the Noosa River area in order to assess the dioxins in the Noosa Catchment.

2 Site Selection

All sites selected for study were lakes in the Noosa Catchment. Lakes were chosen as they are likely to be sinks for sediments. Five sites downstream of forestry, or downstream of lakes where historic forestry is known to have occurred in the Noosa Catchment were chosen for sediment sampling (Figure 1):

- Two sites in Lake Cootharaba (Lake Cootharaba North, Lake Cootharaba South)
- One site in Lake Cooroibah
- One site at Doonella Lake
- One site at Lake Weyba.

Two sites in the Cooloola National Park were also selected (Figure 2) as control sites representing sub-catchments unlikely to have received any applications of 2,4-D or 2,4,5-T.

3 Sampling Methodology

3.1 Sediment

Sediment sampling occurred in February 2020. Ten samples were collected at each site using a standardised coring device comprised of an aluminium tube (15cm length, 2.8cm diameter) attached to the corer. The ten samples were collected in a triangular formation and were approximately 25m apart. After collection the samples were combined to form a composite sample. At three sites the composite samples were split into three, with blind duplicates sent to the main analytical laboratory, Australian Laboratory Services (ALS), and a triplicate sample sent to a secondary laboratory, National Measurement Institute (NMI), as part of quality control measures (see Appendix A for a summary of quality control results). Both these laboratories are National Association of Testing Authorities (NATA) accredited for dioxin analysis in sediment. As well as dioxins, particle size distribution and total organic carbon analysis were undertaken on each sample at the Chemistry Centre, Department of Environment and Science. Analysis results for samples sent to ALS and NMI are presented in Appendix B and Appendix C, respectively.

3.2 Biota

Biota were collected in June 2020. Mullet, oyster and Mud crab were collected at a number of sites (

Table 1). Edible portions of fish, oysters and mudcrab were prepared for analysis. For fish this is fillets with scales removed but skin retained, for crabs it is the white meat and for oysters it is the whole soft tissues. For each site, the biota samples were composited prior to sending to NMI for analysis (Table 1). Lipid concentrations were measured in all samples other than oysters, as there was not enough oyster sample to undertake both dioxin and lipid analysis. Results from biota sampling are presented in Appendix D.

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Table 1: Biota species, location and composite numbers collected during the June 2020 biota survey

Species	Location	Composite numbers
Mullet	Lake Weyba	Five fillets
Mullet	Lake Cootharaba	Four fillets
Oyster	Lake Cooroibah	Seven oysters
Oyster	Lake Weyba	Nine oysters
Mud crab	Lake Cootharaba	Flesh of two crabs

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Figure 1: Sites in the Noosa River Catchment downstream of historical forestry.

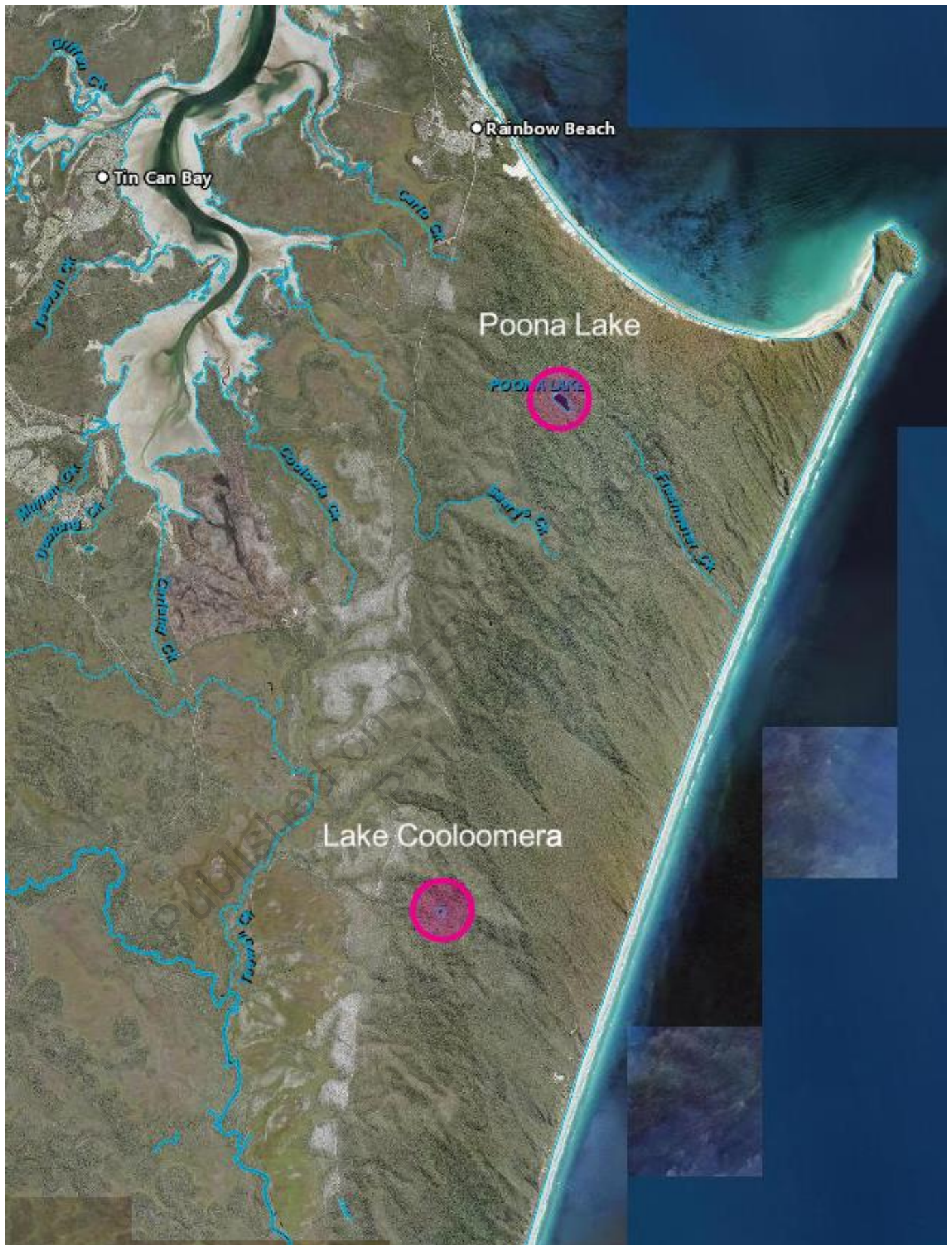


Figure 2: Control sites in the Cooloolool National Park

4 Results

4.1 Sediment

TCDD was reported at two sites, at Lake Cootharaba - North (duplicate sample results were <0.5 and 0.7 pg/g dw) and at Lake Weyba (duplicate sample results were 2.7 and 4.4 pg/g dw) (Table 2). Dioxins were reported in sediments in all lakes sampled in the Noosa Catchment. This is consistent with results from the National Dioxins Program, where dioxins were measured in every sediment sample collected (Müller et al. 2004).

Table 2: Dioxin concentrations (pg/g dw) in sediments collected in the Noosa Catchment in February 2020

Dioxins	Lake Poona	Lake Coolamerra	Lake Cootharaba NTH	Lake Cootharaba NTH Duplicate	Lake Cootharaba STH	Lake Cootharaba STH Duplicate	Lake Cooroibah	Doonella Lake	Lake Weyba	Lake Weyba Duplicate
2378-TCDD	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	2.7	4.4
12378-PeCDD	<2.4	<2.4	<2.5	3.6	7.7	6.4	5.7	<2.5	19	44.6
123478-HxCDD	<2.4	<2.4	<2.5	3.9	7.2	5.9	5.6	<2.5	20.4	34.7
123678-HxCDD	<2.4	<2.4	4.4	5.5	13.4	11.4	11.4	2.6	29	44.2
123789-HxCDD	2.5	4.7	11.7	14.6	34.2	28.2	27.6	5.5	66.9	114
1234678-HpCDD	83.4	62.7	142	188	286	285	270	60.3	321	589
OCDD	2210	3050	4530	6080	4230	3640	4930	1210	4410	6410
2378-TCDF	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12378-PeCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
23478-PeCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
123478-HxCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
123678-HxCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
234678-HxCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
123789-HxCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
1234678-HpCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
1234789-HpCDF	<2.4	<2.4	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
OCDF	<4.9	<4.9	<5.0	<5.0	<5.0	<5.0	<4.9	<4.9	<5.0	<5.0
Total TEQ ^{1 A}	1.75	2.01	4.39	10.44	17.31	14.86	14.43	1.77	37.81	76.06

^A WHO excluding LOD data (pg/g dw)

¹ Toxic Equivalents (TEQs) are a way of expressing the overall toxicity of a mixture of dioxins. A set of weighting factors (toxicity equivalence factors - TEFs) were developed by the World Health Organisation (Van den Berg et al. 2006) that express the toxicity of a specific dioxin as an equivalent mass of TCDD. The concentration of the dioxin is multiplied by the weighting factor and then all results are summed as a measure of overall toxicity.

4.2 Biota

The concentrations of TCDD and total dioxins were normalised to lipid concentration (Table 3). The concentrations of TCDD and total dioxins in oysters from Lake Cooroibah were in the same order of magnitude as that measured in Lake Weyba, and the concentrations of TCDD and total dioxins in mullet were the same order of magnitude in Lake Cootharaba and Lake Weyba (Table 3).

Table 3: Concentration of TCDD and Total Dioxins in oysters, mullet and mudcrabs from lakes Cootharaba, Cooroibah and Weyba normalised to lipid concentration.

	TCDD (pg/g lipid)	Total dioxins (pg/g lipid)
Cooroibah Oysters ^a	3913	57739
Weyba Oysters ^a	3008	44513
Weyba Mullet	134	439
Cootharaba Mullet	221	342
Cootharaba Mudcrab	65	1363

^a As lipid content was not obtained in this study, the lipid weight used for the calculation was the average of pacific oyster and pearl oyster as reported in (Matthews, Pöpke, and Gaus 2008)

Queensland Health assessed the risk of consumption of biota collected from Lake Cootharaba, Lake Weyba and Lake Cooroibah. The detailed assessment is presented in Appendix E. In summary they found that:

Consumption of fish from the Noosa area sampled by DES is unlikely to result in an unacceptable risk to public health. Recreational fishers consuming relatively significant amounts over extended seasons may approach the recommended Tolerable Monthly Intake TMI. Seasonal consumption patterns, lifetime patterns of activity, and locality changes mitigate against the possibility of exceeding the dioxin tolerable intake guideline value.

This assessment has not considered the risks associated with commercial fishing. As the concentration in fish is below the FSANZ limit of 6 pg TEQ/g, the risk is not expected to be a concern. However, this may need to be further investigated with Department of Agriculture and Fisheries if there is significant commercial fishing in the area.

Further assessment of the potential of risks associated with commercial fisheries will be conducted in the first quarter 2021.

5 Conclusions

TCDD was reported at two of the seven sites sampled. Dioxins were measured at all sites, including national park sites. Biota was collected in lakes Cootharaba, Cooroibah and Weyba. An assessment of risks of the dioxins present in the biota to recreational fishers/consumers undertaken by Queensland Health indicated a low risk. Further assessment of the risks associated with commercial fisheries will be conducted in the first quarter 2021, and will include an additional round of sediment sampling.

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Appendix A – Quality Control Results

All samples passed the quality control acceptance criteria of a relative percentage difference of 50% (DES 2018) apart from samples collected at Lake Weyba (Table A1), which has the highest percentage of clays. This may indicate a difficulty in extraction due to matrix interference. The variability in results was found in both the blind duplicates sent to a single laboratory, and between different laboratories at this site.

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Table A1: Quality Control results (blind laboratory duplicates and inter-laboratory results). Red highlighted cells indicated exceedance of acceptance criteria.

				Dioxins																
Lab Name	Field ID	Date	Sample Type	1,2,3,4,6,7,8- Heptachlorooxanthrene	1,2,3,4,6,7,8- Heptachlorodibenzofuran	1,2,3,4,7,8,9- Heptachlorodibenzofuran	1,2,3,4,7,8- Hexachlorooxanthrene	1,2,3,4,7,8- Hexachlorodibenzofuran	1,2,3,6,7,8- Hexachlorooxanthrene	1,2,3,6,7,8- Hexachlorodibenzofuran	1,2,3,7,8,9- Hexachlorooxanthrene	1,2,3,7,8,9- Hexachlorodibenzofuran	2,3,7,8-Tetrachlorooxanthrene	1,2,3,7,8- Pentachlorooxanthrene	1,2,3,7,8- Pentachlorodibenzofuran	2,3,4,6,7,8- Hexachlorodibenzofuran	2,3,4,7,8- Pentachlorodibenzofuran	2,3,7,8- Tetrachlorodibenzofuran	1,2,3,4,6,7,8,9- Octachlorooxanthrene	1,2,3,4,6,7,8,9- Octachlorodibenzofuran
				pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g	pg/g
ALSE-Brisbane	CTH - 0220 - S	24/02/2020	Normal	286	<2.5	<2.5	7.2	<2.5	13.4	<2.5	34.2	<2.5	<0.5	7.7	<2.5	<2.5	<2.5	<0.5	4,230.00	<5.0
ALSE-Brisbane	LRB - 0220	24/02/2020	Field_D	285	<2.5	<2.5	5.9	<2.5	11.4	<2.5	28.2	<2.5	<0.5	6.4	<2.5	<2.5	<2.5	<0.5	3,640.00	<4.9
RPD				0	0	0	20	0	16	0	19	0	0	18	0	0	0	0	15	0
ALSE-Brisbane	CTH - 0220 - S	24/02/2020	Normal	286	<2.5	<2.5	7.2	<2.5	13.4	<2.5	34.2	<2.5	<0.5	7.7	<2.5	<2.5	<2.5	<0.5	4,230.00	<5.0
NMI	CTH-0220-S	24/02/2020	Interlab_D	330	<0.2	<0.04	4.9	<0.08	12	<0.08	26	<0.07	<0.4	2.6	0.11	<0.1	0.07	0.16	4,870	0.24
RPD				14	0	0	38	0	11	0	27	0	0	99	0	0	0	0	14	0
ALSE-Brisbane	NSA - 0220	25/02/2020	Normal	142	<2.5	<2.5	<2.5	<2.5	4.4	<2.5	11.7	<2.5	<0.5	<2.5	<2.5	<2.5	<2.5	<0.5	4,530.00	<5.0
ALSE-Brisbane	AES - 0220	25/02/2020	Field_D	188	<2.5	<2.5	3.9	<2.5	5.5	<2.5	14.6	<2.5	0.7	3.6	<2.5	<2.5	<2.5	0.5	6,080.00	<5.0
RPD				28	0	0	44	0	22	0	22	0	33	36	0	0	0	0	29	0
ALSE-Brisbane	NSA - 0220	25/02/2020	Normal	142	<2.5	<2.5	<2.5	<2.5	4.4	<2.5	11.7	<2.5	<0.5	<2.5	<2.5	<2.5	<2.5	<0.5	4,530.00	<5.0
NMI	NSA-0220	25/02/2020	Interlab_D	160	0.21	<0.04	1.6	<0.06	3.7	<0.06	9.2	<0.08	<0.3	0.77	<0.05	<0.06	<0.03	<0.06	5,540	0.39
RPD				12	0	0	0	0	17	0	24	0	0	0	0	0	0	0	20	0
ALSE-Brisbane	WEY - 0220	25/02/2020	Normal	321	<2.5	<2.5	20.4	<2.5	29	<2.5	66.9	<2.5	2.7	19	<2.5	<2.5	<2.5	<0.5	4,410.00	<5.0
ALSE-Brisbane	BEB - 0220	25/02/2020	Field_D	589	<2.5	<2.5	34.7	<2.5	44.2	<2.5	114	<2.5	4.4	44.6	<2.5	<2.5	<2.5	<0.5	6,410.00	<4.9
RPD				59	0	0	52	0	42	0	52	0	48	81	0	0	0	0	37	0
ALSE-Brisbane	WEY - 0220	25/02/2020	Normal	321	<2.5	<2.5	20.4	<2.5	29	<2.5	66.9	<2.5	2.7	19	<2.5	<2.5	<2.5	<0.5	4,410.00	<5.0
NMI	WEY-0220	25/02/2020	Interlab_D	730	0.3	0.06	27	<0.09	44	<0.08	110	<0.08	4	27	0.13	<0.08	0.07	0.15	9,070	0.31
				78	0	0	28	0	41	0	49	0	39	35	0	0	0	0	69	0

Appendix B – Sediment results from ALS

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Appendix C – Sediment Results from NMI

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Appendix D – Biota results from NMI

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Appendix E – Assessment of dioxins for human consumption – Noosa Lakes.

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