

Supplement of Atmos. Chem. Phys., 17, 1401–1415, 2017
<http://www.atmos-chem-phys.net/17/1401/2017/>
doi:10.5194/acp-17-1401-2017-supplement
© Author(s) 2017. CC Attribution 3.0 License.



Atmospheric
Chemistry
and Physics
Open Access
EGU

Supplement of

Atmospheric processes of organic pollutants over a remote lake on the central Tibetan Plateau: implications for regional cycling

Jiao Ren et al.

Correspondence to: Xiaoping Wang (wangxp@itpcas.ac.cn)

The copyright of individual parts of the supplement might differ from the CC-BY 3.0 licence.

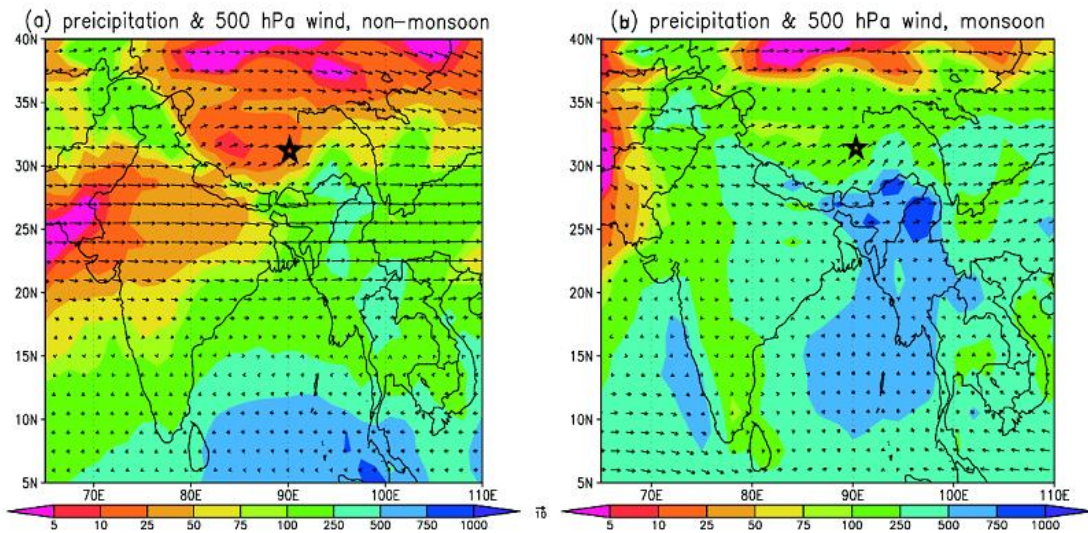
1 **Introduction**

2 This supplement file includes the details about climate of sampling site, methods on
3 the extraction and analysis of samples, detection limits and QA/QC results. Dataset of
4 concentrations for each target compounds in this study and comparisons with
5 literature values from other remote regions are also presented. Furthermore, method
6 on air-water exchange calculation, localized physical-chemical properties of
7 chemicals and derived degradation fluxes are also detailed here. In total, this
8 supplement includes six texts (Text S1 to S6), six figures (Figure S1 to S6) and
9 eighteen tables (Table S1 to S18). They are listed in the order of appearance in the
10 manuscript; please see the summary table below.

11 **Summary of the number of pages, figures, and tables**

Figure S1	The dominated air circulation in Nam Co region for different seasons	Page S4
Figure S2	Temporal variations of air temperature and precipitation in Nam Co station	Page S5
Table S1	Air temperature and wind speed during the sampling period	Page S6-7
Table S2	Information about the water samples	Page S8
Text S1	Preparation, extraction and cleanup method for different sample types	Page S9
Text S2	Details about the chromatographic conditions	Page S10
Table S3	Concentrations of chemicals in the field blanks and procedural blanks	Page S11-13
Text S3	The ways to define method detection limits (MDLs) and treat with the concentrations below MDLs	Page S14
Table S4	Detection frequency and MDLs for individual compound in each kind of samples	Page S15-16
Table S5	Breakthrough estimation of individual compounds in PUF plugs	Page S17
Text S4	Correction of the dissolved concentrations by dissolved organic carbon (DOC)	Page S18
Text S5	Temperature and salinity-corrected Henry's law constant (H)	Page S19
Text S6	Flux calculation of air-water gas exchange	Page S20-21
Table S6	Equations used for temperature-corrected subcooled liquid vapour pressure (P_L) for each compound	Page S22
Table S7	Snow scavenging ratios for PAHs in the gas phase (W_G) and particulate phases (W_P).	Page S23
Table S8	Concentrations of gas phase organic pollutants (OPs) (pg m^{-3}) in the atmosphere of Nam Co	Page S24-27
Table S9	Concentrations of OPs (pg m^{-3}) in the total suspended particulates (TSP) of Nam Co	Page S28-31
Table S10	Concentrations of dissolved phase OPs (pg L^{-1}) in the lake water of Nam Co	Page S32-35
Table S11	Concentrations of particulate phase OPs (pg L^{-1}) in the SPM of water samples from Nam Co Lake	Page S36-37
Table S12	Comparisons of OCPs and PCBs in the air of this study and data reported for other remote areas (pg m^{-3})	Page S38
Table S13	Comparisons of PAHs concentrations from this study and data reported for other remote areas (ng m^{-3})	Page S39

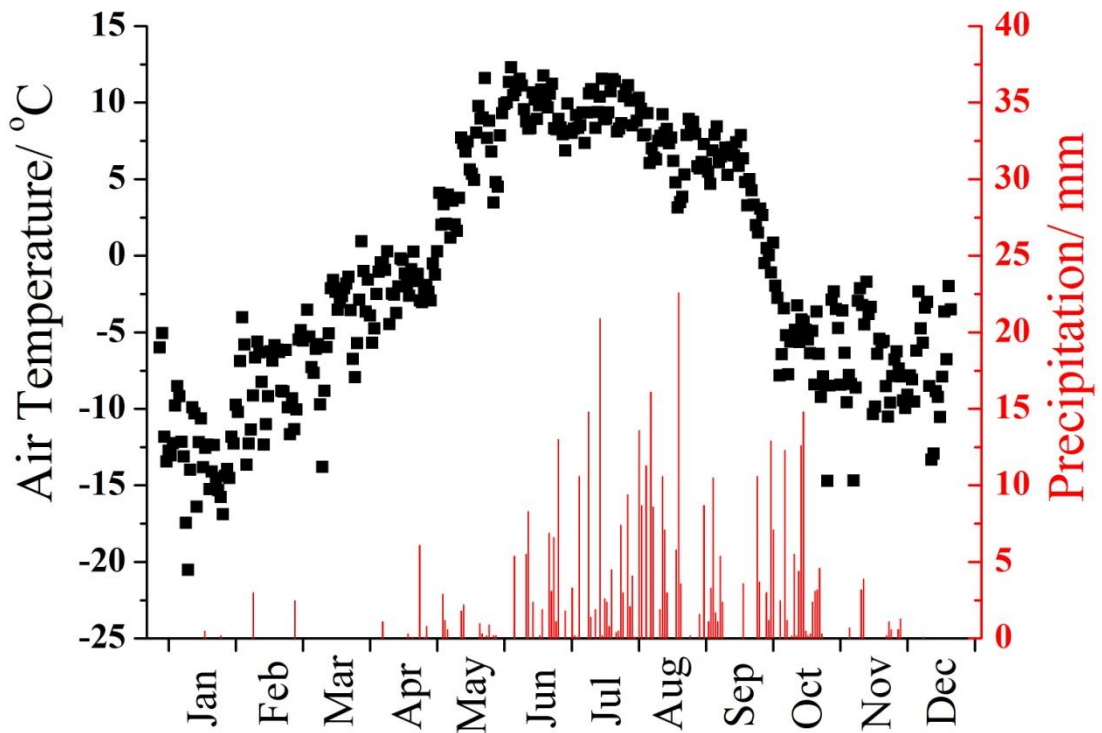
Table S14	Dissolved concentrations of OCPs and PCBs in lake water of this study and other remote sites (pg L⁻¹).	Page S40
Table S15	Concentrations of PAHs in lake water of this study and other remote sites (ng L⁻¹).	Page S41
Table S16	Comparison of isomer ratios of OCPs in this study and the source region	Page S42
Figure S3	Seasonal patterns of gaseous and particulate phase of Σ_{15}PAHs in the atmosphere	Page S43
Table S17	Results of ANOVA to test the concentration difference in lake water from different regions of Nam Co Lake	Page S44
Table S18	Results of Clausius–Clapeyron regression	Page S45
Figure S4	The correlation between EF of α-HCH in lake water and seasonal bacterial abundance in Nam Co Lake.	Page S46
Figure S5	Average atmospheric degradation fluxes for individual OPs	Page S47
Figure S6	Seasonality of the wet deposition fluxes for HCHs in Nam Co Lake	Page S48
References		Page S49-53



12

13 **Figure S1. The dominated air circulation in Nam Co region for monsoon and**
 14 **non-monsoon season (average from 1980-2010). The star is the location of Nam**
 15 **Co Monitoring and Research Station.**

16 (Cited from Zhang et al., 2013: A study of Zhadang glacier energy and mass balance
 17 and its hydrological process, in NamCo basin, central Tibetan Plateau, Doctoral
 18 Dissertation)



19

20 **Figure S2. Temporal variations of air temperature and precipitation in Nam Co**
 21 **station in 2012.**

22 The meteorological parameters were measured by an automatic weather station in the
 23 Nam Co station, and the data were downloaded in the website of High-cold Region
 24 Observation and Research Network for Land Surface Processes & Environment of
 25 China (HORN, <http://www.horn.ac.cn/>)

Table S1. Air temperature and wind speed during the sampling period

Start Date	End Date	Temperature	Wind speed
Y/M/D	Y/M/D	(°C)	(m/s)
2012.09.03	2012.09.15	6.7	3.0
2012.09.16	2012.09.20	6.4	3.1
2012.10.01	2012.10.15	-0.7	3.5
2012.10.24	2012.10.31	-5.5	3.0
2012.11.01	2012.11.15	-7.2	4.3
2012.11.16	2012.11.30	-5.9	NA
2012.12.01	2012.12.15	-8.3	NA
2012.12.16	2012.12.31	-6.6	NA
2013.01.03	2013.01.15	-12.6	3.3
2013.01.16	2013.01.31	-13.0	2.9
2013.02.06	2013.02.16	-8.9	3.6
2013.02.21	2013.03.01	-8.7	3.0
2013.03.02	2013.03.15	-6.1	2.2
2013.03.15	2013.03.31	-5.4	3.2
2013.04.01	2013.04.15	-3.2	3.5
2013.04.15	2013.04.30	-1.1	3.2
2013.05.01	2013.05.15	-0.2	3.1
2013.05.15	2013.06.04	5.2	3.3
2013.06.06	2013.06.15	8.0	2.8
2013.06.15	2013.06.30	9.7	3.2
2013.07.01	2013.07.19	10.0	2.8
2013.07.19	2013.08.03	8.5	3.0
2013.08.04	2013.08.15	8.6	2.4
2013.08.15	2013.08.31	8.9	2.9
2013.09.01	2013.09.15	5.2	2.7
2013.09.15	2013.09.30	4.9	2.9
2013.10.01	2013.10.15	-0.7	3.5
2013.10.15	2013.10.30	-5.5	3.0
2013.11.01	2013.11.15	-8.3	3.7
2013.11.15	2013.11.30	-9.7	3.0
2013.12.01	2013.12.15	-12.6	3.1
2013.12.16	2013.12.30	-9.1	4.1
2014.01.05	2014.01.31	-12.6	3.3
2014.02.01	2014.02.15	-8.7	3.7
2014.02.15	2014.02.28	-9.1	3.8
2014.03.01	2014.03.15	-6.1	2.2
2014.03.15	2014.03.31	-5.4	3.2
2014.04.01	2014.04.15	-2.4	3.2
2014.04.15	2014.04.30	-1.0	3.6
2014.05.01	2014.05.15	2.3	3.4
2014.05.15	2014.05.28	5.2	3.2

2014.06.02	2014.06.15	8.0	2.8
2014.06.22	2014.06.30	9.7	3.2
2014.07.01	2014.07.15	10.0	2.8
2014.07.15	2014.07.31	9.2	2.7
2014.08.01	2014.08.15	9.3	2.5
2014.08.15	2014.08.31	6.8	2.5
2014.09.02	2014.09.15	7.9	2.8
2014.09.15	2014.09.30	4.5	3.1

27

NA: not available

28 **Table S2. Information about the water samples.**

29 The information include water temperature, pH, electric conductivity, salinity,
 30 dissolved oxygen and contents of suspended particulate matter (SPM).

Spatial sample	T (°C)	pH	Electric conductivity (ms cm⁻¹)	Salinity (ppt)	Dissolved Oxygen (mg L⁻¹)	SPM (mg L⁻¹)
S1	14.5	9.48	1.96	1.1	9.2	11.0
S2	NA	9.51	1.92	1.0	9.0	3.2
S3	15.6	9.39	1.85	1.1	8.6	5.5
S4	NA	NA	NA	NA	NA	5.7
S5	14.4	9.48	1.76	1.0	9.3	7.0
S6	12.7	9.56	1.92	1.1	10.2	1.7
S7	11.7	9.44	1.54	0.8	9.4	5.3
S8	12.4	9.56	1.86	1.0	9.9	7.2
S9	12.4	9.56	1.93	1.1	9.6	6.7
S10	8.5	9.63	1.99	1.1	9.7	2.1
S11	8.1	9.49	2.02	1.1	8.9	6.1
S12	14.8	9.50	1.86	1.1	10.1	3.2
S13	14.6	9.40	1.83	1.1	10.2	5.2
S14	14.9	9.34	1.93	1.0	9.5	11.7
S15	14.8	9.38	0.74	1.0	NA	8.2
Seasonal sample	T (°C)	pH	Electric conductivity (ms cm⁻¹)	Salinity (ppt)	Dissolved Oxygen (mg L⁻¹)	SPM (mg L⁻¹)
May-1	8.2	8.98	1.92	1.0	9.8	2.6
May-2	8.5	9.01	1.91	1.1	11.2	2.2
May-3	8.9	9.03	1.89	1.2	12.6	3.0
June-1	10.1	9.13	1.9	1.2	11.7	0.9
June-2	10.3	9.14	1.88	1.1	10.3	2.2
June-3	10.9	9.14	1.86	1.0	8.9	0.8
July-1	16.7	9.16	1.83	0.8	17.3	2.5
July-2	15.9	9.10	1.82	0.9	17.8	4.0
July-3	12.8	9.16	1.83	0.9	12.6	1.9
Aug-1	15.6	9.25	1.75	0.8	20.0	2.4
Aug-2	14.0	9.27	1.80	1.0	20.0	0.4
Aug-3	13.2	9.28	1.85	1.1	NA	0.5
Sep-1	12.4	9.16	1.82	0.8	13.4	1.0
Sep-2	12.2	9.18	1.82	1.0	11.9	2.0
Sep-3	12.3	9.17	1.82	0.9	12.7	0.6

31 NA: not available

32 **Text S1. Preparation, extraction and cleanup method for different sample types**

33 **Preparation.** Polyurethane foam (PUF) and glass fiber filter (GFF, Whatman) were
34 used to absorb the gas and particulate phase organic pollutants (OPs) in air,
35 respectively; while GFFs and XAD-2 resin were used to accumulate the OPs in
36 suspended particulate matter (SPM) and dissolved phases in water, respectively. Prior
37 to field sampling, PUF and XAD resin was pre-cleaned by Soxhlet extraction using
38 dichloromethane (DCM) for 16 h; GFF were pre-combusted at 450 °C for 4 h. Glass
39 adsorption column (internal diameter of 2.5 cm and length of 30 cm) was prepared
40 and each one was filled with about 200 cm³ of XAD resin.

41 **Extraction.** Each collected sample was spiked with a mixture of 2, 4,
42 6-trichlorobiphenyl (PCB 30), Mirex and perylene-D12 as recovery surrogates before
43 extraction. Different extraction methods were used for XAD-resin and other samples,
44 but the procedure for cleanup is the same. The XAD column after passing through the
45 water samples was first eluted with 100 mL of DCM. Then XAD resin was transferred
46 to conical flask and mixed with enough anhydrous sodium sulfate for dehydration.
47 Ultrasonically extraction was repeated for 3 times (20 min with 50 mL DCM for each
48 time) to extract remaining chemicals. For the PUF and GFF filters, Soxhlet extraction
49 was conducted using DCM at 48 °C for 16 h.

50 **Cleanup.** Extracts of the above samples were all concentrated to 1 mL by a rotary
51 evaporator, solvent exchanged to hexane and then cleanup. The samples were loaded
52 on a chromatography column (from the bottom to top: 3 g of 6% deactivated silica gel,
53 2 g of 3% deactivated alumina and 1 g of anhydrous sodium sulfate) and eluted with
54 30 mL of a mixture of hexane/DCM (1:1 v/v). The elute was further cleaned on
55 gel-permeation chromatography (GPC, containing 6 g of Biobeads SX3) with
56 hexane/DCM (1:1). The first 16 mL was discarded and the subsequent 30 mL fraction
57 was collected. After the cleanup, all samples were finally concentrated to 100 µL
58 containing a known quantity of pentachloronitrobenzene (PCNB), decachlorobiphenyl
59 (PCB 209), perylene-D10 and benzo[g,h,i]perylene-D12 as internal standards.

60 **Text S2. Details about the chromatographic conditions**

61 The OPs concentrations in all samples were analyzed on the gas chromatograph-mass
62 spectrometer (GC-MS, Finnigan Trace GC/PolarisQ); however different
63 chromatographic column and temperature program were used for OCPs, PCBs and
64 PAHs. Additionally, the enantiomers of α -HCH were analyzed separately.

65 **OCPs and PCBs.** The GC-MS was operated with a CP-Sil 8CB capillary column (50
66 m \times 0.25 mm, film thickness 0.25 μ m) and under single-ion monitoring (SIM) mode.
67 Helium was used as the carrier gas at 1 mL min⁻¹ under constant-flow mode. The oven
68 temperature began at 100 $^{\circ}$ C for 2 min and was increased at a rate of 20 $^{\circ}$ C min⁻¹ to
69 140 $^{\circ}$ C, then increased at a rate of 4 $^{\circ}$ C min⁻¹ to 200 $^{\circ}$ C, held for 10 min, and finally
70 increased at a rate of 4 $^{\circ}$ C min⁻¹ to 300 $^{\circ}$ C and held for 17 min.

71 **PAHs.** PAHs were analyzed on GC-MS system with a DB-5MS column (60 m \times 0.25
72 mm, film thickness 0.25 μ m). The carrier gas and SIM mode are the same as OCPs
73 and PCBs. The oven temperature began at 50 $^{\circ}$ C for 2 min and was increased at a rate
74 of 20 $^{\circ}$ C min⁻¹ to 180 $^{\circ}$ C, then increased at a rate of 3 $^{\circ}$ C min⁻¹ to 250 $^{\circ}$ C, then
75 increased at a rate of 2 $^{\circ}$ C min⁻¹ to 300 $^{\circ}$ C and held for 10 min, and finally increased
76 at a rate of 10 $^{\circ}$ C min⁻¹ to 310 $^{\circ}$ C and held for 5 min.

77 **Chiral analysis for α -HCH.** Determination of enantiomeric compositions of α -HCH
78 was performed on an Agilent 6890 gas chromatography equipped with a micro-cell
79 ⁶³Ni electron capture detector (μ -ECD) at State Key Laboratory of Environmental
80 Chemistry and Ecotoxicology, Research Center of Eco-Environment Sciences,
81 Chinese Academy of Sciences. Separation for enantiomers of α -HCH was carried out
82 using a BGB-172 chiral column (30 m \times 0.25 mm i.d., 0.25 μ m film thickness, BGB
83 Analytik AG, Switzerland). The carrier gas was nitrogen with a flow of 0.7 mL/min.
84 The injector and detector temperatures were 250 $^{\circ}$ C and 300 $^{\circ}$ C, respectively. The
85 temperature program was: 90 $^{\circ}$ C held for 1 min, increased to 140 $^{\circ}$ C at a rate of
86 15 $^{\circ}$ C/min, followed by 2 $^{\circ}$ C/min to 210 $^{\circ}$ C, held for 5 min and then 20 $^{\circ}$ C/min to
87 240 $^{\circ}$ C, held for 10 min. According to the previous study (Ding et al., 2007a), the
88 elution order of α -HCH on BGB column was (-)- α -HCH and (+)- α -HCH.

89

Table S3. Concentrations of OPs in the field blanks and procedural blanks.

90

Part 1. OCPs and PCBs in the field blanks:

Field blank Air (pg m⁻³)	α-HCH	β-HCH	γ-HCH	HCb	<i>o,p'</i>- DDE	<i>p,p'</i>- DDE	<i>o,p'</i>- DDT	<i>p,p'</i>- DDT	PCB- 28	PCB- 52	PCB- 101	PCB- 153	PCB- 138	PCB- 180
PUF field blank 1	0.10	ND ^a	0.06	1.97	ND	0.44	ND	ND	ND	0.02	ND	ND	ND	ND
PUF field blank 2	0.10	ND	0.03	1.84	ND	0.15	ND	ND	ND	0.04	ND	ND	ND	ND
PUF field blank 3	0.10	ND	0.03	1.50	ND	0.28	ND	ND	ND	0.03	ND	ND	ND	ND
PUF field blank 4	0.13	ND	0.04	0.9	ND	0.38	ND	ND	ND	0.05	ND	ND	ND	ND
PUF field blank 5	0.25	ND	0.03	1.14	ND	0.47	ND	ND	ND	0.07	ND	ND	ND	ND
PUF field blank 6	0.15	ND	0.09	1.43	ND	0.36	ND	ND	ND	0.05	ND	ND	ND	ND
Blank average	0.14	0	0.05	1.46	0	0.35	0	0	0	0.04	0	0	0	0
Field blank Water (pg L⁻¹)	α-HCH	β-HCH	γ-HCH	HCb	<i>o,p'</i>- DDE	<i>p,p'</i>- DDE	<i>o,p'</i>- DDT	<i>p,p'</i>- DDT	PCB- 28	PCB- -52	PCB- 101	PCB- 153	PCB- 138	PCB- 180
XAD field blank 1	0.79	1.31	1.08	1.05	0.57	0.27	0.19	0.34	0.14	0.18	0.15	0.05	0.01	0.09
XAD field blank 2	0.44	1.20	0.93	1.03	0.58	0.44	0.22	0.30	0.08	0.16	0.27	0.15	0.07	0.03
XAD field blank 3	BDL	0.53	0.05	0.85	0.30	0.34	0.14	0.17	BDL	0.05	0.18	0.04	0.02	BDL
Blank average	0.61	1.01	0.69	0.98	0.48	0.35	0.18	0.27	0.11	0.13	0.20	0.08	0.03	0.06

91

^a ND=chemical was not detected in blank.

92

93

Part 2. PAHs in the field blanks:

Field blank Air (pg m⁻³)	Acel	Ace	Phe	Flu	Ant	Fla	Pyr	BaA	Chr	Bbf	Bkf	BaP	IcdP	DahA	BghiP
PUF field blank 1	0.95	0.21	0.76	ND	0.24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PUF field blank 2	0.87	0.19	0.34	ND	0.15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PUF field blank 3	0.73	0.45	0.12	ND	0.46	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PUF field blank 4	0.61	0.54	0.56	ND	0.31	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PUF field blank 5	0.92	0.23	0.92	ND	0.36	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PUF field blank 6	0.59	0.52	0.43	ND	0.27	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Blank average	0.78	0.36	0.52	0	0.30	0	0	0	0	0	0	0	0	0	0
Field blank Water (pg L⁻¹)	Acel	Ace	Flu	Phe	Ant	Fla	Pyr	BaA	Chr	Bbf	Bkf	Bap	IcdP	DahA	BghiP
XAD field blank 1	8.7	12.2	87.0	348.0	350.6	111.5	80.3	7.3	15.6	ND	ND	ND	ND	ND	ND
XAD field blank 2	2.8	3.4	52.9	244.4	41.1	105.8	59.5	4.1	9.1	ND	ND	ND	ND	ND	ND
XAD field blank 3	4.1	6.2	24.1	73.2	218.9	4.0	14.8	2.3	4.6	ND	ND	ND	ND	ND	ND
Blank average	5.2	7.3	54.7	221.9	203.5	73.8	51.5	4.6	9.7	ND	ND	ND	ND	ND	ND

94

Part 3. OCPs, PCBs and PAHs in the procedural blanks (ng sample⁻¹):

(ng sample ⁻¹)	α -HCH	γ -HCH	HCB	<i>o,p'</i> -DDE	<i>p,p'</i> -DDE	<i>o,p'</i> -DDT	<i>p,p'</i> -DDT	PCB-28	PCB-52	PCB-101	PCB-153	PCB-138	PCB-180
procedural blank 1	0.07	0.02	0.78	ND	0.16	ND	ND	ND	0.03	ND	ND	ND	ND
procedural blank 2	0.10	0.02	0.91	ND	0.23	ND	ND	ND	0.02	ND	ND	ND	ND
procedural blank 3	0.08	0.04	0.64	ND	0.20	ND	ND	ND	0.02	ND	ND	ND	ND
procedural blank 4	0.08	0.04	1.04	ND	0.16	ND	ND	ND	0.02	ND	ND	ND	ND
procedural blank 5	0.07	0.04	0.86	ND	0.14	ND	ND	ND	0.02	ND	ND	ND	ND
procedural blank 6	0.11	0.03	0.89	ND	0.28	ND	ND	ND	0.04	ND	ND	ND	ND
average	0.08	0.03	0.85	0	0.20	0	0	0	0.02	0	0	0	0
(ng sample ⁻¹)	Acel	Ace	Phe	Flu	Ant	BaA	Chr	Bbf	Bkf	BaP	IcdP	DahA	BghiP
procedural blank 1	0.24	0.13	0.29	ND	0.14	ND	ND	ND	ND	ND	ND	ND	ND
procedural blank 2	0.28	0.38	0.38	ND	0.27	ND	ND	ND	ND	ND	ND	ND	ND
procedural blank 3	0.13	0.38	0.43	ND	0.08	ND	ND	ND	ND	ND	ND	ND	ND
procedural blank 4	0.19	0.26	0.40	ND	0.17	ND	ND	ND	ND	ND	ND	ND	ND
procedural blank 5	0.05	0.07	0.14	ND	0.07	ND	ND	ND	ND	ND	ND	ND	ND
procedural blank 6	0.25	0.37	0.41	ND	0.31	ND	ND	ND	ND	ND	ND	ND	ND
average	0.19	0.27	0.34	0	0.17	0	0	0	0	0	0	0	0

96 **Text S3. The ways to define method detection limits (MDLs) and treat with the**
97 **concentrations below MDLs**

98 The MDLs were derived as the mean blank concentration plus 3 times its standard
99 deviation; when a target compound was not detected in the blanks, the concentration
100 of the lowest calibration standard was substituted for the MDL. Based on 600 m³ and
101 200 L, the corresponding MDLs for air and water samples were calculated
102 respectively and presented in Table S4.

103 If the concentration of a compound after blank correction was below the MDL, the
104 concentration was substituted with 1/2 MDL in cases where greater than 70% of data
105 were greater than the MDL (Antweiler and Taylor, 2008); otherwise it will be marked
106 with “BDL”.

107 **Table S4. Detection frequency and MDLs for individual compound in each kind of samples**

108

	Air-gas phase			Air-particulate phase			Water-dissolved phase			Water-particulate phase		
	detection frequency (%)	MDL (pg m ⁻³)	1/2 MDL (pg m ⁻³)	detection frequency (%)	MDL (pg m ⁻³)	1/2 MDL (pg m ⁻³)	detection frequency (%)	MDL (pg L ⁻¹)	1/2 MDL (pg L ⁻¹)	detection frequency (%)	MDL (pg L ⁻¹)	1/2 MDL (pg L ⁻¹)
<i>α</i>-HCH	100	0.31	0.16	2	0.23	0.12	100	1.4	0.7	10	0.70	0.35
<i>β</i>-HCH	43	0.33	0.17	2	0.33	0.17	100	2.3	1.1	17	1	0.5
<i>γ</i>-HCH	96	0.12	0.06	19	0.09	0.04	100	2.4	1.2	53	0.26	0.13
HCB	100	2.68	1.34	5	2.11	1.05	79	1.3	0.7	37	6.32	3.16
<i>o,p'</i>-DDE	68	0.33	0.17	0	0.33	0.17	0	1.0	0.5	3	1	0.5
<i>p,p'</i>-DDE	66	0.70	0.35	7	0.59	0.30	10	0.6	0.3	13	1.78	0.89
<i>o,p'</i>-DDT	91	0.33	0.17	23	0.33	0.17	3	0.3	0.2	10	1	0.5
<i>p,p'</i>-DDT	72	0.33	0.17	21	0.33	0.17	3	0.5	0.3	33	1	0.5
PCB-28	100	0.03	0.02	23	0.03	0.02	72	0.2	0.1	50	0.1	0.05
PCB-52	83	0.10	0.05	0	0.08	0.04	17	0.3	0.2	27	0.23	0.12
PCB-101	98	0.03	0.02	74	0.03	0.02	3	0.4	0.2	93	0.1	0.05
PCB-153	81	0.03	0.02	28	0.03	0.02	0	0.3	0.1	47	0.1	0.05
PCB-138	79	0.03	0.02	21	0.03	0.02	7	0.1	0.06	53	0.1	0.05
PCB-180	19	0.03	0.02	5	0.03	0.02	0	0.2	0.09	10	0.1	0.05
Acel	100	1.25	0.63	23	0.75	0.37	100	14	7	100	2.25	1.12
Ace	100	0.85	0.42	72	1.13	0.57	100	21	10	100	3.40	1.70
Flu	100	0.33	0.17	100	0.33	0.17	100	149	75	100	1	0.5
Phe	100	1.39	0.70	100	1.12	0.56	100	638	319	100	3.37	1.69
Ant	100	0.62	0.31	100	0.77	0.39	48	670	335	97	2.31	1.16
Fla	100	0.33	0.17	100	0.33	0.17	56	255	128	100	1	0.5

Pyr	100	0.17	0.08	100	0.17	0.08	93	152	76	100	0.5	0.25
BaA	100	0.17	0.08	100	0.17	0.08	48	12	6	97	0.5	0.25
Chr	100	0.17	0.08	100	0.17	0.08	56	26	13	97	0.5	0.25
Bbf	100	0.33	0.17	86	0.33	0.17	52	1	0.5	55	1	0.5
Bkf	98	0.17	0.08	100	0.17	0.08	100	0.5	0.3	97	0.5	0.25
BaP	98	0.17	0.08	98	0.17	0.08	100	0.5	0.3	97	0.5	0.25
IcdP	49	0.17	0.08	56	0.17	0.08	0	0.5	0.3	55	0.5	0.25
DahA	31	0.33	0.17	33	0.33	0.17	0	1	0.5	48	1	0.5
BghiP	96	0.33	0.17	100	0.33	0.17	100	1	0.5	97	1	0.5

109

Table S5. Breakthrough estimation: the percentage of OCPs, PCBs and PAHs in the second PUF to the total Plugs (PUF₂/(PUF₁+PUF₂))

	α -HCH	β -HCH	γ -HCH	HCB	<i>o,p'</i> -DDE	<i>p,p'</i> -DDE	<i>o,p'</i> -DDT	<i>p,p'</i> -DDT	PCB-28	PCB-52	PCB-101	PCB-153	PCB-138	PCB-180	
breakthrough 1	15%	0%	11%	24%	5%	13%	5%	6%	11%	10%	13%	12%	8%	0%	
breakthrough 2	20%	4%	14%	18%	0%	2%	1%	1%	14%	7%	7%	0%	3%	0%	
breakthrough 3	25%	8%	17%	25%	0%	12%	8%	6%	14%	11%	13%	0%	16%	11%	
breakthrough 4	26%	7%	22%	30%	4%	5%	3%	2%	19%	7%	5%	3%	5%	0%	
breakthrough 5	28%	0%	12%	26%	3%	0%	1%	1%	10%	5%	6%	3%	1%	0%	
breakthrough 6	16%	25%	31%	20%	26%	25%	10%	19%	24%	0%	13%	10%	9%	0%	
breakthrough 7	17%	15%	25%	25%	14%	16%	14%	16%	18%	17%	15%	18%	15%	26%	
breakthrough 8	13%	18%	22%	16%	22%	24%	14%	11%	17%	14%	15%	15%	15%	9%	
breakthrough 9	13%	16%	14%	20%	14%	17%	15%	16%	13%	16%	18%	18%	19%	19%	
breakthrough 10	22%	20%	19%	32%	27%	22%	20%	23%	23%	17%	20%	21%	45%	11%	
breakthrough 11	15%	20%	10%	20%	4%	5%	3%	13%	10%	7%	8%	16%	7%	9%	
average	19%	12%	18%	23%	11%	13%	9%	10%	16%	10%	12%	11%	13%	8%	
	Acel	Ace	Flu	Phe	Ant	Fla	Pyr	BaA	Chr	Bbf	Bkf	Bap	IcdP	DahA	BghiP
breakthrough 1	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
breakthrough 2	33%	34%	32%	31%	26%	20%	19%	31%	25%	39%	33%	38%	0%	0%	37%
breakthrough 3	16%	17%	15%	19%	16%	23%	23%	12%	26%	6%	17%	16%	0%	0%	21%
breakthrough 4	15%	10%	22%	23%	23%	20%	18%	19%	14%	12%	8%	11%	0%	0%	22%
breakthrough 5	24%	23%	28%	34%	31%	28%	24%	21%	19%	21%	24%	32%	26%	19%	24%
breakthrough 6	20%	21%	20%	19%	23%	14%	22%	22%	22%	23%	19%	28%	21%	18%	20%
breakthrough 7	23%	21%	17%	13%	14%	13%	14%	14%	14%	12%	12%	10%	15%	14%	15%
breakthrough 8	22%	23%	24%	19%	13%	20%	23%	33%	30%	33%	35%	34%	35%	27%	32%
breakthrough 9	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
breakthrough 10	22%	22%	23%	32%	30%	30%	31%	17%	24%	26%	21%	31%	50%	0%	23%
breakthrough 11	6%	7%	10%	13%	12%	11%	8%	26%	25%	17%	18%	28%	19%	32%	13%
average	17%	16%	17%	18%	17%	16%	17%	18%	18%	17%	17%	21%	15%	10%	19%

111 **Text S4. Correction of the dissolved OPs concentrations by dissolved organic**
112 **carbon (DOC)**

113 In order to obtain the concentrations of truly freely dissolved OPs (C_w), results of
114 dissolved concentrations retained by the XAD should be corrected by the estimated
115 influence of sorption by DOC in water as follows (Gonzalez-Gaya et al., 2016):

116
$$C_w = C_{XAD} / [1 + K_{DOC} * C_{DOC}]$$

117 where C_{XAD} (pg L^{-1}) is the OPs concentration derived from XAD samples, K_{DOC} is the
118 DOC-water equilibrium partitioning coefficient ($\text{m}^3 \text{ kg}^{-1}$), and C_{DOC} is the
119 concentration of DOC in water (kg m^{-3}). K_{DOC} can be estimated from octanol-water
120 partition coefficient (K_{OW}) by using correlation of $\log K_{DOC}$ versus $\log K_{OW}$ derived
121 by Burkhard et al. (2000):

122
$$\log K_{DOC} = 0.85 * \log K_{OW} - 0.25$$

123 For the Nam Co Lake, a C_{DOC} of 4.23 mg L^{-1} was adopted from previous literature
124 (Liu et al., 2010).

125 **Text S5. Temperature and salinity-corrected Henry's law constant (H)**

126 (1) By using the equations below, H values (unit: Pa m³ mol⁻¹) were corrected for the
 127 measured water temperature in this study.

Compound	Regression equations	References
α -HCH	$\log H = 10.13 - 3098/T(K)$	(Sahsuvar et al., 2003)
β -HCH	$\log H = 9.96 - 3400/T(K)$	(Sahsuvar et al., 2003)
γ -HCH	$\log H = 10.14 - 3208/T(K)$	(Sahsuvar et al., 2003)
HCB	$\log H = 11.6 - 3013/T(K)$	(Jantunen et al., 2006)
PCB-28	$\log H = 10.11 - 2547.1/T(K)$	(Paasivirta et al., 2009)
Acel	$\log H = 10.47 - 2798/T(K)$	(Ma et al., 2010)
Ace	$\log H = 9.37 - 2443.3/T(K)$	(Ma et al., 2010)
Flu	$\log H = 10.66 - 2887.8/T(K)$	(Ma et al., 2010)
Phe	$\log H = 8.13 - 2230.3/T(K)$	(Ma et al., 2010)
Pyr	$\log H = 8.61 - 2528.7/T(K)$	(Ma et al., 2010)
BaA	$\log H = 8.46 - 2568.7/T(K)$	(Ma et al., 2010)
Chr	$\log H = 17.71 - 5384.2/T(K)$	(Ma et al., 2010)
Bbf	$\log H = 6.76 - 2366.8/T(K)$	(Ma et al., 2010)
Bkf	$\log H = 7.3 - 2541.4/T(K)$	(Ma et al., 2010)
Bap	$\log H = 5.54 - 2051/T(K)$	(Ma et al., 2010)
IcdP	$\log H = 3.85 - 1580.5/T(K)$	(Ma et al., 2010)
DahA	$\log H = 11.23 - 3371/T(K)$	(Ma et al., 2010)
BghiP	$\log H = 3.167 - 1384/T(K)$	(Ma et al., 2010)

128 (2) The aqueous solubility of a nonelectrolyte has been found generally to be
 129 dependent on the concentration and type of salt present in solution. The salt effect on
 130 H is frequently described by the Setschenow equation (Cetin et al., 2006):

$$131 \log(H^*/H) = K_S C_S$$

132 where H^* and H are the Henry's law constant in saline water and deionized water,
 133 respectively; K_S is the Setschenow or the salting-out constant (L mol⁻¹); C_S is the
 134 molar concentration of salt in lake water (mol L⁻¹). K_S was estimated from K_{OW} using
 135 a linear relationship derived by Ni et al. (2003):

$$136 K_S = 0.040 * \log K_{OW} + 0.114$$

137 For Nam Co Lake, the measured salinity ranged between 0.8‰ and 1.2‰, thus a
 138 corresponding C_S of 0.02 mol L⁻¹ was used. Finally, the corrected $H^*/H = 1.01$ or 1.02.

139 **Text S6. Flux calculation of air-water gas exchange**

140 The fluxes of air-water gas exchange (F_{AW} , ng m⁻² day⁻¹) were calculated using the
141 two-film model which has been used in many previous studies (Qiu et al., 2008; Xie
142 et al., 2011):

$$143 \quad F_{AW} = K_{ol}(C_w - C_a RT_a / H)$$

144 where C_w and C_a are the dissolved and gaseous concentrations of the target
145 compounds, which are considered to be the measured air and DOC-corrected water
146 concentrations; R is the gas constant (8.314 Pa m³ mol⁻¹ K⁻¹), T_a (K) is the absolute
147 temperature, and H (Pa m³ mol⁻¹) is the Henry's law constant. K_{ol} (m s⁻¹) is the overall
148 mass transfer coefficient, which contains contributions from the mass transfer
149 coefficients of the water layer and the air layer, namely K_w and K_a . The value of K_{ol} is
150 given by (Khairy et al., 2014):

$$151 \quad \frac{1}{K_{ol}} = \frac{RT}{H} \times \frac{1}{K_a} + \frac{1}{K_w}$$

152 where K_w and K_a are the water-side and air-side mass transfer coefficients,
153 respectively. They are related to the wind speed and compound-specific molecular
154 diffusivity. In the present study, K_w and K_a of target compounds were estimated from
155 those of reference substances as follows.

156 K_a (cm s⁻¹) for water vapour and K_w (cm h⁻¹) for CO₂ can be calculated according to
157 the following relations:

$$158 \quad K_a(\text{H}_2\text{O}) = 0.2 \times U_{10} + 0.3$$

$$159 \quad K_w(\text{CO}_2) = 0.45 \times U_{10}^{1.64}$$

160 where U_{10} (m s⁻¹) is the wind speed above the water surface at 10 m. It was calculated
161 by using the wind speed (U_Z , m s⁻¹) at any given height (Z , m) by following equation
162 (Schwarzenbach et al., 2003):

$$163 \quad U_{10} = U_Z \left(\frac{10.4}{\text{LN}(Z) + 8.1} \right)$$

164 Because rates of transfer is related to the molecular diffusivity, these estimates for K_a
165 (H₂O) and K_w (CO₂) allow prediction of K_a and K_w for other compounds of interest
166 with the following relationships (Schwarzenbach et al., 2003):

$$167 \quad K_a(\text{analyte}) = K_a(\text{H}_2\text{O}) \times \left\{ \frac{D_a(\text{analyte})}{D_a(\text{H}_2\text{O})} \right\}^{0.67}$$

168
$$K_w(\text{analyte})=K_w(\text{CO}_2)\times\left\{\frac{S_c(\text{analyte})}{S_c(\text{CO}_2)}\right\}^{-0.5}.$$

169 where D_a is the molecular diffusivity in air and Sc is the Schmidt number, calculated
170 by dividing the kinematic viscosity of water (V_w , $\text{cm}^2 \text{ s}^{-1}$) at a given temperature by
171 the molecular diffusivity in water (D_w):

$$S_c(\text{analyte})=\frac{V_w}{D_w(\text{analyte})}$$

172 D_a and D_w values were estimated using the compound molecular mass to simplify the
173 relationship (Schwarzenbach et al., 2003). We can derive the unknown diffusivity of
174 target compounds in the present study by using the diffusivity of a reference substance,
175 such as D_a (H_2O) and D_w (CO_2) according to the following equation (Schwarzenbach
176 et al., 2003):

177
$$\frac{D_a(\text{analyte})}{D_a(\text{H}_2\text{O})}\approx\left[\frac{M(\text{analyte})}{M(\text{H}_2\text{O})}\right]^{-0.5}$$

178
$$\frac{D_w(\text{analyte})}{D_w(\text{CO}_2)}\approx\left[\frac{M(\text{analyte})}{M(\text{CO}_2)}\right]^{-0.5}$$

179

180 **Table S6. Equations used for temperature-corrected P_L for each compound**

Compound	Regression equations($\log P_L$)	References
Acel	9.93-2855/T	(Odabasi et al., 2006)
Ace	10.17-2979/T	(Odabasi et al., 2006)
Flu	10.61-3233/T	(Odabasi et al., 2006)
Phe	11.43-3726/T	(Odabasi et al., 2006)
Ant	11.54-3780/T	(Lei et al., 2002)
Fla	12.47-4382/T	(Odabasi et al., 2006)
Pyr	11.7-4164/T	(Lei et al., 2002)
BaA	10.87-4269/T	(Lei et al., 2002)
Chr	13.87-5294/T	(Odabasi et al., 2006)
Bbf	12.48-5148/T	(Odabasi et al., 2006)
Bkf	12.5-5165/T	(Odabasi et al., 2006)
Bap	12.59-5252/T	(Odabasi et al., 2006)
IcdP	13.13-5691/T	(Odabasi et al., 2006)
DahA	13.31-5794/T	(Odabasi et al., 2006)
BghiP	13.15-5737/T	(Odabasi et al., 2006)

181 **Table S7. Snow scavenging ratios for PAHs in the gas phase (W_G) and particulate**
 182 **phases (W_P)^a.**

	Acel	Ace	Flu	Phe	Ant	Fla	Pyr	BaA
$W_P * 10^5$	6.1	510	200	300	260	89	180	110
$W_G * 10^5$	0.0065	0.64	0.45	1.7	1.2	2.8	2.3	27
	Chr	Bbf	Bkf	Bap	IcdP	DahA	BghiP	
$W_P * 10^5$	58	51	51	98	50	81	30	
$W_G * 10^5$	12	NA	NA	NA	NA	NA	NA	

183 NA: not available.

184 a: cited from Franz and Eisenreich (1998)

185 **Table S8. Concentrations of gas phase OPs (pg m⁻³) in the atmosphere of Nam Co**

186 **Part 1. Concentrations of gas phase OCPs and PCBs (pg m⁻³) in air:**

Start Date	End Date	α - HCH	β - HCH	γ - HCH	HCB	<i>o,p'</i> - DDE	<i>p,p'</i> - DDE	<i>o,p'</i> - DDT	<i>p,p'</i> - DDT	PCB- 28	PCB- 52	PCB- 101	PCB- 153	PCB- 138	PCB- 180
2012.09.03	2012.09.15	4.8	BDL	2.5	12.2	0.6	2.1	0.7	0.2	0.4	0.25	0.44	0.17	0.35	0.03
2012.09.16	2012.09.20	3.2	BDL	1.3	15.5	0.5	1.3	2.8	0.8	0.8	0.22	0.37	0.06	0.12	BDL
2012.10.24	2012.10.31	3.4	BDL	0.7	12.2	0.17	0.35	3.4	1.3	0.3	0.05	0.05	0.02	0.02	BDL
2012.11.01	2012.11.15	4.6	BDL	0.6	38.4	0.17	0.35	0.8	0.5	0.3	0.14	0.08	0.03	0.03	BDL
2012.11.16	2012.11.30	2.5	BDL	0.4	36.7	0.17	0.35	0.4	0.17	0.4	0.19	0.08	0.03	0.02	BDL
2012.12.01	2012.12.15	1.4	BDL	0.2	26.7	0.17	0.35	0.17	0.17	0.1	0.05	0.04	0.02	0.02	BDL
2012.12.16	2012.12.31	0.7	BDL	0.3	20.8	0.17	0.35	0.17	0.17	0.4	0.14	0.07	0.03	0.02	BDL
2013.01.03	2013.01.15	1.5	BDL	0.3	37.3	0.17	0.35	0.5	0.4	0.5	0.19	0.11	0.02	0.02	BDL
2013.01.16	2013.01.31	1.3	BDL	0.6	29.8	0.17	0.35	0.5	0.17	0.7	0.21	0.08	0.02	0.02	BDL
2013.02.06	2013.02.16	0.8	BDL	0.2	14.1	0.17	0.35	0.6	0.17	0.1	0.05	0.02	0.02	0.02	BDL
2013.02.21	2013.03.01	3.9	BDL	1.2	25.6	0.4	0.8	2.9	2.4	0.4	0.17	0.08	0.03	0.02	BDL
2013.03.02	2013.03.15	1.2	0.3	0.4	18.1	0.17	0.35	0.4	0.17	0.5	0.16	0.09	0.02	0.02	BDL
2013.03.15	2013.03.31	3.2	0.5	1.0	24.3	0.17	0.35	0.7	0.4	0.5	0.15	0.08	0.02	0.02	BDL
2013.04.01	2013.04.15	3.6	0.5	1.0	17.0	0.17	0.35	1.0	0.6	0.6	0.17	0.08	0.02	0.03	BDL
2013.04.15	2013.04.30	6.5	0.9	2.2	19.4	0.5	0.35	6.6	2.1	0.9	0.33	0.19	0.06	0.05	BDL
2013.05.01	2013.05.15	9.0	0.6	1.9	25.7	0.3	0.35	4.8	2.4	0.9	0.29	0.15	0.04	0.05	BDL
2013.05.15	2013.06.04	7.7	1.4	4.2	15.5	0.4	0.8	6.1	2.2	1.4	0.56	0.23	0.05	0.05	BDL
2013.06.06	2013.06.15	3.8	0.8	1.6	12.1	0.17	0.35	2.2	0.7	0.7	0.29	0.16	0.02	0.04	BDL
2013.06.15	2013.06.30	8.1	1.3	4.8	11.9	0.7	1.2	12.0	3.9	1.5	0.56	0.29	0.08	0.09	BDL
2013.07.01	2013.07.19	6.9	0.6	2.3	12.8	0.4	0.6	7.9	1.9	0.8	0.30	0.19	0.08	0.07	BDL
2013.07.19	2013.08.03	6.7	0.9	1.7	15.1	1.4	1.4	6.0	2.0	1.4	0.44	0.39	0.06	0.09	0.03
2013.08.04	2013.08.15	3.7	0.7	0.9	15.9	0.17	0.35	1.0	0.6	1.4	0.44	0.39	0.04	0.05	0.13
2013.08.15	2013.08.31	5.3	0.4	1.2	14.6	0.5	0.9	14.1	4.9	0.6	0.23	0.28	0.08	0.06	BDL

Start Date	End Date	α - HCH	β - HCH	γ - HCH	HCB	<i>o,p'</i> - DDE	<i>p,p'</i> - DDE	<i>o,p'</i> - DDT	<i>p,p'</i> - DDT	PCB- 28	PCB- 52	PCB- 101	PCB- 153	PCB- 138	PCB- 180
2013.09.01	2013.09.15	5.4	BDL	0.06	11.7	3.1	3.4	1.6	0.17	2.7	0.05	0.13	0.07	0.09	BDL
2013.10.01	2013.10.15	4.6	BDL	2.8	11.4	2.2	3.8	4.4	1.1	0.8	0.44	0.28	0.54	0.14	BDL
2013.10.15	2013.10.30	3.5	BDL	5.4	17.5	0.6	1.0	3.2	0.9	0.3	0.38	0.24	0.33	0.11	BDL
2013.11.01	2013.11.15	2.2	BDL	1.0	40.5	0.5	1.3	1.0	1.0	0.7	0.96	0.31	0.24	0.12	BDL
2013.11.15	2013.11.30	1.9	BDL	0.4	24.5	0.17	0.9	0.17	0.2	0.6	0.66	0.30	0.14	0.07	BDL
2013.12.01	2013.12.15	1.2	BDL	3.3	23.4	4.1	2.7	1.5	0.17	1.0	0.05	0.28	0.08	0.07	BDL
2013.12.16	2013.12.30	2.6	BDL	7.2	27.6	1.9	5.3	1.5	0.9	1.8	1.08	1.06	0.33	0.18	BDL
2014.01.05	2014.01.31	1.3	BDL	2.7	16.4	2.3	1.9	1.2	0.2	0.9	0.05	0.32	0.11	0.06	BDL
2014.02.01	2014.02.15	0.7	BDL	0.7	12.4	0.17	0.35	0.17	0.17	0.5	0.62	0.40	0.15	0.07	BDL
2014.02.15	2014.02.28	2.7	0.5	4.9	33.0	0.6	1.4	0.6	0.17	1.9	0.59	0.71	0.18	0.08	BDL
2014.03.01	2014.03.15	1.7	BDL	1.4	20.4	0.4	1.0	1.6	0.4	0.5	0.81	0.51	0.18	0.07	BDL
2014.03.15	2014.03.31	2.3	BDL	3.7	18.3	0.5	0.9	0.7	0.17	0.8	0.05	0.45	0.14	0.07	BDL
2014.04.01	2014.04.15	4.5	BDL	0.06	16.1	1.4	3.1	3.2	0.4	1.9	0.05	0.48	0.05	0.09	BDL
2014.04.15	2014.04.30	2.9	BDL	1.6	18.6	0.6	0.8	1.6	1.0	0.7	1.02	0.57	0.36	0.15	BDL
2014.05.01	2014.05.15	4.2	0.4	2.2	15.8	0.6	1.3	1.8	1.1	0.7	0.96	0.54	0.26	0.12	BDL
2014.05.15	2014.05.28	2.3	0.5	4.3	14.8	1.5	2.9	4.4	1.7	0.7	0.93	0.75	0.49	0.22	0.05
2014.06.02	2014.06.15	7.1	1.4	3.1	26.8	3.6	6.9	6.3	1.8	2.0	1.30	0.97	0.86	0.39	0.08
2014.06.22	2014.06.30	4.7	0.5	2.1	15.1	0.7	2.1	8.0	2.4	0.8	0.68	0.43	0.26	0.10	BDL
2014.07.01	2014.07.15	6.5	BDL	5.3	12.6	2.4	4.9	4.5	0.17	3.7	5.47	0.74	0.09	0.03	0.05
2014.07.15	2014.07.31	7.4	1.0	3.0	24.3	1.3	2.2	6.6	1.7	1.9	1.40	0.80	0.38	0.97	BDL
2014.08.01	2014.08.15	8.4	1.5	6.7	21.7	13.9	12.8	17.9	1.8	6.9	4.15	1.75	0.41	0.45	0.05
2014.08.15	2014.08.31	7.5	1.4	1.7	25.6	1.7	4.8	6.4	2.8	2.9	1.59	1.22	0.29	0.46	0.06
2014.09.02	2014.09.15	4.0	0.6	1.8	12.0	2.3	6.1	9.8	3.7	3.1	0.71	0.84	0.33	0.27	0.03
2014.09.15	2014.09.30	4.1	BDL	2.3	17.3	1.5	4.1	6.0	3.5	3.1	0.47	0.48	0.15	0.16	BDL

Entries in bold and italics are substituted values at 1/2 MDL.

188

Part 2. Concentrations of gas phase PAHs (pg m⁻³) in air:

189

Start Date	End Date	Acel	Ace	Flu	Phe	Ant	Fla	Pyr	BaA	Chr	Bbf	Bkf	Bap	IcdP	DahA	BghiP
2012.09.16	2012.09.20	52	123	607	1170	121	256	204	13	68	4	9	6	BDL	BDL	7
2012.10.01	2012.10.15	19	31	540	2037	347	383	223	3	18	1	1	1	BDL	BDL	1
2012.10.24	2012.10.31	8	21	115	264	24	51	30	2	6	1	1	1	BDL	BDL	1
2012.11.01	2012.11.15	4	6	85	267	20	65	40	3	8	1	3	2	BDL	BDL	2
2012.11.16	2012.11.30	5	7	80	291	21	52	31	2	5	0.3	1	1	BDL	BDL	1
2012.12.01	2012.12.15	4	6	85	252	19	53	33	3	7	0.3	1	1	BDL	BDL	1
2012.12.16	2012.12.31	14	55	273	701	118	274	167	9	12	2	2	1	BDL	BDL	2
2013.01.03	2013.01.15	11	37	189	328	32	59	38	4	10	2	4	2	BDL	BDL	4
2013.01.16	2013.01.31	27	62	544	1120	85	147	87	3	10	0.5	2	1	BDL	BDL	2
2013.02.06	2013.02.16	5	9	109	320	33	94	54	2	6	0.2	0.3	0.3	BDL	BDL	0.17
2013.02.21	2013.03.01	8	13	171	684	138	314	192	9	13	0.3	1	1	BDL	BDL	1
2013.03.02	2013.03.15	11	31	199	636	66	194	126	2	8	0.1	0.3	0.5	BDL	BDL	1
2013.03.15	2013.03.31	7	11	161	726	124	308	192	7	12	1	1	1	BDL	BDL	1
2013.04.01	2013.04.15	5	7	102	470	34	107	54	2	8	1	2	1	BDL	BDL	2
2013.04.15	2013.04.30	4	4	137	1048	195	453	274	10	16	0.4	1	1	BDL	BDL	1
2013.05.01	2013.05.15	4	5	102	540	69	148	120	32	53	9	22	31	1	1	28
2013.05.15	2013.06.04	4	5	98	817	97	269	157	8	17	1	3	3	BDL	BDL	3
2013.06.06	2013.06.15	3	4	96	694	181	415	262	14	18	1	1	1	BDL	BDL	1
2013.06.15	2013.06.30	4	5	147	1316	301	577	356	13	23	0.4	1	1	BDL	BDL	1
2013.07.01	2013.07.19	5	8	145	1016	225	530	350	14	24	2	1	1	BDL	BDL	2
2013.07.19	2013.08.03	19	44	286	817	100	178	150	13	27	2	6	7	BDL	BDL	5
2013.08.04	2013.08.15	44	87	675	1124	106	205	206	11	33	4	4	5	BDL	BDL	5
2013.08.15	2013.08.31	8	14	162	565	90	124	80	2	11	0.3	1	0.3	BDL	BDL	1
2013.09.01	2013.09.15	170	226	2068	3844	382	176	813	6	34	2	5	4	3	BDL	7
2013.10.01	2013.10.15	10	20	206	829	90	162	145	2	11	2	1	1	1	0.4	1

Start Date	End Date	Acel	Ace	Flu	Phe	Ant	Fla	Pyr	BaA	Chr	Bbf	Bkf	Bap	IcdP	DahA	BghiP
2013.10.15	2013.10.30	3	6	142	453	33	106	60	7	14	9	7	5	4	1	3
2013.11.01	2013.11.15	14	22	265	550	31	75	40	2	8	2	1	0.4	1	BDL	1
2013.11.15	2013.11.30	15	25	236	613	39	115	63	3	8	2	2	0.4	1	BDL	1
2013.12.01	2013.12.15	37	71	491	659	67	58	80	4	8	3	2	1	2	0.4	2
2013.12.16	2013.12.30	53	92	709	1429	112	176	132	10	21	8	6	5	6	1	6
2014.01.05	2014.01.31	34	58	422	758	79	70	78	3	8	2	1	2	1	BDL	2
2014.02.01	2014.02.15	4	6	137	518	24	84	42	2	8	2	1	1	1	BDL	1
2014.02.15	2014.02.28	43	67	547	969	55	70	72	3	9	3	2	1	1	0.3	2
2014.03.01	2014.03.15	4	9	153	590	44	173	86	4	11	3	3	1	1	0.3	2
2014.03.15	2014.03.31	8	18	146	389	23	72	54	1	4	1	1	0.4	0.5	BDL	1
2014.04.01	2014.04.15	56	80	750	1454	119	148	182	9	20	5	5	5	6	1	7
2014.04.15	2014.04.30	10	18	165	436	93	112	68	4	9	3	2	1	1	0.3	2
2014.05.01	2014.05.15	8	16	124	449	40	111	65	3	10	3	3	1	1	0.4	2
2014.05.15	2014.05.28	5	8	100	540	62	178	111	13	28	18	13	9	7	1	7
2014.06.02	2014.06.15	11	15	236	989	107	154	119	19	32	27	13	19	9	2	9
2014.06.22	2014.06.30	15	19	586	1370	173	190	110	3	11	0.4	2	1	BDL	BDL	1
2014.07.01	2014.07.15	118	159	1632	4270	381	104	338	4	68	0.5	2	2	0.5	BDL	3
2014.07.15	2014.07.31	36	45	716	1687	199	176	111	2	11	0.3	1	1	0.3	BDL	2
2014.08.01	2014.08.15	198	311	2580	7057	1310	760	946	22	79	14	8	13	7	2	11
2014.08.15	2014.08.31	16	28	743	4716	1137	1621	1242	269	698	29	0.08	0.08	8	9	0.17

190 *Entries in bold and italics are substituted values at 1/2 MDL.*

191 **Table S9. Concentrations of OPs (pg m⁻³) in the total suspended particulates (TSP) of Nam Co**

192 **Part 1. Concentrations of particulate phase OCPs and PCBs (pg m⁻³) in air:**

Start Date	End Date	α - HCH	β - HCH	γ - HCH	HCB	o,p'- DDE	p,p'- DDE	o,p'- DDT	p,p'- DDT	PCB- 28	PCB- 52	PCB- 101	PCB- 153	PCB- 138	PCB- 180
2012.09.03	2012.09.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	BDL	BDL	BDL
2012.09.16	2012.09.20	BDL	BDL	0.20	3.14	BDL	BDL	BDL	BDL	0.06	BDL	0.13	BDL	BDL	BDL
2012.10.01	2012.10.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	BDL
2012.10.24	2012.10.31	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	BDL	BDL	BDL
2012.11.01	2012.11.15	BDL	BDL	0.10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	BDL
2012.11.16	2012.11.30	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	BDL	BDL	BDL
2012.12.16	2012.12.31	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05	BDL	0.05	BDL	BDL	BDL
2013.01.03	2013.01.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.06	BDL	0.06	BDL	BDL	BDL
2013.01.16	2013.01.31	BDL	BDL	BDL	BDL	BDL	BDL	0.38	0.33	0.09	BDL	0.04	BDL	BDL	BDL
2013.02.06	2013.02.16	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	BDL
2013.02.21	2013.03.01	BDL	BDL	0.16	BDL	BDL	BDL	BDL	0.55	BDL	BDL	0.04	BDL	BDL	BDL
2013.03.02	2013.03.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	0.04	BDL	BDL	BDL
2013.03.15	2013.03.31	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	BDL	BDL	BDL
2013.04.01	2013.04.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	BDL
2013.05.01	2013.05.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	BDL	BDL	BDL
2013.05.15	2013.06.04	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	BDL	BDL	BDL
2013.06.06	2013.06.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	BDL
2013.06.15	2013.06.30	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.04	BDL	0.02	BDL	BDL	BDL
2013.07.01	2013.07.19	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.04	BDL	BDL	BDL
2013.07.19	2013.08.03	0.40	BDL	0.14	3.71	BDL	BDL	0.43	BDL	BDL	BDL	0.04	BDL	0.08	0.03
2013.09.01	2013.09.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.60	BDL	BDL	0.04	0.05	BDL	BDL
2013.10.01	2013.10.15	BDL	BDL	BDL	BDL	BDL	1.01	1.58	2.38	BDL	BDL	0.04	0.04	0.04	BDL
2013.10.15	2013.10.30	BDL	BDL	0.34	BDL	BDL	BDL	0.47	BDL	BDL	BDL	0.03	BDL	BDL	BDL

Start Date	End Date	α -HCH	β -HCH	γ -HCH	HCB	o,p'-DDE	p,p'-DDE	o,p'-DDT	p,p'-DDT	PCB-28	PCB-52	PCB-101	PCB-153	PCB-138	PCB-180
2013.11.01	2013.11.15	BDL	BDL	BDL	BDL	BDL	BDL	0.39	0.43	BDL	BDL	0.05	0.03	0.03	BDL
2013.11.15	2013.11.30	BDL	BDL	BDL	BDL	BDL	BDL	0.43	BDL	0.03	BDL	0.08	0.09	0.04	BDL
2013.12.01	2013.12.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.09	0.11	0.04	BDL
2013.12.16	2013.12.30	BDL	BDL	BDL	BDL	BDL	0.70	BDL	BDL	BDL	BDL	0.14	0.16	0.08	0.04
2014.01.05	2014.01.31	BDL	BDL	BDL	BDL	BDL	BDL	0.36	0.58	BDL	BDL	0.04	BDL	BDL	BDL
2014.02.01	2014.02.15	BDL	BDL	0.16	BDL	BDL	1.31	0.93	0.51	0.08	BDL	0.12	0.07	0.05	BDL
2014.02.15	2014.02.28	BDL	BDL	BDL	BDL	BDL	BDL	0.85	0.66	0.03	BDL	0.07	0.09	0.04	BDL
2014.03.01	2014.03.15	BDL	BDL	BDL	BDL	BDL	BDL	0.91	1.01	0.03	BDL	0.07	0.17	0.06	BDL
2014.03.15	2014.03.31	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.04	0.05	BDL	BDL
2014.04.01	2014.04.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.04	0.04	BDL	BDL
2014.04.15	2014.04.30	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	BDL
2014.05.01	2014.05.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	BDL	BDL	BDL
2014.05.15	2014.05.28	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	BDL
2014.06.02	2014.06.15	BDL	0.47	0.42	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05	0.06	BDL	BDL
2014.06.22	2014.06.30	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	BDL
2014.07.01	2014.07.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	BDL
2014.07.15	2014.07.31	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	BDL	BDL	BDL
2014.08.01	2014.08.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	BDL	BDL	BDL
2014.08.15	2014.08.31	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	BDL
2014.09.02	2014.09.15	BDL	BDL	0.10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	BDL	BDL	BDL

Entries in bold and italics are substituted values at 1/2 MDL.

Part 2. Concentrations of particulate phase PAHs ($\mu\text{g m}^{-3}$) in air:

Start Date	End Date	Acel	Ace	Flu	Phe	Ant	Fla	Pyr	BaA	Chr	Bbf	Bkf	Bap	IcdP	DahA	BghiP
2012.09.03	2012.09.15	1	1	51	519	33	360	239	11	19	2	4	3	BDL	BDL	8
2012.09.16	2012.09.20	4	6	148	1392	216	966	606	34	45	3	5	3	BDL	BDL	7
2012.10.01	2012.10.15	2	2	58	525	75	428	287	20	38	4	16	17	BDL	BDL	29
2012.10.24	2012.10.31	2	2	58	571	70	463	307	23	49	5	19	20	BDL	BDL	30
2012.11.01	2012.11.15	2	3	58	552	76	411	285	21	44	1	21	21	BDL	BDL	28
2012.11.16	2012.11.30	BDL	1	16	74	4	56	43	8	20	0.17	9	10	BDL	BDL	13
2012.12.16	2012.12.31	2	2	26	123	8	82	61	11	25	2	11	12	BDL	BDL	15
2013.01.03	2013.01.15	4	6	74	306	15	198	159	27	58	3	30	27	1	BDL	39
2013.01.16	2013.01.31	2	3	33	156	7	95	69	11	25	1	11	12	BDL	BDL	16
2013.02.06	2013.02.16	BDL	2	18	95	7	110	101	28	61	11	34	36	3	1	37
2013.02.21	2013.03.01	BDL	1	17	105	7	86	75	18	40	3	19	22	BDL	BDL	30
2013.03.02	2013.03.15	BDL	2	60	676	90	618	464	70	146	6	59	74	BDL	1	87
2013.03.15	2013.03.31	BDL	2	31	173	12	124	106	23	59	3	28	33	BDL	BDL	45
2013.04.01	2013.04.15	BDL	1	19	106	11	71	58	13	28	21	21	18	18	2	24
2013.05.01	2013.05.15	BDL	1	21	117	10	61	49	10	25	21	16	17	17	1	27
2013.05.15	2013.06.04	BDL	1	21	116	8	67	52	10	25	19	17	12	16	2	22
2013.06.06	2013.06.15	BDL	1	18	103	10	57	46	9	22	17	15	10	12	1	18
2013.06.15	2013.06.30	BDL	2	27	148	10	69	50	8	17	2	8	10	BDL	BDL	15
2013.07.01	2013.07.19	BDL	1	24	125	6	48	33	4	11	2	4	3	0.5	BDL	6
2013.07.19	2013.08.03	BDL	1	39	379	61	179	125	11	46	2	8	8	BDL	BDL	14
2013.09.01	2013.09.15	BDL	2	25	116	7	74	51	9	25	23	10	8	12	2	15
2013.10.01	2013.10.15	BDL	0.57	19	106	5	105	82	16	62	58	26	23	34	4	38
2013.10.15	2013.10.30	BDL	2	26	123	5	74	54	8	20	17	17	14	16	1	17
2013.11.01	2013.11.15	BDL	2	20	104	5	87	64	12	28	8	14	16	1	1	20
2013.11.15	2013.11.30	BDL	1	20	139	4	197	116	15	41	0.17	17	20	BDL	BDL	23

Start Date	End Date	Acel	Ace	Flu	Phe	Ant	Fla	Pyr	BaA	Chr	Bbf	Bkf	Bap	IcdP	DahA	BghiP
2013.12.01	2013.12.15	BDL	1	18	115	5	104	68	9	22	2	9	11	BDL	BDL	11
2013.12.16	2013.12.30	2	2	32	117	6	80	54	8	25	0	8	10	BDL	BDL	10
2014.01.05	2014.01.31	BDL	0.57	15	96	5	100	75	13	31	0	15	18	BDL	BDL	20
2014.02.01	2014.02.15	BDL	1	24	180	9	186	93	12	27	0.17	11	13	BDL	BDL	12
2014.02.15	2014.02.28	3	3	49	184	7	151	105	21	48	0.17	24	26	BDL	BDL	30
2014.03.01	2014.03.15	BDL	1	20	95	4	94	76	18	45	8	22	29	1	1	30
2014.03.15	2014.03.31	BDL	1	28	125	6	95	77	16	41	29	21	24	24	2	28
2014.04.01	2014.04.15	BDL	0.57	9	43	2	20	14	2	5	3	2	2	2	BDL	3
2014.04.15	2014.04.30	BDL	0.57	9	46	5	37	32	8	20	16	12	11	12	1	12
2014.05.01	2014.05.15	BDL	0.57	5	28	2	21	17	4	12	11	8	8	7	0.4	9
2014.05.15	2014.05.28	BDL	0.57	9	55	2	26	18	2	8	5	3	3	2	BDL	3
2014.06.02	2014.06.15	BDL	2	13	54	2	24	17	2	7	4	2	2	1	BDL	3
2014.06.22	2014.06.30	BDL	0.57	10	53	2	22	15	2	5	3	2	2	1	BDL	2
2014.07.01	2014.07.15	BDL	0.57	13	65	8	33	22	3	10	4	3	2	1	BDL	3
2014.07.15	2014.07.31	BDL	0.57	15	75	7	34	23	4	15	8	6	2	3	BDL	5
2014.08.01	2014.08.15	BDL	0.57	24	110	7	48	29	3	7	4	2	0.4	1	BDL	2
2014.08.15	2014.08.31	BDL	0.57	9	49	2	20	12	1	3	1	1	0.08	0.2	BDL	1
2014.09.02	2014.09.15	BDL	0.57	13	60	9	23	18	2	5	3	3	2	0.3	BDL	3

195 *Entries in bold and italics are substituted values at 1/2 MDL.*

196 **Table S10. Concentrations of dissolved phase OPs ($\mu\text{g L}^{-1}$) in the lake water of Nam Co (after corrected by DOC)**

197 **Part 1. Concentrations of dissolved phase OCPs and PCBs ($\mu\text{g L}^{-1}$) in the water from different sites of the lake (S1-S15):**

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15
α-HCH	5.0	11.8		8.0	9.5	7.5	8.7	9.3	9.3	9.8	6.3	14.7	11.5	8.6	18.4
β-HCH	79.9	104.2		100.3	105.5	116.9	77.9	76.2	70.3	71.7	44.0	100.2	82.7	85.2	77.2
γ-HCH	5.4	7.5		5.8	10.2	8.2	6.7	7.3	3.7	4.4	2.7	9.0	7.5	8.0	11.6
HCB	2.9	4.3		4.7	3.7	5.1	5.3	15.1	6.6	3.3	4.3	5.8	18.0	7.2	19.6
<i>o,p'</i>-DDE	BDL	BDL		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
<i>p,p'</i>-DDE	BDL	BDL		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.9	BDL	BDL	1.2
<i>o,p'</i>-DDT	BDL	BDL		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
<i>p,p'</i>-DDT	BDL	BDL		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PCB-28	2.1	1.8		1.6	1.6	1.6	0.9	1.2	1.8	0.9	1.0	1.8	1.0	2.9	4.3
PCB-52	0.3	0.2		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.2	BDL	1.6	1.0
PCB-101	BDL	BDL		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.3
PCB-153	BDL	BDL		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PCB-138	BDL	BDL		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	0.2
PCB-180	BDL	BDL		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

198 **Part 2. Concentrations of dissolved phase PAHs ($\mu\text{g L}^{-1}$) in the water from different sites of the lake (S1-S15):**

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15
Acel	338	685		685	291	543	571	309	1326	411	283		539	1076	990
Ace	274	244		282	167	183	150	102	236	155	103		195	468	815
Flu	1549	1833		1726	1742	1638	1376	2148	2801	1646	1619		3275	4219	4118
Phe	2515	4311		5065	5497	7423	5732	13822	73236	5791	7499		15907	9883	17748
Ant	BDL	1130		1178	1301	1500	1176	5159	1829	1045	1978		6781	3035	7778
Fla	934	1865		2118	1984	3314	2883	10946	2179	3085	4397		12413	5525	14099
Pyr	751	1266		1390	1311	1553	1293	7633	1589	2445	3585		8871	3738	10669
BaA	48	55		105	87	94	70	380	98	199	302		337	134	401
Chr	484	265		358	291	521	446	514	255	518	595		463	469	2078
Bbf	BDL	BDL		BDL	6	5	BDL	17	BDL	BDL	16		3	2	BDL
Bkf	15	14		52	32	42	36	89	41	88	97		18	15	62
Bap	3	7		27	19	17	9	84	34	22	78		11	8	38
IcdP	BDL	BDL		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL		BDL	BDL	BDL
DahA	BDL	BDL		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL		BDL	BDL	BDL
BghiP	7	7		19	12	15	7	51	16	24	40		11	4	19
$\Sigma_{15}\text{PAHs } (\mu\text{g L}^{-1})$	6918	11680		13005	12739	16848	13747	41255	83641	15429	20592		48825	28575	58817
$\Sigma_{15}\text{PAHs } (\text{ng L}^{-1})$	7	12		13	13	17	14	41	84	15	21		49	29	59

199 **Part 3. Concentrations of dissolved phase OCPs and PCBs (pg L⁻¹) in different months from May to September:**

	α- HCH	β- HCH	γ- HCH	HCB	<i>o,p'</i>- DDE	<i>p,p'</i>- DDE	<i>o,p'</i>- DDT	<i>p,p'</i>- DDT	PCB- 28	PCB- 52	PCB- 101	PCB- 153	PCB- 138	PCB- 180
May-1	6.0	44.7	4.1	5.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
May-2	4.4	35.2	2.6	<i>0.7</i>	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
May-3	4.0	32.3	2.4	1.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
June-1	12.5	83.0	8.5	4.4	BDL	BDL	BDL	BDL	0.2	BDL	BDL	BDL	BDL	BDL
June-2	5.8	62.0	4.1	<i>0.7</i>	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
June-3	7.0	58.0	3.8	2.8	BDL	BDL	0.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL
July-1	0.7	60.0	4.6	1.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
July-2	11.3	66.9	5.5	1.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
July-3	9.7	66.0	4.8	2.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Aug-1	7.2	45.4	4.0	1.7	BDL	BDL	BDL	BDL	0.3	BDL	BDL	BDL	BDL	BDL
Aug-2	7.2	66.8	4.6	<i>0.7</i>	BDL	BDL	BDL	BDL	0.2	BDL	BDL	BDL	BDL	BDL
Aug-3	9.8	83.2	4.3	1.8	BDL	BDL	BDL	BDL	0.4	BDL	BDL	BDL	BDL	BDL
Sep-1	10.6	108.9	7.2	<i>0.7</i>	BDL	0.6	BDL	0.4	1.7	BDL	BDL	BDL	BDL	BDL
Sep-2	9.2	93.0	5.1	<i>0.7</i>	BDL	BDL	BDL	BDL	0.9	BDL	BDL	BDL	BDL	BDL
Sep-3	3.5	32.3	1.8	<i>0.7</i>	BDL	BDL	BDL	BDL	0.2	BDL	BDL	BDL	BDL	BDL

200 *Entries in bold and italics are substituted values at 1/2 MDL.*

201 **Part 4. Concentrations of dissolved phase PAHs (pg L⁻¹) in different months from May to September:**

	Acel	Ace	Flu	Phe	Ant	Fla	Pyr	BaA	Chr	Bbf	Bkf	Bap	IcdP	DahA	BghiP	Σ ₁₅ PAHs (pg L ⁻¹)	Σ ₁₅ PAHs (ng L ⁻¹)
May-1	64	116	1510	2755	BDL	BDL	264	BDL	BDL	BDL	3	1	BDL	BDL	1	4715	4.7
May-2	35	74	771	1677	BDL	BDL	226	BDL	BDL	4	3	1	BDL	BDL	1	2793	2.8
May-3	87	105	697	1608	BDL	BDL	172	BDL	BDL	2	2	1	BDL	BDL	1	2674	2.7
June-1	309	220	1913	3358	BDL	BDL	352	BDL	26	BDL	4	2	BDL	BDL	2	6187	6.2
June-2	36	76	560	1153	BDL	BDL	74	BDL	BDL	BDL	1	1	BDL	BDL	1	1901	1.9
June-3	186	131	885	1501	BDL	BDL	74	BDL	BDL	BDL	1	1	BDL	BDL	1	2779	2.8
July-1	138	106	844	1034	BDL	BDL	74	BDL	BDL	1	0	1	BDL	BDL	1	2198	2.2
July-2	314	196	1744	2211	BDL	BDL	150	BDL	BDL	BDL	1	1	BDL	BDL	1	4617	4.6
July-3	214	120	1562	2142	BDL	BDL	167	BDL	BDL	2	1	1	BDL	BDL	1	4211	4.2
Aug-1	281	131	900	1281	BDL	BDL	74	BDL	BDL	2	1	1	BDL	BDL	1	2673	2.7
Aug-2	316	140	1233	1578	BDL	BDL	74	BDL	BDL	3	3	1	BDL	BDL	1	3349	3.3
Aug-3	463	193	1226	1645	BDL	BDL	74	BDL	BDL	3	2	1	BDL	BDL	1	3608	3.6
Sep-1																	
Sep-2	448	188	1529	2120	1430	BDL	226	BDL	26	BDL	0	2	BDL	BDL	2	5972	6.0
Sep-3	315	166	1220	1779	BDL	BDL	74	BDL	BDL	2	1	2	BDL	BDL	0	3560	3.6

202 *Entries in bold and italics are substituted values at 1/2 MDL.*

203 **Table S11. Concentrations of particulate phase OPs (pg L⁻¹) in the SPM of the water samples from Nam Co Lake**

204 **Part 1. Concentrations of particulate phase OCPs and PCBs (pg L⁻¹) in the lake water:**

	α -HCH	β -HCH	γ -HCH	HCB	<i>o,p'</i> -DDE	<i>p,p'</i> -DDE	<i>o,p'</i> -DDT	<i>p,p'</i> -DDT	PCB-28	PCB-52	PCB-101	PCB-153	PCB-138	PCB-180	PCBs
S1	BDL	BDL	0.5	BDL	BDL	2.3	BDL	BDL	1.3	0.7	0.8	0.3	0.7	0.1	3.9
S2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.3	BDL	0.4	BDL	0.5	BDL	1.3
S3	BDL	1.1	BDL	BDL	BDL	BDL	BDL	BDL	0.5	BDL	0.2	BDL	BDL	BDL	0.7
S4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.2	BDL	0.3	BDL	0.1	BDL	0.6
S5	BDL	BDL	0.5	BDL	BDL	BDL	BDL	BDL	0.8	0.3	0.2	BDL	BDL	BDL	1.3
S6	BDL	BDL	0.7	BDL	BDL	BDL	BDL	BDL	0.6	BDL	0.3	BDL	0.2	BDL	1.1
S7	BDL	BDL	0.5	BDL	BDL	BDL	BDL	BDL	0.5	BDL	0.3	BDL	0.1	BDL	0.9
S8	BDL	BDL	0.4	BDL	BDL	BDL	BDL	BDL	0.5	0.2	0.3	BDL	0.2	BDL	1.3
S9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.4	BDL	0.2	BDL	BDL	BDL	0.6
S10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.2	0.3	0.4	BDL	0.2	BDL	1.1
S11	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.8	0.2	BDL	0.2	BDL	BDL	BDL	0.4
S12	BDL	BDL	0.6	BDL	BDL	BDL	BDL	BDL	0.4	0.3	0.5	0.1	0.4	BDL	1.7
S13	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.3	BDL	0.3	BDL	BDL	BDL	0.5
S14	BDL	2.2	3.3	BDL	BDL	BDL	BDL	BDL	7.3	BDL	1.6	BDL	0.8	BDL	9.8
S15	BDL	BDL	1.0	BDL	BDL	BDL	BDL	BDL	0.7	0.5	0.7	0.2	0.7	0.1	3.0

Part 2. Concentrations of particulate phase PAHs ($\mu\text{g L}^{-1}$) in the lake water:

	Acel	Ace	Flu	Phe	Ant	Fla	Pyr	BaA	Chr	Bbf	Bkf	Bap	IcdP	DahA	BghiP	$\Sigma_{15}\text{PAHs}$ ($\mu\text{g L}^{-1}$)	$\Sigma_{15}\text{PAHs}$ (ng L^{-1})
S1	12	29	145	641	136	927	777	240	980	114	185	232	8	20	297	4742.7	4.7
S2	11	27	161	727	107	549	442	107	248	BDL	102	81	BDL	BDL	140	2700.2	2.7
S3	9	19	128	639	107	338	229	38	141	BDL	31	25	BDL	BDL	28	1732.6	1.7
S4	13	37	169	870	170	1240	1052	406	768	BDL	277	380	6	BDL	336	5723.1	5.7
S5	46	135	387	9800	151	613	488	64	162	38	40	57	BDL	BDL	50	12030.6	12.0
S6	16	42	352	1607	329	920	717	187	521	32	165	184	BDL	BDL	241	5312.4	5.3
S7																	
S8	9	11	135	787	232	2185	2005	830	1380	BDL	605	827	19	BDL	910	9935.9	9.9
S9	11	17	111	597	121	796	665	281	561	BDL	266	363	8	BDL	396	4192.7	4.2
S10	9	15	252	1696	699	5404	4308	2835	4159	BDL	2050	3242	31	47	3437	28184.3	28.2
S11	6	11	188	1155	301	2163	1818	1025	1652	BDL	620	1052	BDL	9	1105	11104.4	11.1
S12	5	8	139	972	148	563	441	54	269	BDL	58	65	BDL	BDL	74	2794.8	2.8
S13	6	13	122	668	121	379	237	43	103	5	25	35	2	BDL	29	1788.2	1.8
S14	28	56	266	1517	316	1296	1299	149	1432	BDL	217	331	BDL	BDL	328	7235.7	7.2
S15	9	23	216	1313	204	753	628	49	599	88	23	92	BDL	BDL	120	4117.8	4.1

206 **Table S12. Comparisons of OCPs and PCBs in the air of this study and data reported for other remote areas (pg m⁻³)**

Location	Nam Co Lake, TP	Nam Co, TP	Lhasa, TP	Lulang, southeast TP	Mt. Everest	Rocky Mountains	Central Pyrenees	Antarctic	Alert, Arctic
Sampling Year	2012-2014	2006-2008	2006-2007	2008-2011	2002	2000	2001-2003	2007-2010	2000-2003
Sampler	AAS	FTS	AAS	AAS	AAS	AAS	AAS	AAS	AAS
α-HCH	4 (0.7-9)	48.7 (4.0-144)	2.3 (BDL-9.2)	12.1 (0.61-51)	19.2	21	8	0.2	22 (1.4-66)
β-HCH	0.8 (BDL-1.5)				7.7				0.1 (0.018-1.0)
γ-HCH	2.1 (0.1-7.2)	7.9 (0.9-19.9)	10.3 (3.7-20.9)	(BDL-7.07)		2.3	22		5.6 (0.43-19)
HCB	20 (11.4-40.5)	17.1 (7.3-31.7)		7.87 (0.05-27.1)	8.9	42	49	22.9	64 (20-130)
o,p'-DDE	1.2 (0.2-13.9)	0.6 (BDL-0.99)		(BDL-7.3)				0.03	0.089 (0.013-0.36)
p,p'-DDE	1.9 (0.3-12.8)	0.6 (BDL-1.0)	2.9 (BDL-12.1)	6.4 (0.08-23.8)	5.1		33		0.41 (0.051-3.6)
o,p'-DDT	3.6 (0.2-17.9)	8.2 (0.3-19.7)	5.8 (BDL-34.3)	(BDL-60.5)	5.1				0.14 (0.016-0.56)
p,p'-DDT	1.2 (0.2-4.9)	3.9 (0.3-12.67)	3.2 (BDL-9.7)	(BDL-33.6)	3.7		BDL		0.09 (0.015-1.1)
∑PCBs	2.5 (0.2-13.7)	1.4 (0.1-2.6)	10.6 (3.4-45.4)	(BDL-16.7)			34	0.5	
Reference	This study	(Xiao et al., 2010)	(Gong et al., 2010)	(Sheng et al., 2013)	(Li et al., 2006)	(Wilkinson et al., 2005)	(Van Drooge et al., 2004)	(Kallenborn et al., 2013)	(Su et al., 2006 and 2008)

207 AAS: active air sampler; FTS: flow-through sampler.

208

Table S13. Comparisons of PAHs concentrations from this study and data reported for other remote areas (ng m⁻³)

209

Location	Sampling Year	Sampler	Gaseous (G)/ Particulate (P)	∑PAHs (ng/m ³)	Reference
Nam Co, central TP	2012-2014	AAS	G	2.2 (0.5-13)	This study
			P	0.6 (0.1-3.4)	
Nam Co, central TP	2006-2008	FTS	G+P	0.7 (0.08-2.2)	(Xiao et al., 2010)
Lulang, southeast TP	2008-2011	AAS	P	2.0 (0.2-5)	(Wang et al., 2015)
Lahsa, TP	2006-2007	AAS	G+P	35.7 (11.4-72.5)	(Gong et al., 2011)
Pyrenees, Europe	1996-1997	AAS	G	(1.3-2.6)	(Fernandez et al., 2002)
Alps, Europe	1996-1997	AAS	G	(2.7-3.7)	
Open water of Lake Superior	2011	PE-PAS	G	(BDL-1.9)	(Ruge et al., 2015)
Mediterranean Sea	2006-2007	AAS	G	38.38 (25.84-86.47)	(Castro et al., 2012)
			P	1.4 (0.9-1.8)	
Pacific and Arctic Ocean	2010	AAS	G	(0.91-7.4)	(Ma et al., 2013)
			P	(0.0002-0.36)	
Atlantic Ocean	2005	AAS	G+P	0.6 (0.02-2.8)	(Nizzetto et al., 2008)
Terra Nova Bay, Antarctica	2009-2010	AAS	G	0.004 (0.0004-0.01)	(Piazza et al., 2013)
			P	0.13 (0.02-0.3)	
Arctic	2003	AAS	G	3.3 (0.9-6.3)	(Ding et al., 2007b)
			P	0.5 (0.02-2.6)	

210

AAS: active air sampler; PE-PAS: polyethylene passive air sampler; FTS: flow-through sampler.

211

Table S14. Dissolved concentrations of OCPs and PCBs in lake water of Nam Co Lake and other remote sites (pg L⁻¹).

212

Location	Year	α -HCH	β -HCH	γ -HCH	HCB	<i>o,p'</i> -DDE	<i>p,p'</i> -DDE	<i>o,p'</i> -DDT	<i>p,p'</i> -DDT	Σ_6 PCBs	Reference
Nam Co Lake	2013	9.9 \pm 3.4	85.2 \pm 18.8	7 \pm 2.5	7.6 \pm 5.6	BDL	BDL-1.2	BDL	BDL	2.0 \pm 1.4	This study
Yamdro, TP	2002	850	2400				260				(Zhang et al., 2003)
Co Ngoin, TP	2002	550	810						190		(Zhang et al., 2003)
Taihu Lake, China	2004-2005	1887 \pm 1372	1773 \pm 944	484 \pm 373		53 \pm 113	77 \pm 91	135 \pm 287	12 \pm 4		(Qiu et al., 2008)
Chaohu Lake, China	2010-2011	460 \pm 460	900 \pm 480	280 \pm 310	170 \pm 70	1640 \pm 1820	20 \pm 40	140 \pm 390	220 \pm 220		(Ouyang et al., 2013)
European mountain lake	2000	68 \pm 35		139 \pm 89	8.5 \pm 3.2		12 \pm 3				(Fernandez et al., 2005)
North Pacific	2010	101.6	27.7	17.9	2.8						(Cai et al., 2012)
Indian Ocean	2011	3.2 \pm 0.8	5.4 \pm 2.2	2.2 \pm 1.3		48 \pm 120	37 \pm 85	330 \pm 840	1600 \pm 4000		(Huang et al., 2013)
Ross Sea, Antarctic	2003-2004	1.4 \pm 0.9		2.9 \pm 2.2							(Cincinelli et al., 2009)
North Atlantic and Arctic	2004	13.0 \pm 16.3		4.7 \pm 5.6	0.9-9.6	BDL	0.15 \pm 0.08	BDL	BDL-0.2		(Lohmann et al., 2009)
										<1	(Gioia et al., 2008)

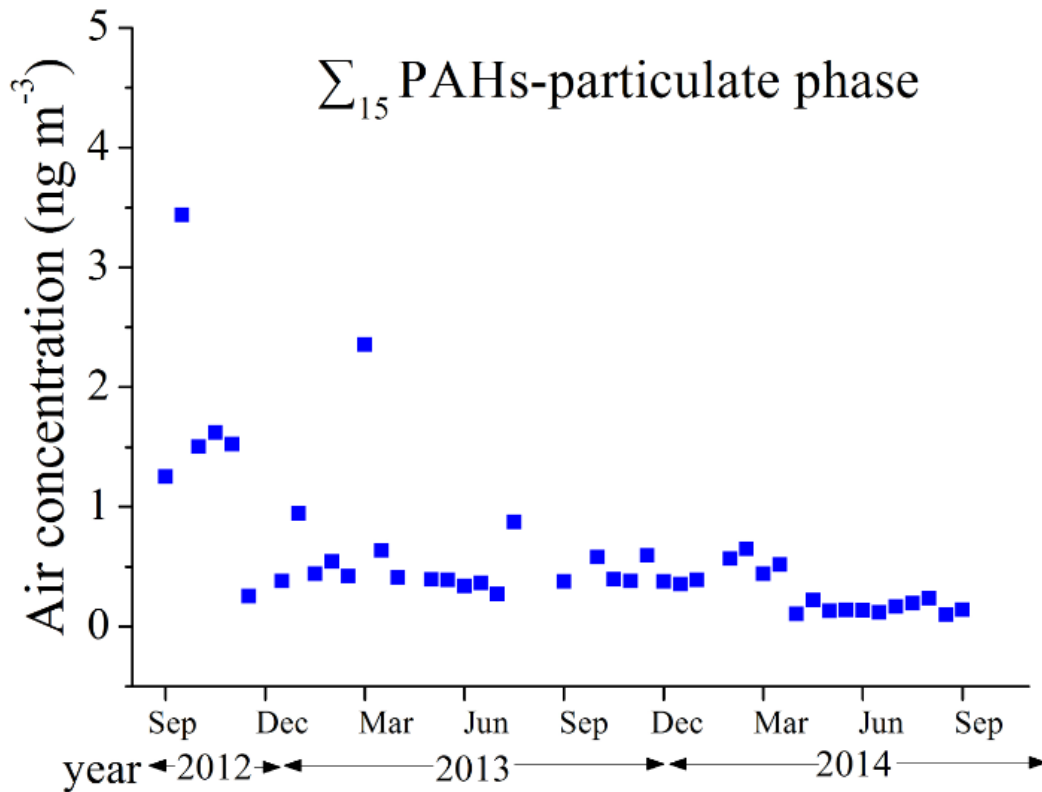
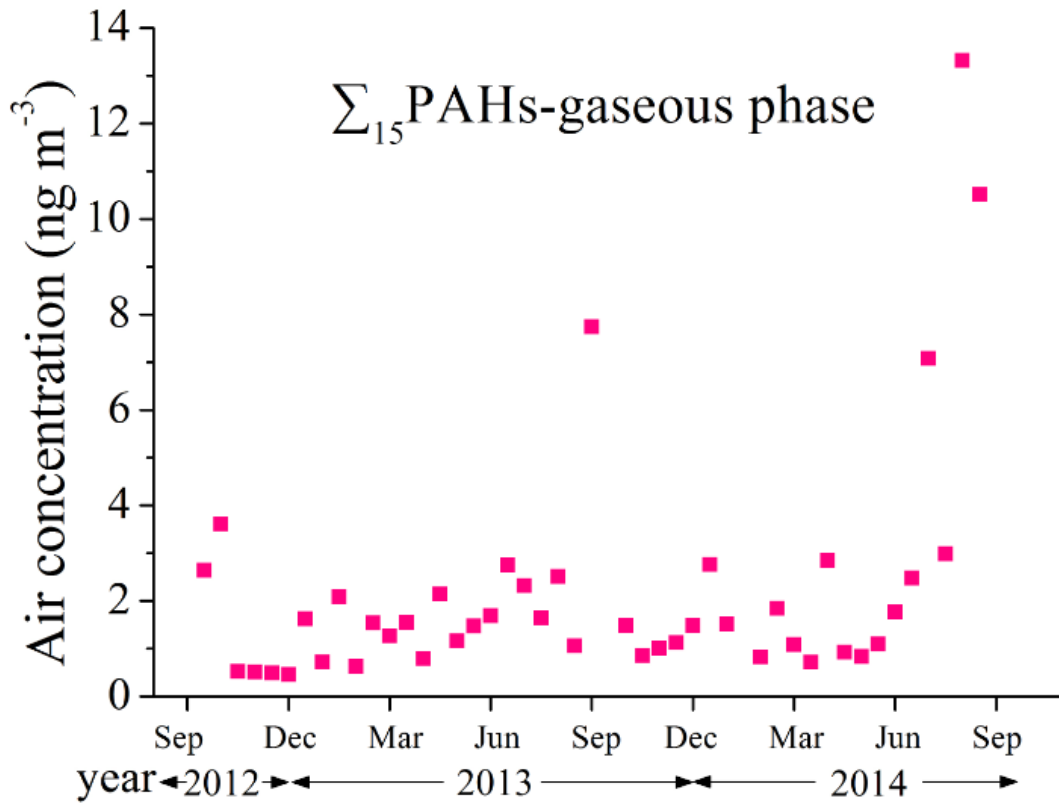
213 **Table S15. Concentrations of PAHs in lake water of Nam Co Lake and other remote sites (ng L⁻¹).**

214

Location	Year	Σ PAHs		Reference
		dissolved phase	particulate phase	
Nam Co Lake	2013	28.6 (6.9-83.6)	7.3 (1.7-28)	This study
Lakes in Himalayan region, Nepal	2007	1.96 ± 1.86		(Guzzella et al., 2011)
Lake Redo, Pyrenees	2000	0.27 ± 0.19	0.41 ± 0.13	(Vilanova et al., 2001)
Lake Gossenkolle, Alps	2000	0.35 ± 0.19	0.57 ± 0.34	(Vilanova et al., 2001)
Lake Ladove, High Tatras	2000	3.4 ± 0.4	8.5 ± 0.7	(Fernandez et al., 2005)
Lake Ontario	2011-2012	5.5 ± 3.2		(Venier et al., 2014)
Lake Erie	2011-2012	4.8 ± 1.4		(Venier et al., 2014)
Lake Superior	2011-2012	1.1 ± 0.5		(Venier et al., 2014)
Atlantic Ocean	2005	(0.058-1.07)		(Nizzetto et al., 2008)
North Pacific and Arctic	2010	(0.014-0.76)		(Ma et al., 2013)
Gerlache Inlet Sea, Antarctica	2001	2.4 (2.1-2.9)	3.6 (2.8-4.7)	(Stortini et al., 2009)

215 **Table S16. Comparison of isomer ratios of OCPs in this study and the source**
 216 **region**

Sampling site	α/r-HCH	p,p'-DDT/p,p'-DDE	Reference
Nam Co, TP	2.7±1.7	1.3±1.6	This study
Lulang, TP	3.7±1.99	>1	(Sheng et al., 2013)
Indian major cities	0.67±0.5	0.9±0.5	(Chakraborty et al., 2010)
Indian coastal region	0.11-4	2	(Zhang et al., 2008)
Bay of Bengal		>1	(Gioia et al., 2012)



219 **Figure S3. Seasonal patterns of the gaseous and particulate phase of Σ_{15} PAHs in**
 220 **the atmosphere of Nam Co.**

221 **Table S17. Results of randomized block ANOVA to test the concentration**
 222 **difference of OPs in the lake water from different regions of the Nam Co Lake.**

223 (a) Before the ANOVA analysis, the sampling sites of surface water in the present
 224 study were classified as four regions according to the different locations:

Site	Region
S1	south
S2	south
S3	south
S4	south
S5	south
S6	south
S7	south
S8	northwest
S9	northwest
S10	north
S11	north
S12	north
S13	east
S14	east
S15	east

225 (2) *p* values derived from the ANOVA test:

Location		<i>p</i> values		
		HCHs	HCB	PAHs
south	northwest	0.161	<i>0.05</i>	<i>0.001</i>
	north	0.106	0.96	0.303
	east	0.518	<i>0.002</i>	<i>0.005</i>
northwest	north	0.983	0.086	<i>0.007</i>
	east	0.424	0.25	0.16
north	east	0.361	<i>0.006</i>	<i>0.068</i>

226 (The values of $p < 0.05$ were highlighted in bold and italics, which indicates that the
 227 levels of pollutants significantly differ between two regions)

228 **Table S18. Results of Clausius–Clapeyron regression**

229 Clausius-Clapeyron (C.C.) equation is often used for assessing the relative
 230 contribution of re-volatilization from local surface versus long range atmospheric
 231 transport:

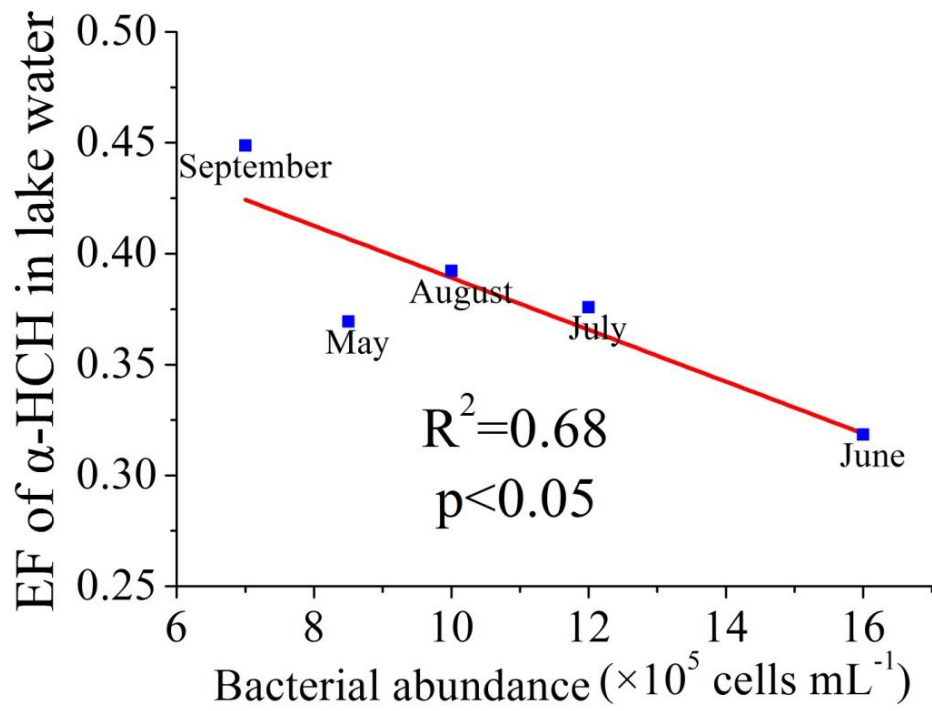
232
$$\ln P = \frac{m}{T} + b$$

233 where P is the partial pressure of pollutants in air (Pa), T is the air temperature (K), m
 234 and b are slopes and intercepts derived from C.C. regression for each compound.
 235 Carlson and Hites (2005) found that the temperature dependence will reduce or
 236 disappear when T is below the freezing point. Thus, the sampling periods with $T < 0$ °C
 237 were excluded in the present study. Results included slope m , R^2 , p -value, and number
 238 of data points, n , as shown in the table below.

Compound	slope (m)	R^2	p -value	n	Compound	m	R^2	p -value	n
α -HCH	-7893	0.29	0.01^a	18	Acel	\	\	0.83	14
β -HCH	\ ^b	\	0.27	14	Ace	\	\	0.93	14
γ -HCH	\	\	0.50	17	Flu	\	\	0.56	14
HCB	\	\	0.55	18	Phe	\	\	0.37	14
o,p'-DDE	\	\	0.90	18	Ant	\	\	0.13	14
p,p'-DDE	\	\	0.58	18	Fla	\	\	0.17	14
o,p'-DDT	\	\	0.06	18	Pyr	\	\	0.37	14
p,p'-DDT	\	\	0.33	18	BaA	\	\	0.71	14
PCB-28	\	\	0.78	18	Chr	\	\	0.87	14
PCB-52	\	\	0.61	18	Bbf	\	\	0.28	14
PCB-101	\	\	0.96	18	Bkf	\	\	0.15	13
PCB-153	\	\	0.61	18	Bap	\	\	0.61	13
PCB-138	\	\	0.89	18	IcdP	\	\	0.91	6
PCB-180	\	\	0.60	18	DahA	\	\	0.28	4
					BghiP	\	\	0.60	13

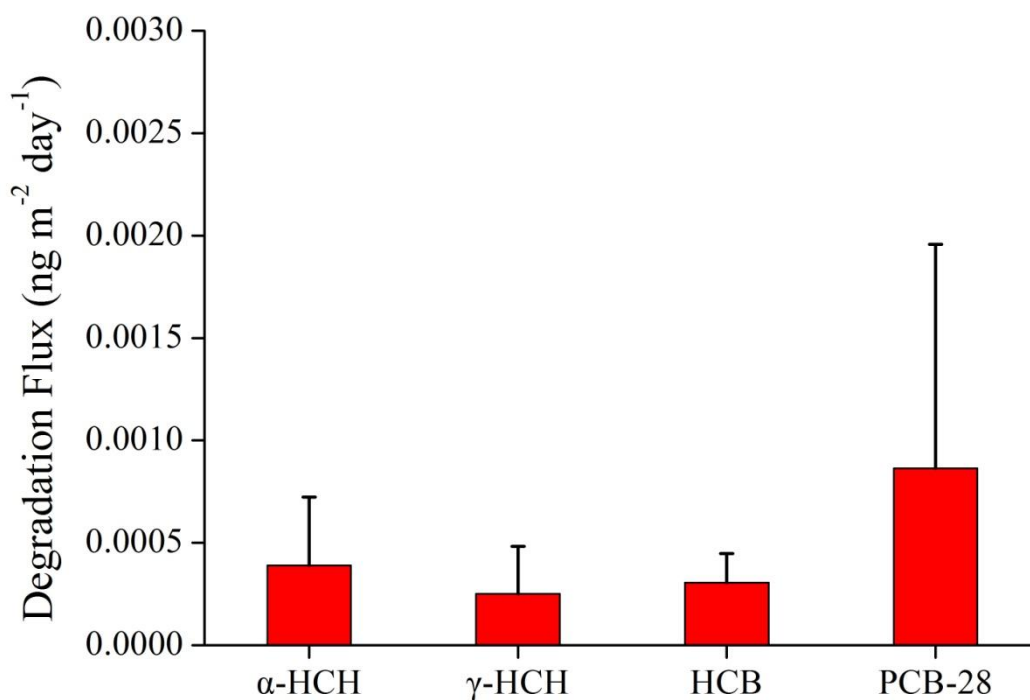
239 a: Numbers in bold font stand for $p < 0.05$, indicating that the relationship is
 240 significant.

241 b: “\” stands for the unavailable slope and R^2 for some compounds which showed
 242 insignificant correlation ($p > 0.05$).

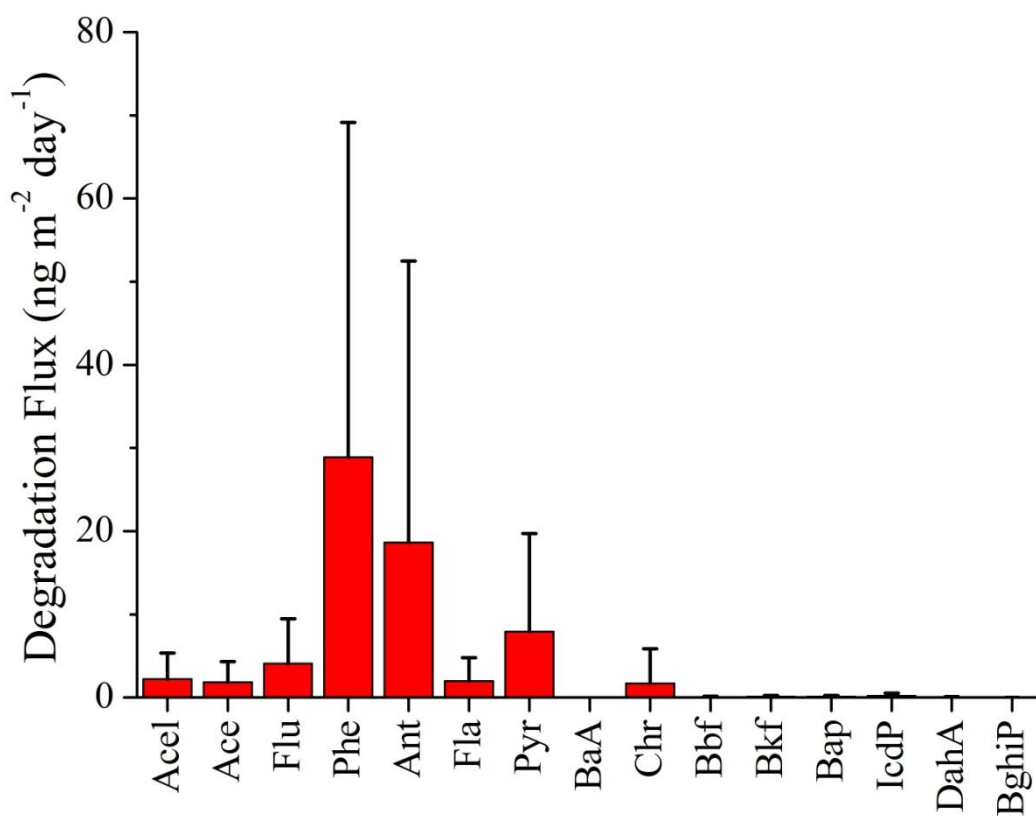


243

244 **Figure S4. The correlation between EF of α -HCH in lake water and seasonal**
245 **bacterial abundance in Nam Co Lake.**

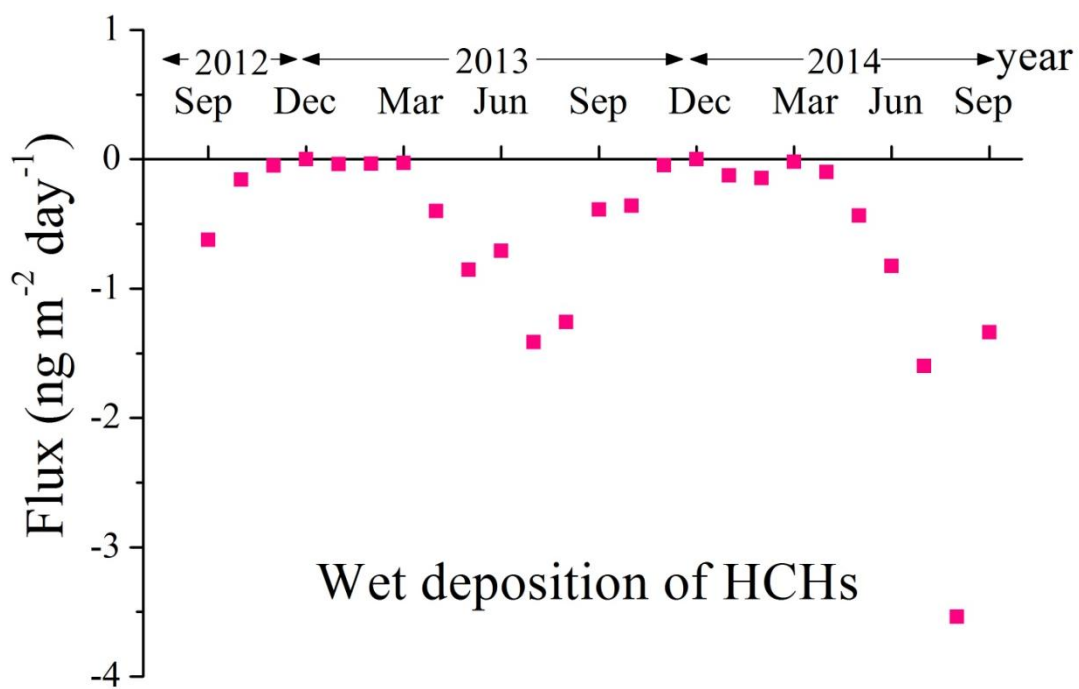


246



247

248 **Figure S5. Average atmospheric degradation fluxes of individual OPs.**



249

250 **Figure S6. Seasonality of the wet deposition fluxes for HCHs in Nam Co Lake.**

251 **References**

- 252 Antweiler, R. C., and Taylor, H. E.: Evaluation of statistical treatments of left-censored
253 environmental data using coincident uncensored data sets: I. Summary statistics, *Environ. Sci.*
254 *Technol.*, 42, 3732-3738, doi:10.1021/es071301c, 2008.
- 255 Burkhard, L. P.: Estimating dissolved organic carbon partition coefficients for nonionic organic
256 chemicals, *Environ. Sci. Technol.*, 34, 4663-4668, doi:10.1021/es001269I, 2000.
- 257 Cai, M. H., Ma, Y. X., Xie, Z. Y., Zhong, G. C., Moller, A., Yang, H. Z., Sturm, R., He, J. F.,
258 Ebinghaus, R., and Meng, X. Z.: Distribution and air-sea exchange of organochlorine
259 pesticides in the North Pacific and the Arctic, *J. Geophys. Res.*, 117,
260 doi:10.1029/2011jd016910, 2012.
- 261 Carlson, D. L., and Hites, R. A.: Temperature dependence of atmospheric PCB concentrations,
262 *Environ. Sci. Technol.*, 39, 740-747, doi:10.1021/es049081f, 2005.
- 263 Castro-Jimenez, J., Berrojalbiz, N., Wollgast, J., and Dachs, J.: Polycyclic aromatic hydrocarbons
264 (PAHs) in the Mediterranean Sea: Atmospheric occurrence, deposition and decoupling with
265 settling fluxes in the water column, *Environ. Pollut.*, 166, 40-47,
266 doi:10.1016/j.envpol.2012.03.003, 2012.
- 267 Cetin, B., Ozer, S., Sofuoglu, A., and Odabasi, M.: Determination of Henry's law constants of
268 organochlorine pesticides in deionized and saline water as a function of temperature, *Atmos.*
269 *Environ.*, 40, 4538-4546, doi: 10.1016/j.atmosenv.2006.04.009, 2006.
- 270 Chakraborty, P., Zhang, G., Li, J., Xu, Y., Liu, X., Tanabe, S., and Jones, K. C.: Selected
271 Organochlorine Pesticides in the Atmosphere of Major Indian Cities: Levels, Regional versus
272 Local Variations, and Sources, *Environ. Sci. Technol.*, 44, 8038-8043, doi:
273 10.1021/Es102029t, 2010.
- 274 Cincinelli, A., Martellini, T., Del Bubba, M., Lepri, L., Corsolini, S., Borghesi, N., King, M. D.,
275 and Dickhut, R. M.: Organochlorine pesticide air-water exchange and bioconcentration in
276 krill in the Ross Sea, *Environ. Pollut.*, 157, 2153-2158, doi: 10.1016/j.envpol.2009.02.010,
277 2009.
- 278 Ding, X., Wang, X. M., Xie, Z. Q., Xiang, C. H., Mai, B. X., Sun, L. G., Zheng, M., Sheng, G. Y.,
279 and Fu, J. M.: Atmospheric hexachlorocyclohexanes in the North Pacific Ocean and the
280 adjacent Arctic region: Spatial patterns, chiral signatures, and sea-air exchanges, *Environ. Sci.*
281 *Technol.*, 41, 5204-5209, doi:10.1021/es070237w, 2007a.
- 282 Ding, X., Wang, X. M., Xie, Z. Q., Xiang, C. H., Mai, B. X., Sun, L. G., Zheng, M., Sheng, G. Y.,
283 Fu, J. M., and Poschl, U.: Atmospheric polycyclic aromatic hydrocarbons observed over the
284 North Pacific Ocean and the Arctic area: Spatial distribution and source identification, *Atmos.*
285 *Environ.*, 41, 2061-2072, doi:10.1016/j.atmosenv.2006.11.002, 2007b.
- 286 Fernandez, P., Grimalt, J. O., and Vilanova, R. M.: Atmospheric gas-particle partitioning of
287 polycyclic aromatic hydrocarbons in high mountain regions of Europe, *Environ. Sci. Technol.*,
288 36, 1162-1168, doi: 10.1021/Es010190t, 2002.
- 289 Fernandez, P., Carrera, G., and Grimalt, J. O.: Persistent organic pollutants in remote freshwater
290 ecosystems, *Aquat. Sci.*, 67, 263-273, doi:10.1007/s00027-005-0747-8, 2005.
- 291 Franz, T. P., and Eisenreich, S. J.: Snow scavenging of polychlorinated biphenyls and polycyclic
292 aromatic hydrocarbons in Minnesota, *Environ. Sci. Technol.*, 32, 1771-1778, doi:
293 10.1021/Es970601z, 1998.
- 294 Gioia, R., Lohmann, R., Dachs, J., Temme, C., Lakaschus, S., Schulz-Bull, D., Hand, I., and Jones,

295 K. C.: Polychlorinated biphenyls in air and water of the North Atlantic and Arctic Ocean, *J.*
 296 *Geophys. Res.*, 113, doi: 10.1029/2007jd009750, 2008.

297 Gioia, R., Li, J., Schuster, J., Zhang, Y. L., Zhang, G., Li, X. D., Spiro, B., Bhatia, R. S., Dachs, J.,
 298 and Jones, K. C.: Factors Affecting the Occurrence and Transport of Atmospheric
 299 Organochlorines in the China Sea and the Northern Indian and South East Atlantic Oceans,
 300 *Environ. Sci. Technol.*, 46, 10012-10021, doi: 10.1021/Es302037t, 2012.

301 Gong, P., Wang, X. P., Sheng, J. J., and Yao, T. D.: Variations of organochlorine pesticides and
 302 polychlorinated biphenyls in atmosphere of the Tibetan Plateau: Role of the monsoon system,
 303 *Atmos. Environ.*, 44, 2518-2523, doi: 10.1016/j.atmosenv.2010.04.025, 2010.

304 Gong, P., Wang, X. P., and Yao, T. D.: Ambient distribution of particulate- and gas-phase n-alkanes
 305 and polycyclic aromatic hydrocarbons in the Tibetan Plateau, *Environmental Earth Sciences*,
 306 64, 1703-1711, doi:10.1007/s12665-011-0974-3, 2011.

307 Gong, P., Wang, X. P., Xue, Y. G., Sheng, J. J., Gao, S. P., Tian, L. D., and Yao, T. D.: Influence of
 308 atmospheric circulation on the long-range transport of organochlorine pesticides to the
 309 western Tibetan Plateau, *Atmospheric Research*, 166, 157-164,
 310 doi:10.1016/j.atmosres.2015.07.006, 2015.

311 Gonzalez-Gaya, B., Zuniga-Rival, J., Ojeda, M. J., Jimenez, B., and Dachs, J.: Field
 312 Measurements of the Atmospheric Dry Deposition Fluxes and Velocities of Polycyclic
 313 Aromatic Hydrocarbons to the Global Oceans, *Environ. Sci. Technol.*, 48, 5583-5592,
 314 doi:10.1021/es500846p, 2014.

315 Gonzalez-Gaya, B., Fernandez-Pinos, M. C., Morales, L., Mejanelle, L., Abad, E., Pina, B., Duarte,
 316 C. M., Jimenez, B., and Dachs, J.: High atmosphere-ocean exchange of semivolatile aromatic
 317 hydrocarbons, *Nature Geoscience*, 9, 438-442, doi:10.1038/NGEO2714, 2016.

318 Guzzella, L., Poma, G., De Paolis, A., Roscioli, C., and Viviano, G.: Organic persistent toxic
 319 substances in soils, waters and sediments along an altitudinal gradient at Mt. Sagarmatha,
 320 Himalayas, Nepal, *Environ. Pollut.*, 159, 2552-2564, doi:10.1016/j.envpol.2011.06.015,
 321 2011.

322 Huang, Y. M., Xu, Y., Li, J., Xu, W. H., Zhang, G., Cheng, Z. N., Liu, J. W., Wang, Y., and Tian, C.
 323 G.: Organochlorine Pesticides in the Atmosphere and Surface Water from the Equatorial
 324 Indian Ocean: Enantiomeric Signatures, Sources, and Fate, *Environ. Sci. Technol.*, 47,
 325 13395-13403, doi: 10.1021/Es403138p, 2013.

326 Jantunen, L. M., and Bidleman, T. F.: Henry's law constants for hexachlorobenzene, p,p'-DDE and
 327 components of technical chlordane and estimates of gas exchange for Lake Ontario,
 328 *Chemosphere*, 62, 1689-1696, doi: 10.1016/j.chemosphere.2005.06.035, 2006.

329 Kallenborn, R., Breivik, K., Eckhardt, S., Lunder, C. R., Mano, S., Schlabach, M., and Stohl, A.:
 330 Long-term monitoring of persistent organic pollutants (POPs) at the Norwegian Troll station
 331 in Dronning Maud Land, Antarctica, *Atmospheric Chemistry and Physics*, 13, 6983-6992, doi:
 332 10.5194/acp-13-6983-2013, 2013.

333 Khairy, M., Muir, D., Teixeira, C., and Lohmann, R.: Spatial Trends, Sources, and Air-Water
 334 Exchange of Organochlorine Pesticides in the Great Lakes Basin Using Low Density
 335 Polyethylene Passive Samplers, *Environ. Sci. Technol.*, 48, 9315-9324,
 336 doi:10.1021/es501686a, 2014.

337 Lei, Y. D., Chankalal, R., Chan, A., and Wania, F.: Supercooled liquid vapor pressures of the
 338 polycyclic aromatic hydrocarbons, *J. Chem. Eng. Data.*, 47, 801-806, doi:10.1021/je0155148,

339 2002.

340 Li, C. L., Kang, S. C., Chen, P. F., Zhang, Q. G., and Fang, G. C.: Characterizations of
341 particle-bound trace metals and polycyclic aromatic hydrocarbons (PAHs) within Tibetan
342 tents of south Tibetan Plateau, China, *Environmental Science and Pollution Research*, 19,
343 1620-1628, doi:10.1007/s11356-011-0678-y, 2012.

344 Li, J., Zhu, T., Wang, F., Qiu, X. H., and Lin, W. L.: Observation of organochlorine pesticides in
345 the air of the Mt. Everest region, *Ecotoxicol. Environ. Saf.*, 63, 33-41, doi:
346 10.1016/j.ecoenv.2005.04.001, 2006.

347 Liu, X. B., Yao, T. D., Kang, S. C., Jiao, N. A. Z., Zeng, Y. H., and Liu, Y. Q.: Bacterial
348 Community of the Largest Oligosaline Lake, Namco on the Tibetan Plateau, *Geomicrobiol. J.*,
349 27, 669-682, doi:10.1080/01490450903528000, 2010.

350 Lohmann, R., Gioia, R., Jones, K. C., Nizzetto, L., Temme, C., Xie, Z., Schulz-Bull, D., Hand, I.,
351 Morgan, E., and Jantunen, L.: Organochlorine Pesticides and PAHs in the Surface Water and
352 Atmosphere of the North Atlantic and Arctic Ocean, *Environ. Sci. Technol.*, 43, 5633-5639,
353 doi: 10.1021/Es901229k, 2009.

354 Ma, Y. G., Lei, Y. D., Xiao, H., Wania, F., and Wang, W. H.: Critical Review and Recommended
355 Values for the Physical-Chemical Property Data of 15 Polycyclic Aromatic Hydrocarbons at
356 25 degrees C, *J. Chem. Eng. Data.*, 55, 819-825, doi: 10.1021/Je900477x, 2010.

357 Ma, Y. X., Xie, Z. Y., Yang, H. Z., Moller, A., Halsall, C., Cai, M. H., Sturm, R., and Ebinghaus,
358 R.: Deposition of polycyclic aromatic hydrocarbons in the North Pacific and the Arctic, *J.*
359 *Geophys. Res.*, 118, 5822-5829, doi:10.1002/jgrd.50473, 2013.

360 Ni, N., and Yalkowsky, S. H.: Prediction of Setschenow constants, *Int. J. Pharm.*, 254, 167-172,
361 doi:10.1016/S0378-5173(03)00008-5, 2003.

362 Nizzetto, L., Lohmann, R., Gioia, R., Jahnke, A., Temme, C., Dachs, J., Herckes, P., Di Guardo, A.,
363 and Jones, K. C.: PAHs in air and seawater along a North-South Atlantic transect: Trends,
364 processes and possible sources, *Environ. Sci. Technol.*, 42, 1580-1585,
365 doi:10.1021/es0717414, 2008.

366 Odabasi, M., Cetin, E., and Sofuoglu, A.: Determination of octanol-air partition coefficients and
367 supercooled liquid vapor pressures of PAHs as a function of temperature: Application to
368 gas-particle partitioning in an urban atmosphere, *Atmos. Environ.*, 40, 6615-6625, doi:
369 10.1016/j.atmosenv.2006.05.051, 2006.

370 Ouyang, H. L., He, W., Qin, N., Kong, X. Z., Liu, W. X., He, Q. S., Yang, C., Jiang, Y. J., Wang, Q.
371 M., Yang, B., and Xu, F. L.: Water-gas exchange of organochlorine pesticides at Lake Chaohu,
372 a large Chinese lake, *Environmental Science and Pollution Research*, 20, 2020-2032, doi:
373 10.1007/s11356-012-1374-2, 2013.

374 Paasivirta, J., and Sinkkonen, S. I.: Environmentally Relevant Properties of All 209
375 Polychlorinated Biphenyl Congeners for Modeling Their Fate in Different Natural and
376 Climatic Conditions, *J. Chem. Eng. Data.*, 54, 1189-1213, doi: 10.1021/Je800501h, 2009.

377 Piazza, R., Gambaro, A., Argiriadis, E., Vecchiato, M., Zambon, S., Cescon, P., and Barbante, C.:
378 Development of a method for simultaneous analysis of PCDDs, PCDFs, PCBs, PBDEs,
379 PCNs and PAHs in Antarctic air, *Anal. Bioanal. Chem.*, 405, 917-932,
380 doi:10.1007/s00216-012-6464-y, 2013.

381 Qiu, X. H., Zhu, T., Wang, F., and Hu, J. X.: Air-water gas exchange of organochlorine pesticides
382 in Taihu Lake, China, *Environ. Sci. Technol.*, 42, 1928-1932, doi: 10.1021/Es071825c, 2008.

383 Ruge, Z., Muir, D., Helm, P., and Lohmann, R.: Concentrations, Trends, and Air-Water Exchange
384 of PAHs and PBDEs Derived from Passive Samplers in Lake Superior in 2011, *Environ. Sci.*
385 *Technol.*, 49, 13777-13786, doi:10.1021/acs.est.5b02611, 2015.

386 Sahsuvar, L., Helm, P. A., Jantunen, L. M., and Bidleman, T. F.: Henry's law constants for alpha-,
387 beta-, and gamma-hexachlorocyclohexanes (HCHs) as a function of temperature and revised
388 estimates of gas exchange in Arctic regions, *Atmos. Environ.*, 37, 983-992,
389 doi:10.1016/S1352-2310(02)00936-6, 2003.

390 Schwarzenbach, R. P., Gschwend, P. M., and Imboden, D. M.: *Environmental Organic Chemistry*,
391 John Wiley and Sons, New Jersey, 2003.

392 Sheng, J., Wang, X., Gong, P., Joswiak, D. R., Tian, L., Yao, T., and Jones, K. C.: Monsoon-driven
393 transport of organochlorine pesticides and polychlorinated biphenyls to the tibetan plateau:
394 three year atmospheric monitoring study, *Environ. Sci. Technol.*, 47, 3199-3208,
395 doi:10.1021/es305201s, 2013.

396 Stortini, A. M., Martellini, T., Del Bubba, M., Lepri, L., Capodaglio, G., and Cincinelli, A.:
397 n-Alkanes, PAHs and surfactants in the sea surface microlayer and sea water samples of the
398 Gerlache Inlet sea (Antarctica), *Microchemical Journal*, 92, 37-43,
399 doi:10.1016/j.microc.2008.11.005, 2009.

400 Su, Y., Hung, H., Blanchard, P., Patton, G. W., Kallenborn, R., Konoplev, A., Fellin, P., Li, H.,
401 Geen, C., Stern, G., Rosenberg, B., and Barrie, L. A.: A circumpolar perspective of
402 atmospheric organochlorine pesticides (OCPs): Results from six Arctic monitoring stations in
403 2000-2003, *Atmos. Environ.*, 42, 4682-4698, doi:10.1016/j.atmosenv.2008.01.054, 2008.

404 Su, Y. S., Hung, H., Blanchard, P., Patton, G. W., Kallenborn, R., Konoplev, A., Fellin, P., Li, H.,
405 Geen, C., Stern, G., Rosenberg, B., and Barrie, L. A.: Spatial and seasonal variations of
406 hexachlorocyclohexanes (HCHs) and hexachlorobenzene (HCB) in the Arctic atmosphere,
407 *Environ. Sci. Technol.*, 40, 6601-6607, doi: 10.1021/Es061065q, 2006.

408 Van Drooge, B. L., Grimalt, J. O., Camarero, L., Catalan, J., Stuchlik, E., and Garcia, C. J. T.:
409 Atmospheric semivolatile organochlorine compounds in European high-mountain areas
410 (Central Pyrenees and High Tatras), *Environ. Sci. Technol.*, 38, 3525-3532, doi:
411 10.1021/Es030108p, 2004.

412 Venier, M., Dove, A., Romanak, K., Backus, S., and Hites, R.: Flame Retardants and Legacy
413 Chemicals in Great Lakes' Water, *Environ. Sci. Technol.*, 48, 9563-9572,
414 doi:10.1021/es501509r, 2014.

415 Vilanova, R. M., Fernandez, P., Martinez, C., and Grimalt, J. O.: Polycyclic aromatic
416 hydrocarbons in remote mountain lake waters, *Water Res.*, 35, 3916-3926, doi:
417 10.1016/S0043-1354(01)00113-0, 2001.

418 Wang, X. P., Gong, P., Sheng, J. J., Joswiak, D. R., and Yao, T. D.: Long-range atmospheric
419 transport of particulate Polycyclic Aromatic Hydrocarbons and the incursion of aerosols to
420 the southeast Tibetan Plateau, *Atmos. Environ.*, 115, 124-131,
421 doi:10.1016/j.atmosenv.2015.04.050, 2015.

422 Wilkinson, A. C., Kimpe, L. E., and Blais, J. M.: Air-water gas exchange of chlorinated pesticides
423 in four lakes spanning a 1,205 meter elevation range in the Canadian Rocky Mountains,
424 *Environ. Toxicol. Chem.*, 24, 61-69, doi: 10.1897/04-071r.1, 2005.

425 Xiao, H., Kang, S. C., Zhang, Q. G., Han, W. W., Loewen, M., Wong, F., Hung, H., Lei, Y. D., and
426 Wania, F.: Transport of semivolatile organic compounds to the Tibetan Plateau: Monthly

- 427 resolved air concentrations at Nam Co, *J. Geophys. Res.*, 115, doi: 10.1029/2010jd013972,
428 2010.
- 429 Xie, Z., Koch, B. P., Moller, A., Sturm, R., and Ebinghaus, R.: Transport and fate of
430 hexachlorocyclohexanes in the oceanic air and surface seawater, *Biogeosciences*, 8,
431 2621-2633, doi:10.5194/bg-8-2621-2011, 2011.
- 432 Zhang, G. S: A study of Zhadang glacier energy and mass balance and its hydrological process, in
433 NamCo basin, central Tibetan Plateau, Doctoral dissertation, 2013.
- 434 Zhang, W. L., Zhang, G., Qi, S. H. and Peng, P. A.: A preliminary study of
435 organochlorinepesticides in water and sediments from two Tibetan Lakes. *Geochimica*. 32 (4),
436 363-367 (in Chinese with English abstract), 2003.
- 437 Zhang, G., Chakraborty, P., Li, J., Sampathkumar, P., Balasubramanian, T., Kathiresan, K.,
438 Takahashi, S., Subramanian, A., Tanabe, S., and Jones, K. C.: Passive Atmospheric Sampling
439 of Organochlorine Pesticides, Polychlorinated Biphenyls, and Polybrominated Diphenyl
440 Ethers in Urban, Rural, and Wetland Sites along the Coastal Length of India, *Environ. Sci.*
441 *Technol.*, 42, 8218-8223, doi: 10.1021/Es8016667, 2008.