



**International Atomic Energy Agency**  
**Analytical Quality Control Services**  
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# REFERENCE SHEET

REFERENCE MATERIAL

**IAEA-432**

**ORGANOCHLORINE COMPOUNDS AND  
PETROLEUM HYDROCARBONS  
IN A  
MUSSEL HOMOGENATE**

Date of issue: April 2004

*PESTICIDES AND PCBs*

Recommended Values  
(Based on dry weight)

Analyte	Concentration ng/g	Standard deviation ng/g	N*
HCB	0.2	0.1	21
pp' DDE	2.1	1.0	39
pp' DDD	0.88	0.49	30
PCB No 49	0.29	0.08	6
PCB No 70	0.64	0.35	7
PCB No 101	1.2	0.49	24
PCB No 110	1.12	0.4	10
PCB No 118	1.09	0.42	24
PCB No 138	2.2	0.84	31
PCB No 149	1.4	0.41	10
PCB No 153	2.8	0.99	31
PCB No 180	0.2	0.11	16

\* Number of accepted laboratory results which were used to calculate the recommended value and its standard deviation about the mean value.

**PETROLEUM HYDROCARBONS**

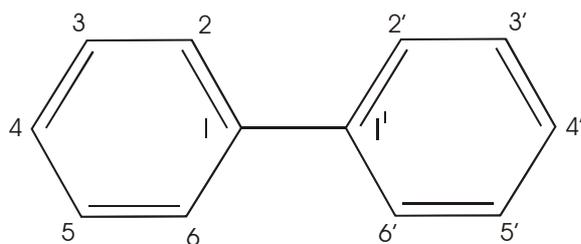
**Recommended Values**  
*(Based on dry weight)*

<b>Analyte</b>	<b>Concentration ng/g</b>	<b>Standard deviation ng/g</b>	<b>N*</b>
<b>Phenanthrene</b>	<b>27</b>	<b>21</b>	<b>32</b>
<b>1 Methyl Phenanthrene</b>	<b>4.2</b>	<b>2.8</b>	<b>8</b>
<b>2 Methyl Phenanthrene</b>	<b>9.4</b>	<b>4.9</b>	<b>5</b>
<b>Anthracene</b>	<b>1.5</b>	<b>1.1</b>	<b>11</b>
<b>Chrysene</b>	<b>5.5</b>	<b>3.8</b>	<b>23</b>
<b>Fluorene</b>	<b>4.1</b>	<b>2.2</b>	<b>8</b>
<b>Fluoranthene</b>	<b>12</b>	<b>6.5</b>	<b>27</b>
<b>Pyrene</b>	<b>13</b>	<b>6.0</b>	<b>25</b>
<b>Benzo (b) Fluoranthene</b>	<b>4.8</b>	<b>1.7</b>	<b>10</b>
<b>Benzo (k) Fluoranthene</b>	<b>1.9</b>	<b>1.1</b>	<b>12</b>
<b>Benz (a) Anthracene</b>	<b>3.8</b>	<b>3.1</b>	<b>24</b>
<b>Benzo (a) Pyrene</b>	<b>0.9</b>	<b>0.5</b>	<b>17</b>
<b>Benzo (e) Pyrene</b>	<b>4.5</b>	<b>1.7</b>	<b>11</b>

\* *Number of accepted laboratory results which were used to calculate the recommended value and its standard deviation about the mean value.*

## Systematic numbering of PCB congeners

IUPAC No.		IUPAC No.	
	Dichlorobiphenyl		Hexachlorobiphenyl
<b>8</b>	2,4'	<b>128</b>	2,2',3,3',4,4'
		<b>138</b>	2,2',3,4,4',5'
	Trichlorobiphenyl	<b>141</b>	2,2',3,4,5,5'
<b>18</b>	2,2',5	<b>146</b>	2,2',3,4',5,5'
<b>28</b>	2,4,4'	<b>149</b>	2,2',3,4',5',6
<b>31</b>	2,4',5	<b>151</b>	2,2',3,5,5',6
		<b>153</b>	2,2',4,4',5,5'
	Tetrachlorobiphenyl	<b>156</b>	2,3,3',4,4',5
<b>44</b>	2,2',3,5'	<b>158</b>	2,3,3',4,4',6
<b>49</b>	2,2',4,5'	<b>167</b>	2,3',4,4',5,5'
<b>52</b>	2,2',5,5'		
<b>66</b>	2,3',4,4'		Heptachlorobiphenyl
<b>70</b>	2,3',4',5	<b>170</b>	2,2',3,3',4,4',5
<b>74</b>	2,4,4',5	<b>174</b>	2,2',3,3',4,5,6'
		<b>177</b>	2,2',3,3',4',5,6
	Pentachlorobiphenyl	<b>180</b>	2,2',3,4,4',5,5'
<b>82</b>	2,2',3,3',4	<b>183</b>	2,2',3,4,4',5',6
<b>87</b>	2,2',3,4,5'	<b>187</b>	2,2',3,4',5,5',6
<b>95</b>	2,2',3,5',6	<b>189</b>	2,3,3',4,4',5,5'
<b>97</b>	2,2',3',4,5		
<b>99</b>	2,2',4,4',5		Octachlorobiphenyl
<b>101</b>	2,2',4,5,5'	<b>194</b>	2,2',3,3',4,4',5,5'
<b>105</b>	2,3,3',4,4'	<b>195</b>	2,2',3,3',4,4',5,6
<b>110</b>	2,3,3',4',6		
<b>118</b>	2,3',4,4',5		



**CHLORINATED PESTICIDES**

**Information Values**  
*(Based on dry weight)*

<b>Analyte</b>	<b>Concentration ng/g</b>	<b>Standard deviation ng/g</b>	<b>N*</b>
<b><math>\gamma</math> HCH (Lindane)</b>	<b>0.58</b>	<b>0.54</b>	<b>30</b>
<b><math>\alpha</math> HCH</b>	<b>0.23</b>	<b>0.25</b>	<b>8</b>
<b><math>\beta</math> HCH</b>	<b>0.22</b>	<b>0.11</b>	<b>7</b>
<b>pp' DDT</b>	<b>0.67</b>	<b>0.46</b>	<b>25</b>
<b>op DDE</b>	<b>0.62</b>	<b>0.64</b>	<b>5</b>
<b>op DDD</b>	<b>1.8</b>	<b>2.7</b>	<b>4</b>
<b>op DDT</b>	<b>1.8</b>	<b>2.0</b>	<b>4</b>
<b>Heptachlor</b>	<b>1.0</b>	<b>1.0</b>	<b>19</b>
<b>Heptachlor Epoxide</b>	<b>11</b>	<b>18</b>	<b>12</b>
<b>Aldrin</b>	<b>1.5</b>	<b>1.4</b>	<b>17</b>
<b>Dieldrin</b>	<b>1.3</b>	<b>0.94</b>	<b>24</b>
<b>Endrin</b>	<b>5.4</b>	<b>6.9</b>	<b>16</b>
<b><math>\alpha</math> Endosulfan</b>	<b>4.0</b>	<b>3.6</b>	<b>11</b>
<b><math>\beta</math> Endosulfan</b>	<b>1.8</b>	<b>2.0</b>	<b>11</b>
<b>Endosulfan Sulfate</b>	<b>1.8</b>	<b>1.3</b>	<b>8</b>
<b><math>\alpha</math> Chlordane</b>	<b>0.25</b>	<b>0.1</b>	<b>6</b>
<b><math>\gamma</math> Chlordane</b>	<b>0.49</b>	<b>0.58</b>	<b>8</b>
<b>Cis Nonachlor</b>	<b>0.2</b>	<b>0.17</b>	<b>3</b>
<b>Trans Nonachlor</b>	<b>0.53</b>	<b>0.29</b>	<b>3</b>
<b>Aroclor 1254</b>	<b>27</b>	<b>17</b>	<b>16</b>
<b>Aroclor 1260</b>	<b>16</b>	<b>12</b>	<b>15</b>

\* *Number of accepted laboratory results which were used to calculate the information value and its standard deviation about the mean value.*

*PCB CONGENERS*

Information Values  
(Based on dry weight)

Analyte	Concentration ng/g	Standard deviation ng/g	N*
PCB No 8	0.57	0.32	4
PCB No 18	1.6	1.7	11
PCB No 28	0.32	0.26	18
PCB No 31	1.0	1.04	10
PCB No 44	0.7	0.68	10
PCB No 52	1.2	1.2	23
PCB No 66	0.38	0.16	4
PCB No 74	0.13	0.03	4
PCB No 82	0.11	0.08	3
PCB No 87	0.27	0.11	4
PCB No 95	1.1	0.79	8
PCB No 97	0.31	0.16	4
PCB No 99	2.1	2.4	7
PCB No 105	0.5	0.39	14
PCB No 128	0.25	0.08	7
PCB No 141	0.19	0.22	3
PCB No 146	0.59	0.11	3
PCB No 151	0.4	0.04	3
PCB No 156	0.35	0.31	8
PCB No 158	0.17	0.07	4
PCB No 167	0.32	0.1	3
PCB No 170	0.57	0.51	7
PCB No 174	0.26	0.27	4
PCB No 177	0.26	0.14	4
PCB No 183	0.24	0.05	6
PCB No 187	0.87	0.13	7
PCB No 189	0.12	0.15	3
PCB No 194	0.27	0.28	4
PCB No 195	0.22	0.18	5

\* Number of accepted laboratory results which were used to calculate the information values and its standard deviation about the mean value

**PETROLEUM HYDROCARBONS**

**Information Values**  
*(Based on dry weight)*

<b>Analyte</b>	<b>Concentration ng/g</b>	<b>Standard deviation ng/g</b>	<b>N*</b>
<b>UVF equivalent ROPME oil</b>	<b>11000</b>	<b>4900</b>	<b>3</b>
<b>Total Aliphatics</b>	<b>10000</b>	<b>9000</b>	<b>5</b>
<b>Resolved Aliphatics</b>	<b>18000</b>	<b>20000</b>	<b>9</b>
<b>Unresolved Aliphatics</b>	<b>38000</b>	<b>43000</b>	<b>5</b>
<b>Pristane</b>	<b>140</b>	<b>130</b>	<b>10</b>
<b>n - C 17</b>	<b>200</b>	<b>140</b>	<b>12</b>
<b>n - C 18</b>	<b>67</b>	<b>68</b>	<b>11</b>
<b>Phytane</b>	<b>41</b>	<b>44</b>	<b>9</b>
<b>Σ n-Alkanes (C 14 - C 34)</b>	<b>4500</b>	<b>4800</b>	<b>10</b>
<b>Total Aromatics</b>	<b>3000</b>	<b>3900</b>	<b>8</b>
<b>Resolved Aromatics</b>	<b>1500</b>	<b>1800</b>	<b>10</b>
<b>Naphthalene</b>	<b>15</b>	<b>18</b>	<b>15</b>
<b>1 Methyl Naphthalene</b>	<b>8.8</b>	<b>9.5</b>	<b>3</b>
<b>2 Methyl Naphthalene</b>	<b>14</b>	<b>13</b>	<b>3</b>
<b>Perylene</b>	<b>5.0</b>	<b>2.8</b>	<b>3</b>

\* *Number of accepted laboratory results which were used to calculate the information values and its standard deviation about the mean value.*

The values listed above were established on the basis of statistically valid results submitted by laboratories which had participated in an international intercomparison exercise conducted in 2003. The details concerning the criteria for qualification as a recommended or information value can be found in the report (IAEA/AL/146; IAEA/MEL/74), "World-wide and Regional Intercomparison for Determination of Organochlorine Compounds and Petroleum Hydrocarbons in Mussel Tissue IAEA-432" [1]. This report is available free of charge upon request.

### **Intended Use**

This sample is intended to be used as a reference material for the determination of chlorinated compounds and petroleum hydrocarbons in biota samples. It can also be used as a quality control material for the assessment of a laboratory's analytical work, for the validation of analytical methods and for quality assurance within a laboratory.

### **Origin and preparation of the material**

A large batch of mussels (*Mytilus edulis*) was collected from the North Sea to be used as an intercomparison material. This material was freeze-dried and ground. It was further sieved through a 250 µm stainless steel sieve.

The mussel powder fraction of particle size less than 250 µm was further homogenized by mixing in a rotating drum for two weeks. Then, aliquots of about 45 grams were packaged into glass bottles with aluminum screw caps and sealed with Teflon tape.

### **Homogeneity**

The homogeneity of the material for organochlorine compounds and petroleum hydrocarbons was checked by determining the concentration of some compounds (chlorinated pesticides and petroleum hydrocarbons) in 10 replicate analyses taken randomly in the bulk of the powder. A one-way variance analysis indicated that the material could be considered homogeneous.

### **Dry weight determination**

The moisture content of the lyophilized sample as determined by drying to a constant weight at 105°C, was found to be 2.5 %. Since the moisture content can change with the ambient humidity and temperature, it is recommended that the water content of this material always be determined in a separate sub-sample (not that taken for analysis) by drying to a constant weight (~24 hours) at 105°C. Results should always be reported on a dry weight basis.

### **Instructions for use**

The recommended sample size for analysis is 2 g for petroleum hydrocarbons and 5 g for organochlorine pesticides and PCB's respectively. Analysts are reminded to take appropriate precautions in order to avoid contamination of the material during handling. The material should be stored in the dark and kept in a refrigerator.

### **Legal disclaimer**

The IAEA makes no warranties, expressed or implied, with respect to the data contained in this reference sheet and shall not be liable for any damage that may result from the use of such data.

### **References**

- [1] Villeneuve J. P., de Mora S. J. and Cattini C., World-wide and Regional Intercomparison for Determination of Organochlorine Compounds and Petroleum Hydrocarbons in Mussel Tissue IAEA-432. IAEA/AL/146 (IAEA/MEL/74), IAEA, Monaco, 2004.

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