

# Contents

<b>1</b>	<b>Introduction</b>	<b>9</b>
<b>2</b>	<b>Characteristics of <math>^3\text{H}</math>, <math>^{90}\text{Sr}</math>, <math>^{137}\text{Cs}</math></b>	<b>12</b>
2.1	Basic characteristics	12
2.2	Chemical properties	14
2.3	Radioecological importance	15
<b>3</b>	<b>Environmental sources of <math>^3\text{H}</math>, <math>^{90}\text{Sr}</math> and <math>^{137}\text{Cs}</math></b>	<b>14</b>
3.1	Natural processes in tritium formation	16
3.2	Atmospheric nuclear weapons tests	16
3.3	The Chernobyl disaster	18
3.4	Further sources of artificial radionuclides in the environment	24
<b>4</b>	<b>Radionuclides in aquatic environment</b>	<b>25</b>
4.1	Receptivity of radionuclides by living organisms	26
4.2	Dynamics of radionuclide concentration in time	28
<b>5</b>	<b>Parameters of NPP Temelín</b>	<b>29</b>
5.1	Basic characteristics of the power plant	29
5.2	Water management	31
5.3	Limits	31
<b>6</b>	<b>Biological characteristics – phytoplankton</b>	<b>34</b>
<b>7</b>	<b>Methodology</b>	<b>35</b>
7.1	Monitored parts of the hydrosphere	35
7.1.1	Radioactive substances	35
7.1.2	Non-radioactive substances	36
7.2	Sampling and sample processing	38
7.3	Determination of $^3\text{H}$	38
7.4	Determination of $^{90}\text{Sr}$	39
7.5	Determination of $^{134}\text{Cs}$ (sediments) and $^{137}\text{Cs}$	39
7.6	Determination of gross beta activity	40
7.7	Laboratory, Department of Radioecology	40
7.8	Determination of non-radioactive indicators	41
7.9	Data processing	41

<b>8</b>	<b>Results</b>	<b>47</b>
8.1	Development of volumic activities of monitored radionuclides in surface waters	47
8.1.1	Development of tritium activity in surface waters	47
8.1.2	Development of $^{90}\text{Sr}$ activity in surface waters	49
8.1.3	Development of activity $^{137}\text{Cs}$ in surface waters	53
8.1.4	Gross beta activity	56
8.2	Development of mass activity of $^{90}\text{Sr}$ , $^{134}\text{Cs}$ , and $^{137}\text{Cs}$ in sediments	57
8.2.1	Development of $^{90}\text{Sr}$ activity in sediments	57
8.2.2	Development of activity of $^{134}\text{Cs}$ in sediments	58
8.2.3	Development of activity of $^{137}\text{Cs}$ in sediments	60
8.3	Development of mass activities of $^{90}\text{Sr}$ and $^{137}\text{Cs}$ in fish	64
8.3.1	Development of $^{90}\text{Sr}$ activity in fish	64
8.3.2	Development of $^{137}\text{Cs}$ activity in fish	65
8.4	Development of mass activities of $^{90}\text{Sr}$ and $^{137}\text{Cs}$ in water plants	66
8.4.1	Development of $^{90}\text{Sr}$ in plants	66
8.4.2	Development of activity of $^{137}\text{Cs}$ in plants	67
8.5	Assessment of monitored radionuclides activity balance – comparison of NPP Temelín contribution and the Orlík reservoir impact	70
8.5.1	Assessment of $^3\text{H}$ , $^{90}\text{Sr}$ and $^{137}\text{Cs}$ activity balance and of NPP Temelín discharges upstream and downstream from NPP Temelín wastewater discharge	70
8.5.2	Assessment of $^3\text{H}$ activity balance in the longitudinal profile of the Vltava and Labe and of NPP Temelín discharges	72
8.5.3	Assessment of the Orlík reservoir impact on $^{90}\text{Sr}$ and $^{137}\text{Cs}$ activity outflow from the monitored area	74
8.5.4	Comparison of $^{90}\text{Sr}$ and $^{137}\text{Cs}$ activity outflow and their deposition	77
8.6	Distribution coefficients of $^{137}\text{Cs}$ and $^{90}\text{Sr}$ in the water-sediment system	81
8.7	Concentration factors of $^{90}\text{Sr}$ and $^{137}\text{Cs}$ in fish	83
8.8	Concentration factors of $^{137}\text{Cs}$ and $^{90}\text{Sr}$ in plants	84
8.9	Results of phytoplankton monitoring	86
8.10	Results of monitoring physico-chemical indicators	91
8.10.1	Temperature	91
8.10.2	Biochemical oxygen demand ( $\text{BOD}_5$ )	92
8.10.3	Potassium	93
8.10.4	Chlorides	94



8.10.5 Sulphates	95
8.10.6 Nitrate nitrogen	96
8.10.7 Phosphorus	97
8.11 Relation between selected chemical and radioecological parameters	98
8.11.1 Relation between uptake of suspended solids and $^{137}\text{Cs}$ activity in the Orlík reservoir	98
8.11.2 Impact of potassium concentration factor of $^{137}\text{Cs}$ in fish	100
8.11.3 Impact of calcium concentration on concentration factor of $^{90}\text{Sr}$ in fish	101
<b>9 Discussion</b>	<b>102</b>
9.1 Appraisal of radionuclide content in surface waters	102
9.2 Appraisal of radionuclide content in sediments	110
9.3 Appraisal of radionuclide content in living organisms – in fish and plants	112
9.4 Appraisal of non-radioactive indicators	117
9.4.1 Phytoplankton	117
9.4.2 Physico-chemical indicators	118
<b>10 Conclusions</b>	<b>120</b>
<b>11 References</b>	<b>124</b>
<b>12 Supplements</b>	<b>134</b>
List of abbreviations and symbols	134
List of units	135
Prefixes used for SI units	135