6. Conclusions

The main differenace between present and previous report is the period covered, five years (1996 – 2000) in the present and one year in the previous. In addition, division of the Baltic Sea was modified once again according to the requirements of the HELCOM MONAS 3 meeting and in the preesnt report it only included six main sub-basins of the Baltic Sea. This new division had mainly in mind the needs of the PLC report.

The concluding chapter includes five sections, for nitrogen, lead, cadmium mercury and lindane.

Nitrogen

1. A reduction of annual nitrogen oxides and ammonia emissions can be noticed in all HELCOM countries with the most significant decrease (32% between 1996 and 2000) in Denmark. Nitrogen oxides and ammonia emissions, as a sum from all HELCOM countries, decreaseed 13.5% and 9%, respectively, in the same period. Sum of emissions from the entire EMEP domain was also slightly lower in 2000 than in 1996, 9% for nitrogen oxides and 4% for ammonia.

2. Emissions from the international ship traffic on the Baltic Sea, are only available for nitrogen oxides at present, and only for one year – 1990. Total annual emissions of nitrogen oxides from the international shipping operation on the Baltic Sea are relatively high, 353 ktonnes (NO_x). Compared to annual emissions from the individual HELCOM countries, for the same year, only emissions from Russian Federation, Germany and Poland are higher than emissions from the ship traffic. Therefore, ship emissions should be recognized as a very important source of the deposition to the Baltic Sea, whose contribution deserves further investigation.

3. The pattern in measured air concentrations of nitrogen compounds in the preiod 1996 – 2000 has been uncertain. There is some suggestion of the decline in concentrations on the southern Baltic shore, but otherwise the temporal pattern is somewhat erratic.

4. The observed concentrations of nitrate and of ammonium in precipitation do not themselves reveal clear temporal pattern in the yers 1996 – 2000. Therefore,

analysis have been made of the average rates of nitrogen deposition in precipitation. Even with this approach, no clear trend for the considered 5-year period is apparent.

5. Similar to observations, the time series of computed annual depositions for the period 1996 – 2000 also do not follow the reported emission changes. Taking into account uncertainty in the model results, which is roughly 30%, both measured and computed values do not differ significantly. One likely explanation of why the effects of the modest emission changes are not reflected in the computed depositions may be a dominant effect of meteorology over this short time period 1996 – 2000. A second and potentially important reason may be the lack of information on nitrogen emissions from the international ship traffic on the Baltic Sea for other years than 1990.

Lead

1. According to official data and expert estimates, the emissions of lead from the HELCOM countries have decreased during 1996-2000 by 10%. The decrease for the entire EMEP region is more significant (31%).

2. Measured air concentrations of lead do not indicate a consistent regional and temporal pattern in the years 1996-2000. Time-series of computed atmospheric depositions of lead to the Baltic Sea indicate some decrease (about 4%). Similar to nitrogen compounds computed lead depositions do not follow closely the emission pattern for the years 1996 – 2000.

3. In comparison to 1996 the input of anthropogenic lead emission sources in 2000 is decreased. An essential contribution to total lead depositions belongs to the input of natural, previous and remote anthropogenic sources.

4. Contribution of HELCOM countries to total lead deposition onto the Baltic Sea is decreased from 39% to 31%. Other EMEP countries contribute about 20%. Among the HELCOM countries, the most significant contribution belongs to emission sources of Poland – 14% in 1996 and 11% in 2000.

Cadmium

1. According to official data and expert estimates, cadmium emissions from HELCOM countries have decreased during 1996-2000 by 26%. The decrease for the entire EMEP region is accounted for 22%.

2. Measured air concentrations of cadmium do not indicate a consistent regional and

temporal pattern in the years 1996-2000. Time-series of computed atmospheric depositions of cadmium to the Baltic Sea indicate some decrease (about 4%). Similar to nitrogen compounds computed cadmium depositions do not follow closely the emission pattern for the years 1996 – 2000.

3. In comparison to 1996 the input of anthropogenic cadmium emission sources in 2000 is decreased. An essential contribution to total cadmium depositions belongs to the input of natural, previous and remote anthropogenic sources.

4. Contribution of HELCOM countries to total lead deposition onto the Baltic Sea is decreased during the 1996-2000 from 50% to 39%. Other EMEP countries contribute 7% in 1996 and 11% in 2000. Among the HELCOM countries, the most significant contribution belongs to anthropogenic lead emission sources of Poland – 34% in 1996 and 24% in 2000.

Mercury

1. According to official data and expert estimates, the emissions of mercury from HELCOM countries have decreased during 1996-2000 by 15%. The decrease of mercury emissions for the entire EMEP region is accounted for 17%.

2. Time-series of computed atmospheric depositions of mercury to the Baltic Sea region indicate an increase about 14% in period 1996-2000.

3. Contributions of HELCOM countries, EMEP countries and other sources including the input of natural, previous and remote anthropogenic sources to mercury depositions onto the Baltic Sea were practically on the same level during the period 1996-2000. The most significant contribution from HELCOM countries belongs in 1996 to Poland (15%) and in 2000 to Germany (19%). Other EMEP countries contribute about 5-6%. An essential contribution to total depositions of mercury belongs to the input of natural, previous and remote anthropogenic sources (about 50%).

Lindane

1. According to available official information and expert estimates of POPCYCLING-Baltic project, during the period 1990-1998 emissions of lindane (γ-HCH) in the Baltic Sea region decreased by almost two orders of magnitude. At the same time lindane emissions of the entire European region decreased only by 20% during this period.

2. Usage of POPCYCLING-Baltic project emission estimates makes it possible to

evaluate long-term trends in lindane (γ-HCH) concentrations and deposition fluxes for the Baltic Sea region.

3. In spite of significant decrease in emissions of HELCOM countries during the period 1990-1998 the level of lindane (γ-HCH) depositions to the Baltic Sea decreased only by 14%. This is connected with the influence of sources of lindane emissions outside the Baltic Sea region.