COMMISSIONS INTERNATIONALES POUR LA PROTECTION DE LA MOSELLE ET DE LA SARRE
INTERNATIONALE KOMMISSIONEN ZUM SCHUTZE DER MOSEL UND DER SAAR

Second Assessment of the river basin Moselle-Saar[1]

International Commissions for the Protection of the Moselle and the Saar (ICPMS)

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I. Description of the basin

The river basin of the Moselle and its largest tributary, the Saar, is one of nine sub-basins of the international River Basin District of the Rhine. Its area of around 28,000 km² (corresponding to 15 % of the Rhine River Basin District) is shared between four Member States of the European Union (EU): France, Luxembourg, Germany and Belgium (see map A-13).

The Moselle originates in the Vosges region of France, and flows into the Rhine 520 km later in Koblenz (Germany). Its main tributaries are the Saar (227 km), the Sauer (173 km) and the Meurthe (161 km).

4.3 million inhabitants live in the river basin of the Moselle and the Saar (see Table 1), corresponding to an average population density of 150 inhabitants/km². There are a total of 93 towns with more than 10,000 inhabitants, four of which have more than 100,000 inhabitants (Nancy, Metz, Saarbrücken, Trier).
Around half of the river basin is used for agricultural purposes, with equal shares of arable land and grassland. Vines are grown extensively on the slopes above the Moselle in Germany and Luxembourg, as well as along the Saar in Rhineland-Palatinate. Around one-third of the area is wooded.

The aforementioned four countries collaborate in the International Commissions for the Protection of the Moselle and the Saar (ICPMS) to ensure the sustainable management of these two rivers. This collaboration also serves to coordinate implementation of the European Water Framework Directive [2] (WFD) throughout the river basin. In this connection, at the end of 2009, an international river basin management plan (RBMP) was drawn up documenting implementation of the Directive and its international coordination.

[1] Contribution of the ICPMS to the Second Assessment of Transboundary Rivers, Lakes and Groundwater in the UNECE region (Water Convention)
[2] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

II. Hydrology and hydrogeology (integrated overview on surface waters and the shared aquifers in the basin)

The area is dominated by a moderate oceanic climate with a continental tendency, which manifests itself in significant temperature differences, a prolonged cold season, and fairly regular precipitation over the course of the year.

The long-term average annual precipitation for the entire river basin is 900 mm. The highest precipitation levels measured in the mountain ranges are 1,800 mm/a in the Vosges, and around 1,200 mm/a in the Rhenish Slate Mountains (Schiefergebirge), the Eifel and the Hunsrück. The minimum precipitation is recorded in the middle and lower Moselle region (600 mm). Taking into account evapotranspiration, the average annual outflow (surface run-off and groundwater recharge) ranges between 550 mm/a in France and 335 mm/a in Saarland.

River	River basin (km^2)	Average annual outflow at the mouth (m^3/s)
Moselle	28286	328 (based on the measurements in Cochem, extrapolated)
Saar	7431	80
Sauer	4234	34
Meurthe	2900	40

In application of the Water Framework Directive, the surface waters have been defined according to

- category (rivers, lakes etc.). For each category, criteria have been proposed to determine the water body type. For watercourses, the ecological type is determined by the ecoregion, watercourse size, and discharge regime (gradient, grain size, geochemistry etc.),
- and/or the pressures acting on them.

Some 600 waterbodies have been identified in this manner, including around 30 that belong to two or three different countries (cf. map A-3). A large proportion of the watercourses in the river basin of the Moselle and the Saar remain in a natural state (87 %), despite extensive anthropogenic interventions, and only 13 % are classified as heavily modified (Heavily Modified Water Bodies - HMWB).

In the case of groundwater, variations in the definitions applied have led to country-specific differences in the quantity and size of groundwater bodies. One aspect common to all definitions is the consideration of hydrogeological conditions. In total, 71 groundwater bodies have been identified in the Moselle-Saar sub-basin (cf. map A-4). This includes 26 groundwater bodies in the vicinity of a border.

III. Main problems in the basin

The countries in the sub-basin carried out a joint analysis within the way of implementing the WFD, which has highlighted the following six key transboundary problem areas:

- Water use along the Moselle and Saar, coupled with local regional planning policy, is not always consistent with the environmental objectives of the WFD, particularly in the areas of navigation, energy generation and flood protection.
- The biological continuity of the Moselle and Saar is not guaranteed, which impairs fish migration.
- Common forms of pollution – particularly nutrients (nitrogen and phosphorus) – and diffuse discharges adversely affect the status of surface waters.
- Levels of pollution with hazardous substances remain too high in certain parts of the river basin.
- Groundwater is impaired by diffuse discharges (plant protection agents, nitrate, contaminated sites and metals).
- The ecological equilibrium of the waters is impaired by mining (coal and iron ore basins).

Since many decades, the Moselle and the Saar have been developed into major shipping lanes along a large proportion of their length. This has significantly transformed the habitats of flora and fauna. In particular, the 28 locks on the Moselle and a further 6 on the Saar represent a major barrier to fish migration. These physical and biological changes also influence the oxygen balance and hence the water quality.

The so-called common pollutants, whether from point or diffuse sources, originate primarily from discharges from wastewater treatment plants and agriculture.

Number of wastewater treatment plants and annual discharges:

	No. of municipal wastewater treatment plants				Annual load (t)		
	> 2,000 inhabitants	> 10,000 inhabitants	> 100,000 inhabitants	Total	COD	N total	P total
France	80	43	3	126	4912	1120	55
Luxembourg	28	9	1	38	3501	1209	104
Saarland (Germany)	30	29	2	61	4900	1427	142
Rhineland-Palatinate (Germany)	76	39	1	116	1990	580	88
North Rhine-Westphalia (Germany)	2	0	0	2	20	4.5	0.6
Wallonia region (Belgium)	1	1	0	2	76	27	3

The following main pressures affect the groundwater of the sub-basin and influence its quality (ranked in order of importance):

- Nitrate pollution
- Pollution with plant protection agents
- Mineralisation (chloride and sulphate)
- Chlorinated solvents

Pollution with heavy metals, PCB and PAH has been detected across the entire area. Plant protection agents likewise contribute to contamination of the rivers and groundwater.

Chloride from anthropogenic discharges also continues to pose a major problem in the Moselle downstream of the Meurthe. The lower reaches of this Moselle tributary are affected by salt discharges (or more precisely, calcium chloride discharges $CaCl_2$) from the Lothringian salt industry (soda plants).

Mining activities have been closed down in both the coal basin and in the iron ore basin. Mining has permanently disturbed and altered the ecological equilibrium of surface waters and groundwater, causing a number of cross-regional problems which will need to be tackled in the long term.

The Saar in particular is affected by discharges of industrial wastewater from mining and from decommissioned mines, leading to high concentrations of chloride and other priority substances. Mining-related changes to the soil and subsoil and the discontinuation of mining directly impair the quality of groundwater in the iron ore and coal basin, which in turn affects the water supply to the population at local level.

IV. Status and transboundary impacts

According to the WFD, the status of a surface water body is determined by a combined assessment of its chemical status and ecological status. The overall status is considered good if both the chemical status and ecological status are at least "good".
In the entire Moselle-Saar sub-basin, based on the data from surveillance monitoring (2007), only 118 **surface water** bodies out of a total of 620, i.e. 19 %, exhibit a good status. This is due to both a bad chemical and ecological status (maps A-7 and A-8), as only 261 waterbodies (i.e. 43 %) exhibit a good chemical status and 35 % a good ecological status. Polycyclic aromatic hydrocarbons (PAHs) are primarily responsible for the bad chemical status and exceed the environmental quality standards at many monitoring sites. If PAHs were to be disregarded, 85 % of surface waterbodies would exhibit a good chemical status.
Due to their chemical status, only 24 % of bodies of surface water will achieve a good status by 2015 through the implementation of the programmes of measures accompanying the 2010-2015 river basin management plan. However, the proportion of waterbodies with a good ecological status will improve significantly to 56.5 %.

In terms of quantity, 97 % of a total of 71 **groundwater bodies** exhibit a good quantitative status (map A-12). In qualitative terms, 65 % of groundwater bodies exhibit a good chemical status, while 35 % of groundwater bodies are classified as having a bad status due to diffuse pollution with nutrients (nitrate) and plant protection agents (map A-11). In the Moselle-Saar sub-basin, it is expected that 99 % of groundwater bodies will achieve a good quantitative status by 2015, and 75 % a good chemical status.

This assessment of both the current status and the projected status for 2015 entailed close transboundary harmonisation and coordination, particularly with regard to waterbodies in the vicinity of national borders. Despite some differences in assessment methods, particularly with regard to biological aspects, harmonisation was facilitated through discussions between experts and separately documented in the management plan.

V. Response measures (including implemented measures, gaps and foreseen measures)

The basic measures to improve the hydromorphology of watercourses and reduce pollution are derived from the relevant European Directives and corresponding legislation of the Member States.

In the Moselle-Saar sub-basin, the sometimes complex transboundary harmonisation of measures and programmes of measures (such as the Moselle-Saar Action Programme 1990-2000) has the benefit of a long tradition under the umbrella of the ICPMS, supported by its permanent secretariat.

The various countries involved undertook a joint analysis of the problems relevant to the sub-basin, which highlighted the main cross-regional challenges and issues outlined in chapter III. In order to tackle these challenges, plans include the following measures:

Water use

Mindful of the provisions of the Water Framework Directive, the programmes of measures adopted by the Member States ensure that consistent approaches are adopted in the areas of water management, land use planning, agriculture and forestry. Close collaboration between these areas makes it possible to develop measures that fulfil several objectives simultaneously.

Continuity

Technical modifications to the Moselle and Saar and many of their tributaries have considerably altered the aquatic living conditions. Measures to improve biological continuity essentially comprise the conversion or demolition of weirs and other obstacles to migration, the construction of fish ladders, guaranteeing the required minimum outflow, and improving habitats. To this end, the ICPMS drafted an inventory of biological continuity in the river basin of the Moselle and Saar in 2010.

Nutrient load / diffuse pressures

The pressures from human settlements are to be reduced by a raft of measures on buildings, residential areas, wastewater collection systems and wastewater treatment plants. Improved rainwater management, achieved by building new residential areas with separate sewer systems and by the construction of storm water storage tanks in combined sewer systems, will help to further optimise the purification level of wastewater treatment plants. Public education campaigns are being conducted to raise awareness of the problem of waste disposal via the sewer system.

Diffuse pollutants are predominantly due to agricultural practices, but regional and local authorities and private individuals also contribute. One important measure is therefore to provide targeted advice to all user groups on good practices.

By mediating factual knowledge, findings and correlations and by analysing operational procedures, the aim is to optimise production factors and their sustainability. This includes improving fertiliser management via the more efficient use of production goods.

Another objective is to avoid or reduce the discharge of nutrients and plant protection agents by means of sustainable land management through extensification measures, extended crop rotation and intercropping, as well as soil cultivation measures including environmentally sound soil management to prevent erosion and minimise run-off.

Hazardous substances

Measures to prevent discharges of **plant protection agents** from agricultural land into rivers have been jointly developed, outlined and evaluated with regard to their effectiveness by the water management and agricultural authorities of all ICPMS Parties. Here too, measures are needed to advise and educate the relevant players, including private consumers.

Polycyclic aromatic hydrocarbons (PAHs) and **polychlorinated biphenyls** (PCBs) are widespread in the Moselle-Saar river basin. Levels of PCB contaminations in suspended matter have been monitored here since the early 1990s as part of the international ICPMS monitoring programme, and in 2004 a special monitoring programme with regard to PCB in suspended matter and fish, was devoted to this aspect.

When the programmes of measures were drawn up it became evident that with regard to diffuse sources, it will not be possible to reduce PAH sufficiently to meet the environmental quality standards (EQS) by the specified deadline. As these discharges are not solely a water management responsibility, and sometimes extend far beyond the national framework, an EU-wide response is needed.

Funding from the European Agricultural Fund for Rural Development (EAFRD) will be used to specifically to encourage the introduction or retention of environmentally sound agricultural management and cultivation practices in the Moselle-Saar sub-basin.

Mining

For as long as the transboundary mine workings remain flooded, estimated to last 10 years, and thereafter, the development of groundwater levels and quality will need to be monitored by means of a suitable monitoring network. Initial expert reports on this issue have been commissioned. As a final decision on the future form of mine drainage has yet to be reached, and a number of alternatives are still under discussion, it is impossible to predict exactly how the mine workings are to be flooded, and when long-term stability is likely to set in.

Monitoring networks

The monitoring networks for **surface waters** in place since the mid-1960s have been adapted in line with the requirements of the WFD to obtain a coherent and comprehensive overview of waterbody status. The international monitoring network of the ICPMS currently comprises some 50 monitoring sites.

During the course of implementing the Water Framework Directive, a monitoring network for **groundwater** comprising a total of 401 monitoring sites started operation.

Informing the general public and involving stakeholders

All Parties have taken care to involve users and stakeholders in decision-making processes regarding the measures to be taken under the WFD. Throughout all countries, German Federal States (*Länder*) and regions, the regional bodies (e.g. representatives of the regional and local authorities, agriculture, industry, consumers, environmental NGOs, electricity producers, chambers of commerce) have received information in varying levels of detail and have thus been involved in the planning of programmes of measures. The management plan for the international Moselle-Saar sub-basin is published on the website of the ICPMS (www.iksms-cipms.org).

VI. Future trends

The rise in average air temperatures, the clearest indicator of climate change, will have a tangible influence on the hydrological cycle. Surface waters and groundwater will be affected by changes in the precipitation and evaporation regime.

Experts predict that in addition to the long-term changes in current average conditions, annual extremes will also increase. The impacts will vary according to region, necessitating a specific consideration of each river basin, and some large river basins may need to be broken down into smaller units for individual analysis.

To date, it remains difficult to make any generally valid projections with regard to trends.

Changes and impacts are expected in key sub-aspects of water management, such as:

- Flood protection, due to the changes in the level, duration and frequency of flood discharges, and the resulting changes in the risk of damage
- Water supply, due to changes in groundwater recharge, groundwater properties and groundwater management and also, in some cases, the management of reservoirs
- Water protection, due to changes in the seasonal discharge and temperature conditions affecting the balance of materials in rivers and lakes as well as the biocoenosis
- Waterbody development, due to changes in the dynamics of watercourses and lakes, their morphological conditions, their thermal regime and their ecosystems, and
- The use of waters, especially due to changes in management techniques for flood and drinking water reservoirs, reservoirs for raising low water levels, hydropower use, the navigability of waters, cooling water use, and agricultural irrigation.

The Interreg IV A project FLOW MS (Flood and Low Water Management Moselle - Saar) was launched in early 2009 under the umbrella of the ICPMS. The project, which is timetabled to run for

five years with a budget of 3.4 million euro, is 50 % co-financed from ERDF[3] funds and aims to improve precautionary flood protection, to reduce the potential damage associated with flooding and advance low water management in the river basin of the Moselle and the Saar. Within this framework, the consequences of climate change on the genesis of flooding and low water will be investigated on a transboundary basis. The results of existing climate scenarios, and those currently under development, serve as the basis for analysis using available hydrological balance models (such as LARSIM[4]).

The ICPMS will continue to function as an international coordination platform for the implementation of the WFD and the European Flood Risk Management Directive[5] of 2007. In this context, the ICPMS Flood Action Plan, which was adopted in 1998 and which outlines measures up until 2020, will be incorporated into the flood risk management plan under the European Flood Risk Management Directive.

[3] ERDF - European Regional Development Fund
[4] LARSIM - Large Area Runoff Simulation Model (http://larsim.sourceforge.net/index.en.php)
[5] Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks

Table 1 General description of the Moselle/Saar sub-basin – Key figures

	BELGIUM	GERMANY			LUXEM-BOURG	FRANCE	Moselle/Saar sub-basin
	Wallonia region	Saar-land	Rhineland-Palatinate	North Rhine-Westphalia			
Surface area [km²]	767	2569	6980	88	2521	15360	28286
Average altitude	400	220	300	570	300	322	308
Average precipitation (mm/a)	1020	867	930	950	782	900	908
Discharge (mm/a)	370	335	420	578	366	550	477
Watercourse length (km)	292	737	2786	31	866	5761	10483
Drainage density (km/km²)	0.4	0.3	0.40	0.35	0.4	0.4	0.4
No. of lakes	0	0	0	0	0	2	2
Total surface area of lakes (ha)	0	0	0	0	0	190	190
No. of retention areas/ponds	0	2		1	2	20	25
Surface area of retention areas/ponds (ha)	0	224	-	44	525	4734	5527
Population: Inhabitants (x 1000)	38	1066	855	4	399	1981	4343
No. of communities	17	52	792	2	114	1680	2657
No. of towns > 100,000 inhabitants	0	1	1	0	0	2	4
No. of towns > 10,000 inhabitants	2	39	18	0	4	30	93
Forested area	38 %	33 %	46 %	51 %	35 %	30 %	35 %
Agricultural grassland	40.8 %	15 %	18 %	43 %	25 %	20 %	20 %
Agricultural arable land	17 %	15 %	19 %	1 %	24 %	27 %	23 %
UGBN/Livestock units (x 1000)	60.4	75	215.4	5	150	400	961