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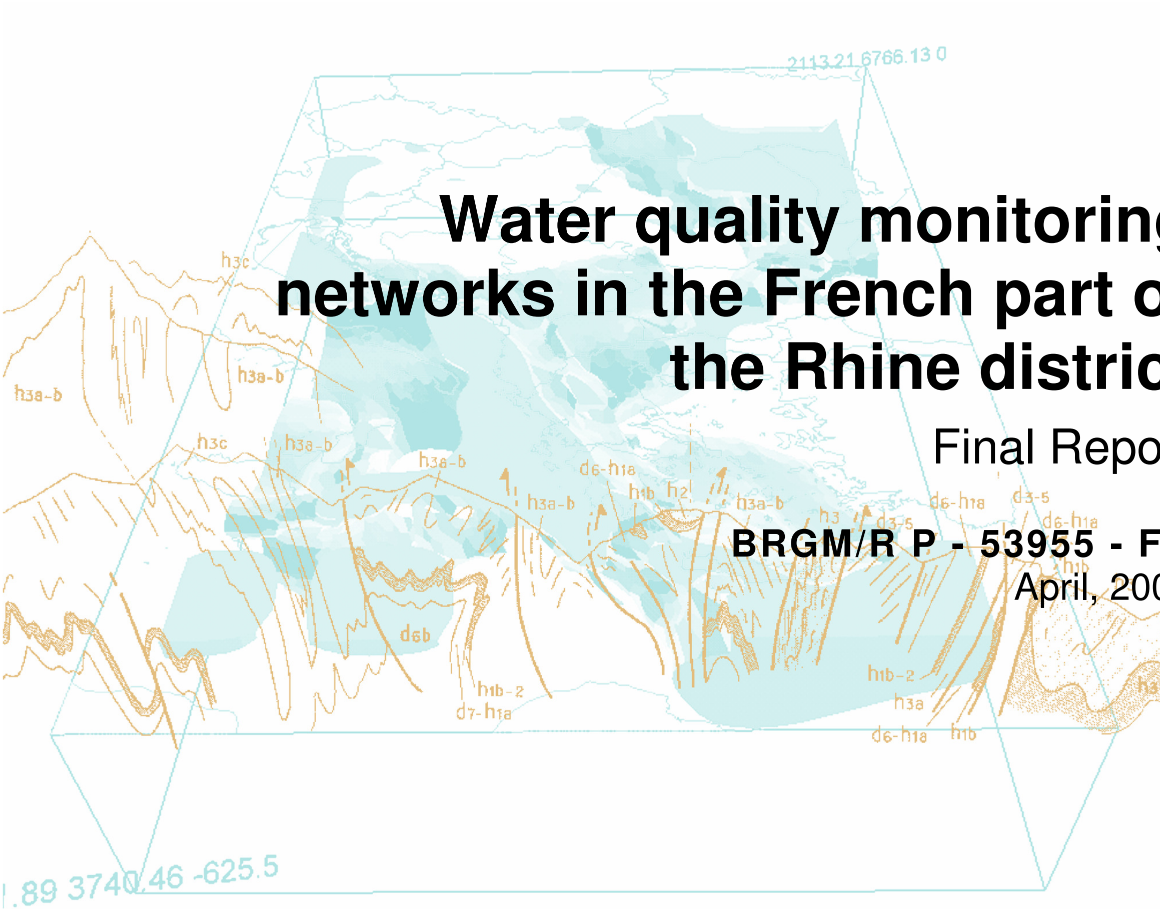

Water quality monitoring networks in the French part of the Rhine district

Final Report

BRGM/R P - 53955 - FR

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Geoscience for a sustainable Earth

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Brgm's Research activities - BRGM 2005

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Summary

This report presents the first part of what had been done in the 6th and 7th Work Packages of SWIFT project, which aims at integrating the findings of new screening devices of water quality monitoring in the monitoring needs to comply with the WFD (Water Framework Directive) requirements. Work is made by several partners on different local case studies and BRGM is responsible for the French Rhine district case study.

Rhine district is divided in two main basins: the Upper Rhine basin and the Moselle-Sarre basin. The basin characterisations had lead to the identification of 416 natural river water bodies, 58 artificial water bodies, 2 natural lakes and 15 large groundwater bodies. Both surface and groundwaters are submitted to organic matters, nitrates, micro pollutants pressures coming from houses and urban areas, industries and agriculture. With monitoring and modelling data the importance of these pressures on each water body had been assessed and each water body identified at risk or not towards WFD objective of reaching good chemical status (basin characterisation). 9 groundwater bodies out of 15 and 50 % of all surface water bodies have been identified at risk towards at least one type of pollution, often pesticides, but also organic compounds, mines mineralisation and nitrates are at the origin of this assessment. A lot of quality data information is missing in order to finalise and precise basin characterisation.

Today’s existing networks can be classified in four major types according to their finality: (i) Surveillance (**General or patrimonial)** monitoring networks, (ii) **Impact** monitoring networks, (iii) **Operationnal** monitoring networks, (iv) **Water use** monitoring networks. Other characterisation of networks such as type of water monitored and types of pressure distinguish the networks. There are two main reasons why water quality measures are made: on a voluntary basis or a legislative basis.

In the Rhine district, groundwater surveillance monitoring is carried out by the Water Agency basin network completed by local five years inventories (less frequent but denser). Surface water monitoring is larger (more sampling sites) and provided by the water agency basin network (denser and more frequent than groundwater national basin network) completed by a local (Bas-Rhine department only) complementary network as well as major rivers monitoring programs (Rhine, Moselle and Sarre only). Point source pollution networks, such as IPCC groundwater data collection can be distinguished from potential impact networks that focus on industries inputs. More local and non legislative-bounded diffuse pollution impact networks (nitrates and especially pesticides) also exist as well for groundwater as for surface waters. Operational monitoring networks emerged where specific pollution problems had to be solved and monitoring is a way to help decontamination decisions: in Rhine district iron and potash mines have this type of networks. Water use networks, although not treated in WFD, are of high importance in the water monitoring market: drinking and bathing are the two

human uses, which require strict water quality checking programs. Alert networks can complete these legislative use networks on local initiatives.

Cost of network can be divided in various parts, this decomposition helps understanding global cost. Costs of networks are very different from one network to the other mainly according to the (i) sampling parameters: types of water, sampling site… (ii) analysis parameters: parameters, methods and techniques used and finally (iii) to the extend of the network (number of sampling sites) and frequencies of measurements.

The WFD presents another classification of networks that have to be implemented by the end of 2006. **Surveillance monitoring** will have to be implemented in all water bodies, whereas an **operational monitoring** (and an **investigative monitoring** in special cases for surface waters) will have to be established in all water bodies identified as being at risk (according to WFD). The first type of monitoring (surveillance) is similar to the actual surveillance monitoring networks described above and managed at present by the Water Agencies. The second one (operational), which focuses on the parameters responsible of water body's contamination, can be assumed partly as gathering both actual impact monitoring network and operational monitoring network and adding new stations.

Surveillance monitoring is already relatively well achieved by public partnerships. On the opposite today's existing networks do not fulfil operational and investigative monitoring requirements, before all for surface waters, thought data's from existing networks could provide part information. Characterisation of basin demanded by the WFD has also showed a lack of quality water information, before all for dangerous priority substances (among them pesticides and halogen-organic volatile substances) in surface waters. Water stretches (lakes…) have no monitoring program.

Today's networks use classical analysing methods that consist in sampling collection and off site, laboratory analysis in major cases. SWIFT project's aim is at studying the feasibility of new alternative devices, and, assessing the needs in terms of water monitoring, will enable further work of exploring potential uses (scenarios construction) of these new devices in networks. Therefore analysing jointly costs of existing networks and their efficiency towards their aim (surveillance, operational, investigative) will be an important step in the evaluation of the interests (or demand) for emerging tools. It is before all in terms of spatial and time confidence that Swifts' tools could be of interest, corresponding with the WFD demand of studying tendencies and monitoring particular pressures.

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Abbreviation

AERM : Agence de l’eau Rhine-Meuse

APRONA : Association pour la protection de la nappe d’Alsace

CSP : Conseil Supérieur de la Pêche

DDASS : Direction départementale des affaires sanitaires et sociales

DIREN : Direction régionale de l’environnement

FREDON : Fédération régionale de défense contre les organismes nuisibles

ICPE : Installation Classée pour la Protection de l’Environnement

MEDD : Ministère de l’écologie et du développement durable

MN: Monitoring networks

OIEAU : Office International de l’EAU

SDEA Syndicat des Eaux et Assainissement du Bas-Rhin

SRPV : Service Régional de Protection des Végétaux

VOH: volatile organic halogen compounds

WFD: Water Framework Directive

1. Introduction

Since two decades, a large number of innovative in situ and on site monitoring techniques have been developed by research institutions. They include very diverse technologies, such as physic-chemical sensors, immunoassays, biosensors and they have been tested and applied in various domains, such as the space industry, the food and beverage industry and environmental monitoring. One of the objectives of the Swift project – as part of which this case study is carried out – is **to assess to what extend and under which conditions these new technologies could be used for water quality monitoring at the level of large river basin districts**.

The use of these innovative technologies depends on their technical ability to provide the information required, on their affordability and on their social acceptability by all the actors involved in water management. A series of 5 European case studies was designed to investigate these issues under different regulatory, social, technical and economic contexts. This report presents the first results of the French case study, conducted in the Rhine river district basin. The main objectives of this report is to characterise existing monitoring networks (MN) in the Rhine basin, with a focus on chemical monitoring networks (biological monitoring being out of the scope of the project). MN are defined here as systems able to account for the evolution over time of the quality of specific water resources (groundwater, rivers, wetlands, wastewater, drinking water, etc). A MN is not only a technical "thing", but the assembling of technical components (equipped sampling points, chemical analysis laboratory, data storage and management systems) and human components (actors in charge of the different steps of the monitoring process and that will use the delivered data).

The report is organised as follows. The first section presents the case study area with a focus on the type of polluting pressures, their impact on water resources and an assessment of the risk of non compliance with the objectives of the WFD. The second section describes criteria used for describing existing monitoring networks. The three following sections (5, 6 and 7) present major monitoring networks in details (see also the set of detailed description sheets given in appendix on this report). This description does not only focus on networks related to the Water Framework Directive (WFD), it also covers other networks aiming at monitoring water for specific uses (bathing and drinking water) or impact networks (nitrate directive monitoring network, IPPC directive monitoring network…). This methodological choice is underlain by the assumption that the innovative monitoring techniques could be useful for different types of water quality monitoring networks – not only for those related to the implementation of the WFD. Section 8 provides information on cost of existing networks, information that will be used later on as a reference to assess the economic feasibility of integrating new techniques in monitoring activities. Section 9 points at technical and organisational changes which will have to be made for existing monitoring networks to comply with the requirements of the WFD, identifying some possible uses for new in situ and on site monitoring techniques. Future activities are briefly presented in a concluding section.

2. Presentation of the Case study area

The data and figures presented in this section are extracted from the initial characterisation of the Rhine District (article 5 report) carried out by the Agence de l'Eau Rhin Meuse (www.eau2015-rhin-meuse.fr).

2.1. LOCATION AND WATER RESOURCES

The French case study focuses on the Rhin-Moselle-Sarre basin which includes two sub-districts of the upper Rhine: the Rhine river itself and its direct tributaries located in the Alsace region (8,160 km²); and the Moselle and Saar basins up to the German border (15,360 km²). The upper Rhine district is shared between France and Germany as the Moselle-Sarre basin extended over France, Germany, Luxembourg and Belgium. In this case study, we will focus on the French part only.

The district is composed of two major river basins:

- the eastern basin comprises the 214 kilometres of the **Rhine** from the Swiss border at Basel (South) to the German border at Lauterbourg (North) and its direct tributaries which take their spring in the Vosges mountains (Moder, Sauer, Lauter, Bruche, Zorn, Lauch, Doller) and in the Alsatian Jura mountains (Ill river). The total length of the rivers of this basin is 3960 km.

- The western basin comprises the **Moselle and the Saar** Rivers and their tributaries. The Moselle has a total length of 313 kilometres between its spring in the Vosges Mountains and the border with Germany and Luxembourg. Its main tributary is the Meurthe River. The Saar also has its spring in the Vosges Mountain and it flows to the German border at Saarguemines. The total length of the rivers of the Moselle Saar basin is 6114 km.

The Agence de l'Eau Rhin Meuse has identified a total number of **469 surface water bodies** in the Rhine district:

- **406 natural river water bodies**, classified according to their average discharge (3 classes), the natural region in which they are located (6 regions) and the type of fish habitat (corresponding to the Freshwater fish directive); 45 of these river water bodies have been classified as heavily modified water bodies;

- **64 artificial water bodies**, including 28 canal and 33 artificial lakes;

- **2 natural lakes,** both located in the Vosges Mountains;

Also, **15 large groundwater bodies** have been designated, two of which are lying across the Rhine and the Meuse river basin districts. Different types of aquifers are present in the case study area (hard rock, alluvial and karstic aquifers) and they represent an essential resource for human needs in both sub-districts (total abstraction of 750 millions cubic meters per year – approximately 60% for drinking water needs).

Figure 1 : Location of the case study area and major rivers (source: Agence de l'Eau Rhin Meuse)

2.2. PRESSURES AND IMPACTS

The two sub-districts (Rhine and Moselle-Saar) include remote and mountainous areas, such as the Vosges hills where water resources are not subject to significant pressures, as well as densely populated and past and present industrialised areas, where groundwater resources and rivers are under significant pressures. Impacts on water resource depend from the local hydrological or hydro geological context. Rivers are provisioning alluvial aquifer so that pollution affects these water bodies in addition to diffusion. Karsts aquifers, also present in the region, are also very sensitive to surface pollution.

2.2.1. Organic matter

Pressures

Wastewater from urban areas generates a significant pressure on surface water bodies (3, 7 million equivalent habitants with 1, 98 in the Rhine and 1, 72 in the Moselle Saar). The pressure is mainly due to large municipalities (55% of the total pollution in Moselle Saar and 74% in the Rhine) and to municipalities smaller than 2000 inhabitants (25% of the total pollution in Moselle Saar and 10% in the Rhine). The pollution generated by households not connected to public sewage networks contribute to 6% of the organic matter pollution in the Rhine sub-district and 21, 9% in the Moselle-Saar district.

Industry is another major source of organic pollution in both districts. The total industrial pollution load collected by municipal wastewater treatment plants is equal to 1, 1 million equivalent habitants (75% in the Rhine and 25% in Moselle Saar). The food and beverage industry contributes to respectively 55% and 30% of this pollution load in the Rhine and Moselle Saar districts. In addition, respectively 260 and 190 industrial sites directly discharge their effluents in rivers, generating a total pollution load of 615,000 and 455,000 equivalent inhabitants in the Rhine and Moselle Saar basins.

Animal production (mainly cattle breeding) also represents a significant source of pressure, as only one third of the cattle breeding farms are complying with the standards (in terms of effluent management practices). This pressure is much higher in the Moselle Saar basin (340,000 equivalent inhabitants) than in the Rhine basin (87,600 inh. eq) (AERM 2004).

Impact on surface water resources

Organic pollution (organic matters, phosphorous and nitrogen – nitrate excepted) is considered as a significant source of pressure for 55% of the total length of rivers (206 water bodies). Information is not sufficient to assess the level of pressures for 143 water bodies (representing 18% of the total river length of the basin). Missing data concerns essentially small rivers and artificial water bodies which are not systematically monitored.

2.2.2. Nitrates diffuse pollution

Pressures

In the two river sub-districts districts, the two major sources of pressure are agriculture, (25,000 farms) and wastewater from urban areas or industry (food industry in particular). Concerning agriculture, groundwater pollution is mainly caused by the leaching by rainfalls in autumn of nitrates which remains in the soil at the end of the cropping season. This risk of nitrate leaching is higher in the Rhine valley (Alsace region) than in the rest of the district (AERM 2004, p.79). During the last decade, nitrate leaching has progressively been reduced after farmers changed their cropping practices (Ramon, 2003). Agricultural nitrate pollution of surface water is mainly due to manure management practices and direct leakage from manure tanks. The contribution of wastewater treatment plants has not been assessed by the Water Agency although treatment plants older than 20 years are not very efficient in terms of pollution reduction.

Impact on water resources

- **Groundwater:**

The following table depicts the percentage of monitoring points where the measured nitrate concentration have exceeded the threshold value of 40 mg/l (80% of the drinking water quality standard) in 2003. This value is exceeded in significant percentage of the monitored points in 3 groundwater bodies. The Alsace valley aquifer (water body No. 2001) is the most severely affected, with concentration exceeding 40 mg/l in 20 % of the points monitored by the Water Agency and approximately 20% of the area exceeding the same threshold value (source : Water quality census of the Alsace Region). The two other water bodies affected by nitrate are “Sundgau versant Rhin et Jura Alsatian” (water body 2002) and the water body 2006 (Calcaires du Muschelkalk).

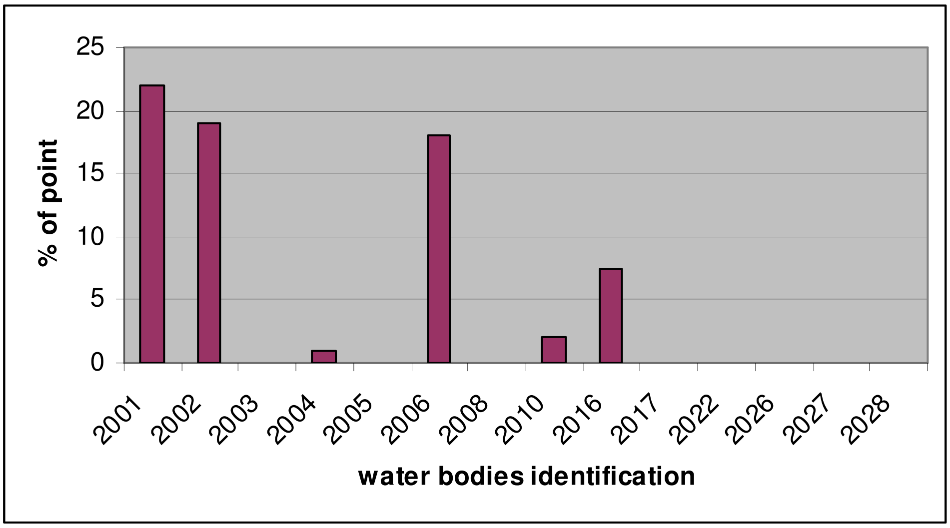

Figure 2 Percent of monitoring points with more than 40mg/L nitrates for 14 major groundwater bodies numbered 2001 to 2028 (source : AERM)

- **Surface water:**

The impact of river pollution with nitrates has not been presented separately in article 5's report of the Rhine district.

2.2.3. Micropollutants

Pressure

Micropollutants include all mineral or organic compounds, which have toxic effects (for humans, flora or fauna), at low concentration. They include the 33 priority substances (see Annex 12), among which the 10 dangerous priority substances. These substances can be classified in three categories: heavy and trace metals, pesticides and other organic compounds.

Relatively little information is available on direct and indirect discharges of toxic substances in water. A survey conducted by Agence de l'Eau Rhin Meuse (AERM, 2004) in 124 industrial sites and 7 waste water treatment plants shows that toxic substances have been found in 64 of 131 surveyed sites, with Priority Dangerous Substances found in 15 sites.

An important amount of **organic micropollutants** are found in surface and groundwaters, before all pesticides. Atrazine and its metabolites (desethylatrazine) are found in respectively 37% and 15% of the samples. Diuron and isoproturon are also found in 15% of the sample. Glyphosphate (and its metabolite AMPA) which presence has been monitored are also increasingly found (AERM, 2004 p 85). The level of information on pesticides varies from one area to the other: it is rather high in the Alsace Region, where a dense network of monitoring point is operating since 1983.

The presence of **mineral micropolluants** (Fe, Cr, Cu, Zn, Cd…) in water is mainly due to industrial activities, mining activity, pollution from roads and urban wastewaters. Agriculture also contributes to this pollution (Cu, Cd). Metals can be directly discharged in rivers (industrial effluents, wastewater treatment plants), washed away from soils (erosion) or come from atmospheric pollution. The average total input of heavy metals is one and a half time higher in the Moselle Saar basin than in the Rhine. The total discharge in kg/year has been estimated by Agence de l'eau as follows:

	Hg	Cd	Cu	Zn	Pb	Cr	Ni
Moselle Saar	87	556	15274	79064		5365	8929
Rhine	62	287	10070	44517	6847	3334	5625

Figure 3 Total heavy metal input in water (kg/year) in 2000 in Rhine district.

Impact on water resources

- **Mineral micropollutants**

Mineral toxic substances (mainly heavy metals) represent a source of significant pressure for 77 surface water bodies, representing 28 % of total surface water length. Only 9 water bodies (4% of total river length) have been characterised as not affected by such a pressure. The information is not sufficient to assess the level of pressure for 383 other surface water bodies, representing 68 % of the total river length. This is due to the fact that the number of measurement points where mineral toxic substances are monitored are not very developed and mainly located on large rivers where there presence is known. See also (2.2.4).

- **Organic micropollutants**

    - **Pesticides**

This pressure has been estimated using water quality data and indirect indicators, based on land use. The result of the analysis shows that this pressure is significant for 209 surface water bodies (representing 52% of total river length), whereas 179 surface water bodies (33% of river length) could not be characterised because of a lack of information. This pressure affects the entire district with exception from Vosges Mountains. Missing data's WBs are situated mainly between plains and hills.

Seven groundwater bodies are seriously affected by pesticides pollution, with drinking water standards exceeded in more than 20% of the monitoring points. The situations is particularly serious in the Alsatian alluvial aquifer (major WB of the district) where the presence of atrazine is detected in 59 % of the monitoring points (regional water quality census of 1997) whereas the drinking water standards are exceeded in 13% of points. More than half of the points show a pesticides pollution in Meurthe and Moselle's aquifers and the drinking water standards are exceeded in 37 % (Meurthe) and 52 % (Moselle) of the monitored points.

    - **Other micropollutants**

Organic toxic substances other than pesticide include chlorinated solvents, PAH, PCB, etc. Given that very little information is available to characterise this pressure, the Agence de l'Eau Rhin Meuse has not assessed this pressure at the river district level.

More detailed information however exists at the level of the Alsace valley aquifer, where the most frequently encountered organic substances are volatile organo-halogenous compounds (VOH). Their presence is detected in nearly one third of the 422 monitored points (water quality census of 97); tétrachloroethylène had been found in more than 20.6% of the cases and in more of 6% of the points they exceed potability norm. Aquifers in the Moselle Sarre district are also affected by these compounds (water quality census of 2003).

Concerning industrial effluent discharges, a census of significant discharge points of **dangerous priority substances (DPS)** has identified 15 sites emission sites, affecting in 12 surface water bodies (of which 5 in the Rhine district).

2.2.4. Pressures and impact due to mining activities

Mining activities are also a significant source of pressure in the district. There are for major mining sites in the regions, each one generating different type of pressures on water resources. See map in Annex 6**.**

The **iron mining fields of Lorraine** located between Metz, Verdun and Luxembourg cover an area of 1000 km drained by the Moselle River. They have been exploited for more than 100 years until the closure of the mines in 1997. After mine closure, water invaded galleries and its mineral content has gradually raised (sulphate, heavy metals, hydrocarbons, phenols). Mine water now overflows to rivers, generating a significant pressure on some surface water bodies.

- The **coal mining fields of Loraine** covers over 250 km2. Exploitation stopped in 2004 but mine water pumping is going on. Mine flooding generates a problem similar what is happening in the Iron mining fields. Mining surface installation and waste dumps are also the origin of sulphates and chlorides contamination.

- The **potash mining fields of Alsace** had been exploited widely for more than hundred years but are not anymore in exploitation; still important pollution is threatening groundwater with important salted (NaCl) waste dumps which are the residues of these mines. Infiltration of chloride in the aquifer had lead to the formation of two salted plumes of 80 km2 (with more than tens gram per litre in deep layers). The removal of waste dumps and pumping of groundwater (fixing chlorides) should be completed by 2010.

- The **salt Moselle basin** is the location of an important very good quality salt deposit and more than one millions tons of refined salt and sodium bicarbonate are exploited every year. Natural and artificial (resulting from salt industries) salinity highly contribute to the Rhine salinity through Moselle river. No solution for reduction of salinity emission had been proposed until now.

2.3. RISK ASSESSMENT

This section briefly describes the risk of non compliance assessed by the Rhine Meuse water agency. This information is likely to help identifying the type of substances for which intensive monitoring is required.

2.3.1. Methodology for assessing risk

Objective and scope : The risk assessment methodology established by the Rhin Meuse Water Agency consists in extrapolating the evolution of water quality in the future (2015), based on a characterisation of existing pressures in 2004 and on an assessment of the economic trends likely to change the pressures (baseline scenario). The extrapolation itself consists in simulating the impact on water resources of the anticipated changes in pressures. This simulation has been carried out using different approaches and tools depending on the type of pressure and the type of water resource (groundwater or surface water).

Information sources: The baseline scenario is elaborated using three type of information. Firstly, statistical data are used to assess past trends of economic activities using (or having an impact on) water resources (population, agriculture); future evolution of these activities were then forecasted – with different assumptions. Secondly, experts are consulted to identify future events likely to modify or reverse the observed trends (for instance the common agricultural policy for agriculture). Thirdly, planning and regional development documents are consulted to identify development projects which have been (or likely to be) approved (for instance wastewater treatment plans, development of industrial compounds, etc).

Steps of the analysis: The baseline scenario is described at the river basin district level. It is then used to assess precisely and quantitatively the pressures in 2015 at the level of water bodies. In particular, the 2015 pollution loads are estimated for all major wastewater treatment plants, industrial units and agriculture (cattle breeding units). Based on this, anticipated changes of the chemical status of water resources are assessed, using expert judgement or a model.

Uncertainty of the risk assessment: The risk assessment is relatively robust when models have been used, which was only possible where a sufficient amount of data was available. This is the case, for instance, for the assessment of the risk related to nitrate and pesticide contamination of groundwater. A "risk" indicator is assessed taking into account the intensity of land use, the type of agricultural activity and the vulnerability of the aquifer (type of soil covering the aquifer for instance). The GIS based model assesses the risk (high / low) at the pixel level, a water body is considered as at risk if more than 20% of its area is characterised by a high risk level. A mathematical simulation model (PEGASE) is also used to simulate the evolution of organic pollution for surface water bodies (carbon, phosphorus, nitrogen); it computes the concentration of various substances for each river stretch, taking as input river stretches characteristics, the minimum river flow (5 year return) and point source pollution loads; the model simulates dilution and natural attenuation processes. In its current version, the model only represents 8000 of the 12,000 kilometres of rivers of the territory of the Water Agency.

Recognising this uncertainty, the Water Agency insists, in its conclusion, that this risk assessment has to be considered as a preliminary analysis, aiming at identifying significant water management issues and identifying water bodies where monitoring has to be strengthened and additional measures might have to be implemented.

2.3.2. Results of the risk assessment for surface waters

The first result of the prospective analysis is the simulated evolution of pressures for 2015. The analysis of Water Agency shows that only organic pollution is expected to decrease, as a result of the progressive implementation of the Urban Wastewater Directive. Other pollution sources are not expected to decrease significantly, as show by Figure 4 below. This statement applies for the Rhine and the Moselle-Sarre sub-districts.

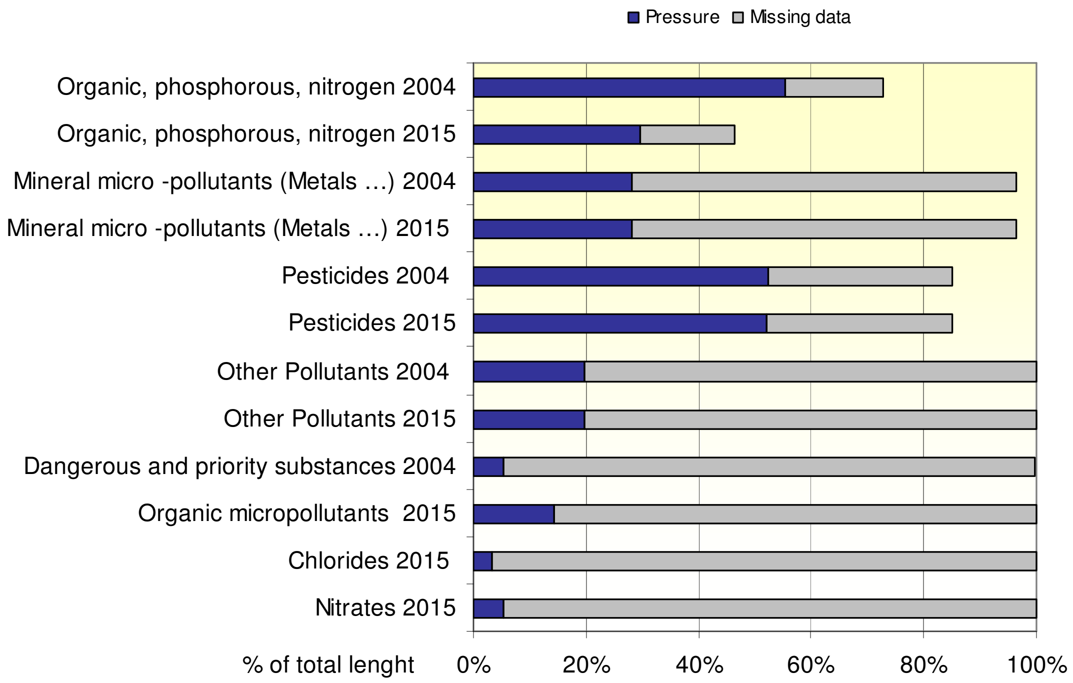

Figure 4 : Polluants pressures on surface water bodies in 2004 and projected in 2015

More than half of total river length have been characterised with a significant pressure of pesticides for 2004 and still for 2015. Pesticides is the main pollution that is responsible for ranging water bodies as risky to not reach good water status by 2015. For other pollutants it's difficult to say because a lot of data is missing: but all other pollution types analysed here are responsible for risk classification of water bodies as risky.

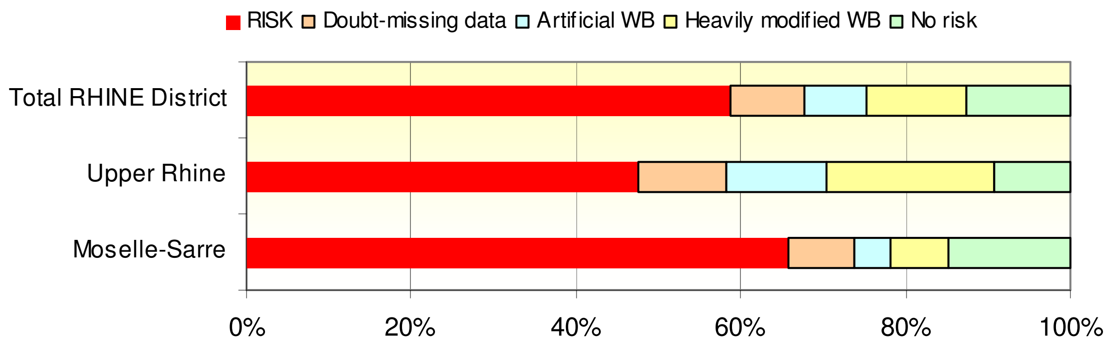

Figure 5 : risk assessment in percent of total river length of Rhine district

Nearly 60 % of the total river length of the Rhine district had been characterised at risk.

Without looking at any specific pollution type, **48 % in Rhine district and 66 % in Moselle-Sarre district** of total water bodies length (38 % in Rhine district and 50 % in Moselle-Sarre district of water bodies in percent of number of water bodies, which is 209 water bodies on 470) have been characterised with **a significant risk to not reach good status by 2015.**

2.3.3. Results of the risk assessment for groundwater

Out of the 15 large scale groundwater bodies of the Rhine-Moselle-Sarre district, 10 have been characterised as “at risk”, 3 are considered as “partly at risk” (the area affected by a significant pressure in 2015 is rather limited) and 2 are not considered at risk. The information is not sufficient to assess the level of risk for another one.

The following figure shows the number of water bodies (under the 15 present in our zone) that have been characterised with significant pressures by 2015.

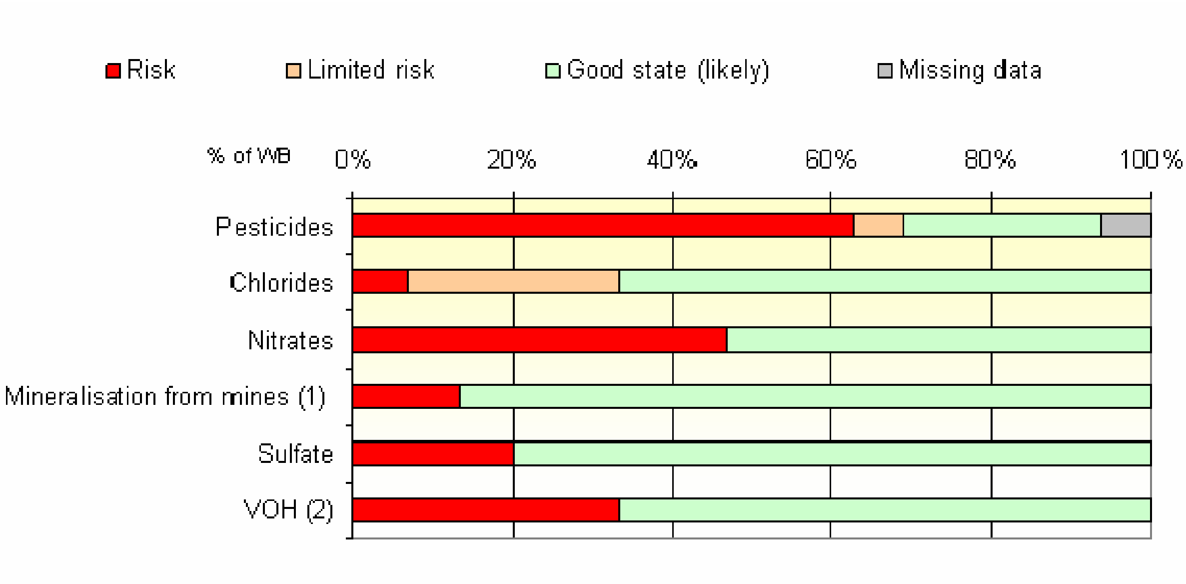

Figure 6 : Number of groundwater bodies per pressure type by 2015 – Rhine district (source AERM (1) sodium, magnesium, iron, manganese, bore, ammonium; (2) volatile organic compounds

For most of the groundwater bodies at risk, the risk is due to more than one polluting substance: 2 water bodies are affected by 4 sources of risk; 3 are affected by 3 sources; 3 by 2 sources and only one by one source. The major sources of risk of non compliance are the following:

- Pesticide is the most serious source of risk of non compliance for groundwater; it concerns all the groundwater bodies at risk (10). Data is not sufficient to assess the level of risk for an 11th one which is classified in the “doubt” category. And one additional groundwater body is partly at risk (local problem) due to pesticide contamination.

- Nitrate is also a significant source of risk: it is estimated that, in 2015, the threshold value of 40 mg/l will be exceeded in more than 20% of the area in 6 of the 15 water bodies.

- Other sources of risk are linked to the presence of chlorinated solvents (5 water bodies, where the solvents have been detected in 13% to 50% of the monitored points), chloride (3 water bodies) and various substances due to mine flooding (sulphates, heavy metals, etc) in the iron mining fields.

3. Criteria for analysing existing monitoring networks

A large number of water quality monitoring networks can be found in the Rhine – Moselle – Sarre river basin district which was selected to conduct the present case study. These networks are operated by different actors, with different objectives. They cover different geographic scales and different water resources (groundwater, rivers and wetlands) and they provide different type of information (parameters monitored, frequency of measurement, etc). The objective of this section is to give an overview of the observed diversity of networks and to list the criteria to be used for their description**. A good understanding of this diversity is considered as a prerequisite for assessing the potential use of the innovative in situ and on site monitoring techniques.**

3.1. OBJECTIVE OF THE NETWORKS

Looking at their objective and the final use of the data they produce, monitoring networks can be classified in four major types, as follows:

Surveillance MN are established to monitor the long term evolution of water quality. They are also a support to improve knowledge on groundwater quality. They do not focus on a specific group of pollutants but aim at detecting any deterioration due to human activity (screening). Depending on the size of (or the number of) water bodies monitored, these networks can be established at the national, regional or local level, and they can be operated either by government agencies or by local territorial bodies (county councils, regional councils, group of municipalities, etc). They may have been established in response to regulatory constraints[1] or on a voluntary basis by local actors where water resources play a significant role in socio-economic development. Some SMN may have been operating for several decades already. Their cost is generally supported by public organism. In some case, private operators – such as a mineral water company – can operate and finance it.

Impact MN are established to monitor the environmental impact of specific point (or diffuse) pollution sources (industrial and mining sites; wastewater treatment plants; etc.). They focus on a limited number of pollutants (those likely to be produced by the pollution source, depending on what was produced in the site, chemical used, etc.). The information provided by these networks are not representative of the overall status of the water body as the monitoring points are exclusively located in polluted areas (or areas at risk). Examples include IPPC networks (monitoring of water in all IPPC registered industries), monitoring of ancient industrial polluted sites, urban and industrial landfills, etc. Some of these networks may have been operated for decades in ancient mining or industrial areas for instance. Their costs are generally born by the actors (private) responsible for the (risk of) pollution.

Operational MN are set up to assess the effectiveness of operational management measures implemented to control or reduce groundwater pollution. The information produced by these networks is directly used to adapt the nature and the intensity of the pollution

[1] In particular, a large number of EU directives impose that specific water quality monitoring is carried out: the Nitrate Directive, the Drinking Water Directive, the Bathing Water Directive, the Integrated Pollution Prevention and Control Directive, the Urban Residual Waste Water Directive, groundwater directive 80/68/EEC. (List to be completed).

control and remediation measures by the actor in charge of the polluted site. These monitoring networks usually cover a limited number of polluting substances related to the nature of the pressure. Their geographic extension is limited to the water resources affected by a specific pressure (it can be a group of water bodies affected by similar pressures). The frequency of water quality measurement is generally high (a few times a year) in order to allow water resource managers to take action as soon as a negative evolution is observed.

Use MN are designed to monitor water quality for specific water use (production of drinking water; shellfish production; bathing waters; etc.) and to ensure that water quality complies with relevant standards. The information they produce is not representative of the status of the water body as only a few water quality parameters are investigated, the location of the monitoring points is not representative of the water body[2] and the MN generally covers only one part of the water body. Their cost can be covered by public actors or by water user providers (which involves water price).

3.2. TYPE OF WATER BODIES MONITORED

A second key criterion to describe the diversity existing monitoring networks is the type of water monitored.

- The technical characteristics of MN vary according **the nature of the monitored water body**. For instance, surface water quality is often much more variable over time than groundwater (Karstic aquifers have however a high time variability). And for a high flow the frequency must be higher than for a water body with a small flow for the same efficiency. It is the same problem with the point density.

- **The type of pressures** (urban, agriculture, industries) observed are components to take into account while designing a network. A determining point is the type of pollution: **point source pollution or diffuse source pollution**: observing points must be adapted. The frequency will have to be determined according the observed parameters: for instance turbidity, pesticides and nitrates vary much more than other parameters due in particular to their sensitivity by unpredictable events such as strong rains and date of product application by agriculture. In consequence a specific network focusing on pesticides would choose a frequency and collecting dates according to this.

- **Quality parameters** are ordered with the perspective of the WFD logic: the WFD have two main objectives for surface waters: the good **ecological** status and the good **chemical** status and, for the groundwaters: the good **chemical** status.

3.3. ACTORS INVOLVED IN MONITORING

Monitoring networks significantly differ in terms of organisational characteristics, type and numbers of actors involved and relationships between the different actors. The organisational analysis of a MN can be analysed by looking at the actors in charge of the different steps of the monitoring process: (i) design of the network (selection of points to be monitored, frequencies, parameters, analytical techniques selected, etc); (ii) sampling; (iii) chemical analysis of the samples; (iv) data acquisition, storage and management; (v) data analysis,

[2] For instance, data from Drinking Water Quality MN underestimate pollution as monitoring points are always located within protected areas.

validation and interpretation and (vi) data dissemination. Three major configurations are encountered in the basin:

- The MN is entirely designed and operated – from the design to the data interpretation and dissemination – by a single actor who owns all the technical assets. In France, this may be the case of certain government agencies (DIREN) who have invested in modern laboratory equipment. This configuration is however only found when the actor in charge of the network has to produce a large number of water sample and chemical analysis, either for its own network or for others – so that its own chemical analysis costs are not significantly above market prices. This configuration has not been observed in the Rhine district, unless the hydro biological network in Lorraine region (managed entirely by DIREN Lorraine), generally this type configuration is more and more rarer.

- The different steps of the MN are also carried out by one single actor, except for sampling and chemical analysis which is subcontracted to a private laboratory – allowing the operator to save on investment costs and doesn't need any competency in chemical nor biological analysis. A call for tender is prepared by the operator of the MN, specifying the sampling points and frequency, the parameters to be analysed and accuracy of the analysis (detection limits) and sometimes the analytical methods to be used. All the other activities are carried out by the operator of the network. In this configuration, like in the previous one, the actor in charge of the network bares all the cost of monitoring and the responsibility for data production. The River basin district monitoring network, operated by the Rhine Meuse Water Agency is representative of this configuration (see description in the following chapters).

- The MN is established to monitor water quality (for instance drinking water) or the environmental impact of polluting activities (industries, wastewater treatment plants, contaminated sites, etc) in routine or as a preliminary impact study, in compliance with environmental or human health regulations (for instance IPPC directive, urban wastewater directive, etc). A Government agency is responsible for ensuring that a minimal current monitoring is made, punctual monitoring, analysing the results, taking action to enforce the law if any infringement is observed and reporting to the European Commission (in certain cases: not in drinking water case?). But the production of major data (sampling and chemical analysis) is left under the responsibility of the actors generating the source of risk (IPPC directive) or having to monitor the quality of water they use (drinking water directive). A system of random control may be organised to ensure that the technical prescriptions imposed by the Government agency are followed. In this configuration, the investment and recurring costs as well as the responsibility for data production is shared between private actors and government agencies. In the Rhine district, at least three networks correspond to this configuration: the Drinking Water MN operated by the Government Agencies for Health and Social Affairs (DDASS), the sampling and analysis being carried out by water companies and municipalities; and the IPPC MN networks, operated by the Regional Government Agency for Industry Research and Environment (DRIRE), the sampling and analysis being carried out by registered industries; the Wastewater MN operated by navigation service.

  A slightly different configuration, connected to the previous one, is the realisation of a self -monitoring programme by the actor generating the pollution and /or a public organism or distributing water on own initiatives (further than the legally constraints) to improve management of process (treatment of used waters or drinking waters). In this context there are no technological constraints.

In each of these configurations monitoring main objective is clearly defined, nevertheless there are other potential uses for the water data produced in these contexts. Final data use is larger than the use by the stakeholder in major cases where data is on free access.

The innovative monitoring techniques studied in Swift are likely to provoke different reactions and expressions of interest in each of these three different configurations according to each objective of monitoring.

3.4. GEOGRAPHICAL SCALE

Water quality networks can extend on very different scales. National networks exist but they are in reality a computation of more local basin networks. We note that networks extend both on hydrological entities such as river basins but also on administrative entities, this is far rarer, but corresponds to those who are implemented by local communities. A very local scale can also be observed for ‘private networks’ such as drinking water utilities alarm networks, investigative local networks and even measurement points for industries.

3.5. OPERATIONNAL ISSUES

More **practical aspects** characterise networks and are relevant to examine quality of the delivered data and confidence of the data towards objective:

- The methods used and the way sampling and analyses are done is a determining factor. Today a lot of sampling and chemical analysing methods are normalised: laboratories do not have really the choice of the methods. This is the case in general for networks that respond to a particular legislation, they are usually the same for a given type of parameter. Among them we could cite electrodes (for pH, conductivity and ions), chromatography, spectrophotometers, polarography, which are for all of them voluminous, delicate and expensive material. Nowadays we note also that in some cases legislation tend to accept, in special cases, methods that would not be accredited ones.

- The computerisation times of the data and the delay before data are published or delivered after sampling and analysed is also a very important criteria of network’s efficiency before all in cases of alert and control networks.

- Extend of the network or campaign is also determining for the characterisation: (i) density of points, (ii) frequency and the time scale. They will be determined according to the technique chosen and the goal of the monitoring:” what is the data collected for?”

All these criteria’s are important to be described, because for one monitoring objective, different networks could be implemented (according to different technical proposals) and lead to different costs and information quality and quantity, which will be crucial to the aim of swift which is evaluating the potentiality of new techniques.

Networks of the Rhine district are described in the following part, they are presented according several types of network (“typology”) according their objective.

4. Surveillance monitoring network

Surveillance monitoring networks are implemented to have a general overview of monitored water bodies. They exist for surface and groundwaters and are generally managed by public institutions. As the objective is the surveillance, parameters are not restricted on special pressures and focus on, both, point and diffuse pollution (but mainly on diffuse source pollution considering the usually large scale of this type of network): this is why they produce a huge quantity of data. This type of monitoring enables to increase knowledge of water bodies and also to help defining policies for safeguarding water quality.

4.1. GROUNDWATER NETWORKS

4.1.1. Rhine-Meuse basin groundwater quality network : « Réseau de suivi de la qualité des eaux souterraines du bassin Rhin-Meuse (RBES) »

The objective of this network is the knowledge and understanding of the resource and to identify possible trends in water quality. This data's network is a component of a national network.

Water agency (AERM) owns and operates this network since 1970. The Water agency, DIREN Alsace and DIREN Champagne-Ardennes support it financially. The technical characteristics of the network are fixed according to the national protocol signed in 1999 by the 6 Water Agencies. The circular DCE 2003/07-MEDD-book over « Terms and conditions for the evolution of the inspection networks » requirements are aiming at making this network evolve (apparently not drastically here) and meet the WFD requirements. Data are stored in the bank of water Rhine-Meuse and at national level, they area accessible through the national groundwater database ADES (www.ades.eaufrance.fr)

The RBES network includes 185 points and extends over the whole Rhine-Meuse basin district. It is operational since 1999, on nearly 60 parameters in routine, to 1 to 6 times per year. The parameters are those of the national protocol supplemented by pesticides chosen according to a regional list (called SIRIS). It shows that this network-thought it is a surveillance network- is partly adapted to local pressures.

Private laboratories carry out the water sample analyses. The computerisation delay is of 2 months after sampling.

4.1.2. Five years water quality regional surveys of Alsacian, Sundgau and Lorraine ('Inventaire quinquennal de la qualité des eaux souterraines')

The objective of regional surveys is to obtain a complete characterisation of the water quality every five years in order to assess trends and detect emerging threats (Région Alsace 2000). This survey is made separately in Alsace, Lorraine and for the Sundgau (the south part of Alsace). In Alsace the management of this network is made by APRONA, a local association for the protection of the Alsatian aquifer. In the Sundgau and in Lorraine it is managed by the Water agency (Agence de l'eau du bassin Rhin–Meuse) and is financed by the regional administrations (« Conseil Régionaux »). It exists since beginning of the nineties (had been made in 1991, 1997 and 2003 for the Alsatian network).

The Alsatian inventory have a real local importance as the aquifer is, there, of primary importance: it represents an enormous amount of high quality water that could be and is used as well for drinking water and industries. In 1997 and 2003 the Alsatian inventory has been coupled with German monitoring program under a European commission financing program (INTERREG). Not all parameters have been the same but most of them. More and more parameters are followed from year to year.

For the Alsatian part this network is a relative dense network, with a mean of 1 point per 4 square km. It is much denser than the national basin network. The samples had been taken essentially in the upper part of the aquifer, which means between 10 and 40 meter depth. 16 deep piezometers had lead to specific analysis. Sampling for the 1997 inventory had been done one time, in the period between August and October 1997. The choice of parameter have been made in accordance to the following criteria's: (i) potential agricultural, industrial or domestic rejects, (ii) present risk in groundwaters, (iii) toxicological risks, (iv) anterior analysis results, (v) existence of analysing methods and their costs. Here again we note that the network is designed according to local characteristics.

Private companies make the analyses. In Lorraine 2003 surveys aren't published yet, in Alsace first results had been given out in April 2005: the time is very long before publishing.

4.1.3. Complementary networks

A very particular network is the one of the Strasbourg Community (CUS), which developed an "aquifer observatory" ("observatoire de la nappe") in order to prevent and to manage water drinking borehole contaminations (4 wells from which water is then distributed to the whole Strasbourg area). Several strategic points are monitored every 2 years to inform whether pollution is 'arriving' on boreholes. This information enables the community to react and when decontamination is needed to manage it in time, before it arrives to the well, or to stop pumping for distribution.

4.2. SURFACE WATER QUALITY MONITORING

The water quality monitoring of surface waters is more extended than that of groundwater, because purposes and stakes of water have been considered, until today, differently. In the case of surface waters, water is considered as a whole natural environment where the conservation of biology and a good chemical status (for the ecosystem itself and for seas and oceans) is as important as protection for a potential drinking water. The parameters analysed in these networks are therefore of different nature and include biological parameters which where out of groundwater networks. In this border region water surveillance of rivers is of main importance because Rhine, Moselle and Sarre cross the French border.

4.2.1. Water quality monitoring of surface waters of the Rhine-Meuse basin (« Réseau de suivi de la qualité des eaux superficielles du bassin Rhin-Meuse »)

This network is a part of the national basin network ("Réseau national de bassin") that extends in whole France over 1700 points. Goal of this network is knowledge, information and evaluation of the surface water quality and is, though, relatively geographically uniform (see Annex 5).

The operators are the AERM, the regional environmental direction, DIREN -Champagne-Ardennes, -Lorraine, -Alsace and the fisheries council: CSP (« Conseil Supérieur de la

Pêche »). Stakeholders are the water agency and the ministry of ecology and environment (the MEDD). The network includes 253 sites over whole basin and the analysed parameters are of an important amount: pesticides[3], organoleptic, mineral and organic micropollutants, physicochemical parameters. They are analysed with a variable frequency according to the parameters' (twice weekly to semi-annual). Other supports as water are less frequently analysed: sediments (parameters are measured every year), suspended matter (every month), bryophytes (micropolluants mineral: every year). Data are accessible on Internet from the water agency's portal.

4.2.2. Complementary basin networks : Bas-Rhin surface water monitoring network: « Le réseau d'intérêt départemental de suivi de la qualité des eaux superficielles du Bas Rhin »

This network has the same goal as the national basin network, but it is realised in partnership with the Bas-Rhin department ("Conseil Général") and financed partly by the Water Agency (50%) on important local rivers. In the Rhine district it is the only complementary surveillance surface water network. So Bas-Rhin's surface waters are the best monitored in terms of surveillance in the district.

The purpose of this network is the information of water quality and, before all the alarm control of water state. The Bas-Rhin department is manager, stakeholder and owner of this network.

50 points are monitored but particularly physic-chemicals criteria's (flow, pH, Oxygen, conductivity) that give simple information of the global state and can be relevant to spot anomalies. This network raises the density of information that could be available only from national river basin network.

4.2.3. International monitoring of Rhine and Moselle Sarre Rivers : « Suivi international de la qualité des eaux du Rhin »

International commissions of Rhine and Moselle-Sarre rivers structure international monitoring networks on these transboundary rivers. French measurement stations are managed and financed by water agency. Parameters followed are general physic-chemical parameters, micro pollutants as well as hydro biological parameters, mainly phytoplankton.

Main purposes are knowledge of the resource and the observation of flows of polluting substances across the French-German border.

In the Rhine case there is only one station followed (in Lauterbourg) just before the German border and in the case of Moselle and Sarre monitoring program around 10 (from the 34) points are followed in France. The parameters followed cover all general parameters and pollutants. The frequency is quite high (once or twice monthly all year round in the case of the Rhine). See Annex 8 for the monitoring points of Moselle-Sarre Commission network and Annex 9 for the Rhine Commission's network.

The International Rhine Protection Commission and the International Moselle-Sarre Protection Commission collect also information over the total extend of rivers, in border countries such as Germany, Belgium Switzerland, Netherlands….

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[3] The Diren is specially in charge of following pesticides in all surface water

4.2.4. Special surveillance programs

- The national park of « Ballon des Vosges » is the administrator of the Natural Machais peat bog reserve[4]. It has established since 1994 a hydro biological network of the Machais peat bog. The objective is the monitoring of water areas and their protected species that are not largely distributed. The goal is also to detect toxicological drifts. The parameters are exclusively hydro biological such as aquatic flora and fauna (bio-indicative species). The frequency is more than once a year. This work is entrusted by the park to the Loraine's sites conservatory (« conservatoire des sites Lorrain »).

- The Vosges department (Conseil General) has also launched a special program with university over a few years to collect information about acidification of their water courses.

4.3. CONCLUSION

Different surveillance networks covering the entire Rhine district have been established to monitor ground and surface waters. The national basin surface water network is larger (more frequent and more dense) than for groundwaters. In the Rhine district the different networks cited before follow 385 surface water stations and results are on free access on Internet via the water agency portal. Analysed chemical parameters are generally the same among all major networks (around 100 in both cases) while surface water are also examined under biological parameters which would have no sense in the case of groundwaters.

Generally speaking there is also a spatial variability of density and frequency of surveillance networks. We note that groundwater surveillance monitoring is denser on the Alsatian aquifer then on the rest of the district. The Bas-Rhin department is more covered (in surface water monitoring) than other parts of the district, because of local administration initiatives. We could explain this with the high importance with which people and state gives to different water bodies: in Alsace the aquifer is the first water resource and furthermore it is the quality (more than the quantity) that is the relevant factor for water management. Other groundwaters in the district are considered with less importance by the authorities.

Speaking of parameters different surveillance monitoring network analyses approximately the same number and types of parameters: for groundwaters we note that inventories inspect a little less parameters (do not check all priority substances[5] like organic micro pollutant) than national basin network, and are less frequent but much denser.

Surveillance monitoring can also have a direct role of alert and control, which is implicit in "surveillance".

For surface waters, we note **a lack of surveillance monitoring for smooth water areas** (lakes…), despite the fact that they are a relevant number of them in the Rhine district: water agency, nor DIREN, nor superior fisheries council (CSP) have any program to monitor this areas. Only specific protected water zones (such as peat bog for instance) are monitored with the goal of surveillance. Obviously bathing areas are monitored, but this is the concern of use monitoring which we will come up to later on.

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[4] « La tourbière de Machais -parc des ballons des Vosges »

[5] as defined in WFD

5. Impact assessment networks

These networks aim at following the impact of an identified pollution or the composition or impact of pollution discharges. They usually deal with point source pollutions, but also diffuse pollution such as agricultural pollution.

Some of these networks have been established in response to specific legislation that obliges monitoring of specific risky installations such as industries or animal farms. They refer to the legislation of the IPCC (« ICPE: Installation Classée pour la Protection de l'Environnement »). These networks can either be on surface or on groundwaters.

5.1. MONITORING OF POINT SOURCE POLLUTION N FROM INDUSTRIES AND FARMS

5.1.1. The groundwater self-monitoring of IPCC industrial sites

Sites regulated by IPPC generally have potential impact on water resource. They include industries and agricultural animal production farms. A local decree specific to each industry determines the obligations of self-monitoring according to their characteristics in term of potential impacts. All sites have a minimum request of two monitoring wells downstream the site and one up-stream. Methods that can be used for monitoring are also described in the decree (annexe I (1998) and are all accredited one's. Different logic of monitoring installation exists according to the type of environmental risk: (i) No impact to the groundwater (the logic is to detect an anomaly); (ii) there is impact on groundwater (logic of follow-up and alarm). Since 1998 all industrial sites that present a risk of pollution must satisfy the monitoring conditions and have a compulsory monitoring network.

It is, in fact, not a homogeneous network as this collection of data is not uniform and depends on each monitoring protocol fixed in the decrees specific for each site. Efficiency will depend on industries if they apply correctly the principles of monitoring. 184 sites (1780 points) in Alsace and 185 in Lorraine are followed up. The frequency is more or less regular.

The most common pollutants analysed are the hydrocarbons, aromatic polycyclic hydrocarbons, the halogenated chlorinated solvents and metals, because they are the most frequent substances used by industry. According to the type of industry private laboratories carry out the analyses.

DIREN is in charge of law enforcement. In Alsace, BRGM is responsible for making a synthesis of the data in terms of evolution of the groundwater quality.

All these data will soon be accessible through a unique internet groundwater database named ADES ("Accès aux Données des Eaux Souterraines") to facilitate the follow-up of water quality evolution in the long term.

5.1.2. Monitoring of industrial and treatment plants discharges: potential impact on surface waters

This data collection is of a different type in the sense that resource is not the object of the analyses, but effluents that will discharged into the water resource.

Industries

All industries that are under ICPE legislation (ICPE law 1976) are bounded to an individual legislative decree, adapted to each site of the integrated text, the « arrêté ministériel du 2 février 1998 » (1998). It states the maximum discharge they can emit in the receiving water resource. According to the quantities and type of their emissions they can use the collective treatment network or, if their effluents would give problems to normal collective treatment plant, they must have their own treatment plant.

- Industries directly discharging waste water in rivers, if they exceed certain quantities of emission, (see Article 64 of the 2/2/1998 'arrêté' (1998)) have to carry out a self-monitoring to prove that discharge correctly mixes up with water from the river (measures upstream and downstream of emission). This could be done by a group of industries in the case that they reject in the same stretch. Costs are supported by industrial. Results must be sent to IPCC inspection with a maximum one-month delay.

- In order to assess **the pollution tax** due to the water agency**,** industries can manage a self-monitoring program or will be submitted to an external short monitoring program, managed by water agencies. Water agency program goal's is to quantify the amount of emitted pollution and assess the pollution tax[6] owed by each industry. In the case where industrial is not making self-monitoring he will be imposed to pay an inclusive payment tax, that is in general higher than the personalised tax, calculated on self-monitoring analysis. In both cases the rejects of industries are analysed, but with very different frequencies. Aim is to check the respect of the IPCC legislative requirements. Threshold values for each pollutant specified in the IPCC form depends from the type of medium and from the reject types of each industry. Methods of analysis are fixed in the "arrêté" of october 28th 1975 (Les éditions des journaux officiels 2003), they all refer to French norms, unless particularly or automatically analytical determinations (biological demands parameters DCO,COT, DTO) that can be accorded from case to case after acceptance from DIREN. In this case industries have to prove equivalence of their innovative analysing method with classical accredited methods.

Monitored parameters are composed of general parameters that are checked in all cases and of specific parameters according to the type of rejects of each industry: they are mentioned in the individual IPCC legislative binding form.

Self-monitoring frequency vary from one case to the other. Industries that reduced their pollution under defined thresholds are submitted to 4-time-year monitoring whereas other have to make permanent analysis. Water agency controls 4 times per year functioning and industry's rejects.

Urban waste water treatment plants

Urban waste water treatment plants are also submitted to limited quantities of rejects and must prove it through self-monitoring programs as well as industries. 500 stations are concerned in the Rhine - Meuse district. Water agency is putting together the data collected by the local SATESE[7], the assistance service of treatment plants of each department administration concerned (« Conseil Général »).

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[6] « redevance pollution »

[7] Service d'assistance technique aux exploitants des stations d'épuration

In Bas-Rhin department SDEA (Syndicat des Eaux et Assainissement du Bas-Rhin) gather a self-monitoring network of up- and downstream points of treatment plants it operates (around 30 points).

5.2. DIFFUSE CONTAMINATION AGRICULTURAL IMPACT NETWORKS

Following networks do not respond to any legislation: they are local initiatives bounded to a specific context.

5.2.1. Pesticides monitoring on surface waters

- Pesticides monitoring at basin level is include in the national river basin network (RNB) (see 4.2.1), but the pesticides part is managed by DIREN's (of each department) and DIREN is stakeholder of this part of the network (40 stations in Lorraine).

- River LONGEAU pesticides monitoring

This network is a specific local network. This specific site have been chosen to have a plural-annual reference on pesticides contamination and this network aims at evaluating the effect of a year in terms of pesticides pollution on surface waters. Water agency, SRPV (regional service for plant protection[8]) and FREDON[9] (regional association against harmful organism in Lorraine) financed this network, but FREDON is the organism that produces the data and manages the network. Access to data is free.

Only one station is analysed. Parameters followed are all pesticides and other organic micro pollutants. Analyses are made once every month. For pesticides seasonal variability in the water is strongly dependent of the use and of rainy events.

This type of network could also be seen as an investigation network, in the sense that it is supported by a research organism and is a pilot initiative which results could have a wider impact as the local one.

5.2.2. Nitrogen monitoring in groundwater

Nitrate directive

As for the rest of France, a monitoring network aiming at meet the Nitrates Directive (91/676/CE) requirements has been set up. This network is carried out by the the Diren. For groundwater (as for surface water), 4 sampling campaigns are organised every 4 years in order to delineate the vulnerable zones. It is made of more of 100 stations in Alsace and about 250 in Lorraine.

For private water company

The bottle water producing company, Vittel (Nestle Waters) has developed a network to encourage alternatives agricultural practices in the area of the Vittel springs. Motivation was the rising concentration of nitrates in exploited springs. Vittel has developed this network in partnership with INRA, the French research institute for agriculture. This initiative has two

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[8] SRPV : 'service régional de protection des végétaux' - dependent from Regional Direction for Agriculture-DRAF

[9] « fédération régionale de défense contre les organismes nuisibles »

main objectives, one of research and development and one aiming at making the agricultural practices evolve. It has been established in 1989 on the total site representing 6000 hectares covered by 19 groundwater monitoring points. The monitoring program is managed by AGRIVAIR a joint venture company created by Nestle Waters in 1992 dedicated to source protection with a double mission of environment observation and protection of water sources.

INRA and a local laboratory produce the data. Analyses are made on nitrates but also chlorides two times per month.

5.3. CONCLUSION

Impact networks are very heterogenic, but they all exists in order to have a data to control the impact on identified (almost always) source pollution. We stress on the high amount of the data collection resulting from the IPCC legislation, other networks we mentioned are anecdotal, but they show how large the water measurement and analyses market can extend to. In addition IPCC water analyses control is not really a network because analyses are not homogenised and there is rarely an interest to put the data together and comparing them. Though this data could be, in special cases, of high value towards a contamination problem, giving very special information (particular parameters).

6. Operational networks[10]

This type of network responds to a special demand in case of identified point pollution by one or few specific pollutants. They exist where pollution is turned out and the objective is to follow the evolution of the decontamination (natural or forced) to enable the evaluation of implemented measures and the adaptation of managing the local pollution.

These networks, for more efficiency, follow both surface and groundwater because, according to the system, pollution can affect both water types.

6.1.1. The old potash-mine network (réseau Salure)

The Alsatian potash mining fields extend from Mulhouse to Colmar in the Haut-Rhin department. Today the potash mines are not any more in exploitation, however the spoil heaps on which were deposited salted residues until the end of the Thirties are responsible for an important pollution of the groundwater by chlorides.

The DRIRE Alsace and the water agency Rhin-Meuse have asked BRGM (CHABART.M. 2004) to make the control of the salinity of the Alsatian aquifer and of surface waters in parallel to the decontamination work that is managed by the inter-service commission of Alsatian potash mines[11].

The decontamination is oriented year by year with the analysis resulting from this network. This is why the network is also evaluating every year to be more effective regarding the information needs. The « direct » network covers above all groundwater analysis (536 points) and only a few surface water points (11 points). The 525 points are divided as followed: 25 decontamination wells, 28 fixation wells, 2 gravel pit lakes and 470 control points (piezometer). For the analysis of the pollution an « extended » network of data's had been added from other data holders: the mining company (411 works), the DDASS (6 drinking water wells), the drinking water utility « Colmarienne des eaux » (4 wells), the DIREN (9 river stations), the BRGM (90 works).

This network has particularity because he sums up different data's of various yet existing sources. Only a few data are extra collected for this network. (107 works out of 540 in total).

This network is improving in precision from year to year: in 2000, 463 points were analysed while 487 points were analysed in 2001 and 536 points in 2002.

6.1.2. Iron basin monitoring networks :« réseau de suivi des eaux des bassins ferrifères lorrains »

Iron mines in Lorraine are west of a Thionville-Metz-Nancy (Moselle) line. It is divided into two entities: the iron basin of Nancy in the South, which is not monitored because exploitation have stopped for more than 100 years and the iron basin of Briey-Longwy in the north, for which a network has been established.

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[10] It is not the exact signification of WFD « operational monitoring »

[11] « Commission interservices de contrôle des rejets des Mines De Potasse d'Alsace »

Since the stop of the exploitation of iron mines of the Briey basin and, in parallel, the stop of the pumping out[12], galleries were soaked because impermeable layers which allowed, before, maintaining these systems isolated had collapsed. Water circulating, in what was before extraction galleries, is highly mineralised as a result of oxidation of remaining metals. (BRGM, Vaute 2004). Before water were pumped feeding the drinkable water supply networks: this is not possible anymore for quality reasons. The today problem is, in consequence, groundwater and surface water quality.

Following a request of local knowledge the Water Agency and the DIREN entrusted BRGM the water quality follow-up of this iron basin. Two types of installation are used as points of measurement, the old mining wells of a diameter of several meter and new piezometers which were set up for the water monitoring in the Dogger part. These new installations belong to the Water Agency. The mining wells were given to the local communities.

In Lorraine region other sites are exploited as mines: salt mines and coalmines are still running and their impact on water is not seemed to be followed at the moment.

6.1.3. Mining basin network- surface waters

Iron and coal mines had been exploited for more than 100 years. The stop of the exploitation and before all the pumping of water since 1993 have change hydro geological conditions and led to a specific contamination of groundwaters but also of surface water by overflowing (mineralisation). This network focuses on surface water monitoring.

This network aims at evaluating the contamination and managing the eventual decontamination. It was created on joint initiative of DIREN Lorraine and AERM. It exists since 2000. First micro pollutants analyses had been made in 2001. Until 2001 monthly physic-chemical analyses are made.

[12] water pumping took place to allow free access of the galleries

7. Water use networks

The objective of these networks is to check water quality according to the human uses. Monitoring aims at preventing risky uses of water and giving the alarm of an insufficient water quality. It is of no importance if water source is groundwater or surface water: water checked is the one that is used. Those, who are responsible for the quality regarding the uses of the water, manage the networks.

Distributors are responsible for the water they provide, and private or local authorities for the public bathing water. The sanitary regional authority has a role of water police and so, is responsible of the water quality control. Every specific water use has it owns threshold values fixed by European or national legislation. In France they refer to the national « code de la santé publique » and therefore **all the following networks are the direct or indirect implementation of a specific legislation.**

Water framework directive do not mention anything about water use networks, as goal of this directive is the good state of waters as resource and not good state of **used** water[13].

7.1. DRINKING WATER

7.1.1. Self-monitoring by Drinking water providers

The distributors of drinking water are responsible for their distributed water quality so that self-monitoring is made permanently in drinking water producing stations which have enough means. The Code of public health creates an obligation of self-checking: "whoever offers public water for the human consumption (...) is held to make sure that it is proper for consumption" (L.19 article). Moreover, "any operator of a drinking water distribution is held to make check the quality of the water which it distributes" (L.21 article). Companies have to write results of this checking in a sanitary book and, if problems of excess of norms, results must be given to the sanitary administration, DDASS.

Controls are not carried out only at the exit of the factory, but are carried out throughout water production cycle: on the resource level, in the water quality observation stations to detect any possible pollution, on the level of the treatment, to check effectiveness at distribution level, in the tanks, the network. The devices of monitoring differ from one service to another; according to the size of the service and the owner (see decrees n°89-3 and n°2001-1220). Sometimes, the minimal monitoring is hardly exerted.

The monitoring of quality is done on three levels, through three types of complementary analyses:

- **Permanent automatic analyses** in observation stations are made at pumping, production and distribution level. These automatic analyses are continuous. It is thus possible to detect the variations of the quality of water caused either by natural phenomena (risings, rains, dryness), or by pollution (accidental or chronic).

[13] But WFD deals about protection of special areas dedicated to drinking water

- **Frequent and systematic analyses** carried out in field laboratories, which supplement and confirm the automatic analyses.

- **More specific and fine analysis** are done in a central laboratory of the companies, in order to analyze the parameters which require more sophisticated means, and confirmed certain values obtained.

The quality control in the observation stations is exerted either from automatic analysis devices, or by the implementation of warning systems. The automatic analyses continuously measure a certain number of general parameters (pH, temperature, resistivity, dissolved oxygen, turbidity) whose variations can indicate a total pollution. When the concentration of certain elements (mercury, chromium, lead, copper, cadmium...) exceeds a given value, an alarm is set off. There also exists of other warning systems, which relate to the total quality of water, the trout observation, which reacts in a total way to the unit of the polluting elements, contained in water. These devices still are very rare because of the operational and capital costs which they represent (in comparison with the size of the water services), and because of the limited technical skills of certain distribution companies.

For instance in 2003, in the urban community of Strasbourg 617 water samplings have been analysed of which 410 at the tap. 122 bacteriological and physic-chemical parameters were checked. 2100 analyses have been made.

7.1.2. Drinking water police network: a control network the « Réseau DDASS »

The DDASS in load of the public health controls the medical quality of the water distributed for human consumption. The objective is to check the distributed tap water quality according the standards. Analyses are also made at the level of the resource, but before all at distribution points. In the case of non-respect of quality standards, the DDASS have to inform the local government represented by the « prefet » at « departement » scale who must take adequate measures (restriction of consumption for instance) and which can require an investigation of the causes of this non-conformity. A temporary exemption can be granted for the continuation of the distribution, with public information. In general measures to reduce contamination must be taken (particularly measures on the protection perimeters).

The parameters are of two types (DDASS 2003) :

- the reference parameters are indicators that certify the correct functioning of the stations generating and distributing water (23 parameters)

- the quality parameters (related to health). The bacteriological parameters (2) and chemical parameters (29) are distinguished.

The frequency and number of points is defined in the “human health code” according distributional flow and population concerned and type of water. Analyses are made on all public drinking waters, including privates that provide public people. (For instance a hotel which has its own well). The analyses of the laboratories are sent to the DDASS which return them to local communities (the data is public).

See Annex 13.

7.1.3. Alert monitoring networks of major cities: potential used-water monitoring

Strasbourg («réseau CUS[14] ») and Nancy urban communities (CUGN[15]) have implemented special alert networks to monitor the raw water for water distribution. In Strasbourg city case (groundwater) those networks are completely independent from the drinking water network, but the final use and reason to be is the drinking water extraction activity: they extend larger than on the pumping points, the role is to prevent from pollution that could reach pumping stations (groundwater in the case of Strasbourg, surface waters in the case of Nancy). These networks are more than just extensions from the classical self-monitoring network, as they are not at all required by any legislation and are local initiatives. In the case of Strasbourg it has emerged after contamination problems. 33 points are followed in Strasbourg on physic-chemical parameters, mineral and organic micro pollutants. Depending on parameters, frequency is twice a month or less.

In Strasbourg it is the department of urban ecology of the city of Strasbourg that manages a network to monitor the groundwaters located under the city of Strasbourg as this resource has very important stakes because it is the potential drinking water resource[16] of this big urban area. Recurrent pollutions and the local high-industrialised context have motivated this initiative that has been launched in 1995.

In Nancy urban community it is different as water pumped is from surface water (Moselle), risk of pollution is even higher and reactivity must be high because ‘clean water’ reserves are low. The alert system is based on biological and on line devices that should trigger alarm in case of pollution. The alert system is still at an initial stage as many systems are tested and all are not operational.

7.2. BATHING WATERS

7.2.1. Bathing sanitary water network

National sanitary control program ensues from the National bathing directive[17]. This program is of main importance: it cost about 3.8 million euros and is half financed by cities and half by state. This control aims at securing the sanitary protection of bathing. Peak of activity is in summer, when most of bathing areas (as well swimming pools as lakes) are open to the public and frequented.

The monitoring of bathing water focuses on the number of bacteria’s indicating faecal contamination. These micro-organisms, if they are detected in high levels are testimony of eventual pathogenic germs. (Bacteria’s, viruses, parasites…).

Sampling is made by sanitary administration (DDASS) employees or can be subcontracted to local labs. Analyses are made by certified labs.

In the Bas-Rhin department 38 public swimming pools and 19 natural smooth water pools are managed by local public organism.

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[14] Communauté Urbaine de Strasbourg
[15] Communauté Urbaine du Grand Nancy
[16] Nearly all drinking water is provided by groundwater resource in Alsace
[17] 8 DECEMBRE 1975. - Directive du Conseil concernant la qualité des eaux de baignade (76/160/CEE) (JOCE du 05/02/1976, L 31/1)

Norms depend from the nature (natural or artificial bathing area), the use and frequenting of the bathing area.

7.3. CONCLUSION

The aim of these networks, unless the alarm network, is to preserve humans from risky water uses, therefore type of monitoring must be very certain and must before all, be able to give information that can be compared with threshold values. This means, that the chosen monitoring technique must provide information at least as precise as the threshold values (if threshold value is 0.1mg/L, technique must be precise at 0.1mg/L). In consequence we could think that new monitoring devices are not very adapted to this type of monitoring, as they could be not very precise. The certification (accreditation) of monitoring methods is here also of first importance and could be a discriminating factor for new devices.

Alarm networks are more indirectly linked with the use of the water but reason of their existence is the final use of water. Here we can more imagine the utility of screening devices that could enable a high quantity of measures and even a continuous measure (high number of points and high frequency) and not necessarily very precisely. This would also suppose threshold values which devices should be able to detect.

8. The cost of networks

In this section we present different elements of network costs focusing on “public” networks which will be of interest in this WFD focusing study. First general remarks from case studies interview or literature are summed up in order to give an overview on the monitoring market which explains cost characteristics and likely evolution. Then a general overview of the overall networks costs in the case study is given. Then a more detailed analysis of cost decomposition of networks is made. These two parts are based on two main sources of information (i) global aggregated network cost, from public documents and (ii) individual data given by the water agency stemming from laboratories proposals. There could be a slight overestimation on the calculation of cost from these data’s as laboratories are likely to reduce, after command, total bill according the number of analysis.

Water monitoring: a regional market - Nearly all organisms in charge of public networks (Water Agency, Diren see 3.3) do not realize the measures nor the collection of samples anymore: they subcontract theses tasks to private laboratories located in the region (the Diren (environmental administration) is the only public organism to still have a hydro biological laboratory in the Lorraine region). Since the new “Code des marchés publics” they are obliged to publish the market offer and to select the laboratory according a “best offer” rule. Nevertheless costs of analysis vary from one case to another: (i) Indeed, number of molecules analysed do not necessarily correspond to the market minimum conditions but seem to depend highly from the laboratories capacities. Moreover water agencies would not always make the difference between number of parameters required and those really analysed (Gaumand, 2005). One explanation is that offers could differ depending on techniques uses, “packs” (whole set of parameters that have a unit cost) of parameters offered are different, in consequences cost proposed are different.

(ii) For emergent pollutants or difficult to measure parameters, only a few (or even one) labs could be able to analyse it (and with a given precision) : in this monopoly case and for evident technical constraints (high technological material) the bill could be particularly high. Nevertheless, on most parameter competition on this market would be fully expressed (a lot of labs) and prices are and will be continuing to be pressed down in response to the opening market due to the “Code des marches publics”. For the Alsatian 2003 inventory (see 4.1.2), one of the four batches has been attributed to a German lab. In comparison with the other selected French labs he had the best confidence in his results (sampling and analyses) and very good quantification limits.

An increasing market? In the context of both WFD (increasing density /frequency and new parameters like dangerous and priority substances monitoring) and emergent pollutants awareness (pharmaceutical component) there is an increasing demand for new parameters to be analysed. Potential micro pollutants are very numerous and before all, contamination assessments (WFD characterisation or local researches) discover continuously new pollutants which could be required to be monitored. In a certain way labs are able to secure themselves their further work: if they discover new molecules in the environment, state services will ask them to monitor them in next campaign to explore real extension of the pollution. This is a characteristic of the monitoring “economy”. There is a really high interest for private labs to discover new molecules and to make a first free demonstration, as – if they found some- this will bring them more work and income next time…

8.1. GLOBAL COSTS OF NETWORK IN THE BASIN

The global cost for the Water Information System ("Système d'information sur l'Eau") in France in the Rhine-Meuse basin is of 6 millions Euros (2003 data), it includes all public surveillance and impact networks, and among them those which will be refunded, rebuild or recycled into WFD networks. Two third of the monitoring budget is affected to surveillance monitoring while the rest is dedicated to impact networks (rejects) or other particular networks. Much more budget is allocated to surface monitoring than groundwater monitoring.

The following table sums up the overall cost for surveillance network on the Rhine-Meuse basin:

		Number of points	Frequence per year	Number of analysed samples	Costs: Total annual cost (€)	Costs: Mean cost per station (€)	Costs: Mean cost per analysed sample (€)
Surface water monitoring							
R. Bassin Rhin-Meuse (RNB)		**252**	-	6048	**2 290 000**	**9 087**	**379**
of which	general (physico-chemistry)	252	24	6048	**990 000**	3 929	164
of which	pesticides	49	12	588	**310 000**	6 327	527
of which	micro-polluants	40	12	480	**604 000**	15 100	1258
of which	micro-biology	80	9	720	**76 000**	950	106
of which	hydro-biology	250	2	375	**97 000**	388	259
of which	*physical state and flow*				***213 000***		
R.d'interêt 67 (RID 67)		**40**	**24**	960	**110 000**	2 750	115
R. bassin minier (RBM)		**39**	**12**	468	**168 000**	4 308	359
of which	physico-chemistry, bacteriology, hydro-biology	39	12	468	**107 000**	2 744	229
of which	micro-polluants	39	12	468	**61 000**	1 564	130
Groundwater monitoring							
R. Bassin Rhin-Meuse (2004) (RBES)		185	1 to 6	600	**600 000**	3 243	1000
Inventaire Lorraine (1997)		950	1/5	190	**360 000**	379	1895
Inventaire Alsace (1997)		740	1/5	148	**276 000**	373	1865
R. bassin ferrifère (RBF)		37	12	444	**105 000**	2 838	236
R. bassin potassique (RBP)		90	1	90	**24 000**	267	267

Figure 7 : Cost of monitoring networks in the Rhine –Meuse[18] basin for the year 2001.

It is more difficult to have data on other networks (operational, impact and use network), nevertheless we gathered following costs elements:

- **Groundwater IPCC Impact network** is the compilation of data coming from industrial sources (each industrial make its own monitoring program and transfers the data to administration, see also 5.1.1). Public cost is, in consequence, limited to the compilation of data (collecting data, validation, seizure, updating of database and synthesis), which is about 240€ per site (about 300 sites followed) and 70 000€ global cost. (AERM source)
- **Drinking water surveillance:** DDASS surveillance of drinking water in the Bas-Rhin department (only a part from the case study area) is executed by private labs. About 3200 sampling per year are taken for 6 different types of analysis according the type of water (resource, production or distributed water). Unity price of analysis range from 80 € for a simple routine distribution analysis (14 general parameters of which 5 microbiological parameter) to 2000 € per sample for a complete resource water

[18] Data is given for the whole Rhine-Meuse basin slightly larger than the Rhine district

analysis (111 parameter of which 30 pesticides and 7 heavy metals). Total cost (analytical and taking of samples) was slightly more than 1 million € for public drinking water distribution and of 260 000 € for the private distribution in 2001. Sample collection covers one tenth of the total cost.

Comparison between all these costs must be made very carefully because accountancy could differ from one network to the other (for instance some sampling could be made by demanding organism (stakeholder) and not be accounted.

8.2. ANALYSIS OF COSTS DECOMPOSITION

This cost analysis aims at preparing the work for comparing cost of actual network with new design network integrating emerging tools. Cost comparison must be able to enlighten potential cost savings by using other techniques explored by SWIFT. Therefore posts to be detailed are those which will defer from one to the other case. Effective costs are separated from the "labour" cost / time (except labour for analysis), which is an interesting value to have and sometimes difficult to transform into monetary value.

1- Cost of networks designing:

This part includes all costs that rise from the network designing. This gathers all costs that would rise from (i) the definition of the monitoring objective, (ii) from selection of points (examination of already existing data for instance), this step could be very long and time consuming as point selection will be crucial for confidence of monitoring, it depends also on objectives, (iii) the practical information collection on the feasible sampling sites or wells. This steps enable defining precisely which points will be measured (where?); with which frequency; and for which parameters, this means also to know which quantity of water must be taken, and how much samples etc. Description of sites could be required in certain cases: this includes accessibility, environment …

The type of cost is working time (engineer). The real cost will depend on labour cost to the unity. It is usually not accounted in the cost calculation because this work is, of course, not subcontracted.

2- Investment cost:

Investment costs could cover partly both sampling and analysing, it can be machines (such as spectrophotometers etc or pumps), transportation means (cars), buildings (laboratory or on site installations such as shelters to protect permanent material installed on the river bank). In major surveillance networks, the creation of the data bank represents also a punctual cost.

Investment costs are not necessarily accounted separately when monitoring is subcontracted to a lab, in which case the investment cost is partly affected (on the bill) on the individual analysis cost. There it is directly dependent on the quantity of analysis made by the lab (scale economy).

For example a groundwater network could have punctual costs for piezometer or well drilling. In Alsace a common IPCC monitoring well (~10-15m), costs about 5000€; after 20m depth it would cost 1000€ per meter (with equipment). Nowadays, major surveillance network do not invest in piezometer but access to the aquifer through already existing wells (all types: private, drinking water…).

3- Samples' collection cost:

This post gathers: (i) the sampling material (bottles,…); (ii) the eventual material needed for pumping (for groundwater) (ii) the transport cost and the time required to collect the samples (and the type of labour required) (iii) storage of samples should be also accounted in this part.

In the region sample collection is invoiced about 35 € per sample of surface water and 80€ for groundwater. For some special types of analysis it could be more expensive: for suspended matters, sampling and extraction cost about 1500 € (due to centrifugation). Sampling costs about 90€ for sediments and 100€ per preparation for bryophytes analysis.

4- Cost of analysis:

This cost includes supply (reactants and various consumed products) and labour (qualified) which are really affected to a given analysis. This cost is given per sample analysed, for one or more parameters. The monitoring global cost of analyses is obtained by summing for each parameter the multiplication of the parameter analysis units (parameter or group[19]) price by the number of samples to be analysed. Often the parameter analysis price data includes also investment costs (attributed to *prorate* of analyses and the life span of the material). Generally the data is aggregated as labs invoice the analysis for one sample according parameters and methods used. Prices are very different according the parameter from several euros for the temperature (about 1, 5€ HT) or general physical parameters to about 150€ for organic micro pollutants. For examples see Annex 10..

	Total analyses cost	Number of samples	Number of parameters	Number of analysis	Mean price (HT) per analysis
	1 832 000 €		85	112 228	16 €
Water - Physico-chemical	607 000 €	6 048	32	96 426	6 €
Water - Heavy metals	15 000 €	630	9	1 206	12 €
Water - Pesticides	417 000 €	588	10	5 292	79 €
Water - Other micro polluants	252 000 €	420	11	2 928	86 €
Suspended matters (heavy metals- micropollutants)	483 000 €	276	22	5 388	90 €
Sediments (micropollutants)	50 000 €	43	20	644	78 €
Bryophytes (heavy metals)	8 000 €	43	8	344	23 €

Figure 8 : Example of analysis cos in the river basin network (RNB) for 2004 (calculated from AERM sources)

5- Cost of data treatment, seizure and / or management of the data bank:

The analysis results could be provided whether on paper or, in an numeric format. In all cases (independently from who is doing it) the seizure represents a non negligible cost (labour time). At the same time or in parallel validation of the data is often made before integration into the databank is made (qualified person and eventually particular computer programs). Those costs are really linked with the objective of network, for several uses, databank is not needed, for others they can be the finality of the network (and obviously analysis of results). Diffusion of information can also be accounted in a network's cost assessment.

Computerized management of the surveillance networks in Rhine-Meuse basin costs about 93 000 € per year and about one full time job to the Water Agency. Cost of publishing

[19] For a multi residual analysis for instance

surveillance data is about 25 000 € per year (management of the computerized diffusion application) and it requires half a full time employee.

8.3. WHICH FACTORS INFLUENCE MONITORING COSTS?

As aim is to compare cost, it is important to state which factors have influence on the monitoring costs. Surveillance network costs are very different from one case to the other. For instance, while the river basin network have a mean cost of about 250 € per monitoring station for 249 stations, the international monitoring stations (over Rhine and Moselle) analysing hydrobiology (plankton; macro invertebrates) cost more than 1000€ per analysed station for less than 10 stations.

On the one hand field parameters will determine an important part of the global cost and will vary especially for groundwater and surface waters; on the other hand steps linked to the analysis will have an independent cost whether it is surface or groundwater.

- **Sampling cost : field linked parameters**

  - **Type of water** monitored is a determining factor of cost. **Groundwater sampling is more expensive than surface monitoring** (sampling is invoiced more than two times cheaper for surface monitoring, but groundwater sampling should only be more expensive if forage is not in service: in this case pumping of 3 to 5 times the well volume is necessary). Furthermore, in some cases, more than one analysis could be required (for instance if the medium is not continuous and that more than one sampling is made on the water column, like a diagraphy). Non-water analyses such as suspended matter or sediments cost more than water analyses (see 8.2).

  - **The type of monitoring sites and especially its use: s**ampling a well indeed requires to empty 3 to 5 times the well's volume. Therefore, if the monitoring site is a spring or a well used for water public supply or industry needs, there is no need to use any pump. This type of sites allows saving money and time. On the other hand, if the sampling site is an agricultural well which is not in service and that requires to bring a pump, the samples will be more expensive.

- **Analysis cost parameters**

  - **Parameter is the main factor influencing costs:** general physical-chemical parameters are cheap (2 € for temperature or less than 10 € for minerals) in comparison to emergent pollutants (300€ for hydroxyflavones) proposed by less labs and requiring special skills and materials.

  - **Methods / techniques:** for instance 'multi residual' techniques able to analyse a whole family of substances with less precision to a reduced cost in comparison to classical parameter analysis. The cost is also linked with the precision (indication of the Limit of detection and / or limit of quantification) given and with the fact that method (technique) is normalized or not (nowadays all parameters of surveillance networks are analysed with standardized methods).

- **Extend of the network**

  - **Number of samples,** depending from both sampling frequencies of the network and spatial density will able reducing the unity sampling costs (scale economy when transport costs and labour costs could be beard by more samples etc…).

- **Number of analysis** of the campaign enables to reduce the mean cost per point or analysis (simple scale economy). This is a relevant factor for our stake: generally one sample is the support of tens of analysis; in consequence the sampling cost is beard by a lot of analyses. If fewer analyses are made (because, for instance, some parameters are analysed *in situ*) sampling cost per analysed parameter will raise.

Generally speaking it is difficult to collect cost information regarding (i) the cost of designing network ("grey material") and (ii) the cost of having trained and skilled staff whether to collect samples, to manipulate or to analyse results according the analysis results' format. It is also very difficult to enter the time spent on the network, before all time of public organisms which subcontract the analysis (for which there is a precise bill), but which organize and decide, maybe validate and synthesize the monitoring results.

9. Fitting networks for the WFD

In the following part we suggest an analysis to see how far existing networks fulfil the requirements of WFD. This will enable to enlighten lacks in monitoring networks in order to propose scenarios of new designed networks as SWIFT project's aim is at integrating new screening devices in yet existing networks. This part is based on "Guidance on monitoring for the WFD" (2003) and on the SWIFT D60 report "Policy status quo report" on monitoring issues (Dworak, Kampa et al. 2004).

9.1. WFD REQUIREMENTS IN TERMS OF MONITORING PROGRAM'S TO IMPLEMENT

Generally speaking WFD specify more the objective of monitoring and the ability of monitoring to provide specific type of information, than the practical requirements of monitoring that are not clarified. This is the first argument that justifies SWIFT project's objective of integrating new devices in monitoring networks.

9.1.1. Groundwater monitoring

The articles 7 and 8 (annexe V) of WFD states and impose a monitoring program of water in order to build a coherent and complete picture of water characterisation in each hydrographical district. WFD distinguishes a "surveillance monitoring" to implement for all water bodies, from an "operational monitoring" to implement only on risky water bodies[20].

There are very few specific technical requirements on networks (frequency and number of points, parameters) mentioned in WFD. Recommendations are, though, specified in the "Terms and conditions for evolution of groundwater monitoring networks"[21].

The surveillance monitoring must enable to prepare the action program that will be renewed every 6 years and will help evaluating the present program. It has to represent the general tendency of all pollutants regarding the initial state at the beginning of the program[22]. It will include two types of analyses, corresponding to different frequencies:

- A "photographic" analyse every 6 years checking all parameters and all water bodies, it will take place before a new program.

- One to two times per year analyses with main parameters (physic-chemical parameters, major elements, organic matters, silica, few micro-pollutants). Other complementary parameters specific of the water body will have to be included, before all in the case of pesticides that vary from one region to the other depending on the agricultural use and on evolution of legislation.

See requirements on Annex 11.

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[20] which risk to not reach good state by 2015

[21] (2003). Cahier des charges pour l'évolution des réseaux de surveillance des eaux souterraines en France.

[22] Annexe V of WFD 2000/60/CE

The operational monitoring will be done for all water bodies that had been identified at risk. It should enable to determine the type of risky water body (water body): (i) poor quality water body, (ii) poor quality water body with a significant rising evolution, (ii) good quality water body with a significant rising evolution, (iv) good quality water body.

It should include the points of surveillance monitoring and other points -carefully selected- downstream of identifies polluting sources or areas to complete it. Selection of sites will depend on whether pollution is diffuse or punctual. For punctual pollution's access points of IPCC network could be used and included to it. But, they will only be used if the pollutant affects a significant surface of the groundwater body. The monitoring networks built to meet the WFD requirements don't aim at monitoring point source pollution. They just aim at giving a picture of the general state of the whole groundwater body.
Diffuse pollution concerns mainly pesticides and nitrates and particularity of pesticides is that they have a very high spatial and temporal variability. Sites should be 'integrative' of the whole water body such as sources. Until today nitrates analyses have been done in drinking water wells which is not really representative, as these sites are -by nature- more protected than other places. It is proposed to base the futures analyses on the surveillance-monitoring network for more confidence.

Frequency recommended is two times per year with one analysing in 'high water' and the other in 'low waters'. The WFD demands one control minimum per year.

Special density and parameters are supposed for protected areas. See Annex 13.

9.1.2. Surface water monitoring

As well as for groundwater monitoring WFD requires different monitoring programs according to the state of water body. The **surveillance monitoring** must enable to give general overview of the quality of the water, with a minimum frequency of every six years to evaluate the basin water management plan. **Operational** monitoring will take place in water bodies which have been identified at risk or in which priority substances are produced or in heavily modified and artificial water bodies that should fail reaching their environmental objectives. A third monitoring program will be implemented: the **investigative monitoring**, which aim is to research the origins of unidentified pollution's in risky surface water bodies.

The minimum frequency stated in WFD is 3 times per year for most physic-chemical parameters and one per month for priority substances in both surveillance and operational monitoring. The Rhine-Meuse Water Agency has increased it to 12 per year for physic-chemical parameters, mineral and organic micro pollutants in the case of surveillance monitoring.

The covering of **surveillance monitoring** is quiet imprecise as WFD demands to choose a "sufficient number" of points to give a general overview of the state of surface water inside each hydrographical district harnessing.

Biological parameters have to be checked once per year for invertebrate fauna and ichtyfauna (phytoplankton is optional) and once every 3 year for phytobenthos and macrophytes.

See Annex 14 and Annex 15 for the table of detailed WFD requirements.

A minimum of one point per water body is demanded in the case of **operational monitoring** because objective is to clarify the risky state of each water body that has been identified at risk or with discharges of priority substances (only the discharged priority substances will have to be followed). This implies much more than in the case of groundwater in our region, because more than **215 water bodies have been identified at risk** in the Rhine district (Agence de l'eau Rhin-Meuse 2004). Choice of point situations will depend whether pollution is local or diffuse. Changes in the operational monitoring program can be done in case that analysed parameters do not appear in the analyses: these could be abandoned.

9.2. CONFORMITY WITH WFD REQUIREMENTS

Goal of the Water Framework Directive is to protect the water resources. Thought we must note that all networks mentioned before in this report are not necessarily concerned with WFD: as objectives of network over go the WFD requirements. On the other hand they will not necessarily contribute to reach WFD requirements[23], whether because they are not dealing with the resource (drinking water) or because they are too specific (reject monitoring for instance). They could, thought, help reaching the objectives of WFD by enabling, for instance, an emission control in the resource.

For this reason we will focus here on monitoring networks that are implemented by public authorities or at least controlled by local authorities to follow the quality of the groundwater and surface water resource.

The characterisation of the river district carried out by the Water Agency reveals that, although water monitoring networks are well developed and established since a relatively long period of time, the information they provide is neither sufficient to systematically characterise existing pressures in all water bodies nor to assess tendencies (time integration) and as a consequence, the risk of non compliance with the objectives of the WFD by 2015. Diffuse pollution are, on the other hand, well monitored (spatial representativity is quiet good), while there seem to be a lack in time representativity for both surface and groundwater's. To respond to the lack of knowledge towards dangerous and priority substances (micro pollutions), a large campaign was launched in 2005 in order to investigate the micro pollutions (dangerous and priority substances or the WFD) at regional scale and support implementation of the WFD.

It therefore seems that there is a real need for additional information (especially for trend assessment). The networks may have to be developed, both in terms of space and time coverage, to provide the required information. Staffs from the Agency however report that they would not be able to do so, both for financial and technical reasons. The use of alternative monitoring strategies, using emerging tools, could therefore represent an interesting option, although this would be subjected to various practical conditions.

Moreover, given the relatively large number of water bodies classified as “at risk”, there will be a real need to develop operational monitoring networks to assess the effectiveness of the program of measures that will be implemented. The use of emerging monitoring tools could therefore be considered as alternative to current monitoring practices (in particular for pesticides which are the main cause of risk), if it can be proved that they can provide useful information at a lower cost than current practices entail.

9.2.1. Groundwaters

The national basin groundwater network (RBES) covers the requirements of the WFD in terms of **surveillance monitoring** regarding the parameters, frequency and density:

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[23] they have been implemented to follow other legislations

-Parameters to monitor. The only failing is the monitoring of organochlorinated compounds which should be monitored every 6 years as a minimum. This is done by both regional 'inventories' which are 2 complementary local networks and that are made every 5 or 6 years. With these 3 networks, requirements are satisfied in whole Rhine district.

-Frequency: the five-year inventory and basin-network (RBES) provides both photographic analyses and are in accordance with WFD requirements. The inventories permit to have a picture before each six years program.

-Density: the proposed values are of 1 point per 500 km^2 for the sedimentary and alluvial water body. But the density should be decided according the hydro geological running of the system, with obviously a minimum of one point per water body. As groundwater bodies are enough large this will not be a constraint and already much more than one point is followed per water body.

It is very difficult to see how far **operational monitoring** is fulfilled today in the Rhine district, because, for this, we should be able to state where measurement points should be done, and if in the today's existing network (basin network) integrative points are taken (in case of diffuse pollution). The basin network already respects frequency requirements.

9 over the 15 water bodies have been identified at risk in the Rhine district and will have to get an operational monitoring network designed, although yet existing basin network will already provide a part of the required information. Pesticides pressure is the main pressure that lead to classify water bodies at risk (see Annex 7), nitrates threat is also important. Local pollution's of chlorides (and other mineral due to mines) and VOH compounds will also have to be monitored in the operational monitoring.

9.2.2. Surface waters

We note that there is a lack in **water levels (lakes, pond…)** monitoring (lakes, gravel's…). In the Rhine district already 32 smooth water bodies have been identified, they are all from anthropogenic origin (whether heavily modified water body or artificial water body), but none is included in any monitoring program. There is, here, an important need of information and of references, to evaluate the quality of water stretches, which must, like all water bodies, reach good water status by 2015. This lack of information is clearly pointed out in the District Rhine characterisation (Agence de l'Eau Rhin-Meuse 2004) which couldn't deliver any risk evaluation for this type of water body.

In the national basin network 188 points in the Rhine district are followed as **surveillance monitoring** while 371 surface (natural) water bodies have been identified. 76 water bodies have been stated as doubtful (with a lack of information) out of 371 surface water bodies. This is without accounting the 26 artificial water body and the 45 heavily modified water bodies. This shows that there is much less than one point per water body that is followed. Evaluation, on whether it is 'sufficient' or not, is in progress at the water agency.

	organic pollution, nitrogen and phosphore	mineral micropollutant (metals,…)	pesticides	other pollutants	known emmissions of dangerous and priority substances
identified pressure	44%	16%	42%	12%	3%
no pressure	26%	2%	16%	0%	0%
missing data	30%	82%	42%	88%	97%

Figure 9: Much less than an estimation (emission + modelling or monitoring data) per water body: Part of identification of pressures per water body and type of contaminant in Rhine district (data RBN-AERM)

The above figure shows that for any type of pollutant there is always more than 30% of the water bodies that are not monitored and when they are monitored there is always a higher amount of water bodies identified with pressure than without. This is quiet disturbing, unless we could certify that monitored water bodies are those submitted to pressures (important rivers, like Rhine that have a lot of industries at their shore and traffic) and not monitored rivers are those in the Vosges and in more « natural areas » little exposed to pressures.

Before all there is a lake in monitoring information for dangerous priority substances: only 3% of water bodies are informed. If it is not so embarrassing for pesticides which impact can be well estimated as it is a diffuse pollution, it is much more for other point pollution such as halogenous-organo volatile compounds which are emitted by industries. This type of problem justify also the importance of rejects monitoring that is not explicit sited in WFD, but could give precious information about emissions in surface waters.

Operational monitoring should concern all water bodies that have been identified at risk or which present priority substances or water bodies that should fail reaching their environmental objectives (heavily modified and artificial water bodies); in the Rhine district they are 215. Saying how far this requirement is fulfilled is very difficult, because there is (i) to assess how far water bodies can be considered as one unity (ii) look where exactly today's monitoring points are regarding operational monitoring and see whether they are acceptable to follow the water body according pressures. But what is obvious is that this requirement is far from being respected until now, that can be explained by the fact that identification of small water bodies is recent and there is no reason why each one of them should already be followed.

General structure for operational monitoring has not been fixed yet, but it is evident that it will represent an enormous work of monitoring.

Investigative monitoring, as stated in the WFD, **does not exist today** as a separate program from surveillance monitoring. Our review of monitoring network had not pointed out any cases of investigative network, because these analysing campaigns are temporal and are punctual initiatives following accidents or special events[24]. It is difficult to say from the available information whether there is any unexplained pollution, which should be investigated. To this point we will propose examples and scenarios in the further work of the project.

The following table suggests a parallel between existing monitoring networks and WFD requirements.

[24] For example we can site the Benfeld event, where a truck incident lead to a leakage of a chlorinated volatile compound that is found in the aquifer and which was the object of a special monitoring investigative campaign

Type of network / finality	Type of water	Type of pollution	Major monitoring networks in Rhine district	*towards WFD monitoring requirements* *[provide all (=); part (<) information of WFD requirements]*
Surveillance	Ground w.	all	**-Rhine-Meuse basin groundwater quality network** **-Alsatian, Sundgau's and Lorraine's five year inventories**	*= surveillance* *< operational* *(Investigative)*[25]
	Surface w.	all	**-Rhine-Meuse basin network** **-Complementary basin networks: Bas-Rhin surface water monitoring network** **-International monitoring of Rhine and Moselle Sarre rivers** **-** *Special surveillance programs in 'Ballon des Vosges' natural park*	*= surveillance* *< operational* *(Investigative)*
Impact	Ground w.	Industrial and animal farm point pollution	**- Groundwater monitoring of IPCC industrial sites**	*< operational* *(Investigative)*
		Agricultural diffuse pollution	*-Nitrogen monitoring in groundwater for private water company (VITTEL)*	
	Surface w.	Industrial Potential Point pollution	**-Industrial and treatment plants rejects network**	*< operational* *(Investigative)*
		Agricultural diffuse pollution	**-***Pesticides monitoring on a local river (LONGEAU)*	*< Operational* *(Investigative)*
Operationnal	Ground and surface w.	Mineralisation from mines	**- The old potash-mine network** - **Iron basin monitoring network** - **Minery basin network**	*< Operational* *(Investigative)*
Use	Distributed drinking w. and ground w.	Chemical, bacteriological	**-Self-checking by Drinking water providers** **-Drinking water police (DDASS) network**	*None*
			-Groundwater alert monitoring networks of major cities : potential used water monitoring	*<Surveillance* *<operational*
	Bathing w. : surface w.	Chemical, bacteriological	**-Bathing sanitary water network**	*< surveillance*

Figure 10 Existing monitoring networks in Rhine district and their coherence towards new WFD monitoring requirements

[25] () : in braquets according to the risk assessment of the type of water body this network could help fulfilling WFD monitoring requirements

10. Conclusion

The WFD defines a large panel of existing data to use for the realisation of the characterisation of hydrographical districts: this has already been done. But we pointed out that data on water quality is missing before all for surface waters and organic micro-pollutants. Therefore and as previewed in the WFD a general monitoring program must be implemented until 2006 to acquire this data, no special technical requirements are required.

An important number of networks exist and represent a none negligible budget (6 millions of € for all public water information in the Rhine –Meuse basin). Sources and formats of the corresponding data are numerous. In order to better organise the acquiring of new data and to build a coherent reporting system, a 'water data framework scheme' (Schema directeur de données sur l'eau' SDDE) is in progress for each French district. It should enable to define an information system[26] on water that should be implemented in 2006[27].

We have pointed out that the WFD requirements are not very precise and let a large place to local technical decision in terms of monitoring designing. Indeed water bodies functioning and sensitivity to pollution differ from one place to another according to types of water bodies (hydro geological characteristics for groundwaters or hydro morphological characteristics for surface waters) and to local pressures and risks. This makes it difficult to establish whether monitoring is missing. **Thought we figured out that surveillance monitoring is already well adapted for groundwater monitoring, although micro-pollutants are less followed than physic-chemical parameters. We are not able to say it for surface waters as so many water bodies have been identified. On the opposite operational monitoring, as supposed in WFD, is far from being completed in the Rhine district, before all in surface waters as 215 water bodies have been identified at risk and are supposed to be followed regularly.**

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[26] « systeme d'information sur l'eau" SIE

[27] ADES is the already existing national databank: it gathers on a public Internet website groundwater quantity and quality data. It counts until today 73 networks including 1876 piezometers. Near 5 millions analyses are on line viewable. (http://ades.rnde.fr). MEDD and BRGM are studying the feasibility of a systematic integration of data's of classified installation and polluted sites and soils.

11. Perspective for further work

Techniques that are used today spot sampling and ‘classical’ lab analysis are chemical methods that differ from one to the other family parameter. Just very few parameters have to be analysed directly in site because they are none conservative parameters, such as temperature.

These ‘classical methods’ have proved their efficiency as they are, for most of them accredited methods. They have, though, their limits of efficiency. They are expensive because each sample to analyse bears a high unity cost (see further work on costs) and their cost is a limiting factor for network stakeholders who are constrained to make a choice will designing their network (both frequency / density and parameters). This leads to reduce the number of samples and the localisation of sampling although sampling is the most important and delicate part of monitoring. Problem is “representativity” and confidence of monitoring points, frequency and data of measurements that could highly influent results as mediums are very space - and time-variable. Other emerging methods could provide richer information. For instance (i) Passive samplers could provide continuous information. (ii) Not degradable information given by on-site analyses permits to maintain the parameters as narrow as they are in the natural site (lower bias. (iii) Biosensors indicate the biodisponible level of parameters which could be an interesting information regarding the toxicity of pollutants and the ecological evaluation.

So emerging screening methods could, both, complete missing data to fulfil WFD requirements and provide better quality information for the WFD and private demands of water quality monitoring (self-monitoring of rejects by industries for instance). The SDAGE, the French instrument to implement the WFD locally, already speaks of improving quantity of measurements using eventually alternative methods. Further work will select potential uses for emerging tools regarding missing data, type of water body and parameters. As we pointed out here, organic micro-pollutants in surface waters are the most missing datas.

MIQUEL (Assemblée nationale, 2003) in his report about water quality notes that analyses have been multiplied in the past and had been the origin of a high number of poor quality statistics: development of these new emerging methods will also have to integrate ‘intelligent ‘measurement protocols and not only provide a wider number of data. Furthermore, as a complex tool (“Schema directeur de données sur l’eau” SDDE) is being developed in order to gather all public monitoring data in a bank, a concern of stakeholders will be to have results fitting in this format. This is not obvious with emerging tools…

We saw that monitoring is not the only way to acquire data on water quality, modelling is another manner to evaluate it going out from pollution emissions. This assumes that these emissions are known…In the elaboration of the district characterisation modelling[28] have been largely used as we note that more water bodies have been identifies than existing measurement points. This is an important point for the further work: cost efficiency analysis could be done comparing monitoring and modelling with their respective efficiency evaluation and uncertainties…

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[28] PEGASE model for the physicochemical modelisation of macro pollutants

Bibliography

(1998). Arrêté du 2 février 1998 relatif aux prélèvements et à la consommation d'eau ainsi qu'aux émissions de toute nature des installations classées pour la protection de l'environnement soumises à autorisation.

(2003). Cahier des charges pour l'évolution des réseaux de surveillance des eaux souterraines en France.

(2003). Guidance on monitoring for the Water Framework directive**:** 164.

Agence de l'Eau Rhin-Meuse (2004). Eléments de diagnostic de la partir française du district Rhin.

Agence de l'eau Rhin-Meuse (2004). Méthodes et procédures pour l'état des lieux des districts Rhin et Meuse-Sambre**:** 162.

BRGM (Vaute, L. (2004). Surveillance des eaux souterraines du bassin ferrifère lorrain en 2003, BRGM.

CHABART.M., E. P. (2004). Contrôle et surveillance de la salinité de la nappe phréatique d'Alsace dans le bassin potassique et à l'aval (68). Rapport de synthèse des mesures effectuées en 2003., BRGM.

DDASS (2003). Qualité de l'eau distribuée en Alsace de 2001 à 2003.

Dworak, T., E. Kampa, et al. (2004). Swift WFD D60 Policy status quo report on monitoring issues, Ecologic**:** 71.

GAUMAND, C.; MANFREDI, A.; PRIME, JL (2005) Bilan des plans d'action régionaux de lutte contre les pollutions pesticides dans le cadre du premier plan national- Rapport de l'inspection générale de l'environnement

Les éditions des journaux officiels, Ed. (2003). Pollution des eaux - Redevances. Législation et réglementation.

MIQUEL, G. (2003). Rapport sur la qualité de l'eau et de l'assainissement en France, OFFICE PARLEMENTAIRE D'ÉVALUATION DES CHOIX SCIENTIFIQUES ET TECHNOLOGIQUES**:** 195.

Région Alsace (2000). Inventaire de la qualité des eaux souterraines dans la vallée du Rhin supérieur. Strasbourg.

Internet sites:

www.eau-rhin-meuse.fr/sierm/default.htm (Water agency)

www.rnde.tm.fr/français/at/reseau/reseaux.htm (réseau national de données sur l'eau)

http://www.iksr.org (commission internationale de protection du Rhin) and http://www.iksms-cipms.org (commission internationale de protection de la Moselle et de la Sarre)

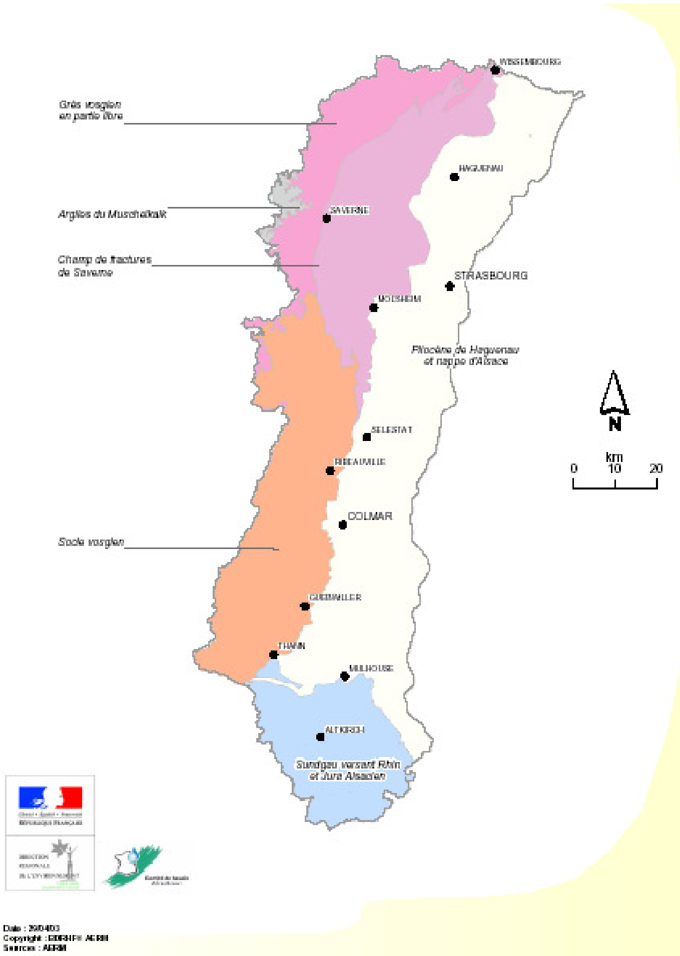
www.ades.eaufrance.fr

http://basol.environnement.gouv.fr and http://basias.brgm.fr

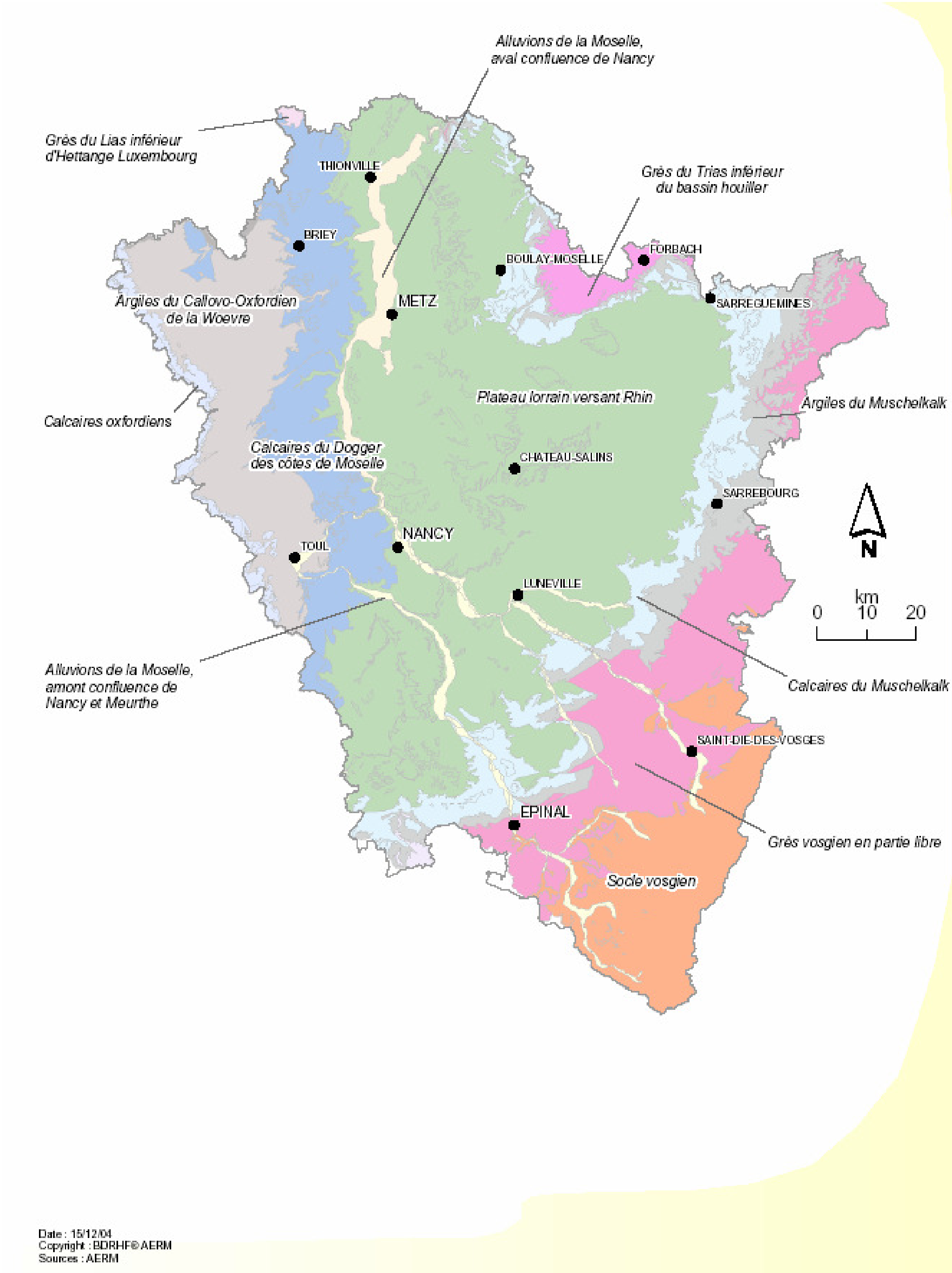
www.baignades.sante.gouv.fr

Annexes

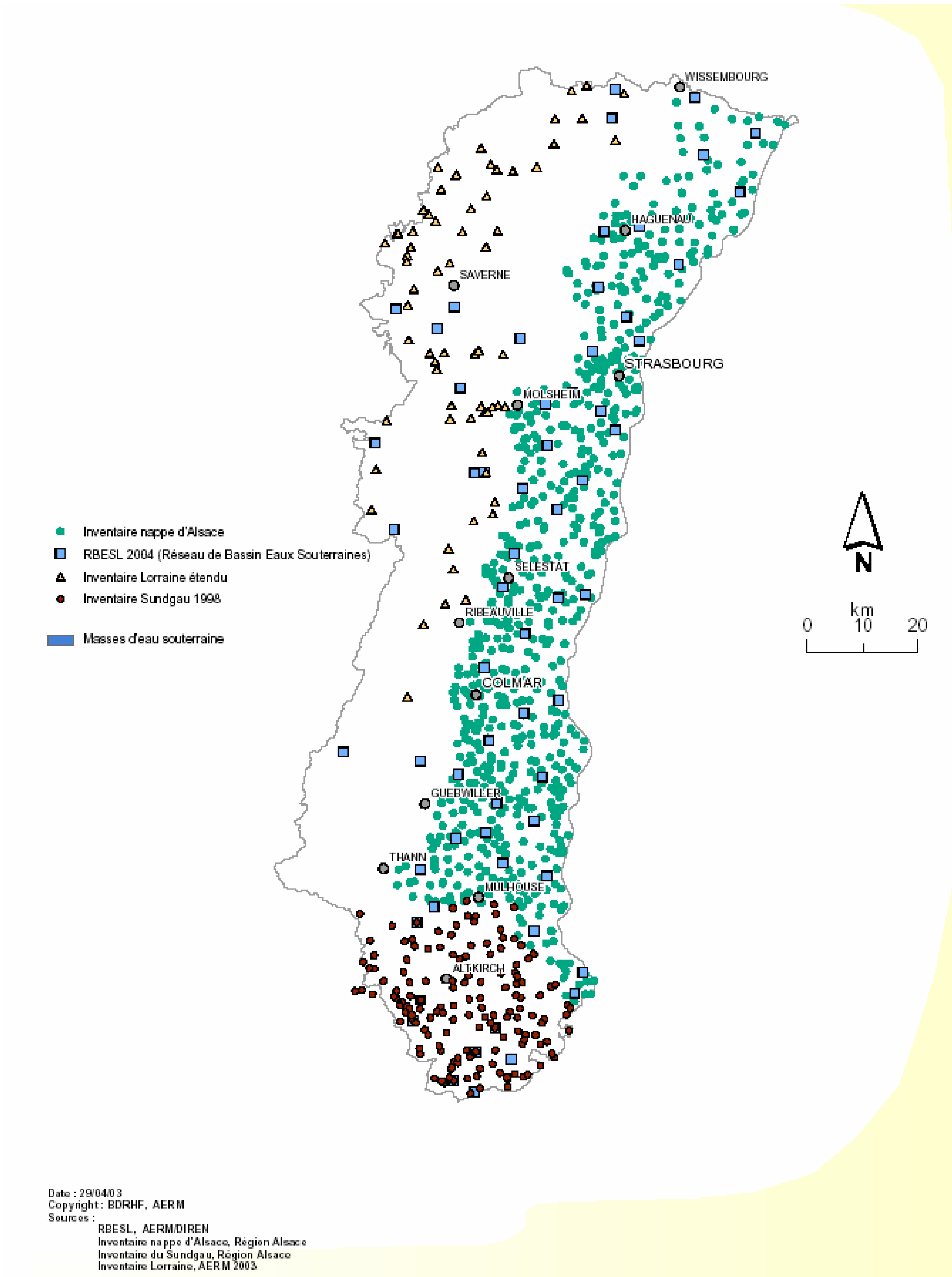
Annex 1: Groundwater bodies in the Upper Rhine sub



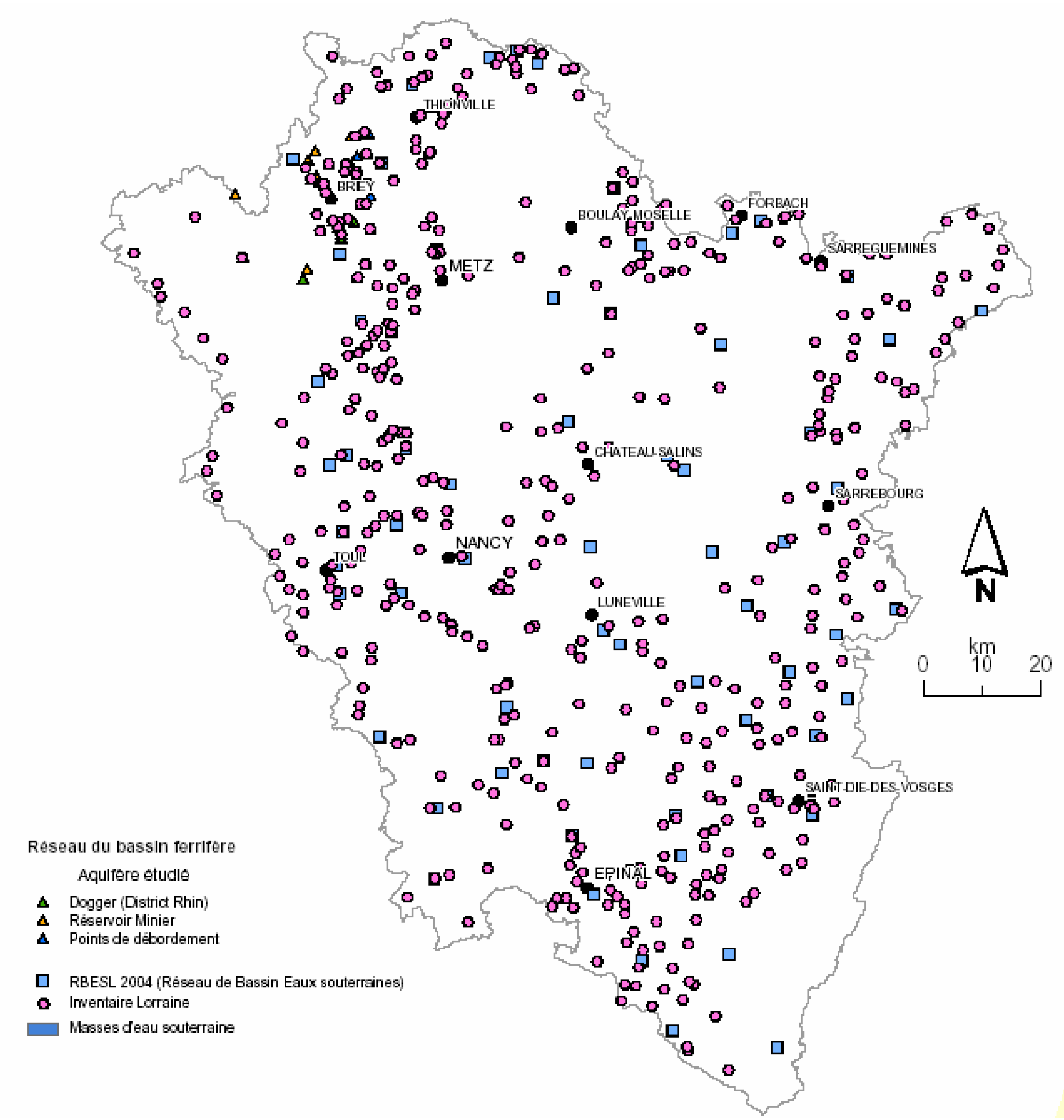
Annex 2 : Groundwater bodies in Moselle-Sarre sub basin district



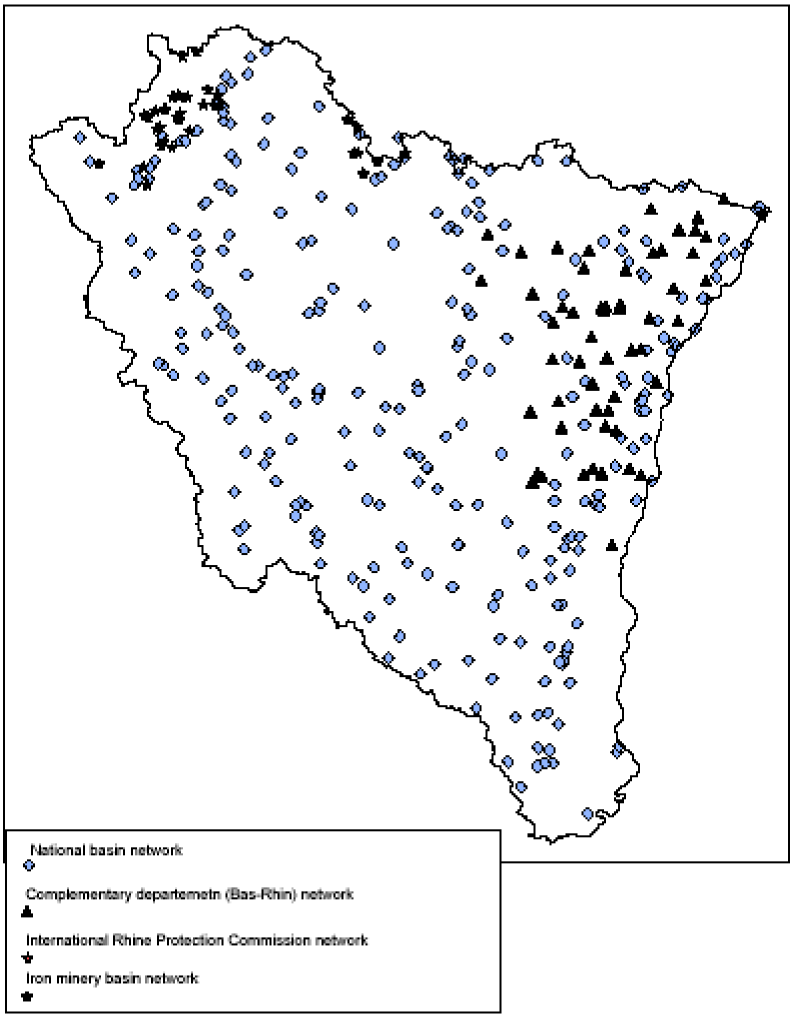
Annex 3 Groundwater surveillance networks of Upper Rhine basin



Annex 4 Groundwater surveillance networks of Moselle-Sarre basin



Annex 5: Major surface water surveillance networks of Rhine district (Source GIS files : AERM, BRGM)



Annex 6: Mining concessions

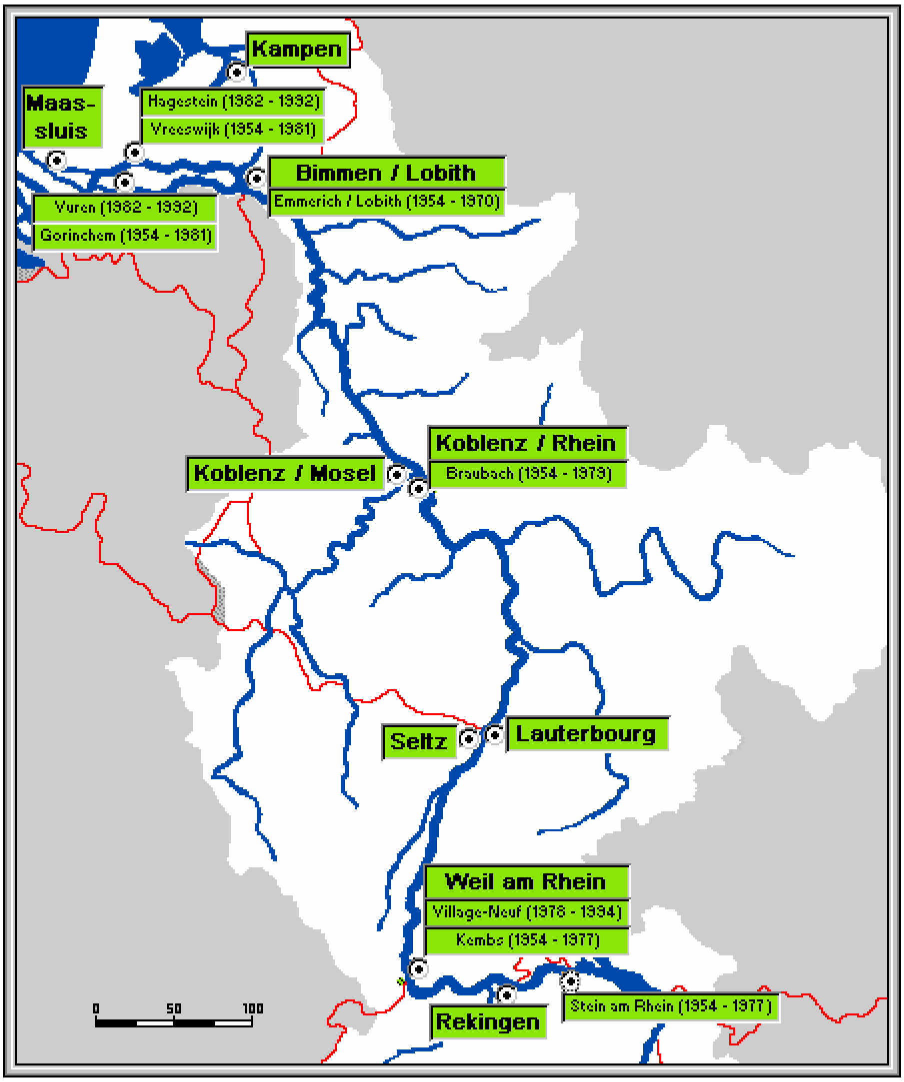
Annex 7 : Synopsis of risk assessment for groundwaters-(source AERM)

Nom de la masse d'eau	Secteurs de travail	Nitrates	Phyto sanitaires	Solvants chlorés	Chlorures	Sulfates	Autres polluants	Evaluation du risque
Pilocène de Haguenau et nappe d'Alsace	Rhin supérieur				Limité			Masse d'eau à risque
Sundgau versant Rhin et Jura alsacien	Rhin supérieur							Masse d'eau à risque
Socle vosgien	Commun aux deux secteurs de travail							
Grès vosgien en partie libre	Commun aux deux secteurs de travail		Limité					Risque
Grès vosgien captif non minéralisé	Commun aux deux secteurs de travail				Limité			Risque Limité
Calcaires du Muschelkalk	Commun aux deux secteurs de travail							Masse d'eau à risque
Plateau lorrain versant Rhin	Moselle Sarre							
Calcaires du Dogger des côtes de Moselle	Moselle Sarre						minér	Masse d'eau à risque
Alluvions de la Moselle en aval de la confluence avec la Meurthe	Moselle Sarre							Masse d'eau à risque
Alluvions de la Meurthe et alluvions de la Moselle en amont de la confluence avec la Meurthe	Moselle Sarre				Limité			Masse d'eau à risque
Argiles du Callovo-Oxfordien de la Woevre	Moselle Sarre							
Argiles du Muschelkalk	Commun aux deux secteurs de travail		doute					doute
réservoir minier-Bassin ferrifère lorrain	Moselle Sarre						minér	Masse d'eau à risque
Champ de fractures de Saverne	Rhin supérieur							Masse d'eau à risque
Grès du Trias inférieur du bassin houiller	Moselle Sarre				Limité			Masse d'eau à risque

Source: extracted from the report on initial characterisation of the Rhine – Moselle – Sarre river basin district (www.eau2015.eau-rhin-meuse.fr)

Annex 8: Monitoring points of Moselle-Sarre International Commission network

Annex 9: Monitoring points of Rhine International Commission network



Annex 10: Unity cost for surveillance monitoring (source: Water Agency)

Code Sandre	Libellé paramètre - Parameter (mg/L)	Prix en € HT 2003 - Price	Code Sandre	Libellé paramètre - Parameter (mg/L)	Prix en € HT 2003 - Price
	prélèvement pompage ou robinet	79,4	1469	1- Chloro-2 Nitrobenzène	41,2
Physico-chimie			1468	1- Chloro-3 Nitrobenzène	41,2
1301	Température (° C)	2,1	1470	1- Chloro-4 Nitrobenzène	41,2
1303	Conductivité (mS / cm)	3,1	1161	1,2- Dichloroéthane	82,5
1302	pH	3,1	1630	1,2,3 Trichlorobenzène	134,0
1330	rH (mv)	3,1	1283	1,2,4 Trichlorobenzène	134,0
1311	Oxygène dissous	3,1	1629	1,3,5 Trichlorobenzène	134,0
	total	14,4	1593	2- Chloraniline	41,2
Macropolluants			1141	2,4 D	77,3
1327	Hydrogénocarbonates	3,1	1169	2,4 DP dichlorprop	82,5
1328	Carbonates	3,1	1212	2,4- MCPA	77,3
1337	Chlorures	4,1	1264	2,4,5 T	77,3
1338	Sulfates	6,2	1602	2-Chlorotoluène	82,5
1374	Calcium	9,3	-	2d, 4,4d, 6d-tetrahydroxychalcone	309,3
1372	Magnésium	9,3	-	2d, 4,4d, 6d-tetrahvdroxvdihvdrochalcone	309,3
1375	Sodium	9,3	-	2d, 4,4d-trihydroxychalcone	309,3
1334	Potassium	9,3	-	2-naphtol	77,3
1350	Phosphore total	12,4	1592	3- Chloraniline	41,2
1433	Orthophosphates	11,3	1586	3,4- Dichloraniline	41,2
1347	Titre alcalim.complet	5,2	-	3,4d, 5, 7-terahydroxyflavone	309,3
1342	Silicates	6,0	-	3d, 4d, 5, 7-tetrahydroxyflavone	309,3
1362	Bore	12,4	-	3d, 7-dihydroxyflavone	309,3
1391	Fluorures	14,4	1591	4- Chloraniline	41,2
1315	Oxydabilité au KMnO4 en milieu acide à chaud	7,2	-	4, 4d-dihydroxybiphényl	154,7
1318	Carbone organique dissous	22,7	-	4,4d-dihydroxychalcone	309,3
1295	Turbidité	4,1	1600	4-Chlorotoluène	82,5
1314	DCO	13,4	-	4d, 5, 7-trihydroxyflavanone	309,3
	carbone total	47,4	-	4d, 5, 7-trihydroxyflavone	309,3
1335	Ammonium	5,2	-	4d, 5d, 7-trihydroxyisoflavone	309,3
1319	Azote Kjeldahl	13,0	-	4d, 5-dihydroxyflavone	309,3
1339	Nitrites	5,2	-	4d, 6-dihydroxyflavone	309,3
1340	Nitrates	5,2	-	4d, 7-dihydroxyflavanone	309,3
	azote total	28,5	-	4d, 7-dihydroxyisoflavone	309,3
Micropolluants			-	4d-hydroxyflavone	309,3
1177	Diuron	77,3	-	4-iso-pentylphénol	154,7
1208	Isoproturon	77,3	-	4-nonylphénol	154,7
1676	Flufénoxuron	77,3	-	4-nonylphénol-diethoxylate	154,7
1209	Linuron	77,3	-	4-sec-butylphénol	154,7
1136	Chlortoluron	77,3	-	4-tert-butylphénol	154,7
1520	Néburon	77,3	-	4-tert-octylphénol	154,7
1107	Atrazine	77,3	-	4-tert-pentylphénol	154,7
1108	Déséthylatrazine	77,3	-	5,7-dihydroxy-4d-methoxyisoflavone	309,3
1263	Simazine	77,3	-	6-hydroxyflavone	309,3
1109	Déséthylsimazine	77,3	-	7-hydroxy-4d-methoxyisoflavone	309,3
1268	Terbutylazine	77,3	1688	Aclonifen	134,0
1137	Cyanazine	77,3	1102	Aldicarbe	77,3
1200	a-HCH	134,0	1370	Aluminium total	12,4
1201	b-HCH	134,0	1105	Aminotriazole	93,8
1202	d-HCH	134,0	1376	Antimoine	14,4
1203	Lindane (g-HCH)	134,0	1368	Argent	12,4
1289	Trifluraline	134,0	1369	Arsenic	14,4
1101	Alachlore	134,0	1110	Azimphos-éthyl	77,3
1221	Métolachlore	77,3	1111	Azimphos-méthyl	77,3
1670	Métazachlore	77,3	1113	Bentazone	77,3
1103	Aldrine	134,0	1114	Benzène	82,5
1173	Dieldrine	134,0	1118	Benzo (ghi) Pérylène	134,0

Annex 11 Requirements of WFD concerning surveillance monitoring in groundwater (Source AERM)

ELEMENTS DE QUALITE	QUALITE	Paramètres	FREQUENCE	DENSITE
PARAMETRES PHYSICO-CHIMIQUES (paramètres généraux)	**Physico-chimie in situ**	température, Conductivité, pH, Eh, oxygène dissous	1 à 2 / an	1/500 km2 à 1/3500 km2
	Eléments majeurs	HCO3-, CO3--, Cl-, SO4--, Ca++, Mg++, Na+, K+	1 à 2 / an	1/500 km2 à 1/3500 km2
	Matières organiques et oxydables	Oxydabilité au KMNO4 à chaud en milieu acide, Carbone organique dissous	1 à 2 / an	1/500 km2 à 1/3500 km2
	Matières en suspension	Turbidité, Fer total, Manganèse total	1 à 2 / an	1/500 km2 à 1/3500 km2
	Minéralisation et salinité	Dureté totale, SiO2 F-	1 à 2 / an 1 / 6 ans	1/500 km2 à 1/3500 km2
	Composés azotés	NO3-, NH4+	1 à 2 / an	1/500 km2 à 1/3500 km2
POLLUANTS	**Micropolluants minéraux** dont substances prioritaires	Sb, As, B, Cd, Cr total, Cu, CN-, Hg, Ni, Pb, Se, Zn Cd, Hg, Ni, Pb	1 / 6 ans	1/500 km2 à 1/3500 km2
	Micropolluants organiques pesticides	**Organochlorés (environnement rural)** Lindane ou gamaHCH, métolachlore, mtazachlore	1 / 6 ans	
		Organoazotés (environnement rural ou industriel/urbain) atrazine, simazine, déséthyl atrazine, déséthyl simazine, terbutylazine	1 à 2 / an	
		Urées substituées (environnement rural ou industriel/urbain) diuron, isoproturon, chortoluron	1 / 2 ans	1/500 km2 à 1/3500 km2
	autres micropolluants	**Composés Organo-halogénés Volatils (COV) (environnement industriel ou urbain)** tétrachloroéthylène, trichloroéthylène ou trichloroéthéne, chloroforme (trichlorométhane), tétrachlorure de carbone, 1,1,1 trichloroéthane	1 / 6 ans	
	Autres paramètres à analyser en fonction de l'environnement de la masse d'eau	Composés organophosphorés, Composés organostanniques, Hydrocarbures persistants et substances organiques toxiques persistants et bioaccumulables, Produits biocides et phytopharmaceutiques		1/500 km2 à 1/3500 km2

Annex 12 Priority substances to follow in the operational monitoring of groundwaters-WFD (source AERM)

Micropolluants organiques	Alachlor
	Anthracene
	Benzène
	Diphenylether pentabromo
	C10-13 Chloroalcanes
	Chlorofenvinphos
	Chorpyrifos éthyl
	1,2 dichloroéthane
	Dichlorométhane
	Diéthylhexylphtalate
	Endosulfan alpha
	Fluoranthène
	Hexachlorobenzène
	Hexachlorobutadiène
	Hexachlorocyclohexane
	Naphtalène
	Nonyphénol
	Octyphénol
	Pentachlorobenzène
	HAP (benzo(a)pyrène, benzo(k)fluoranthène)
	TBT
	Trichlorobenzène
	Trifluraline

Annex 13 Additional controls in protected zones (drinking water) (DIRECTIVE 98/83/CE) - DDASS Network

ELEMENTS DE QUALITE	QUALITE		FREQUENCE
PARAMETRES MICROBIOLOGIQUES	**Paramètres microbiologiques**	Escherichia Coli, Entérocoques	Fonction du volume d'eau produit
PARAMETRES PHYSICO-CHIMIQUES	**Paramètres chimiques**	Acrylamide, Benzène, Benzo(a)pyrène, 1, 2 Dichloroéthane, Epichlorhydrine, Nitrites, HAP (benzo(b)fluoranthène, benzo(k)fluoranthène, benzo(ghi)pérylène, indéno(1,2,3-cd)pyrène), Total trihalométhane (THM), Chlorure de vinyle	Fonction du volume d'eau produit
	Paramètres indicateurs	Aluminium, Couleur, Odeur, Saveur, Teneur en colonies à 22°C, Bactéries coliformes, Cardone organique total	Fonction du volume d'eau produit
	Radioactivité	Tritium, Dose total indicative	Fonction du volume d'eau produit

Annex 14: WFD requirements in surveillance monitoring of surface waters (Source AERM)

ELEMENTS DE QUALITE	QUALITE	paramètres	FREQUENCE
PARAMETRES PHYSICO-CHIMIQUES (paramètres généraux)	Conditions thermiques	température	12/an
	Conditions d'oxygénation	oxygène dissous, %O2, DBO5, DCO, COD (MOOX), THM potentiel, NKJ, NH4+	12/an
	Effets des proliférations	Chlorophylle A, Phéopigments algues	12/an
	Salinité	conductivité, résidu sec, Cl-, SO42-, Ca2+, Mg2+, K+, Na+, TAC, Dureté	2 / an
	Etat d'acidification	pH, alcalinité	12/an
	Nutriments	phosphore total, phosphore soluble réactif, Azote total, nitrates, nitrites, ammonium	12/an
	Autres	MES, transparence, turbidité	12/an
POLLUANTS SPECIFIQUES	Polluants non-synthétiques	Cadmium, Mercure, Plomb, Nickel	12/an (1/an pour sédiments)
	Autres polluants non-synthétiques	Antimoine, Arsenic, Cyanures, Baryum, Bore, Chrome total, Cuivre, Sélénium, Zinc	
	Polluants synthètiques (substances prioritaires)	**Pesticides** : Alachlore ; Atrazine, Chlorfenvinphos, Chlorpyrifos ethyl, Diuron, endosulfan, HCH-lindane, Isoproturon, Simazine, Trifluraline	12/an (1/an pour sédiments) 1/an sédiments pour HAP
		HAP anthracène, Fluoranthene, benzo(a)pyrène, Benzofluoranthene, benzopérylène, Benzofluoranthene, indénopyrène, Naphtalene	
		Autres micropolluants organiques MPOR benzène, chloroformes, Pentachlorobenzene, Pentachlorophenol, diphtalate, dichloroéthane, dichlorométhane, hexachlorobenzene, hexachlorobutadiène, TBT, Trichlorobenzene, nonylphénol, pentabromodiphényléther, octylphénol	
	Autres polluants synthètiques (ref. annexe VIII DCE) liés à une pression spécifique	Organochlorés, Organophosphorés, Organostanniques, Substances et préparations….caractère cancérigène…(§4 ann.VIII), Hydrocarbures persistents et substances organiques toxiques persistantes et bio-accumulables (§5. annVIII), Produits biocides et pesticides	12/an (1/an pour sédiments)
PARAMETRES BIOLOGIQUES	Faune invertébrée	Composition, Abondance (chaque taxon + indice oligochètes), présence de taxons sensibles, diversité	1/an
	Ichtyofaune	Composition, Abondance, présence de taxons sensibles, répartition des âges par populations	1/an
	Phytobenthos	Composition, Abondance, présence de taxons sensibles	1/3 ans
	Macrophytes	Composition, Abondance, présence de taxons sensibles	1/3 ans
	Phytoplancton	Composition, Abondance, intensité/fréquence des blooms, biomasse	8/an optionnel

Annex 15 Parameters to control in the surveillance monitoring of water stretches

ELEMENTS DE	QUALITE	paramètres	FREQUENCE
PARAMETRES PHYSICO-CHIMIQUES (paramètres généraux)	Conditions thermiques	température	12/an
	Transparence	MES, transparence SECCHI, turbidité	4/an
	Conditions d'oxygénation	oxygène dissous, %O2, DBO5, DCO, COD (MOOX), THM potentiel, NKJ, NH4+	4/an
	Effets des proliférations	Chlorophylle A, Phéopigments algues	4/an
	Salinité	conductivité, résidu sec, Cl-, SO42-, Ca2+, Mg2+, K+, Na+, TAC, Dureté	4/an
	Etat d'acidification	pH, alcalinité	4/an
	Nutriments	phosphore total, phosphore soluble réactif, Azote total, nitrates, nitrites, ammonium	4/an
	Potentiel de relargage des sédiments	N dans eau interstitielle P dans eau interstitielle perte au feu	1/6 ans
POLLUANTS SPECIFIQUES	Polluants non-synthétiques (substances prioritaires)	Cadmium, Mercure, Plomb, Nickel	1/an (séd+eau)
	Autres polluants non-synthétiques	Antimoine, Arsenic, Cyanures, Baryum, Bore, Chrome total, Cuivre, Sélénium, Zinc	1/an (séd+eau)
	Polluants synthètiques (substances prioritaires)	**Pesticides** Alachlore ; Atrazine, Chlorfenvinphos, Chlorpyrifos ethyl, Diuron, endosulfan, HCH-lindane, Isoproturon, Simazine, Trifluraline	4/an sur l'eau et 1/an pour sédiments pour les pesticides et autres polluants organiques
		HAP anthracène, Fluoranthene, benzo(a)pyrène, Benzofluoranthene, benzopérylène, Benzofluoranthene, indénopyrène, Naphtalene	
		Autres micropolluants organiques MPOR benzène, chloroformes, Pentachlorobenzene, Pentachlorophenol, diphtalate, dichloroéthane, dichlorométhane, hexachlorobenzene, hexachlorobutadiène, TBT, Trichlorobenzene, nonylphénol, pentabromodiphényléther, octylphénol	et 1/an sur sédiments pour les HAP
	Autres polluants synthètiques (ref. annexe VIII DCE) liés à une pression spécifique	Organochlorés, Organophosphorés, Organostanniques, Substances et préparations….caractère cancérigène…(§4 ann.VIII), Hydrocarbures persistents et substances organiques toxiques persistantes et bio-accumulables (§5. annVIII), Produits biocides et pesticides	4/an sur l'eau(1/an pour sédiments)
PARAMETRES BIOLOGIQUES	Faune invertébrée	Composition, Abondance (chaque taxon + indice oligochètes), présence de taxons sensibles, diversité	1/6 ans
	Ichtyofaune	Composition, Abondance, présence de taxons sensibles, répartition des âges par populations	selon profondeur 1/6 ans ou 1/3ans
	Phytobenthos	Composition, Abondance, présence de taxons sensibles	selon profondeur 1/6 ans ou 1/3ans
	Macrophytes	Composition, Abondance, présence de taxons sensibles	selon profondeur 4 à 7/an
	Phytoplancton	Composition, Abondance, intensité/fréquence des blooms, biomasse	8/an optionnel
	Zooplancton		selon profondeur 4 à 7/an

Annex 16: Tables for network description

Water quality monitoring of surface waters in Rhine-Meuse basin
Réseau de suivi de la qualité des eaux superficielles du bassin Rhin-Meuse (RNB) **ID: Sw.1**
Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	All rivers with more than 20 km long
Number of water bodies concerned	121 rivers
Area , catchment area	6000 km

Objective of the monitoring (WHY)	
Type of MN	Surveillance MN
Description of main objective	The objective of this network is the knowledge, information and evaluation of the environment.
Related regulatory constraints	It is in conformity with the signed protocol between water direction and water agencies
Socio-economic objectives if any	Assess and prevent new degradations Deliver the necessary knowledge to implement national and European regulations
Brief description of the history of implementation of the network	This network has been coupled firstly to the national basin network (RNB, "réseau national de la qualité des eaux superficielles") in 1985 but had began to structure really since 1987 with national minimum requirements (frequency, parameters…). Micropollutants are followed since 1991. Since 1993 stations are also followed on bacteriological parameters Density of points is increase from year to year (about 1700 for whole France)

Geographic features (WHERE)	
Number and location of points	188 points on district Rhine and 60 on Meuse district
Density	One monitoring point every 25 km. (the most dense of France)
Is the information provided representative	Program of analyses is made very carefully between AERM and DIREN, to show maximum representativeness of the quality of the rivers. But no data in the southern part of the Rhine (all Haut-Rhine) 75000 datas per year

Parameters monitored (WHAT)	
List parameters monitored	-physicochemical and organoleptic parameters, -pesticides, Organic and Mineral micropollutants and ecotoxical parameters (only on 49 stations in RM basin) Bacteriological parameters are analysed on 69 stations (salmonellas on 25 stations). Diatomic and invertebrates (biological parameters) are analysed on 140 stations. Support of analyse are also sediments (MES) and bryophytes (85 stations).

Frequency (WHEN)	
Frequency of monitoring	Physicochemical and micro-pollutants: twice monthly Hydro bio. : 1-2 /year; Microbiological : 9 / year
Period of the year	All year round
Since when	1985

Technique (HOW)	
Monitoring technique :	Classical sampling and lab analysis According to the national protocol of RNB (procedure cards)

Organisation (BY WHOM)	
Owner of the network	AERM, MEDD (ministry for environment and sustainable development)
Operator of the network	AERM, DIREN (for pesticides), CSP (fishery council) ; for hydrobiology it is very complex according to different departments
Actor in charge	AERM
Links between different actors involved : financial , control	Diren and AERM share the management and validation of datas according to localisation of points. Animation is made by both also.

End use (WHAT FOR)	
Final use of the data collected	Knowledge and following L'OIEAU –international water office exploits the database.
Other possible end users	Governmental administrations, Environmental NGO's, citizen, fishers
Current level of accessibility of the data	Internet free access on http://www.eau-rhin-meuse.fr/sierm Every month the database is brought up to date Compatible SANDRE (national) format

‘Bas-Rhin’ Departmental interest network
Réseau d’intérêt départemental du Bas-Rhin **ID: Sw.2**
Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	Different surface water, main rivers of the department
Area catchment area	Main rivers in Bas Rhin

Objective of the monitoring (WHY)	
Type of MN	Surveillance MN
Description of main objective	The objective of this network is the knowledge and also to give the alarm in case of pollution
Related regulatory constraints	none

Geographic features (WHERE)	
Number and location of monitoring points	54 points in all Bas - Rhin department
Density	
Is the information provided representative	For the Bas-Rhine , North eastern part of the district (in the sub district upper-Rhine)

Parameters monitored (WHAT)	
List parameters monitored	Physicochemical parameters (flow, pH, conductivity, oxygen) that give simple information of the global state and can be relevant to spot anomalies.

Frequency (WHEN)	
Frequency of monitoring	Physico-chemical and general parameters : 2 times per month HAP:2 times per year Other parameters : depend
Period of the year	All year round
Since when	Computerised data: 2000-2004

Technique (HOW)	
Monitoring technique :	Classical sampling and lab analysis In accordance with the national RNB protocol
Uncertainty of measurements:	

Organisation (BY WHOM)	
Owner of the network	AERM , Conseil general (departmental state administration)
Operator of the network	Each Conseil general (5 departmental state administration in the basin); SATESE make the sampling and analysis are sub contracted
Actor in charge of reporting / official responsibility for monitoring (if different)	Conseil general (departmental state administration)
Links between different actors involved	

End use (WHAT FOR)	
Final use of the data collected :	Following quality and alarming
Other possible end users	Governmental administrations, Environmental NGO’s, citizen
Current level of accessibility of the data	Free access on internet Database management by OIEAU

International commissions network of Rhine and Moselle –Sarre rivers
Réseau hydrobiologique internationaux de suivi des eaux du Rhin CIPR / et Moselle-Sarre CIPMS **ID: Sw.3**
Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	Rhine, Moselle, Sarre rivers
Area , catchment area	Transbordary rivers

Objective of the monitoring (WHY)	
Type of MN	Surveillance MN
Description of main objective	The objective of this network is the knowledge and understanding of the resource and to identify possible trends in water quality. Monitoring of water quality is one of the main objectives of the international commissions of transbordary rivers.
Related regulatory constraints	none
Socio-economic objectives if any	These monitoring programs have developed to follow and insure the objectives of international rivers conventions such as Rhine convention which role is to insure protection of the ecosystem Rhine, the production of drinking water from Rhine water and the protection of North sea while reducing pollution emissions from Rhine river.
Brief description of the history of implementation of the network	The Rhine commission have gather for the first time in 1950 on a Dutch initiative, to solve pollution problems. In the first 20 years after the creation commission have worked on the implementation of a monitoring programs of the river. Analysing points extend all over the Rhine which crosses 9 countries. The same type of commission have than emerged for Moselle (1962) and Sarre river

Geographic features (WHERE)	
Number and location of monitoring points	Rhine: 9 points ; but only 1 in France (Lauterbourg) country see res_CIPR.bmp-annex Moselle-Sarre : 34 points and around 10 in France (1997) see res_CIPMS.bmp-annex
Density	Rhine is 1320 km long, and points are not regularly distributed
Is the information provided representative	Maybe not very representative as the quality of surface water vary a lot with the various pressures that exert on it, and, in this region industries are frequent in the border of rivers and can be punctual sources of pollution's. Thought today's legislations minimise the accidental pollutions on rivers, the general background pollution could be well represented by these networks.

Parameters monitored (WHAT)	
List parameters monitored	General physical-chemical parameters ; Mineral / organic micro-pollutants Hydrological parameters (no fishes) : Benthic invertebrate, Phyto- and zooplankton

Frequency (WHEN)	
Frequency of monitoring	Rhine Lauterbourg station (France) : 2 or 1 times per month according to parameters .
Period of the year	All year round
Since when (number of years with data collected)	Rhine: Since 54 datas have been collected; datas are online viewable since 1972-but the number of analyses have intensively risen constantly

Technique (HOW)	
Monitoring technique :	Lauterbourg station is functioning in 'automatic service'

Organisation (BY WHOM)	
Owner of the network	AERM
Operator of the network	AERM, DIREN
Actor in charge of reporting / official responsibility for monitoring (if different)	AERM, CIPR and CIPMS: international Rhine / Moselle - Sarre protection commissions
Links between different actors involved :	

End use (WHAT FOR)	
Final use of the data collected	Knowledge and following
Other possible end users :	Governmental administrations, Environmental NGO's, citizen
Current level of accessibility of the data	Data is reachable on the internet (free) : French points are reachable via water agency site : http://www.eau-rhin-meuse.fr/sie; and all data-for Rhine : http://had.bafg.de:8080/iksr-zt/ for Moselle-Sarre http://www.iksms-cipms.org/Testf.htm

Groundwater quality network of the Rhine-Meuse basin
Réseau de suivi de la qualité des eaux souterraines du bassin Rhin-Meuse (RBESL)

ID: S.gw1

Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body	All aquifers (km2)
Number of water bodies concerned;	15 in Rhine district
Area , catchment area	aquifers

Objective of the monitoring (WHY)	
Type of MN	Surveillance MN
Description of main objective	The objective of this network is knowledge and understanding of the resource and identifies possible trends in water quality. It helps to lay down safeguarding policies of the water quality and to enable the evaluation of effectiveness of implemented policies.
Related regulatory constraints	WFD until 2000
Socio-economic objectives if any	Follow the quality of the highly important socio-economic resource that represents the alsacian aquifer, as it is a huge water resource for all types of human uses for today and the future.
Brief description of the history of implementation of the network	It has been established in April 1999. It was named before 'réseau patrimonial'. First datas exist from 1964

Geographic features (WHERE)	
Number and location of monitoring points	185 points in whole Rhine Meuse basin; 130 in Rhine district see Map Annex
Density	1 point/ 130 km2-(mean for the district)
Is the information provided representative	600 measures in total per year points are well distribute over the whole basin, but density is low

Parameters monitored (WHAT)	
List parameters monitored	For all points : 60 physico-chemical et micro-pollutants parameters fixed at national level, Pesticides are chosen from a local list 'SIRIS' because use of pesticides is different from a region to another.

Frequency (WHEN)	
Frequency of monitoring	6 times per years : 54 stations; 3/ year for 32 stations 2/year for 81 stations ; 1 /year for 18 stations (in 2000)
Period of the year	All over the year
Since when	Since 1970 AERM is in charge of surveillance monitoring of groundwater's but this network is operational since 1990

Technique (HOW)	
Monitoring technique :	Classical sampling and lab analysis
Uncertainty of measurements:	

Organisation (BY WHOM)	
Owner of the network	AERM
Operator of the network	Co-managing convention :AERM, DIREN Alsace, DIREN lorraine,DIREN Champagne Ardennes.
Actor in charge of reporting / official responsibility for monitoring (if different)	BRGM is exploiting the database
Links between different actors involved :	Laboratories

End use (WHAT FOR)	
Final use of the data collected :	Knowledge and following
Other possible end users :	Governmental administrations, Environmental NGO's, citizen
Current level of accessibility of the data	Public access, the data is stored in ADES database accessible on internet www.ades.rnde.fr and on www.eau-rhin-meuse.fr computerization delay : 2 months

Inventory of groundwater quality of Lorrain's aquifer - Inventaire qualité lorraine
ID: S.2
Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	aquifer (km2)
Number of water bodies concerned:	12 in Rhine district
Area, catchment area	All aquifer in Moselle-Sarre sub district

Objective of the monitoring (WHY)	
Type of MN	Surveillance MN
Description of main objective	General overview of the state of the groundwater quality and to diagnose the origins of contamination's and propose actions to protect the aquifer
Related regulatory constraints	None before 2000; now DCE
Socio-economic objectives if any	Follow the quality of the highly important socio-economic resource that represents the alsacian aquifer, as it is a huge water resource for all types of human uses for today and the future.
Brief description of the history of implementation of the network	Since 1973 investigation have started in the Rhine-Meuse basin, they main goal was to follow the general state of the groundwater resources but 2003 results serve to implement the state of waterbodies as required by the WFD to fix the program of measure to achieve the good water status until 2015.

Geographic features (WHERE)	
Number and location of monitoring points	950 points (less just in the district); see Map Annex
Is the information provided representative	In all water bodies of Moselle-Sarre sub district-It is not very uniformly distributed. Particularly dense around the urban areas

Parameters monitored (WHAT)	
List parameters monitored	For all points : 2 0 physico-chemical parameters For nearly all points: physico-chem. + 80 micropollutants parameters

Frequency (WHEN)	
Frequency of monitoring	Every 6 years
Period of the year	autumn
Since when	2 campaigns (1992, 2003)

Technique (HOW)	
Monitoring technique	Classical sampling and lab analysis

Organisation (BY WHOM)	
Owner of the network	Region Lorraine
Operator of the network	AERM

End use (WHAT FOR)	
Final use of the data collected :	Evaluate the impact of European, national and regional environmental policies on the aquifer - Propose remediation action and actions to fight against the main sources of contamination identified with the 'exploitation of data collections. The last campaign serves to assess the state of groundwater resources in Rhine-Meuse basin operated by 'agence de l'eau'.
What level of precision is needed:	It is not so the accuracy of the measure which is important but more the density of the points that should cover the whole resource. The accuracy of the measure should enable to provide information whether a given pollution had reached the groundwater or not.
Other possible end users :	Governmental administrations, Environmental NGO's, citizen
Current level of accessibility of the data	Public access, press conference at the outcome of results, but publication of results comes after a long delay (nearly two years : datas collected in autumn 2003 had been given out in spring 2005.

Groundwater quality in Sundgau
Inventaire qualité Sundgau **ID: S.3**
Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	Sundgau aquifer (997 km2)
Number of water bodies concerned;	1
Area , catchment area (river, aquifer if confined);	Sundgau sediment aquifer ‘cailloutis’

Objective of the monitoring (WHY)	
Type of MN	Surveillance MN
Description of main objective	General overview of the state of the groundwater quality and to diagnose the origins of contaminations and propose actions to protect the aquifer
Related regulatory constraints	None before 2000; now DCE
Socio-economic objectives if any	Follow the quality of the highly important socio-economic resource that represents the alsacian aquifer, as it is a huge water resource for all types of human uses for today and the future.
Brief description of the history of implementation of the network	Since 1973 investigation have started in the Rhine-Meuse basin, they main goal was to follow the general state of the groundwater resources but 2003 results serve to implement the state of waterbodies as required by the WFD to fix the program of measure to achieve the good water status until 2015.

Geographic features (WHERE)	
Number and location of monitoring points	151 points (in 1998) (and 144 in 2003) of which: -104 sources and 47 wells /boring see Map Reseau de mesure[sundgau].pdf
Density	Around 1 points / 7 km2
Is the information provided representative (	The distribution is not as homogenic as wished because the access to the centre of the aquifer system is limited. Most of the points are located in the border of the aquifer, at the source of the springs.

Parameters monitored (WHAT)	
List parameters monitored	For all points : 2 0 physico-chemical parameters For nearly all points: physico-chem. + 80 micropollutants parameters

Frequency (WHEN)	
Frequency of monitoring	Every 6 years
Period of the year	autumn
Since when	2 times (1998, 2003)

Technique (HOW)	
Monitoring technique :	Classical sampling and lab analysis

Organisation (BY WHOM)	
Owner of the network	Region Alsace
Operator of the network	APRONA
Actor in charge of reporting / official responsibility for monitoring	APRONA, LfU, DIREN
Links between different actors involved :	This network is worked out with a German network which is in the continuity of the Franco German border and both are operated in the same synthesis. German partner is LFU (Landesanstalt für Umweltschutz Baden-Württemberg) a public institut for environement protection

End use (WHAT FOR)	
Final use of the data collected :	Evaluate the impact of European, national and regional environmental policies on the aquifer - Propose remediation action and actions to fight against the main sources of contamination identified with the ‘exploitation of data collections The last campaign serves to assess the state of groundwater resources in Rhine-Meuse basin operated by ‘agence de l’eau’
What level of precision is needed by the end user :	It is not so the accuracy of the measure which is important but more the density of the points that should cover the whole resource. The accuracy of the measure should enable to provide information whether a given pollution had reached the groundwater or not.
Other possible end users :	Governmental administrations, Environmental NGO’s, citizen
Current level of accessibility of the data	Public access, press conference at the outcome of results, but publication of results comes after a long delay (nearly two years: datas collected in autumn 2003 had been given out in spring 2005.

Groundwater quality of the alsacian aquifer
Inventaire qualité Alsace **ID: S. 4**
Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	aquifer
Number of water bodies concerned;	1
Area, catchment area	2 880 km2

Objective of the monitoring (WHY)	
Type of MN	Surveillance MN
Description of main objective	General overview of the state of the groundwater quality and to diagnose the origins of contamination's and propose actions to protect the aquifer
Related regulatory constraints	None before 2000; now : DCE
Socio-economic objectives if any	Follow the quality of the highly important socio-economic resource that represents the alsacian aquifer, as it is a huge water resource for all types of human uses for today and the future.
Brief description of the history of implementation of the network	Since 1973 investigation have started in the Rhine-Meuse basin, they main goal was to follow the general state of the groundwater resources but 2003 results serve to implement the state of waterbodies as required by the WFD to fix the program of measure to achieve the good water status until 2015.

Geographic features (WHERE)	
Number and location of monitoring points	720 points : 0 to 40 m deep + about 20 deep piezometer
Density	1 points / 4 km2
Is the information provided representative	Yes, because points are regularly spread over the aquifer area and points had been selected to maximise representativeness

Parameters monitored (WHAT)	
List parameters monitored	For all points : 2 0 physico-chemical parameters For more than 700 : physico-chem. + 80 micropollutants parameters

Frequency (WHEN)	
Frequency of monitoring	Every 6 years
Period of the year	autumn
Since when	3 (1991, 1997, 2003)

Technique (HOW)	
Monitoring technique :	Classical sampling and lab analysis

Organisation (BY WHOM)	
Owner of the network	Region Alsace
Operator of the network	APRONA
Actor in charge of reporting / official responsibility for monitoring	APRONA, LfU, DIREN
Links between different actors involved :	This network is worked out with a German network which is in the continuity of the Franco German border and both are operated in the same synthesis. German partner is LFU (Landesanstalt für Umweltschutz Baden-Württemberg) a public institut for environement protection

End use (WHAT FOR)	
Final use of the data collected :	Evaluate the impact of European, national and regional environmental policies on the aquifer Propose remediation action and actions to fight against the main sources of contamination identified with the 'exploitation of data collections. The last campaign serves to assess the state of groundwater resources in Rhine-Meuse basin operated by 'agence de l'eau'
What level of precision is needed by the end user :	It is not so the accuracy of the measure which is important but more the density of the points that should cover the whole resource. The accuracy of the measure should enable to provide information whether a given pollution had reached the groundwater or not.
Other possible end users :	Governmental administrations, Environmental NGO's, citizen
Current level of accessibility of the data	Public access, press conference at the outcome of results, but publication of results comes after a long delay (nearly two years : datas collected in autumn 2003 had been given out in spring 2005.

Strasbourg city groundwaters network
Réseau CUS eaux souterraines **ID: S.gw5**
Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	Alsatian aquifer
Number of water bodies concerned	1
Area , catchment area	Over Strasbourg agglomeration

Objective of the monitoring (WHY)	
Type of MN	Surveillance (alert and control) MN
Description of main objective	The objective of this network is to prevent the pollution due to industries or other pressure in the future drinking water of the city.
Related regulatory constraints	No it is a local initiative
Socio-economic objectives if any	Checking waters quality before, as it is the potential drinking water, there is a really big stake to survey this water
Brief description of the history of implementation of the network	Established in 1995 after a contamination that occurred in the pumped raw drinking water of the urban area

Geographic features (WHERE)	
Number and location of monitoring points	33
Density	
Is the information provided representative	No, just part of the aquifer is concerned by this network.

Parameters monitored (WHAT)	
List parameters monitored	Physico-chemical parameters, nitrogen, pesticides, HAP, PCB mineral micro pollutants. Taste and smelling, colouring (and also piezometrics analyses)

Frequency (WHEN)	
Frequency of monitoring	2 times per month for common physico-chemical parameters and less for the others
Period of the year	All year round
Since when	1995

Technique (HOW)	
Monitoring technique :	Classical sampling and lab analysis-
Uncertainty of measurements	

Organisation (BY WHOM)	
Owner of the network	CUS: urban community of Strasbourg
Operator of the network	CUS : department of urban ecology
Actor in charge of reporting / official responsibility for monitoring (if different)	CUS
Links between different actors involved	

End use (WHAT FOR)	
Final use of the data collected :	Surveillance, tendencies
Current level of accessibility of the data	Restricted access to data-

Groundwater impact network of industrial sites IPCC
Réseau ICPE **ID: I.1**
Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	aquifers
Number of water bodies concerned	15 (all in the basin)
Area , catchment area	Extend in the whole basin

Objective of the monitoring (WHY)	
Type of MN	Impact MN
Description of main objective	The objective of this network is to follow the pollution due to industries and animal farms on groundwater right under the sites.
Related regulatory constraints	Regulation of the 'installation classée pour la protection de l'environnement'-inventoried industries and animal farms legislation for the protection of environment
Socio-economic objectives if any	Preventing waters from dangerous industrial pollution's

Geographic features (WHERE)	
Number and location of monitoring points	Industrial sites: 184 in Alsace and 185 in Lorraine (but in number of points : Alsace : 816 points (Bas-Rhin) et 964 (Haut-Rhin).) -2 downstream and 1 upstream per industrial site
Density	
Is the information provided representative	Representative of the industries emissions but not representative of the waterbody.

Parameters monitored (WHAT)	
List parameters monitored	Individually defined parameters according to the industries But mostly: hydrocarbons, aromatic polycyclic hydrocarbons, halogens chlorinated compounds and heavy metals.

Frequency (WHEN)	
Frequency of monitoring	According to the individual cases-variable Minimum two times per year
Period of the year	All year round
Since when	1998

Technique (HOW)	
Monitoring technique	Classical sampling and lab analysis-private labs or owns industrial labs as a part of controlled industries have their own labs.

Organisation (BY WHOM)	
Owner of the network	Industrials for operating AERM for the data compilation
Operator of the network	Industrials : self-monitoring for measurement and analyses DRIRE: receive the analyses and storage
Actor in charge of reporting / official responsibility	BRGM-treating information's and making a synthetically work in the Alsace region
Links between different actors involved	DRIRE is responsible for the water police and therefor responsible for making this Regulation applied AERM and BRGM financed to 50%each data treatment

End use (WHAT FOR)	
Final use of the data collected	Control industrials and animal pollution impact and possibly restrict them.
Other possible end users :	Governmental administrations-would interests NGO's
Current level of accessibility of the data	Restricted access to data-Project to gather all the data in a national databank 'ADES" A yearly synopsis is given out by AERM

Surface water refinement stations rejects (impact network)
Rejets des stations d'épurations collectives **ID: I.2** Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	Here it is not the water body that is directly monitored but the water that is rejected by refinement stations (this reject will depend on the type of water that had been treated: in refinement stations both domestic and industrial rejects are treated. Not all industries can emit their rejects in the collective network, it will depend on types and concentration of water their reject.
Area , catchment area	Extend in the whole basin

Objective of the monitoring (WHY)	
Type of MN	Impact MN
Description of main objective	The objective of this network is to control emissions of refinement stations in surface waters.
Related regulatory constraints	Regulation of the 'installation classée pour la protection de l'environnement'- IPCC
Socio-economic objectives if any	Preventing waters from pollutions
Brief description of the history of implementation of the network	These rejects control is working since the seventies, at the departmental scale. It was first managed by SATESE ("Service d'Assistance Technique aux Exploitants de Stations d'Epuration") and nowadays SATESE is part of "Conseil Général" : the local (department) administration.

Geographic features (WHERE)	
Number and location of monitoring points	500 stations in whole Rhine-Meuse basin (104 in Bas-Rhin; 62 in haut-Rhin) [in 2001: 438 industrial sites were connected to the collective network in Rhine district]
Is the information provided representative	No: it is really a specific measure which role is to qualify the punctual emission.

Parameters monitored (WHAT)	
List parameters monitored	DBO5,DCO, MES, Nitrogen (total, nitrate , ammonium), total phosphor, pH.

Frequency (WHEN)	
Frequency of monitoring	3 times per year by SATESE
Period of the year	All year round
Since when	1972

Technique (HOW)	
Monitoring technique :	Classical sampling and lab analysis-SATESE own labs

Organisation (BY WHOM)	
Owner of the network	Conseil Général - Financial input from social and sanitary administration (DDASS) and water agency (AERM) in the Bas-Rhin department
Operator of the network	Conseil Général – represented by SATESE : Technical assistance service for refinement stations managing
Actor in charge of reporting	Water agency put together all provided datas at basin level in a database

End use (WHAT FOR)	
Final use of the data collected :	The water police is the first concerned by this data : it controls stations emissions and potential impact with this data. The final goal is to check whether the IPCC Regulation is respected.
Other possible end users :	Governmental administrations-could interest NGO's
Current level of accessibility of the data	A part of the data is viewable on Internet- in the water information system of Rhine-Meuse water agency -Detailed data is only provided to water police

Self –monitoring and monitoring of industries refinement stations and rejects –Tax calculation (surface water)

Auto-surveillance et surveillance des stations d'épurations et des rejets industriels pour le calcul de la redevance

ID: I.3

Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	Here it is not the water body that is directly monitored but the water that is rejected by refinement stations of industries. Industries that have their own refinement station are the one's that could not connect with the collective purification network, because of to high concentration of certain types of pollutants. They must have their own treatment plant.
Area, catchment area	Extend in the whole basin

Objective of the monitoring (WHY)	
Type of MN	Impact MN
Description of main objective	The objective of this network is to control emissions of industries treatment plant in surface waters.
Related regulatory constraints	Regulation of the 'installation classée pour la protection de l'environnement'- IPCC - Arrêté relatif à la réglementation des ICPE
Socio-economic objectives if any	Calculate the emission tax pollution owed to water agencies by industries – Preventing waters from pollution
Brief description of the history of implementation of the network	Since 1980: monitoring has been implemented. Until 1996 data's of self monitoring exist on paper; since 1998 datas are collected in an informatics database. In 2002 financing of the extern monitoring was taken up by 100% by water agency.

Geographic features (WHERE)	
Number and location of monitoring points	Number of non – connected industries : 258 in Moselle-Sarre and 192 in Upper Rhine zone. More than 200 industries and 150 treatment plants make self-monitoring.
Is the information provided representative?	No: it is really a specific measure which role is to qualify the punctual emission.

Parameters monitored (WHAT)	
List parameters monitored	For all industries : Heavy metals, AOX, DBO5 , DCO ,METOX, nitrogen, Phosphorus, temperature + specific pollutants according to each type of industry

Frequency (WHEN)	
Frequency of monitoring	Self-monitoring : Permanently or if industry are under threshold value defined in the arrêté IPCC :3 times per year Water agency monitoring: 4 times per year (3 on whole stations + 1 on the reject)
Period of the year	All year round
Since when	1980

Technique (HOW)	
Monitoring technique :	Multiple sampling is made to have a good representativity Adapted effluent lab analysis (techniques are different from a non-concentrated water)- accredited or can be authorised (by water agency) to use alternatives non-accredited methods (industrials have to prove efficiency) For self monitoring can be done in the own accreditation industrial lab. If more industries emit in the same zone they can group each other for monitoring (threshold are then adapted)

Organisation (BY WHOM)	
Owner of the network	Industries and local communities (for treatment plants)
Operator of the network	Industries and local communities (for treatment plants); and, for the treatment of datas AERM and DRIRE
Actor in charge of reporting / official responsibility for monitoring	Water agency put together all provided datas at basin level in a informatics database
Links between different actors involved :	Industries must send results to the local inspection of IPCC every month.

End use (WHAT FOR)	
Final use of the data collected :	The water police is the first concerned by this data : it

	controls stations emissions and potential impact with this data. The final goal is to check whether the IPCC Regulation is respected.
Other possible end users :	Governmental administrations-could interest NGO's
Current level of accessibility of the data	Access of data is restricted to AERM and DRIRE

Iron Mine basin network-groundwaters **ID: M.1**
Réseau de suivi de la qualité des eaux souterraines du Bassin Ferrifère Lorraine
Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	Aquifers (calk and iron formation)
Number of water bodies concerned	1
Area , catchment area	Dogger Calc

Objective of the monitoring (WHY)	
Type of MN	Management MN
Description of main objective	The objective of this network is to follow the pollution due to old iron mines, formed by chemical and physical reactions due to the stop of exploitations of mines. The initial demand was the knowledge.
Related regulatory constraints	The 'Code minier' states the following of water quality after exploitation stop to check
Socio-economic objectives	For a part of the zone : prevent the degradation of water for drinking.
Brief description of the history of implementation of the network	Iron mines had been exploited for more than 100 years. The stop of the exploitation and before all the pumping of water since 1993 has change hydrogeological conditions and led to a specific pollution (mineralisation) . Created on joint initiative of DIREN Lorraine and AERM a following begun in 1995. Managing of this network was entrusted to BRGM.

Geographic features (WHERE)	
Number and location of monitoring points	37points total: -19 points in the mine reservoirs of which : 7 points in wells, 7 points in overflow, 5 points drinking water wells (followed use network by DDASS-sanitary administration) - Dogger calks : 12 points in 1998 - iron formation (non exploited) : 6 points
Is the information provided representative	Protocol elaborate for a maximum confidence by BRGM, but there is a problem of confidence because a few wells does not dispose of pumping installation and are relative close to the minerals : as mineralisation is not uniform it is difficult to conclude to a general state with these data. 5this could be remediated by a long time (24-48h pumping) as long as physico-chemical parameters stabilise.

Parameters monitored (WHAT)	
List parameters monitored	Physicochemical parameters and major ions, metals, hydrocarbons

Frequency (WHEN)	
Frequency of monitoring	Every month : flow, temperature and conductivity- Iron: every 6 month
Period of the year	All year round
Since when	1995

Technique (HOW)	
Monitoring technique :	Classical sampling and lab analysis

Organisation (BY WHOM)	
Owner of the network	AERM / DIREN
Operator of the network	BRGM-regional Service Lorraine
Actor in charge of reporting / official responsibility	BRGM

End use (WHAT FOR)	
Final use of the data collected :	Following the evolution of specific pollution due to the stop of exploitation; before all minerals.
Other possible end users :	Governmental administrations, Environmental NGO's, citizen, drinking water providers
Current level of accessibility of the data	BRGM public Report

Old potash mine network-Alsace-groundwaters
Réseau de suivi de la salure des eaux souterraines dans le bassin potassique (Alsace)

ID: M.2

Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	Alsatian aquifer
Number of water bodies concerned	1
Area , catchment area	Extend from Mulhouse to Colmar in the Haut-Rhin department-(upper-Rhine sub-district)

Objective of the monitoring (WHY)	
Type of MN	Impact MN
Description of main objective	The objective of this network is to follow the pollution due to old potash mines (chlorides) , and before all by spoil heaps on which were deposited salted residues until the end of the 30. The goal is to control and to orient depollution that is led by the commission of control of Alsace potash mines
Related regulatory constraints	
Socio-economic objectives	For a part of the zone: prevent the degradation of water for drinking. Risk of pollution for the whole alsacian aquifer that is of primary economic importance in the region.
Brief description of the history of implementation of the network	DRIRE and AERM have missioned BRGM to follow up this pollution over a long lasting program. The program is readapted year to year. Network is improving in accuracy from year to year with the increasing of the number of points.

Geographic features (WHERE)	
Number and location of monitoring points	525 points are divided as followed: 25 depollution wells, 28 fixation wells, 2 gravel mines and 470 control points (type piezometer). For the analysis of the pollution an « extended » network of datas had been added from other data holders: the MDPA (411 works), the DDASS (6 drinking water wells), the « Colmarienne des eaux » (4 wells), the DIREN (9 river stations), the BRGM (90 works).
Is the information provided representative	Points are carefully selected to maximise efficiency

Parameters monitored (WHAT)	
List parameters monitored	Physicochemical parameters and dissolved chlorides

Frequency (WHEN)	
Frequency of monitoring	One's a year

Technique (HOW)	
Monitoring technique :	Classical sampling and lab analysis

Organisation (BY WHOM)	
Owner of the network	AERM
Operator of the network	BRGM-regional Service Alsace (financing 50% BRGM and 50% AERM)
Actor in charge of reporting / official responsibility for monitoring	BRGM

End use (WHAT FOR)	
Final use of the data collected :	Actions to remediate with chlorinated pollution's.
Other possible end users :	Governmental administrations, Environmental NGO's, citizen, drinking water providers
Current level of accessibility of the data	Free access at water agency data but not published

Mine basin network-surface waters
Réseau de bassin minier - cours d'eau **ID: M.3** Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	Rivers and channel
Area , catchment area	rivers

Objective of the monitoring (WHY)	
Type of MN	Managing MN
Description of main objective	The objective of this network is knowledge (increasing number of data's from national basin network) and also to give the alarm in case of pollution
Related regulatory constraints	none
Socio-economic objectives if any	Iron and coal mines had been exploited for more than 100 years. The stop of the exploitation and before all the pumping of water since 1993 have change hydrogeological conditions and led to a specific contamination of groundwaters but also of surface water by overflowing (mineralisation). this network aims at evaluating the contamination and managing the eventual depollution
Brief description of the history of implementation of the network	Created on joint initiative of DIREN Lorraine and AERM. It Exists since 2000. First mircopollutants analyses had been made in 2001 August 2001: monthly physico-chemical analyses. AERM was stakeholder until 31/12/ 2003.

Geographic features (WHERE)	
Number and location of monitoring points	39 points
Density	
Is the information provided representative	Points are geographically well allocated

Parameters monitored (WHAT)	
List parameters monitored	Physicochemical parameters - microbiological parameters - PCB Water analyses but also sediments (arsenic, HAP) and bryophytes IBGN (1-2 par an);

Frequency (WHEN)	
Frequency of monitoring	For microbiol. parameters : 12 / year ; PCB 4 / year ; IBGN : 1-2 / year
Since when	2000

Technique (HOW)	
Monitoring technique :	Classical sampling and lab analysis DIREN is making the biological analyses (invertebrates

Organisation (BY WHOM)	
Owner of the network	Water agency (AERM) / DIREN Lorraine
Operator of the network	Water agency (AERM) / DIREN Lorraine
Actor in charge of reporting / official responsibility for monitoring	Water agency : physico-chemical and bacteriological aspects DIREN : hydrobiology (macro invertebrates, mircopollutants)

End use (WHAT FOR)	
Final use of the data collected :	Following the evolution of the network
Other possible end users :	Governmental administrations, Environmental NGO's, citizen
Current level of accessibility of the data	Free data access on : www.eau-rhin-meuse.fr

Drinking water police –use MN
Réseau DDASS : AEP **ID: U.1**
Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	Water designated to human drinking consumption Surface waters designated to production of drinking water
Number of water bodies concerned;	None
Area ,catchment area	All over the basin

Objective of the monitoring (WHY)	
Type of MN	Use MN
Description of main objective	The objective is to guaranty a standard sanitary quality of drinking water to the public. It is to note that these data does not reflect the quality of the resource because it takes only in consideration the waters that are distributed (treated or selected waters)
Related regulatory constraints	'code de la santé public'- public health code
Socio-economic objectives if any	To insure that drinking water providers delivers the public with a good quality water
Brief description of the history of implementation of the network	This network is the first one to have been implemented in France, it started in the 1960th.It have encountered specific problems data transmissions in 1999 and 2000

Geographic features (WHERE)	
Number and location of monitoring points	-All units of distributions : distributed water -Wells : resource level
Is the information provided representative	The analyses are made to maximise the representativeness of distributed water: the samples are taken in various places of the distribution network (in private / public house tabs, wells…)

Parameters monitored (WHAT)	
List parameters monitored	Reference parameters (23) : they indicate whether stations work correctly and Quality parameters : they are related to health (bacteriological (2) and chemicals (29) [of which nitrates, pesticides]

Frequency (WHEN)	
Frequency of monitoring	Every 3 month for DDASS checking and permanently for distributor
Period of the year	All year round

Technique (HOW)	
Monitoring technique :	Classical sampling and lab analysis

Organisation (BY WHOM)	
Owner of the network	DDASS
Operator of the network	DDASS - drinking water providing companies or communities
Actor in charge of reporting / official responsibility	The local communities (cities in charge of water distribution) is responsible for publishing the results of water quality they provide

End use (WHAT FOR)	
Final use of the data collected	Check the distributed tab water quality according to human consumption DDASS can authorise or not the following of the distribution of water by making an alert to the prefet (departmental administrator)
What level of precision is needed by the end user :	The data must enable to track any threat for human's health in the water distributed, therefor analyses are in accordance to WHO (world health organisation) requests
Other possible end users :	citizens, Environmental NGO's,
Current level of accessibility of the data	Public access : analyses results are viewable in the town council

Bathing water control network –use MN
Réseau DDASS baignade **ID: U 2**
Country/Case study: France / Rhine-Meuse basin

Water bodies monitored (WHO)	
Type of water body :	Bathing water (lakes and artificial swimming pools…) as soon as they are more than 10 person that bath per season
Area, catchment area	All over the basin

Objective of the monitoring (WHY)	
Type of MN	Use MN
Description of main objective	The objective is to guaranty a standard sanitary quality of bathing water in public bathing places.
Related regulatory constraints	National 'code de la santé public' and European bathing directive
Socio-economic objectives if any	To insure that bathing water is of health acceptable good quality
Brief description of the history of implementation of the network	The norms are fixed since 7 April 1981 and follow the 1975 directive. Authorisation had been abandoned for the bathing area, so the following of water quality is now compulsory

Geographic features (WHERE)	
Number and location of monitoring points	In Bas-Rhin : 19 lakes (and 38 swimming pools); 2 in Haut Rhin ; Meuse : 14 ; Meurthe et Moselle : 5 ; Vosges :15
Is the information provided representative	The analyses are made to maximise the representativeness of bathing water: the samples are taken where people bath.

Parameters monitored (WHAT)	
List parameters monitored	Bacteriological parameters indicating faecal contamination: when they are detected they are testimony of eventual pathogenic germs (bacteria's, viruses, parasites...) physicochemical parameters (6)

Frequency (WHEN)	
Frequency of monitoring	While the water area is open to public with a minimum of one's per month. National mean is 6 times per season in 1998 for smooth waters.
Period of the year	Mostly in the summer for lakes and natural smooth water places
Since when	1975 : national legislation

Technique (HOW)	
Monitoring technique :	Classical sampling and lab analysis

Organisation (BY WHOM)	
Owner of the network	DDASS
Operator of the network	DDASS
Actor in charge of reporting / official responsibility for monitoring	The responsible of the bathing place must provide public with this information

End use (WHAT FOR)	
Final use of the data collected :	Check the bathing water quality according to human health. 3 quality category exists(good, medium and bad) DDASS can authorise or not the following of the possibility to open the freshwater pool for the public.
What level of precision is needed by the end user :	The data must enable to track any threat for human's health in the water , therefor analyses are in accordance to WHO (world health organisation) requests
Other possible end users :	citizens, Environmental NGO's,
Current level of accessibility of the data	Public access : analyses results are viewable by the users