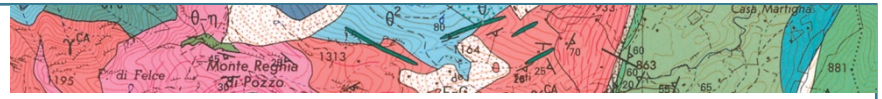

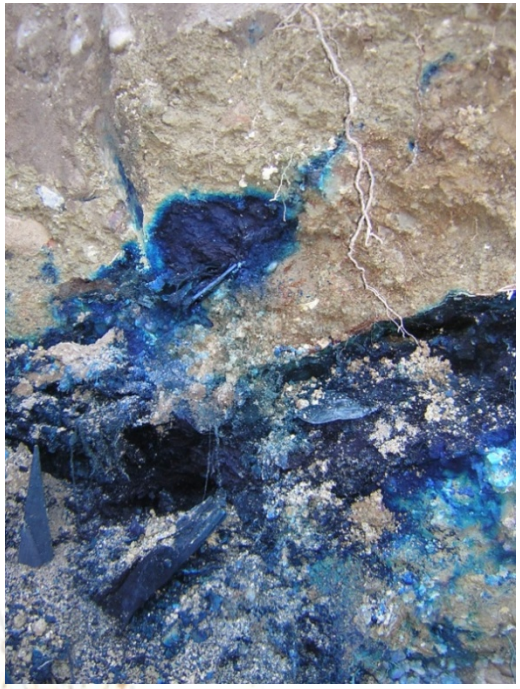

Integrated approach on global groundwater contamination of the area of the Dreieckland (F, CH, D) in an urban multisite context

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Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

ADEME
Agence de l'Environnement et de la Maîtrise de l'Energie

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Vendredi 18 mai 2013

Framework & issue

The europeen Water Framework Directive impose to establish the status and to identify the most important pressures and their impact on groundwater ressources (and the risk on their users/consumers).

>**The densely industrialized** area of the « Dreieckland » (=triangle of three countries) is affected by various pollutions in relation with several dumps, suspected having received hazardous waste of the chemical industrie of the Basel region (Switzerland) in the 50ies and 60ies

>After the **first inventories** of dumps in the Alsace region (ADEME/BRGM), several dumps have been classified to could likely contain waste that should be examined by priority 1.

>2005 to 2007, a first step of the impact assessment of groundwater quality downstream of these dumps has been realized by the public services BRGM and ADEME

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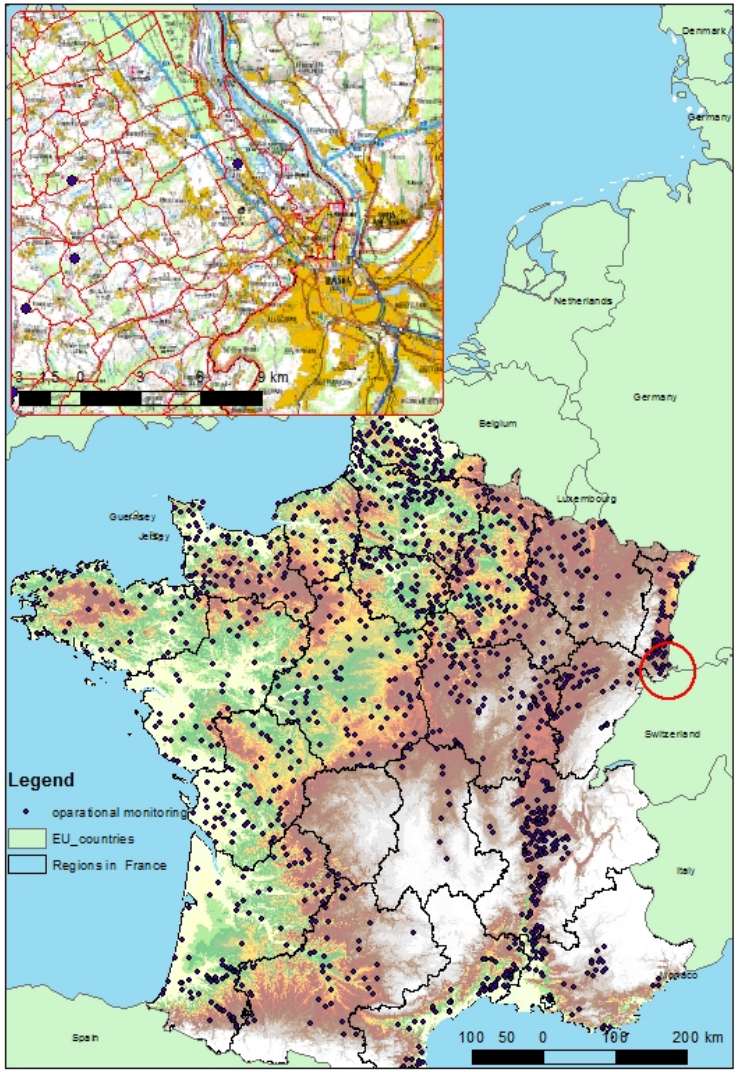
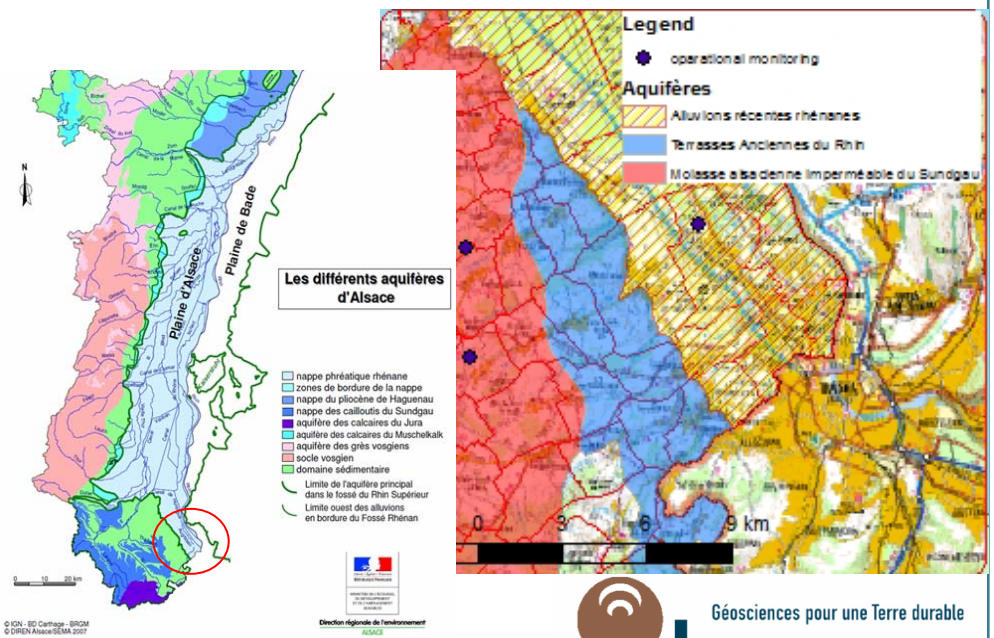
Localisation of the area and aquifer of concern



“Operational monitoring permits to establish the status of those bodies identified as being at risk of failing to meet their environmental objectives, and assess any changes in the status of such bodies resulting from the programs of measures.”



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The challenges

- An important but vulnerable groundwater body forming a water ressource that has to be protected because of the important uses (high density of groundwater wells), **in particular by the GFD, Water management plan of the zone Ill-Rhine**

- The chemical industry dump of the 50ies and 60ies from *pharmaceutical* and *agropharmaceutical-chemistry, as well as dye industry* → sludge and production waste with **(often unknown)** complexe chemistry with very little historical information about it.

- Very little knowledge of occurrence, nature, environmental fate and behavior (persistance, adsorption, etc.) and (eco)toxicity of these *organic and organometallic* compounds

- A mixture of aromatic amines, chlorobenzenes, sulfones, barbiturics, Halogenated volatile organic compound, nitro and/or chloro-(polyaromatics), heavy metals (Cu, Hg etc.), polar solvents, ...

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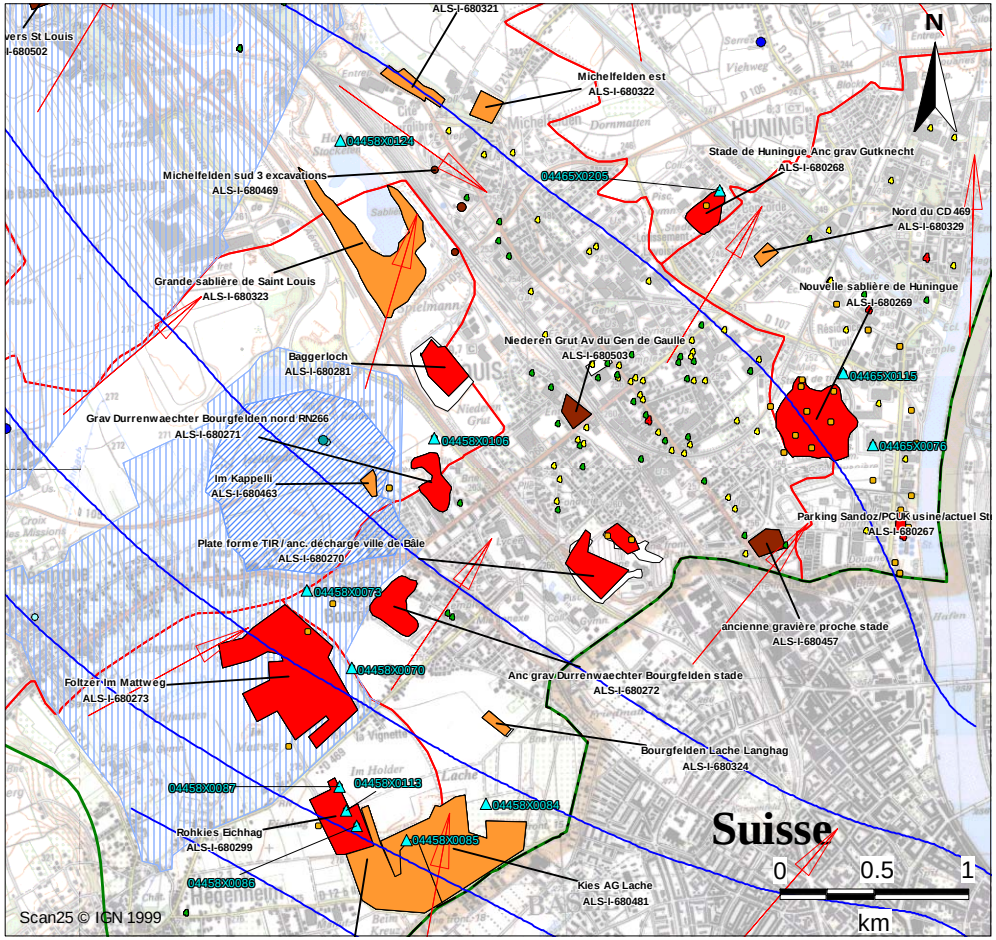
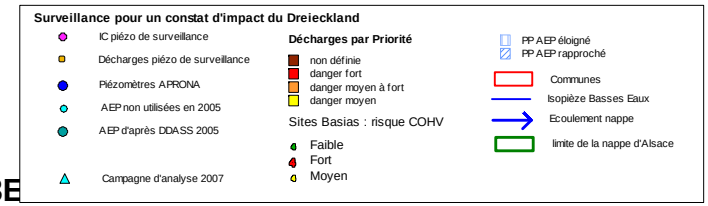
Methodologie of the impact statement





Step 1: Inventory of the zone of suspicion and the existing groundwater well network

- Dumps classed by envir. risk and GW-well network
- Classified industries and their GW-well network
- Former industries (closed, classed by contamination risk)

→proposed network for the impact statement

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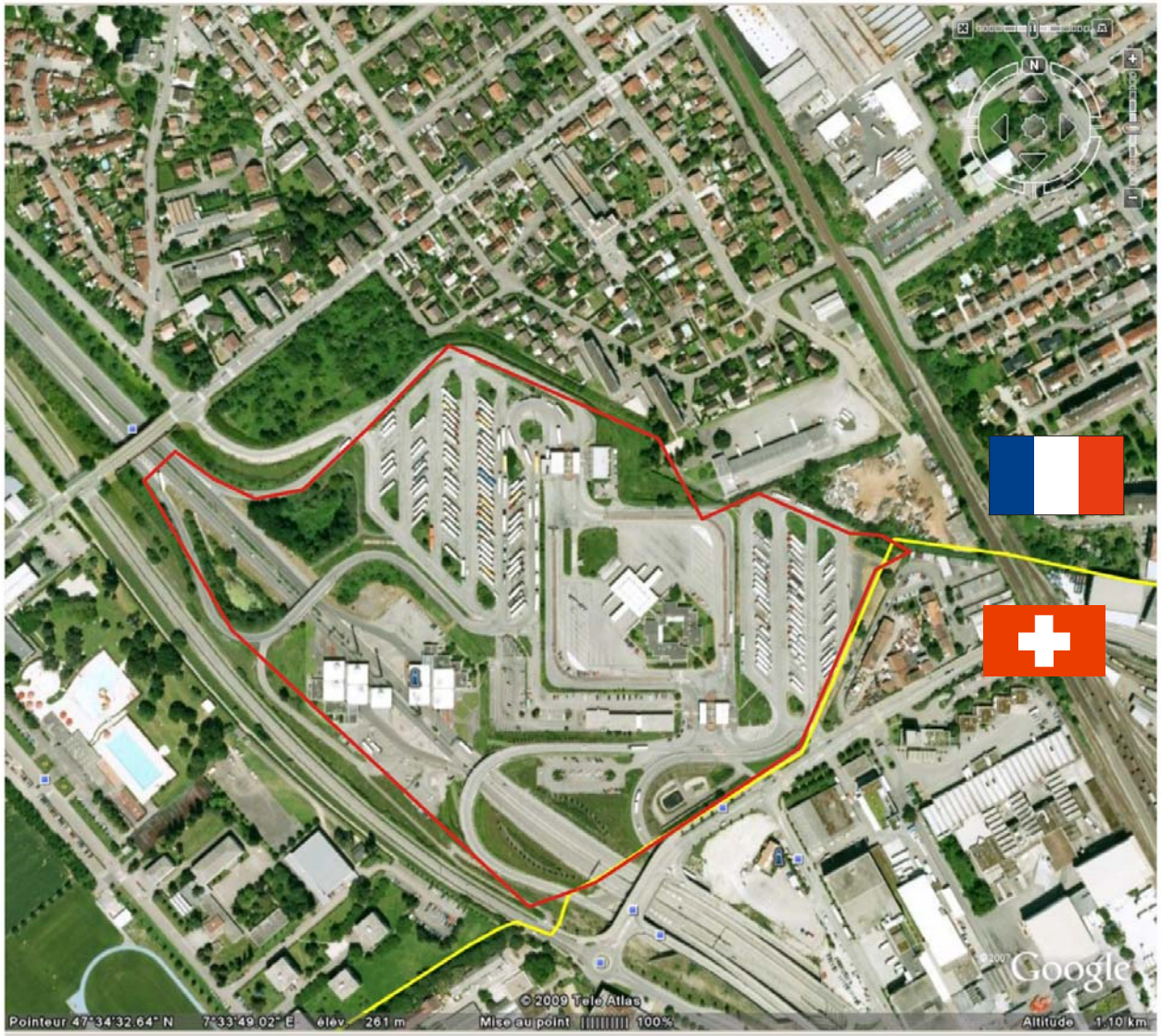

2005

How does a former dump look like today?

« International custom Platform »

Novoday

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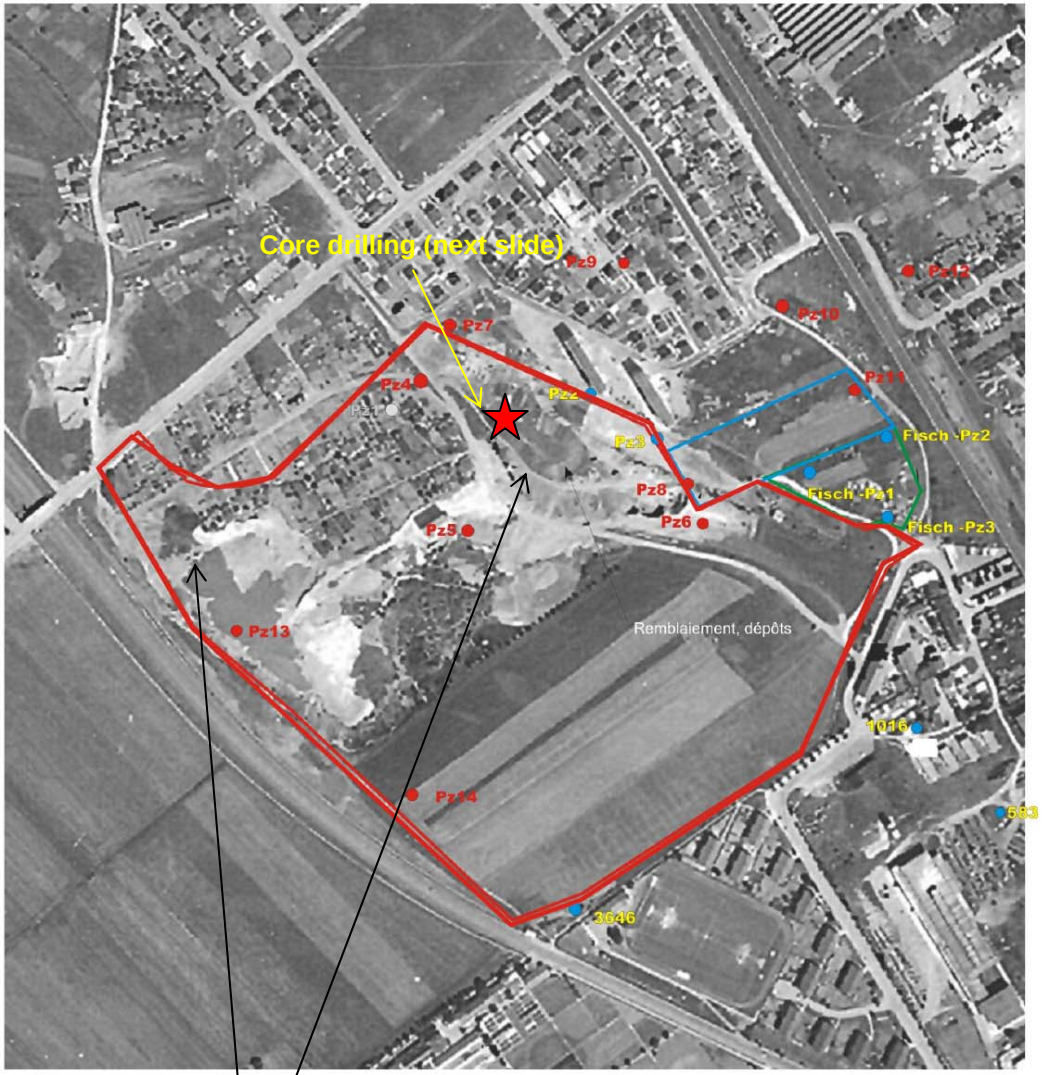
Photographie SWISSTOPO 1954

1953



Photographie SWISSTOPO 1959

1959

An example of a former gravel pit filled with hazardous wastes from the industrie and machefer in the 50ies → wastes had been dumped in the open pit where groundwater outcrops

14 m thick waste layer include 4 m in the aquifer (saturated zone)

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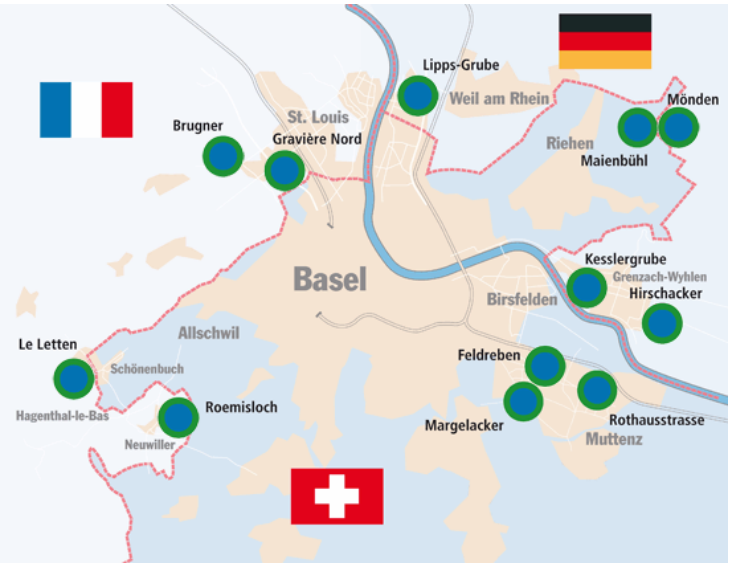

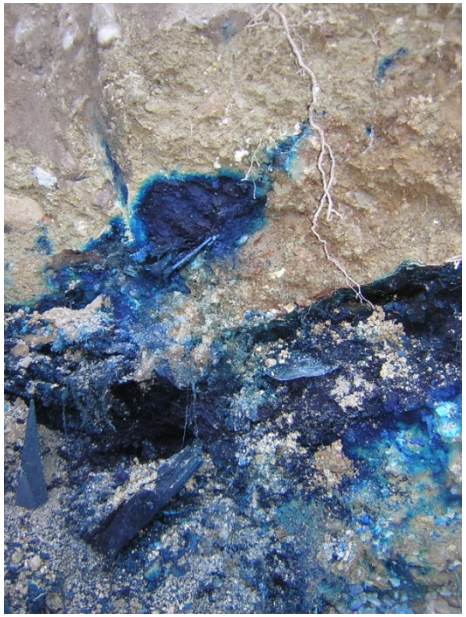

Hazardous waste Excavation by The Letten Landfill (2007)

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Method of the impact assessment

> **Step 2: two groundwater sampling campaigns of about ten observation wells, for low and high groundwater levels, chosen from existing and accessible points downstream of the former dumps.**

Step 3: analysis of water samples by semi-quantitativ « *screening* ». The analysis of organic compounds, focused on volatile compounds, by the analysis method of « *purge and trap*- GC/MS » (not detected by *screening)*.

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Step 3 : Analytical results

- **In 2005, 40 % of compounds had been identified,**

→60 % are non identified (with a proposition of corresponding chemical group)

- **In 2007, 80 % of compounds had been identified**

→Many compounds could be in relation to pharmaceutical industry

BUT: 18 compounds > 1µg/L are non identified

FAMILLE	Grands Groupes	Pharma	Chimie non pharma (plastique, solvants, agroalim, textiles…)	Hydrocarbure et dégradation	Pesticides
Alcane	Hydrocarbures		x	x	
Alcene					
Alcynes					
KWS/Alcynes					
Butyle					
Aromatiques		x	x		
Triazines	Triazines		x		x
Pesticide chloré	/				x
thiophosphate	Pestic. Ou dégradé				
Alcool	Alcool, Cetones	x	x	x	
tert.-Butyle cyclohexanol		x	x		
Cetone		x	x	x	
Ester		x	x	x	
Phtalates			x		
Amines	Amines		x		
		x			
Amines aromatiques			x		
Amides			x		
Benzoyles	contenu dans le temoin d'essai				
Composé halogénés non aromatiques			x		
Nitrile				x?	
Phosphore?	Organophosphates			x	x
thiophosphate					
Thiol	(contient du soufre)		x		
Medicaments	Pharmaceutique	x			
Phenol polyaromatique					
Amides					
Sucre					
Thioester					
Epoxyde			x		

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Results : Downstream of several dumps, traces of compounds from chemical and pharmaceutic industry, with concentrations > 1 µg/L.
BUT: Many of these compounds without any toxicity reference values.

Année	Konz.	Komponenten_Name	No BSS	substances sans certitude	Groupe
2007	**27.21**	**inconnu**	**04465x0115**	**??? aromatische chlorierte Verbindung mit Schwefel**	Aromatique
2006	25.000	inconnu	04465x0115	Propanoic acid, 2-propenylester	Hydrocarbures dégradé
2006	21.800	inconnu	04465x0115	Pyrazine, 6-chloro-3-(2,4-dichlorophenocyl)	Hydrocarbures dégradé
2006	8.730	inconnu	04465x0115	Propanoic acid, 2-propenylester	Hydrocarbures dégradé
2007	**6.72**	**inconnu**	**04465x0115**	**Isomeres zu 51.95???**	
2007	**6.66**	**Dichlorophenoxyderivat (Abfallprodukt bei der Herstellung eines Phenoxyessigsäureherbizids?)**	**04465x0115**		Amines aromatiques?
2006	5.370	inconnu	04465x0115	Pentanoic acid, 3-oxo, methyl ester	Hydrocarbures dégradé
2006	5.170	Crotetamid	04465x0115		traceur chimie pharmaceutique
2006	5.070	Tributylphosphat	04458x0124		Organophosph
2006	4.810	inconnu	04465x0115	11 Ethyl-9-methyl-azatric…	Amines
2007	**3.99**	**Benzotriazol**	**04458x0124**		Triazine
2007	**3.98**	**inconnu**	**04465x0115**	**???**	inconnu
2007	**3.94**	**inconnu**	**04465x0115**	**??? Strukturell ähnlich zu 46.72 - enthält Chlor**	contient Chlore
2006	3.730	inconnu	04465x0115	Benzene, Ethylpentamethyl-….	Aromatique
2007	**3.29**	**inconnu**	**04465x0115**	**Phenol, 2-methoxysulfonyl?**	Amine aromati
2006	3.000	Triphenylphosphin-Derivat	04465x0089		Phosphore?
2007	**2.5**	**Methyliertes Benzotriazol**	**04458x0124**		Triazine
2007	**2.03**	**Dichlorophenoxyderivat (Abfallprodukt bei der Herstellung eines Phenoxyessigsäureherbizids?)**	**04465x0115**		Amines aroma
2007	**1.96**	**inconnu**	**04465x0115**	**???**	inconnu
2007	**1.81**	**Chloriertes Keton oder Ester**	**04465x0205**		Cétone, Ester
2007	**1.8**	**inconnu**	**04465x0115**	**Isomeres von 41.87 - Chinolinderivat?**	?
2007	**1.71**	**Chloro-amino-benzensulfonalkylderivat**	**04465x0115**		Amine
2007	**1.58**	**inconnu**	**04465x0115**	**???**	inconnu
2007	**1.54**	**p-Toluensulfonamide**	**04458x0124**		Amide
2007	**1.51**	**inconnu**	**04465x0115**	**??? aromatische chlorierte Verbindung mit Schwefel- entspricht 46.24 mit Methylgruppe**	Aromatique
2007	**1.48**	**inconnu**	**04458x0087**	**???**	inconnu
2007	**1.46**	**Barbiturat (Der wahre Gehalt kann 5 bis 10 mal höher sein - nicht alle Barbiturate sind mittels GC/MS nachweisbar)**	**04465x0205**		Barbiturique
2007	**1.37**	**inconnu**	**04465x0115**	**???**	inconnu
2007	**1.19**	**inconnu**	**04465x0115**	**???**	inconnu
2007	**1.14**	**Propylester unspezifisch**	**04465x0115**		Ester
2007	**1.14**	**inconnu**	**04465x0205**	**???**	inconnu
2007	**1.12**	**Chloro-amino-benzensulfonamidderivat**	**04465x0115**		Amide

Various sources : actual industrial activities, former dumps, agriculture - identified with degradation of hydrocarbons, pesticides and pharmaceutical products

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Cross-frontier relationships – pressure on IGDRB

Local presse

Organisms like Greenpeace, environmental associations (NGO)

The mayors of the towns of the Dreieckland (Switzerland and France)

IGDRB represents the chemical and pharmaceutical industry of Basel (Switzerland)*

IGDRB Interessengemeinschaft Deponiesicherheit Regio Basel

The DREAL represents the state and controles the classified industry in environmental questions (BUT only in France)

L'ADEME
Public service under the supervision of the ministeries of environment and education, intervene also in financing of studies and rehabilitation of former dumps

Prefect
Represents the state in the région

***IGDRB has been created to assess and to remediate to the hazardous wastes in the Dreieckland.**

Two dump has been remediated in 2011

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Remediation and management of mesures

Today, the dumps of the area of concern in the north of the Dreieckland is not treated… because:

- The concentrations are generally very low (traces), even after high groundwater levels ;

- The downstream impact seems to be limited, because the wells further downstream don't show comparable concentrations;

- The most important concentrations found are in the actual industrial area (mixture of sources).

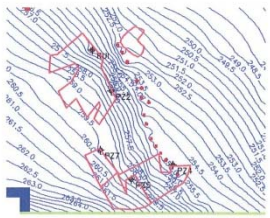


Figure 23 : positionnement des puits de pompage et cotes piézométriques

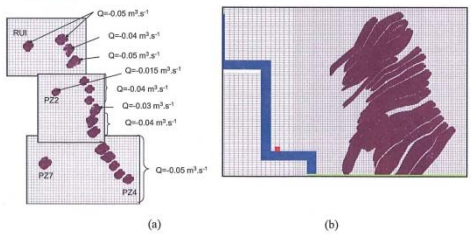


Figure 24 : Dimensionnement des essais de pompage : (a) zones d'empreinte des puits après 4 jours de pompage, (b) Interception des flux de masse des polluants issus des décharges du Sud Ouest

BUT: actual lack of de toxicity/ drinking water standards for many substances

Test of the RANKING methode (source : University of Strasbourg, IFARE (2007): impossible because of very low concentrations AND the need of a very high pumping rate to reach GW under the dumps (Rhine Alluvions are very pervious and importante thickness of Gwbody

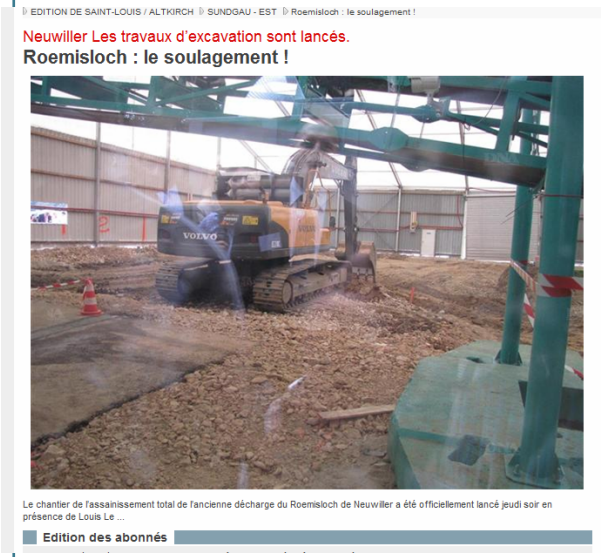
Cross-border relationships between Préfect-IGDRB and remediation

- IGDRB financed the risk assessment in 2001 - 2008 (ANTEA, Daniel Hube) especially for two dumps, today **entirely cleaned up**: the polluted soil with about 50.000 tons of waste and toxic substances, treated in specialized centers. The oldest of these wastes stayed since the 50ies in these dumps.

- Not responsible by law, le IGDRB accepted though to take in a volonteer way the necessary steps to pay more than 26 M€ to clean up these former dumps and to reaforest the area with native plants.
- The monitoring of the groundwater will be maintained until 2015.

Pressure by Greenpeace Suisse in 2005

….



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(Original) Global approach / (traditional) site specific approach

Global approach,

•→ **concerns public** (health, environment, water ressources policies) **and private** (industries, regional and local development,…) **stakeholders,**

•→ **promotes a better understanding of the role and mission of stakeholders in the common interest,**

•→ **defines viable and realistic remediation goals taking into account the global contamination background (concentrations and fluxes),**

•→ **contributes to enhanced knowledges and survey on global contamination (soil, groundwater, ambient air) and exposure,**

•→ **complementery to site-specific approach by defining 1) the backgrounds levels , 2) the stakeholder involved, 3) the action priorities in remediation and/or assessment on former contaminated sites onto the area in concern 4) contribute to the management of groundwater ressource in urban area with dense industrials networks.**

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Screening is a analytical tool efficient for global approaches

→Completed the identification of compounds in concern for **risk assessement** and **remediation option appraisal** when lacks on historical information occur (reduction of uncertainties). This approach is helpfull for risk assessment when exposure calculation based on targeted pollutant conduct to **uncertainties**,

→A better understanding of the behavior and the possible **degradation of organic compounds** by the identification of metabolites,

→Benefit of screening in the *location of pollutions sources and responsabilities: fingerprinting of the typical chemical composition of the sources*,

→Controlling the completeness and the sufficiency of applied standard operating procedures and analytical chains (**Quality assurance / Quality control**).

500 – 700 € HT per sample (specialized Universities, Laboratory …)

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Thank you for your attention

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